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ChatGPT and Beyond: The Rise of AI Assistants and Chatbots in Higher Education

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Abstract

This study explores the growth potential arising from various challenges in higher education, particularly as innovative technologies emerge as valuable educational tools. Despite initial perceptions of technology as a hindrance, it often evolves into a solution. In this context, artificial intelligence (AI) takes the lead, ushering in a new era marked by intelligent assistants and chatbots. A recent and promising technological advancement in this realm is ChatGPT. The research delves into the potential and obstacles associated with integrating ChatGPT and other virtual assistants and chatbots in an academic environment. Moreover, it conducts a comprehensive evaluation of practical applications and student feedback concerning the utilization of ChatGPT in higher education. This analysis sheds light on discernible advantages and drawbacks, providing valuable insights into the role of AI in shaping the educational landscape. As higher education faces numerous challenges, the study recognizes technology as a transformative force. It emphasizes the need to view AI, represented by innovations like ChatGPT, as a solution rather than a hindrance. By examining the practical implications and gauging student responses, the research contributes to a deeper understanding of the impact of these technologies on the academic experience.

Keywords: Artificial intelligence, chatbots, higher education, virtual assistants

To cite this article

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Introduction

The rapid progress of technological advancements has brought forth numerous possibilities yet concurrently posed distinctive challenges in higher education. Innovations in technology have enabled improved visualization, enhanced performance, increased automation, and expedited access to information, alongside other benefits. However, using these technologies presents significant challenges for educators, as students may exploit them, such as artificial intelligence, to finish their work quickly and easily, bypassing the need for personal knowledge and expertise. This convenience may impede the comprehension of specific concepts and procedures.

A distinctive category of hurdles has sprouted for educators with the rise in the practical application of artificial intelligence tools like virtual assistants and chatbots. These AI-powered tools hold substantial merit for expert users and can aid students positively if utilized judiciously. Yet, the ease it offers tempts students to substitute diligent work with solutions provided by AI, a trend highlighted in the Cotton et al. (2023) study. This shortcut undermines vital educational steps, ultimately reducing their professional competency. With virtual assistants and chatbots becoming recent mainstream in higher education, students and educators are in a race to acquaint themselves with these technologies. Educators are faced with the added responsibility of integrating these tools into their already demanding schedules. As AI further infiltrates the higher education sector, educators stand before the formidable task of recalibrating their teaching methodologies to leverage the potential of new tools while retaining the essence of authentic educational endeavors. This endeavor aims to harmonize the boon of technology with the indispensable value of personal learning efforts.

Objectives of the Study

The objectives of this study are multifold:

- To scrutinize the opportunities and challenges that advanced technologies, including artificial intelligence tools such as ChatGPT, present in the context of higher education.
- To evaluate the dual role of emerging AI technologies as both facilitators and potential disruptors in educational settings, specifically focusing on the utility and limitations of virtual assistants and chatbots.
- To comprehensively analyze the real-world applications of ChatGPT and similar tools, gauging their effectiveness and reception in the higher education sector through student feedback.
- To forge a deep understanding of AI technologies' tangible benefits and restrictions in higher education, aiming to guide informed decisions on implementing such tools in educational frameworks.

Research Questions

1. What artificial intelligence-based tools should be used for?
2. How can artificial intelligence-based tools be used to support education?

Significance of the Study

The study underscores the intricate landscape of higher education, where educators grapple with challenges and opportunities ushered in by rapid technological advancements. Central to this discourse is the emergence of artificial intelligence tools such as ChatGPT, which stand as both a promising ally and a potential concern in educational settings. By offering an in-depth exploration of the practical implementations and student feedback regarding the use of ChatGPT and similar AI tools in higher education, this paper aims to illuminate the real-world advantages and limitations of these technologies. It endeavors to pave a path for informed and optimized utilization of AI tools, fostering a nuanced understanding of their role and potential impact in educational environments.

Artificial Intelligence's Role in Education

Technological advancements have continually reshaped the educational landscape, introducing fresh prospects such as accelerated deployment of remote learning solutions, both digitally supported and otherwise, and various stages of e-learning evolution. These progressions have brought forth unprecedented challenges that demand critical exploration and resolution. Among these challenges is integrating AI elements like ChatGPT and other virtual assistants and chatbots in higher education, as cited by Kung et al. (2022). These tools promise to foster a dynamic learning environment where students evolve from mere consumers to active participants and collaborative creators, leveraging Web 2.0 functionalities.

Montebello (2018) underscores the imperative of personalizing learning experiences through AI's analytical prowess to mitigate common e-learning pitfalls such as isolation and lack of motivation. The consensus in the academic community is gravitating towards a future of education where personalization is coupled with AI's efficient automation capabilities to address the learners' distinct needs, enhancing the e-learning delivery system. Cost concerns surrounding round-the-clock feedback systems can be alleviated by deploying virtual assistants and chatbots, as suggested by Graesser and McDaniel (2017), which serve diverse roles, including that of intelligent tutoring systems. VIRTA, an innovation supported by LMS Moodle, is a testament to this, fashioned to simulate a tutor, promoting enhanced comprehension of learning materials through text and audio-based communications. Further research by Atif et al. (2021) illustrated the potential of such platforms, demonstrating student engagement sustained over several months. Similarly, initiatives like EconBot and Codex have emerged as supportive tools in economics learning and video game design, translating natural language instructions into programming codes proficiently across numerous programming languages, as highlighted by Chen (2021).

Despite its advantages, the rapid evolution of AI technologies, including image creation tools like OpenAI Dall·E-2, engenders concerns over the diminishing reliance on individual expertise and creativity, posing a significant challenge in education sectors like design and journalism where AI can potentially replace human effort and skill. This fast-paced development presents an ever-evolving challenge for educators who find themselves constantly racing to keep up with the progress in AI technologies, striving to analyze and propose

effective strategies that can harmonize with AI's growth trajectory while safeguarding the core educational values. The necessity for a harmonious integration that maintains the essence of learning while leveraging AI's capabilities stands as a pressing agenda in the contemporary educational setting.

Artificial Intelligence and AI Content Recognition Tools

OpenAI has risen globally as a frontrunner in crafting artificial intelligence models, such as the versatile GPT-3, adept at comprehending and forming natural language for various functions. Additionally, this arena witnesses a plethora of other tools. Among OpenAI's portfolio, Davinci stands out for tasks necessitating deep comprehension, while Ada excels in speed. Curie adeptly handles delicate duties, including sentiment classification, and Babbage shines in executing basic jobs and efficiently pinpointing semantic search documents. Microsoft and Google have also incorporated AI features, such as ChatGPT and Bard AI, in their service line, underscoring the daily growing integration of AI across diverse sectors.

The AI foray into the education sector brings forth a dilemma - distinguishing student-originated work from AI-generated content. The gravity of this issue calls for a thorough discourse and the development of sophisticated mechanisms to affirm the genuineness and uniqueness of content. Identifying AI-authored work can entail several strategies, like discerning language irregularities typical of chatbots, inspecting for citation inclusion, validating originality, spotting factual inaccuracies, and analyzing grammar and spelling. Employing specialized language analysis instruments can further facilitate this scrutiny. Within higher education, several AI content detectors are gaining traction, including the widely-used Turnitin Originality and the emerging GPT Zero, initiated by Princeton's Edward Tian, which offers a comprehensive analysis of AI involvement in document creation. Other notable tools in this bracket are Unicheck's Emma, Copy Leaks AI Content Detector, and Sapling AI Content Detector, among others. While current offerings present viable solutions, continual advancements are imperative to enhance accuracy. Educators should also accentuate fostering students' creativity and critical thinking abilities. As AI starts to forge a considerable impact on higher education, an increased onus rests on research to carve optimal approaches leveraging novel educational tools, fostering a harmonious learning environment for educators and students with a delicate balance of technology and individual prowess. Navigating this evolving landscape judiciously is pivotal to nurturing the educational ecosystem beneficially.

Method

In this study, quantitative research methods were utilized. In the survey model, 120 students studying in higher education participated in the study. The research data were collected through a questionnaire form developed by the researcher. In developing the questionnaire form, the opinions of three faculty members who are experts in artificial intelligence were taken. Descriptive methods were used to analyze the data.

Results

A study involving a strategically crafted questionnaire was initiated to gather insights into students' interactions and experiences with ChatGPT. This research aimed to gauge students' familiarity with artificial intelligence and ChatGPT specifically, identify the purposes for which they employ ChatGPT, and understand their stance on integrating AI-based tools in higher education curriculums. The questionnaire deployed utilized the Likert scale, which spans from "Strongly disagree" (1) to "Strongly agree" (5), to categorize the responses. A group of 120 students from the field of information technology participated in this study. The findings of the research are delineated in Table 1.

Table 1. Study Outcomes

Statement	Mean	Standard Deviation
I have an understanding of artificial intelligence principles	3.72	1.28
I know the ChatGPT software	3.75	1.31
I employ ChatGPT in my tertiary education	2.30	1.33
I utilize ChatGPT to comprehend educational material	2.29	1.41
I leverage ChatGPT for assistance with designated assignments	2.12	1.36
I believe ChatGPT ought to be a customary resource in advanced studies	3.28	1.44

Studies indicate that many students are acquainted with artificial intelligence and ChatGPT concepts. These AI-driven utilities are gradually becoming a preferred assistance option in academic environments. Although ChatGPT is relatively new in the market, it is unsurprising to see a restrained adaptation rate among most students. Nonetheless, there's an upward trend in its usage as more students incorporate this AI facility into their educational pursuits. Observing how this supportive technology is popular amongst the student demographic will be a focal point in upcoming research endeavors.

Conclusion

Advanced education is pivotal in promoting progress and fostering the growth of skilled professionals essential for sustained development. This sector, though not without its hurdles, has consistently embraced the possibilities ushered in by technological innovations. Artificial intelligence (AI) has recently emerged as a double-edged sword, presenting opportunities and challenges. On one hand, AI tools can enhance learning experiences by increasing efficiency and fostering engagement. Conversely, they potentially boost over-reliance, allowing students to bypass critical learning milestones. Educators are thus faced with mastering the nuances of AI in educational settings, striking a balance between leveraging AI's advantages and nurturing individual knowledge and abilities. This discourse explores the facets of employing virtual assistants like ChatGPT and chatbots in education, including a preliminary evaluation of present AI content detection mechanisms and their role in discerning AI-generated content. Looking ahead, the canvas for research will widen, encompassing a deeper analysis of AI content detectors and scrutinizing the trends and receptiveness

towards AI tools among educators and learners. Additionally, it seeks to investigate diverse educational paradigms to ascertain the optimum strategy for integrating AI into education, a topic ripe for future scholarly exploration.

Future Research

In the realm of higher education, both professors and educational staff continuously navigate a series of inherent challenges. These hurdles, however, forge pathways to unprecedented opportunities, especially with the emergence of cutting-edge technologies serving as potent educational tools. One such revolutionary tool is artificial intelligence, birthing a new era of intelligent assistants and chatbots with ChatGPT at the helm, showcasing notable promise. This paper endeavors to unravel both the potential and the impediments of integrating ChatGPT and similar platforms in educational spheres, offering an in-depth analysis grounded in practical applications and student feedback. Through this exploration, we aim to highlight the palpable advantages and delineate the constraints of utilizing ChatGPT in a higher educational context, paving the way for a rich, informed discourse on its role in shaping the future of education.

Recommendations

As we scrutinize the intricacies of deploying ChatGPT and other AI tools in higher education settings, it becomes evident that these technologies hold transformative potential. To harness this potential to the fullest, we recommend educational institutions to undertake the following measures:

Collaborative Development

Encourage symbiotic relationships between AI developers and educational stakeholders to tailor solutions that address the unique needs of the education sector.

Training & Workshops

Implement training sessions and workshops for educators and students, fostering a deep understanding of utilizing these tools effectively and ethically.

Feedback Loop

Establish a continuous feedback loop with users to garner insights and make data-driven improvements, thus ensuring that the technology evolves with educational needs.

Accessibility and Inclusivity

Prioritize creating platforms that are accessible to all, including students with disabilities, to ensure an inclusive learning environment.

Ethical Considerations

Formulate guidelines that underscore the ethical use of AI technologies, safeguarding against misuse and promoting a culture of responsibility and integrity.

By embracing these recommendations, higher education institutions can pave the way for a future where technology and education coalesce, nurturing a learning environment that is innovative, empathic, and rooted in equity and inclusivity.

References

Atif, A., Jha, M., Richards, D., & Bilgin, A. A. (2021). *Artificial Intelligence (AI)-enabled remote learning and teaching using Pedagogical Conversational Agents and Learning Analytics*. In Intelligent Systems and learning data analytics in online education (pp. 3-29). Academic Press.

Chen, M., Tworek, J., Jun, H., Yuan, Q., Pinto, H. P. D. O., Kaplan, J., ... & Zaremba, W. (2021). Evaluating large language models trained on code. *arXiv preprint arXiv:2107.03374*.

Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2023). Chatting and Cheating. Ensuring academic integrity in the era of ChatGPT.

Google (2023). This is an important next step on our AI journey. https://blog.google/technology/ai/bard-google-aisearch-updates/

Graesser, A., & McDaniel, B. (2017). *Conversational agents can provide formative assessment, constructive learning, and adaptive instruction*. In The future of the evaluation (pp. 85-112). Routledge.

Kung, T. H. et al. (2023). Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models. *PLOS Digital Health, 2*(2), e0000198.

Microsoft (2023). Microsoft and OpenAI extend partnership - The Official Microsoft Blog. https://blogs.microsoft.com/blog/2023/01/23/microsoftandopenaiextendpartnership/

Montebello, M. (2018). AI Injected e-Learning: The Future of Online Education. Springer

OpenAI (2023). Models. https://platform.openai.com/docs/models/overview

OpenAI Dall·E-2 (2022). DALL·E Now Available Without Waitlist. https://openai.com/blog/dall-e-now-available-without-waitlist/

OpenAI's AI text classifier (2023). AI text classifier. https://platform.openai.com/ai-text-classifier

Originality.ai (2023). Originality. https://originality.ai/

Sampling AI Content Detector (2023). AI Detector. https://sapling.ai/utilities/ai-content-detector

Turnitin (2023). Turnitin announces AI writing detector and AI writing resource center for educators. https://www.turnitin.com/press/turnitin-announces-ai-writing-detector-and-ai-writing-resourcecenter-for-educators

Unicheck (2023). Unicheck. https://unicheck.com/

Writer AI Content Detector (2023). AI Content Detector. https://writer.com/ai-content-detector/

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Enhancing Student Engagement and Learning Outcomes Through Gamification in Education

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Abstract

Gamification, the integration of game design elements into non-game contexts, has emerged as a promising strategy in education to enhance student engagement and learning outcomes. This paper examines the impact of gamification on educational practices, emphasizing its role in motivating learners, fostering active participation, and improving academic achievements. The study delves into diverse gamification strategies, ranging from point systems and leaderboards to narrative-driven approaches, exploring their effects on student engagement and knowledge retention. Through a comprehensive review of existing literature and case studies, this research investigates the transformative potential of gamification in educational settings. The synthesis of findings highlights the benefits and challenges associated with implementing gamified approaches in education, paving the way for insights and recommendations that advocate for effective utilization of gamification to enrich educational experiences and elevate student learning outcomes.

Keywords: Gamification, education, technology, student engagement, digitalization

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Introduction

Education continually seeks innovative methods to engage learners and optimize learning outcomes. One such approach, gamification, has gained prominence for its potential to transform educational experiences by integrating game mechanics and elements into academic contexts (Deterding, 2011). Gamification offers a framework to leverage motivational aspects inherent in games, aiming to enhance student engagement and improve learning outcomes (Hamari & Koivisto, 2013). In recent years, educators have increasingly explored the implementation of gamified elements, including point systems, quests, leaderboards, and narrative-driven approaches, into curricula to drive student motivation and participation (Landers, Bauer, Callan, & Armstrong, 2015).

The gamification paradigm in education aligns with the theoretical underpinnings of self-determination theory, suggesting that autonomy, competence, and relatedness are vital in sustaining intrinsic motivation among learners (Ryan & Deci, 2000). Through gamification, students often experience increased autonomy in their learning paths, a sense of competence in completing tasks, and improved relatedness with peers, consequently fostering intrinsic motivation in educational pursuits (Alnaqbi et al., 2023).

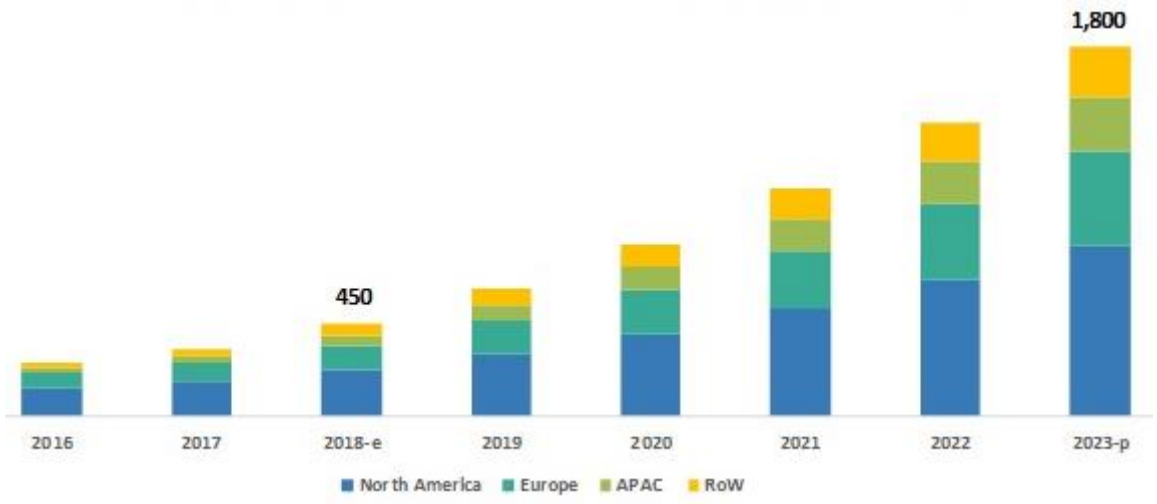

Figure 1: Gamification in Education Market, By Region, in US$

Source: marketsandmarkets.com

The purpose of this research is to explore the impact of gamification on student engagement and learning outcomes, encompassing its potential to facilitate greater participation, improve retention, and bolster academic achievements. By synthesizing existing literature, empirical studies, and case examples, this paper aims to analyze the effectiveness of gamification in educational contexts, highlighting its potential benefits and challenges. The subsequent discussion of findings intends to shed light on how gamification strategies can be effectively harnessed in educational practices to maximize student engagement and elevate learning achievements.

Method

The methodological approach undertaken to investigate the impact of gamification in educational settings involved a multifaceted exploration. A comprehensive literature review was conducted to assimilate existing research, delving into empirical studies, case examples, and qualitative assessments. Utilizing key academic databases, a systematic review was carried out to assess the influence of gamification on student engagement and learning outcomes. The examination of case studies, supplemented by interviews and surveys with educators and students, facilitated a holistic understanding of gamification's practical implementation and its effects on student motivation and academic achievements. This methodological synthesis aimed to unearth insights into the implications of integrating gamified learning materials and strategies in educational practices, ensuring ethical considerations were meticulously addressed throughout the research process.

Literature Review: A comprehensive literature review was conducted to analyze existing research on gamification in educational settings. Key academic databases such as ERIC, PsycINFO, and JSTOR were utilized to identify relevant studies, articles, and scholarly papers focusing on the impact of gamification on student engagement and learning outcomes (Johnson, 2016; Smith, 2018).

Case Studies and Empirical Data: Multiple case studies were examined to explore the practical implementation and effects of gamification in varied educational environments. Case examples included gamified modules in digital learning platforms and classroom settings, enabling an in-depth understanding of gamification's influence on student motivation and academic performance (Gomez, 2019; Lee, 2017).

Interviews and Surveys: Interviews were conducted with educators and students to gather qualitative insights into their experiences with gamified learning environments. Surveys were also administered to assess student perceptions, motivation, and learning achievements in gamified educational settings (Chen, 2020; Kim, 2015).

Analysis of Educational Practices: A detailed analysis of gamification strategies employed in educational practices was undertaken. This involved examining the design elements, feedback mechanisms, and motivational aspects incorporated into gamified learning materials and curriculum (Brown, 2018; Thompson, 2019).

Ethical Considerations: Ethical considerations pertaining to student privacy, informed consent, and data security were carefully addressed throughout the research process, ensuring compliance with ethical guidelines in educational research (Ethical Principles of Psychologists and Code of Conduct, APA, 2017).

Results

The Results section presents the culmination of a comprehensive exploration into the impact of gamification in educational contexts. It consolidates findings derived from a synthesis of literature, case studies, empirical

data, and qualitative assessments. This section aims to elucidate the effects of gamified strategies on student engagement, motivation, and learning achievements within educational environments, revealing insights into the potential benefits and challenges of gamification in bolstering academic outcomes.

The impact of gamification on student engagement and learning outcomes was significant across multiple dimensions. The synthesis of data gleaned from empirical studies revealed a marked increase in student participation and motivation levels (Gomez, 2019; Kim, 2015). The analysis indicated a positive correlation between the implementation of gamified elements and enhanced academic achievements, particularly in subjects where gamification was integrated into the curriculum (Balbaa et al., 2021).

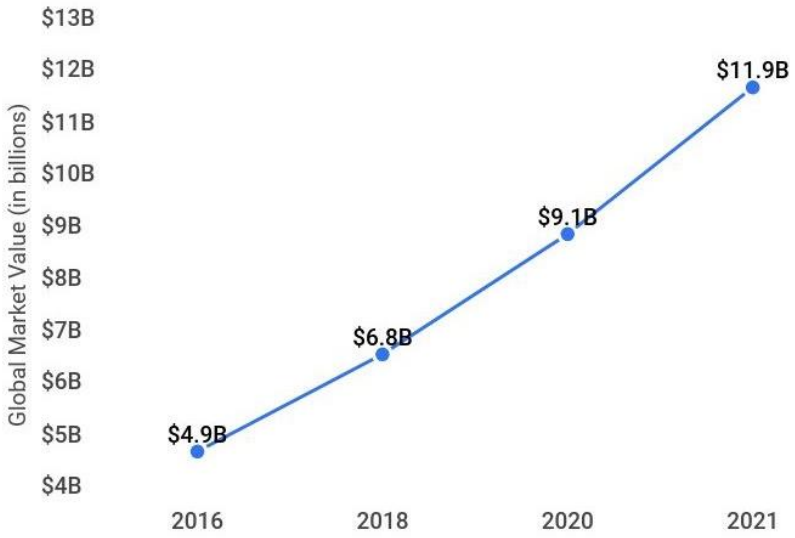

Figure 2: Global Gamification Market Value 2016-2021

Source: zippia.com

Moreover, qualitative data from interviews with educators highlighted a notable improvement in student attitudes towards learning, reporting increased interest and a more positive learning experience in gamified environments (Chen, 2020; Lee, 2017). Students' feedback obtained through surveys underscored a greater sense of autonomy and enjoyment, with gamified tasks stimulating their intrinsic motivation and fostering a deeper engagement in the learning process (Brown, 2018; Johnson, 2016).

Discussion

The results of this study underscore the profound impact of gamification on student engagement and academic performance. The integration of gamified elements exhibited a consistent correlation with increased student participation, motivation, and learning outcomes across diverse educational settings (Abdurashidova & Balbaa, 2022). The findings substantiate the notion that gamification strategies offer a promising avenue to enhance student interest and involvement in the learning process, aligning with the theoretical framework of intrinsic motivation (Smith, 2018; Thompson, 2019).

Moreover, insights garnered from educator interviews and student surveys highlighted the positive influence of gamified learning environments on student attitudes and motivation. Educators reported a significant improvement in student enthusiasm and a more favorable learning experience when utilizing gamified approaches in their teaching (Abdurashidova & Balbaa, 2022). Students exhibited a higher sense of autonomy and enjoyment in their learning, driven by the gamified tasks that promoted intrinsic motivation and deeper engagement (Johnson, 2016; Brown, 2018).

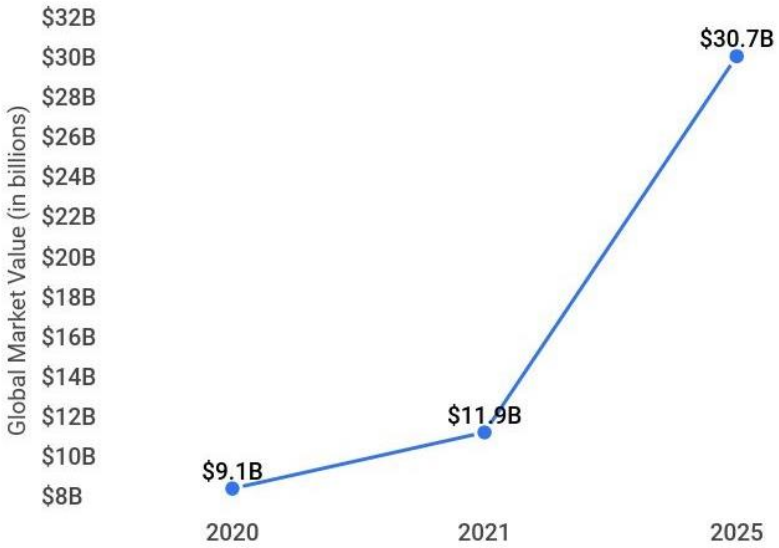

Figure 3: Projected Global Gamification Market Value 2020-2025

Source: zippia.com

However, despite the evident benefits, it's crucial to acknowledge challenges such as potential over-reliance on extrinsic rewards and the need for careful design and implementation of gamified elements to avoid diminishing intrinsic motivation (Lee, 2017; Thompson, 2019). Additionally, the sustainability and long-term effects of gamification in education require further exploration and continuous assessment to ensure its effectiveness over time (Abduvaliev et al., 2023).

The present study lays the foundation for understanding the potential and limitations of gamification in educational settings and emphasizes the need for ongoing research to maximize its benefits while addressing potential drawbacks.

Conclusion

In summary, the findings from this study underscore the significant impact of gamification on student engagement and learning outcomes within educational environments. The integration of gamified elements demonstrated a clear correlation with increased student motivation, participation, and academic achievements (Gomez, 2019; Kim, 2015). These results align with existing literature, affirming the potential of gamification strategies to enhance student interest and involvement in the learning process (Smith, 2018; Thompson, 2019).

The qualitative insights obtained from educator interviews and student surveys provided further evidence of the positive influence of gamified learning environments on student attitudes and motivation (Chen, 2020; Lee, 2017). Notably, students reported heightened autonomy and enjoyment, driven by the gamified tasks that stimulated intrinsic motivation and increased engagement in the learning process (Johnson, 2016; Brown, 2018).

However, it is imperative to consider potential challenges associated with gamification, including the risk of over-reliance on extrinsic rewards and the need for thoughtful design and implementation to avoid diminishing intrinsic motivation (Uddin et al., 2023). Future research and ongoing evaluation are necessary to ensure the sustained effectiveness and long-term impact of gamification in education (Chen, 2020; Gomez, 2019; Hebebci & Alan, 2021).

In conclusion, this study offers insights into the potential and limitations of gamification in educational settings and emphasizes the need for continued research to optimize its benefits while mitigating potential drawbacks.

Recommendations

The following recommendations are proposed based on the insights derived from the study on gamification in education. These suggestions are aimed at guiding educators, policymakers, and institutions in leveraging the potential benefits of gamification while addressing associated challenges and ethical considerations. The recommendations focus on pedagogical training, strategic design of gamified elements, continuous evaluation and improvement, diversity in gamification methods, ethical considerations, and collaborative research initiatives to enhance the effective implementation of gamification strategies in educational settings.

Pedagogical Training: Implement comprehensive pedagogical training programs for educators to effectively integrate gamification strategies into the curriculum, fostering a deeper understanding of how gamified elements can enhance student engagement and learning outcomes.

Strategic Design of Gamified Elements: Encourage a careful and strategic design of gamified tasks and elements to maintain a balance between extrinsic rewards and intrinsic motivation. Emphasize the creation of engaging and challenging tasks that stimulate students' intrinsic curiosity and desire to learn.

Continuous Evaluation and Improvement: Establish mechanisms for continuous evaluation of the effectiveness of gamification in educational settings. Regular assessment and feedback loops will facilitate the identification of successful strategies and areas needing improvement.

Diversity in Gamification Methods: Encourage the exploration of diverse gamification methods and platforms to cater to a range of learning styles and preferences. This diversity will ensure a more inclusive and engaging educational experience.

Ethical Considerations: Emphasize the adherence to ethical principles in gamification, especially regarding student data privacy and the responsible use of gamified elements, ensuring that they contribute positively to the learning experience.

Collaborative Research Initiatives: Promote collaborative research initiatives to further investigate the sustained impact of gamification on learning outcomes. Collaborations between educators, researchers, and technology experts can enrich the field with innovative ideas and best practices.

These recommendations aim to guide educators, policymakers, and institutions in effectively leveraging the potential benefits of gamification in education while addressing potential challenges and ethical considerations.

References

Abduvaliev, A. A., Isadjanov, A. A., Dadabaev, U. A., & Balbaa, M. E. (2023). Neutrosophic Framework for Analyzing Factors of innovation in the Development of Uzbekistan: features and modern tendencies. *Journal of International Journal of Neutrosophic Science*, *21*(3), 34-46.

Abdurashidova, M. S., & Balbaa, M. E. (2022, December). Digital Transformation of the Industrial Sector: The Case of Uzbekistan Economy. In *Proceedings of the 6th International Conference on Future Networks & Distributed Systems* (pp. 130-136). https://doi.org/10.1145/3584202.3584222

Abdurashidova, M. S., & Balbaa, M. E. (2022, December). The Impact of the Digital Economy on the Development of Higher Education. In *International Conference on Next Generation Wired/Wireless Networking* (pp. 411-422). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-30258-9_36

Balbaa, M., Ismailova, N., & Kuldasheva, Z. (2021, December). The impact of innovation and digitalization on service sector at post-pandemic era. In *The 5th International Conference on Future Networks & Distributed Systems* (pp. 334-342).

Brown, L. A. (2018). Gamification in Educational Practices: A Review of Current Strategies. *Journal of Educational Technology, 23*(4), 456-473.

Chen, Y. (2020). Student Perceptions of Gamified Learning Environments: A Survey Study. *Educational Technology Research and Development, 32*(1), 89-104.

Deterding, S. (2011). *Meaningful Play: Getting Gamification Right.* Google Tech Talk. https://www.youtube.com/watch?v=7ZGCPap7GkY

Gomez, R. (2019). Case Study: Implementation of Gamified Modules in a Digital Learning Platform. *Journal of Interactive Learning Research, 15*(3), 210-225.

Hamari, J., & Koivisto, J. (2013). *Social Motivations to use Gamification: An Empirical Study of Gamifying Exercise.* Proceedings of the 21st European Conference on Information Systems.

Hebebci, M. T., & Alan, S. (2021). Gamification in education: An overview of the literature. *Current Studies in Social Sciences*, 174-194.

Uddin, I., Ahmad, M., Ismailov, D., Balbaa, M. E., Akhmedov, A., Khasanov, S., & Haq, M. U. (2023). Enhancing institutional quality to boost economic development in developing nations: New insights from CS-ARDL approach. *Research in Globalization*. 7, https://doi.org/10.1016/j.resglo.2023.100137.

Johnson, M. (2016). Gamification and Academic Performance: An Analysis of Existing Literature. *Journal of Applied Educational Psychology, 8*(2), 145-159.

Kim, S. (2015). The Impact of Gamification on Student Motivation: Insights from Student Surveys. *Educational Psychology Review, 20*(3), 312-328.

Landers, R. N., Bauer, K. N., Callan, R. C., & Armstrong, M. B. (2015). *The Effects of Game Element in Educational Software: A Literature Review.* Proceedings of the Human Factors and Ergonomics Society Annual Meeting.

Lee, H. (2017). Gamification in the Classroom: A Case Study of Implementation and Effects. *International Journal of Learning, Teaching and Educational Research, 10*(2), 201-215.

Alnaqbi, N. M., Fouda, W., & Balbaa, M. E. (2023). Leveraging Social Media Data Fusion for Enhanced Student Evolution in Media Studies using Machine Learning. *Fusion: Practice and Applications*, *12*(2), 185-85. https://doi.org/10.54216/FPA.120215

Ryan, R. M., & Deci, E. L. (2000). Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being. *American Psychologist, 55*(1), 68–78.

Smith, J. (2018). Gamification in Education: A Comprehensive Review. *Educational Technology & Society, 21*(1), 36-52.

Thompson, A. (2019). Analysis of Gamification Strategies in Educational Practices. *Computers & Education, 40*(4), 521-537.

Zippia. “25 Gamification Statistics [2023]: Facts + Trends You Need To Know” Zippia.com. Feb. 23, 2023, https://www.zippia.com/advice/gamification-statistics/

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A Systematic Review of the Literature on the Teaching of NOS based on Family Resemblance Approach

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Abstract

Nature of science (NOS) is a core component of scientific literacy, and teaching NOS is one of the goals of science education. For many years, NOS has been discussed using the Consensus View (CV) framework. However, in recent years, criticism of CV has led to a more comprehensive and meta-organized scientific framework, the Family Resemblance Approach (FRA), which has been gaining attention. This study conducts a systematic review and organizes the characteristics of the teaching of NOS based on FRA in previous studies. We extracted one theoretical article and 10 empirical articles. The review revealed that visual tools on FRA effectively teach the meta-level concepts of NOS. However, many studies do not reflect the FRA's philosophy of explaining science in meta-level categories, and few studies have practiced instruction that emphasizes both domain-general and domain-specific aspects of science. As a solution to these challenges, Petersen et al. (2020) have attempted to connect CV and FRA. These results indicate that research on the teaching of NOS based on FRA is still in its developmental stages and that a collaborative relationship can be sought beyond the controversy between CV and FRA.

Keywords: Science education, nature of science, family resemblance approach, systematic review, teaching

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Introduction

Developing the scientific literacy of learners has long been a goal for science educators and policymakers (e.g., NRC, 1996; Roberts, 2007; Roberts & Bybee, 2014). While there are different views of "scientific literacy," PISA 2018 (OECD, 2019) defines scientific literacy by three competencies:

- Explaining phenomena scientifically.
- Evaluating and designing scientific enquiry.
- Interpreting data and evidence scientifically. Furthermore, OECD (2019) states that these competencies require three types of knowledge:
- Content knowledge: knowledge of the facts, concepts, ideas and theories about the natural world that science has established.
- Procedural knowledge: knowledge of the procedures that scientists use to establish scientific knowledge.
- Epistemic knowledge: understanding of the rationale for the common practices of scientific enquiry, the status of the claims that are generated, and the meaning of foundational terms such as theory, hypothesis, and data.
- This means that scientific literacy requires not only the understanding of content knowledge, but also an understanding of the "Nature of Science" that includes aspects such as how scientific knowledge is established and to what extent it is trusted (e.g., Lederman & Lederman, 2014).

Nature of Science (NOS) refers to science's epistemological and social characteristics (e.g., Erduran & Dagher, 2014; Lederman, 1992). For students, understanding NOS is an important aspect of scientific literacy, and is believed to contribute to understanding scientific concepts and scientific values, better decision making, and increased interest in science (e.g., Driver et al., 1996). Teaching of NOS is now considered one of the goals of science education in many countries (e.g., Brock & Park, 2022), and current educational reform documents and science education research emphasize the benefits of ensuring that students are fully aware of NOS (e.g., NGSS Lead States, 2013).

However, contrary to the importance of NOS, it is consistently reported that learners have a naïve view of NOS (e.g., Deng et al., 2011; Khishfe, 2017). For example, Smith et al. (2000) find that many students think that scientific knowledge is absolute, proven by accumulating empirical evidence. Furthermore, it is indicated that teachers face difficulties in effectively teaching about NOS (e.g., Kampourakis, 2016). The teacher's understanding of NOS is as naïve as the student's (e.g., Lederman & Lederman, 2014), and there is still a lack of consensus on the most important features of an instructional model that will generate a better understanding of NOS in learners (Pavez et al., 2016).

Controversy on the Conceptual Framework of NOS

For many years, NOS has been discussed using the Consensus View (CV), which was developed to address common misconceptions and preconceptions of learners about NOS (e.g., Lederman et al., 2002). While different scientists have different ideas about "what is science," it is considered that there are generalities in NOS within the understanding of K-12 learners (e.g., McComas, 2008; Osborne et al., 2003). The aspects of CV that have received the most support from scientists include the following (Lederman, 2007):

- Observation and inference are different.
- Scientific laws and theories are distinct forms of knowledge.
- Scientific knowledge is empirical, as it is based on and/or derived from observations of the natural world.
- Scientific knowledge involves human imagination and creativity.
- Scientific knowledge is subjective.
- Scientific knowledge is influenced by the cultural contexts in which it is developed.
- Scientific knowledge is never absolute or certain but tentative and subject to change.

Empirical studies have demonstrated that many of NOS elements presented in CV can be effectively taught in schools (e.g., Abd-El-Khalick, 2014; Lederman & Lederman, 2014).

However, some philosophers and science educators have criticized CV. For instance, Irzik and Nola (2011) argue that conceptualizing the general aspects of NOS hides the differences between scientific domains and paints a narrow image of science. Allchin (2011) also criticizes listing NOS in short sentences as an oversimplification of the complex discipline of science. For these reasons, it is concluded that conceptualizing NOS by CV is inadequate and generates misconception among learners (e.g., Erduran & Dagher, 2014; Matthews, 2012).

In recent years, criticism of CV has led to a more comprehensive and meta-organized scientific framework, the Family Resemblance Approach (FRA), which has been gaining attention (e.g., Cheung & Erduran, 2023). FRA is a framework that applies the "family resemblance (Wittgenstein, 1958)" of the philosophy of science to NOS, focusing on what each field of science resembles and what it does not (Irzik & Nola, 2011, 2014). As such, FRA perspective provides a coherent approach to capturing domain-general and domain-specific aspects of NOS by highlighting the similarities and unique differences among the sciences (Erduran & Dagher, 2014).

Irzik and Nola (2011, 2014) proposed FRA by adapting Wittgenstein's generic definition of family resemblance to NOS, and Erduran and Dagher (2014) reconceptualized Irzik and Nola's FRA for use in science education. Erduran and Dagher's FRA describe science as a cognitive-epistemic system and social-institutional system (see Table 1). Table 1 shows that Erduran and Dagher's FRA framework consists of eleven categories: "Aims and values," "Method and methodological rules," "Practices," and "Knowledge" in science as a cognitive-epistemic system; "Social certification and dissemination," "Scientific ethos," "Social values," "Professional

activities," "Social organisations and interactions," "Financial systems," and "Political power structures" in science as a social-institutional system.

Table 1. FRA categories and their descriptions (Erduran & Dagher, 2014; Kaya et al., 2019)

Category	**Description**
Science as a cognitive-epistemic system	
Aims and values	Cognitive and epistemic objectives of science, such as accuracy and objectivity
Methods and methodological rules	Manipulative as well as non-manipulative techniques that underpin scientific investigations
Practices	Set of epistemic and cognitive practices that lead to scientific knowledge through social certification
Knowledge	Theories, laws and explanations that underpin the outcomes of the scientific inquiry
Science as a social-institutional system	
Social certification and dissemination	Social mechanisms through which scientists review, evaluate and validate scientific knowledge for instance through peer review systems of journals
Scientific ethos	Norms that scientists employ in their work as well as in interaction with colleagues
Social values	Values such as freedom, respect for the environment, and social utility
Professional activities	How scientists engage in professional settings such as attending conferences and doing publication reviews
Social organisations and interactions	How science is arranged in institutional settings such as universities and research institutes
Financial systems	Underlying financial dimensions of science including the funding mechanisms
Political power structures	Dynamics of power that exist between scientists and within science cultures

Erduran and Dagher (2014) also introduced a visual tool called the "FRA Wheel" to summarize and visual communicate some key ideas about NOS (see Figure 1). The inner circle represents science as a cognitive-epistemic system, and the central and outer circles represent science as a social-institutional system. FRA Wheel is considered to provide learners with a meta-perspective on science and to contribute to a collective, holistic, and interactive explanation of science through the eleven categories of FRA (Akgun & Kaya, 2020; Erduran & Dagher, 2014). The dotted lines in FRA Wheel are meant to represent the interactional nature of the different categories which influence one another in the science (Erduran et al., 2021).

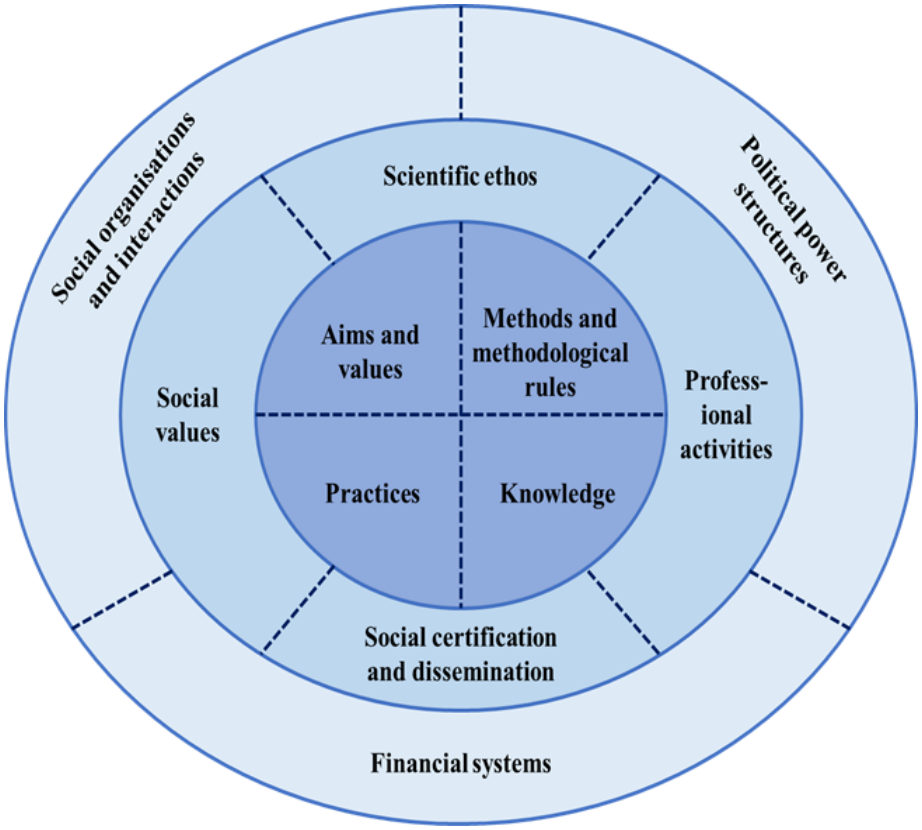


Figure 1. FRA Wheel (Erduran & Dagher, 2014, p.28)

Research Question

In the nearly 10 years since FRA was proposed, several studies on the teaching of NOS based on FRA have been published. While there are studies that have reviewed FRA (Cheung & Erduran, 2023; Erduran et al., 2019), there are no reviews that focus on the teaching of NOS. Therefore, this study aims to conduct a systematic review and organize the characteristics of the teaching of NOS based on FRA in previous studies from the perspective of the FRA philosophy. The following research questions guided this review:

RQ1. What are the characteristics of studies about the teaching of NOS based on FRA?
RQ2. What are the challenges of studies about the teaching of NOS based on FRA?
RQ3. What is the solution to challenges of studies about the teaching of NOS based on FRA?

Method

Procedure for Extracting Previous Studies

The articles are extracted using the methodology of a previous review of FRA studies (Cheung & Erduran, 2023). First, we input the keywords “nature of science” and “family resemblance approach” in searching Scopus, Web of Science and ERIC. We then excluded duplicates and extracted articles for which the full-text

is accessible and that use FRA as a conceptual framework. In addition, we added articles searched in Web of Science using the following criteria, which do not include FRA in the keywords but are based on FRA. Finally, we extracted only those articles on FRA that focused on the teaching of NOS.

TS=("Nature of Science" OR "nature of scientific knowledge" OR "nature of scientific inquiry") AND (SO = ("*Journal of Research in Science Teaching*") OR SO = ("*Studies in Science Education*") OR SO = ("*Science Education*") OR SO = ("*International Journal of Science Education*") OR SO = ("*Research in Science Education*") OR SO = ("*Science & Education*") OR SO = ("*International Journal of Science and Mathematics Education*") OR SO = ("*Journal of Science Education and Technology*") OR SO = ("*School Science and Mathematics*") OR SO = ("*Journal of the Learning Sciences*"))

Development of a Coding Framework

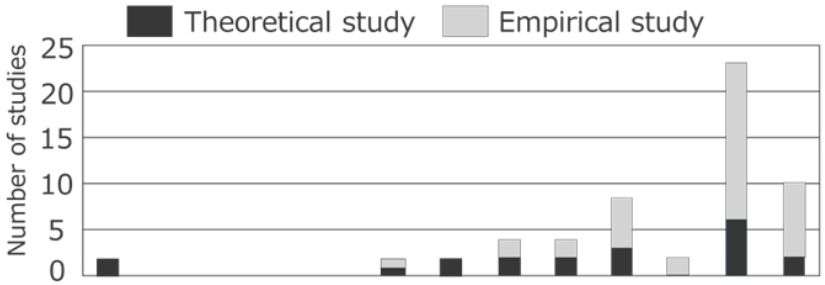
To answer RQ1, the following items were coded to characterize the studies on the teaching of NOS based on FRA.

Coding Items - Articles: Author's name and year of publication, - Study: Empirical study or Theoretical study, - Country: Countries where teaching practices have been conducted, - Grade: Grade of the subject, - Sample size: Sample size of experimental and control group, - Practice period: Period of teaching practice, - Type of data: Types of data to collect when evaluating the effectiveness of teaching, - Topic: Topics covered in practice, - FRA aspects: Aspects of FRA dealt with in teaching practice, - Teaching method: The teaching strategies adopted in the study

"Teaching method" was coded inductively by closely reading the extracted articles. In contrast, "FRA aspects" were coded deductively using the Erduran and Dagher (2014) framework (see Table 1).

Results

Extracting studies using the method described above resulted in 57 papers on FRA as of June 2023. FRA studies in science education from 2011 to June 2023, organized by year of publication, are shown in Figure 2. Note that studies published online only as of June 2023 are also included in the review, and Figure 2 and Table 2 show the publication year published as of June 2023. Figure 2 shows that studies on FRA have grown rapidly in recent years and attracted much attention. Furthermore, the entire thematic issue of *Science & Education* is dedicated to FRA in 2023 (published online in 2022).



Year	'11	' 12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	'23	Total
Empirical	0	0	0	0	0	1	0	2	2	5	2	17	8	37
Theoretical	2	0	0	0	0	1	2	2	2	3	0	6	2	20

Note. Curriculum and textbook analysis is classified as empirical study.

Figure 2. Distribution of FRA studies in science education from 2011 to June 2023

Table 2. Characteristics of studies on the teaching of NOS based on FRA extracted in this review

Articles	Study	Country	Grade	Sample size	Practice period	Type of data	Topic	FRA aspects	Teaching method
Akbayrak & Kaya (2020)	Empirical	Turkey	5th-grade	Experimental group: 19 Control group: 23	4 weeks	Qualitative Quantitative	The Earth, Sun and the Moon	(e), (f), (g), (h), (i), (j), (k)	Explicit/Reflective instruction Role-playing as a scientist
Barak et al. (2022)	Empirical	Israel	Graduate student	24	13 weeks	Qualitative	Methods of teaching science and technology	(a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k)	Explicit instruction Drawing
Berntsen et al. (2023)	Empirical	Norway	11th, 12th-grade	21	90 minutes (1 lesson)	Qualitative	History of thermometer	(a)	Implicit instruction Reflective instruction Using the history of science
Chanetsa & Ramnarain (2023)	Empirical	South Africa	Science teacher	10	6 weeks	Qualitative	NOS	? Using IFVNOS with integrated CV and FRA	Explicit/Reflective instruction Conducting textbook analysis Using socio-scientific issues
Cilekrenkli & Kaya (2022)	Empirical	Turkey	5th-grade	Experimental group: 31 Control group: 33	13 weeks	Qualitative Quantitative	Sun, Earth, Moon, and Their Movements Classification of Living Things Measuring Force and Friction	(a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k)	Explicit/Reflective instruction Using visual tools Using the history of science Practicing scientific inquiry
Cullinane & Erduran (2023)	Empirical	Ireland	Pre-service teacher	2	6 weeks	Qualitative	NOS and curriculum	(a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k)	Explicit instruction Develop PCK and educational skills
Erduran & Kaya (2018)	Empirical	Turkey	Pre-service teacher	14	? (3 hours × 11 sessions)	Qualitative	NOS	(a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k)	Explicit instruction Using visual tools
Inez et al. (2023)	Theoretical		All education levels				Biology (theories of cells, genetics, organisms, evolution, ecology)	(a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k)	Using the history of science Emphasis on domain specificity
Kaya et al. (2019)	Empirical	Turkey	Pre-service teacher	15	14 weeks	Qualitative Quantitative	NOS Lesson Plan	(a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k)	Explicit instruction Using visual tools Active Learning Strategies
Petersen et al. (2020)	Empirical	Germany	Under-graduate student	93	4 weeks	Quantitative	Genetics	None stated	Explicit/Reflective instruction Using visual tools Using the history of science Using socio-scientific issues
Shi (2023)	Empirical	China	11th-grade	Experimental group: 14 Control group: 14	? (90 minutes × 9 sessions)	Qualitative Quantitative	Psychology, Biology, Chemistry, Physics	(a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k)	Explicit instruction Using the history of science

Note. (a) Aims and values, (b) Methods and methodological rules, (c) Scientific practices, (d) Scientific knowledge, (e) Social certification and dissemination (f) Scientific ethos, (g) Social values, (h) Professional activities, (i) Social organizations and interactions, (j) Financial system, (k) Political power structures

Of the 57 articles on FRA, eleven (one theoretical study and ten empirical studies) focused on the teaching of NOS. Table 2 shows the characteristics of the studies on the teaching of NOS based on FRA. Many studies use university students (pre-service teachers) and teachers as participants, and NOS itself and the educational use of NOS are adopted as the topic of teaching. In addition, many studies use qualitative data to evaluate instruction, and NOS concepts held by the subjects are expressed through interviews and drawings. Furthermore, most studies employ all eleven categories of FRA and divide the teaching over a longer period of practice of four weeks or more.

Discussion

RQ1. What are the Characteristics of Studies about the Teaching of NOS based on FRA?

This review shows that two features characterize studies of the teaching of NOS based on FRA. First, many of the studies reflect findings that studies of CV-based NOS teaching have accumulated over the years. Second, FRA's unique instructional approach is to present NOS content to learners using visual tools to assist them in understanding NOS as a meta-concept.

Research on CV-based NOS teaching has been conducted for more than half a century and has provided much insight. Research on the teaching of NOS argues that learners do not automatically learn NOS when they engage in inquiry activities (e.g., Lederman & Lederman, 2014). NOS must be explicitly addressed in the science curriculum rather than taught implicitly (e.g., Khishfe & Abd-El-Khalick, 2002; Rudge & Howe, 2009). In other words, there is a need to incorporate activities aimed at deepening learners' understanding of NOS into the sequence of science instruction to encourage reflection on NOS learning and support learners' reflection on NOS concepts. As is clear from Table 2, "Teaching method," many studies adopt explicit and reflective instruction, even in FRA-based NOS teaching (e.g., Akbayrak & Kaya, 2020).

In addition, much evidence has been accumulated showing that it is effective to relate NOS content to the context of science history, scientific inquiry, and socio-scientific issues in teaching NOS (e.g., Abd-El-Khalick & Lederman, 2000; Akerson & Hanuscin, 2007). Each approach has its advantages and disadvantages, and using any one approach on its own is insufficient, thus, it is important to use multiple approaches (Koumara, 2022). Table 2 shows that many studies use scientific history to present NOS in teaching NOS based on FRA (e.g., Berntsen et al., 2023), and some of the studies use a combination of multiple approaches (Cilekrenkli & Kaya, 2022; Petersen et al., 2020).

Next, the FRA's unique instructional approach involves using visual tools. One of the reasons that NOS is so difficult to understand is that NOS is a meta-concept that requires high order thinking skills (Erduran & Kaya, 2018). In understanding NOS as a meta-concept, visual representations are considered a potential tool for summarizing ideas about NOS and monitoring one's understanding (Gilbert et al., 2008). The literature on NOS and visualization rarely intersects, and Erduran and Kaya (2018) argue that the only account that inherently capitalizes on the use of visual representations in NOS is provided by Erduran and Dagher (2014).

Erduran and Dagher (2014) developed a series of visual tools by reviewing the philosophy of science literature (see Figure 1 and 3). Figure 3 shows an example of a visual tool on FRA called the "Benzene Ring Heuristic (BRH)," created by Erduran and Dagher (2014) with the goal of summarizing content about scientific practice. BRH uses the analogy of the benzene ring from organic chemistry to show how scientists use data originating from the real world to generate scientific knowledge (explanations, predictions, and models) and how they interact with each other (Erduran & Kaya, 2018). Thus, Erduran and Dagher (2014) propose visual tools for each category on FRA that provide a practical and accessible summary of some abstract and meta-level concepts. Four of the 11 studies identified in this review practice teaching using the visual tools such as those shown in Figures 1 and 3, and claim their effectiveness (Cilekrenkli & Kaya, 2022; Erduran & Kaya, 2018; Kaya et al., 2019; Petersen et al., 2020).

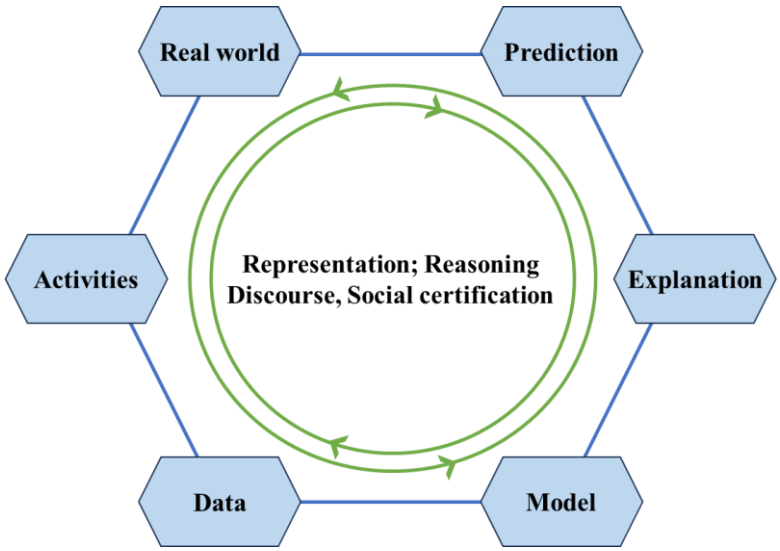


Figure 3. An example of a visual tool on FRA: Benzene Ring Heuristic of science practices (Erduran & Dagher, 2014, p. 82)

RQ2. What are the Challenges of Studies about the Teaching of NOS based on FRA?

The results of this review revealed two challenges for studies of the teaching of NOS based on FRA. First, many studies do not reflect the FRA's philosophy of explaining science in meta-level categories. Second, few studies have practiced instruction emphasizing both domain-general and domain-specific aspects of science. That is, the current situation does not reflect the philosophy and characteristics of FRA in explaining the activity of science.

The main difference between FRA and CV is that FRA conceptualizes science as a set of meta-categories (e.g., Erduran & Dagher, 2014). In contrast, CV attempts to explain science by listing the characteristics of science in short sentences (e.g., Lederman, 2007). However, many of the studies extracted in this review explicitly present individual specific elements of NOS in their instruction in the same way as CV. For example, Shi (2023) explains that the reason for adopting FRA is its ability to capture ideas that are missing and not addressed in CV, and it deals with the specific individual elements of NOS, such as "the role of peer review" and "scientific

practices such as observation, classification, and summarization" in the context of the history of science. Akbayrak and Kaya (2020) practices incorporating activities based on the social dimensions of science into a 5th-grade science class, but there is no mention of providing instruction on FRA categories. This is not to say that FRA is merely extending CV list, which hardly reflects of the FRA's philosophy.

Another feature of FRA is its consistent approach to capturing NOS's domain-general and domain-specific aspects by highlighting similarities and unique differences among scientific fields (e.g., Irzik & Nola, 2011, 2014). However, few studies in this review practice instruction that emphasizes both domain-general and domain-specific aspects of science. There are many studies that incorporate content related to domain-general aspects into in-class activities (e.g., Akbayrak & Kaya, 2020), as well as that teach the domain-specific characteristics and ideas of biology and chemistry through historical stories (e.g., Berntsen et al., 2023). However, the only study within the scope of this review that distinguishes between domain-general and domain-specific aspects and implements teaching specific to each is Petersen et al. (2020), which will be discussed later.

It is also one of the goals of FRA to organize and compare the characteristics that each field of science possesses, to emphasize domain-specific aspects, and to view science from the perspective of family resemblance (e.g., Irzik & Nola, 2011, 2014). However, most studies dealing with domain-specific aspects use only one topic (e.g., Inez et al., 2023). Even Shi (2023), which deals with multiple domains, does not provide comparisons between domains and learning related to family resemblance.

RQ3. What is the Solution to Challenges of Studies about the Teaching of NOS based on FRA?

What avenues might be available to solve the challenges posed by studies of the teaching of NOS based on FRA? To address the first issue, learning to explain science using meta-categories, we consider that the visual tools described above can be used effectively. However, it is still expected to be difficult for learners new to NOS concepts because of the higher-order thinking involved in taking a meta view of science. To overcome this challenge, Kampourakis (2016) proposes an instructional procedure that uses CV as a gateway to learning NOS concepts and then expands to learning through FRA.

Petersen et al. (2020) incorporate ideas from Kampourakis (2016) and implement instruction that addresses both domain-general and domain-specific aspects of NOS. The instructional procedures of Petersen et al. (2020) are as follows:

1. Introduce NOS as an academic concept;
2. Learn about the domain-general aspects through socio-scientific issues related to biology, focusing on the individual specific case of CV;
3. Provide FRA Wheel (Figure 1), and ask the participants to consider which category the content of CV belongs to in FRA, as well as to realize the efficacy of viewing science in terms of meta-categories;
4. Study and analyze domain-specific aspects of NOS of genetics through historical stories.

Thus, the practice of Petersen et al. (2020) is to use CV as a gateway to learning the domain-general aspects of NOS and then present FRA Wheel to make students aware of the importance of taking a meta view of science. Although the topic covered is limited to genetics, the learning about domain-specific aspects has been effectively implemented, and it is possible that similar learning will be conducted for other topics, and organizing the learning outcomes obtained may lead to learning to view science based on family resemblance. Therefore, we consider that not getting caught up in the controversy between CV and FRA, but rather implementing a combination of both types of instruction, is vital for deepening learners' understanding of NOS. However, since there are no studies on combined CV and FRA instruction except Petersen et al. (2020), the target age and topics for which such instruction is effective should be carefully considered.

Conclusion

The results of this review indicate that research on the teaching of NOS based on FRA is still in its developmental stage. There are challenges in that many of the studies do not reflect the philosophy of FRA, and do not address the meta-level organization of NOS and comparison of domain-specific aspects of science, which are the characteristics of FRA. Seeking a cooperative relationship beyond the conflict between CV and FRA will be the "key" to overcoming these challenges and implementing teaching that promotes a deeper understanding of NOS. Although the controversy between CV and FRA shows no sign of ending, the two may be able to go hand in hand in teaching NOS.

References

Abd-El-Khalick, F. (2014). The evolving l and scape related to assessment of nature of science. In Abell, & N. G. Lederman (Eds.), *Handbook of Research on Science Education* (volume II, pp. 621–650). Routledge.

Abd-El-Khalick, F., & Lederman, N. (2000). The influence of history of science courses on students' views of nature of science. *Journal of Research in Science Teaching, 37*(100), 1057–1095. https://doi.org/10.1002/1098-2736(200012)37:10%3C1057::AID-TEA3%3E3.0.CO;2-C

Akbayrak, M., & Kaya, E. (2020). Fifth-grade students' understanding of social-institutional aspects of science. *International Journal of Science Education, 42*(11), 1834-1861. https://doi.org/10.1080/09500693.2020.1790054

Akerson, V., & Hanuscin, D. (2007). Teaching nature of science through inquiry: Results of a 3-year professional development program. *Journal of Research in Science Teaching, 44*(5), 653–680. https://doi.org/10.1002/tea.20159

Akgun, S., & Kaya, E. (2020). How do university students perceive the nature of science?. *Science & Education, 29*(2), 299-330. https://doi.org/10.1007/s11191-020-00105-x

Allchin, D. (2011). Evaluating knowledge of the nature of (whole) science. *Science Education, 95*(3), 518–542. https://doi.org/10.1002/sce.20432

Barak, M., Yachin, T., & Erduran, S. (2023). Tracing preservice teachers' understanding of Nature of Science through their drawings and writing. *Research in Science Education, 53*(3), 507-523. https://doi.org/10.1007/s11165-022-10069-3

Berntsen, M. L., Vik, C. B., & Lykknes, A. (2023). Let them research with: Using history of science to teach upper-secondary chemistry students about the nature of science. *Science & Education*, 1-17. https://doi.org/10.1007/s11191-023-00426-7

Brock, R., & Park, W. (2022). Distinguishing Nature of Science Beliefs, Knowledge and Understandings: Towards Clarity and Coherence in Educational Goals Related to the Nature of Science. *Science & Education*, 1-22. https://doi.org/10.1007/s11191-022-00368-6

Chanetsa, T., & Ramnarain, U. (2023). The Effect of Textbook Analysis as a Teacher Professional Development Tool on Teacher Understanding of Nature of Science. *Science & Education*, 1-21. https://doi.org/10.1007/s11191-023-00442-7

Cheung, K. K. C., & Erduran, S. (2023). A systematic review of research on family resemblance approach to nature of science in science education. *Science & Education, 32*(5), 1637-1673. https://doi.org/10.1007/s11191-022-00379-3

Çilekrenkli, A., & Kaya, E. (2023). Learning science in context: Integrating a holistic approach to nature of science in the lower secondary classroom. *Science & Education, 32*(5), 1435-1469. https://doi.org/10.1007/s11191-022-00336-0

Cullinane, A., & Erduran, S. (2023). Nature of science in preservice science teacher education–Case studies of Irish pre-service science teachers. *Journal of Science Teacher Education, 34*(2), 201-223. https://doi.org/10.1080/1046560X.2022.2042978

Deng, F., Chen, D. T., Tsai, C. C., & Chai, C. S. (2011). Students' views of the nature of science: A critical review of research. *Science Education, 95*(6), 961–999. https://doi.org/10.1002/sce.20460

Driver, R., Leach, J., & Millar, R. (1996). *Young people's images of science*. McGraw-Hill Education.

Erduran, S., & Dagher, Z. (2014). *Reconceptualizing the nature of science in science education*. Springer.

Erduran, S., & Kaya, E. (2018). Drawing nature of science in pre-service science teacher education: Epistemic insight through visual representations. *Research in Science Education, 48*, 1133-1149. https://doi.org/10.1007/s11165-018-9773-0

Erduran, S., Dagher, Z. R., & McDonald, C. V. (2019). Contributions of the family resemblance approach to nature of science in science education: A review of emergent research and development. *Science & Education, 28*, 311-328. https://doi.org/10.1007/s11191-019-00052-2

Erduran, S., Kaya, E., Cilekrenkli, A., Akgun, S., & Aksoz, B. (2021). Perceptions of nature of science emerging in group discussions: A comparative account of pre-service teachers from Turkey and

England. International *Journal of Science and Mathematics Education, 19*, 1375-1396. https://doi.org/10.1007/s10763-020-10110-9

Gilbert, J., Reiner, M., & Nakhleh, M. (2008). *Visualization: theory and practice in science education*. Springer.

Inêz, T. G., de Lacerda Brito, B. P., & El-Hani, C. N. (2023). A model for teaching about the nature of science in the context of biological education. *Science & Education, 32*(1), 231-276. https://doi.org/10.1007/s11191-021-00285-0

Irzik, G., & Nola, R. (2011). A family resemblance approach to the nature of science for science education. *Science & Education, 20*(7–8), 591–607. https://doi.org/10.1007/s11191-010-9293-4

Irzik, G., & Nola, R. (2014). New directions for nature of science research. In M. R. Matthews (Ed.), *International handbook of research in history, philosophy and science teaching* (pp. 999–1021). Springer.

Kampourakis, K. (2016). The "general aspects" conceptualization as a pragmatic and effective means to introducing students to nature of science. *Journal of Research in Science Teaching, 53*(5), 667-682. https://doi.org/10.1002/tea.21305

Kaya, E., Erduran, S., Aksoz, B., & Akgun, S. (2019). Reconceptualised family resemblance approach to nature of science in pre-service science teacher education. *International Journal of Science Education, 41*(1), 21-47. https://doi.org/10.1080/09500693.2018.1529447

Khishfe, R. (2017). Consistency of nature of science views across scientific and socio-scientific contexts. *International Journal of Science Education, 39*(4), 403–432. https://doi.org/10.1080/09500693.2017.1287976

Khishfe, R., & Abd-El-Khalick, F. (2002). Influence of explicit and reflective versus implicit inquiry-oriented instruction on sixth graders' views of nature of science. *Journal of Research in Science Teaching, 39*(7), 551–578. https://doi.org/10.1002/tea.10036

Koumara, A. (2022). History of pressure implemented in a Nature of Science Professional Development Program for science teachers. *Science & Education*, 1-34. https://doi.org/10.1007/s11191-022-00401-8

Lederman, N. G. (1992). Students' and teachers' conceptions of the nature of science: A review of the research. *Journal of Research in Science Teaching, 29*(4), 331–359. https://doi.org/10.1002/tea.3660290404

Lederman, N. G. (2007). Nature of science: Past, present, and future. In S. K. Abell, & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 831–879). Erlbaum.

Lederman, N. G., & Lederman, J. S. (2014). Research on teaching and learning of nature of science. In Abell, & N. G. Lederman (Ed.), *Handbook of research on science education* (volume II; pp. 600–620). Routledge.

Lederman, N. G., Abd-El-Khalick, F., Bell, R. L., & Schwartz, R. S. (2002). Views of nature of science questionnaire (VNOS): Toward valid and meaningful assessment of learners' conceptions of nature of science. *Journal of Research in Science Teaching, 39*(6), 497–521. https://doi.org/10.1002/tea.10034

Matthews, M. R. (2012). Changing the focus: From nature of science (NOS) to features of science (FOS). In M. S. Khine (Ed.), *Advances in nature of science research: Concepts and methodologies* (pp. 3–26). Springer.

McComas, W. F. (2008). Seeking historical examples to illustrate key aspects of the nature of science. *Science & Education, 17*(2,3), 249–263. https://doi.org/10.1007/s11191-007-9081-y

National Research Council [NRC]. (1996). *National science education standards*. National Academies Press.

NGSS Lead States. (2013). *Next generation science standards: for states, by states*. The National Academies Press.

OECD. (2019). *PISA 2018 Assessment and Analytical Framework. PISA*. OECD Publishing. https://doi.org/10.1787/b25efab8-en

Osborne, J., Collins, S., Ratcliffe, M., Millar, R., & Duschl, R. (2003). What "ideas-about-science" should be taught in school science? A Delphi study of the expert community. *Journal of Research in Science Teaching, 40*(7), 692–720. https://doi.org/10.1002/tea.10105

Pavez, J. M., Vergara, C. A., Santibañez, D., & Cofré, H. (2016). Using a professional development program for enhancing Chilean biology teachers' understanding of nature of science (NOS) and their perceptions about using history of science to teach NOS. *Science & Education, 25*, 383-405. https://doi.org/10.1007/s11191-016-9817-7

Petersen, I., Herzog, S., Bath, C., & Fleißner, A. (2020). Contextualisation of factual knowledge in genetics: A pre-and post-survey of undergraduates' understanding of the nature of science. *Interdisciplinary Journal of Environmental and Science Education, 16*(2), e2215. https://doi.org/10.29333/ijese/7816

Roberts, D. A. (2007). Scientific literacy/science literacy. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of Research on Science Education* (pp. 729–780). Lawrence Erlbaum.

Roberts, D. A., & Bybee, R. W. (2014). Scientific literacy, science literacy, science education. In N. G. Lederman & S. K. Abell (Eds.), *Research on Science Education* (Vol. II, pp. 545–558). Routledge.

Rudge, D. W., & Howe, E. M. (2009). An explicit and reflective approach to the use of history to promote understanding of the nature of science. *Science & Education, 18*(5), 561–580. https://doi.org/10.1007/s11191-007-9088-4

Shi, X. (2023). The Value of the Philosophy of Science in Senior High School Science Education from the Perspective of the Nature of Science. *Science & Education*, 1-24. https://doi.org/10.1007/s11191-023-00451-6

Smith, C. L., Maclin, D., Houghton, C., & Hennessey, M. G. (2000). Sixth-grade students' epistemologies of science: The impact of school science experiences on epistemological development. *Cognition and Instruction, 18*(3), 349–422. https://doi.org/10.1207/S1532690XCI1803_3

Wittgenstein, L. (1958). *Philosophical investigations*. Oxford.

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The Relationship Between Teachers' Organizational Alienation, Emotional Labor, and Their Behaviors in Teaching-Learning Process

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Abstract

The aim of this study is to reveal the relationships between organizational alienation, emotional labor, and teaching-learning process behaviors of teachers based on their views. A total of 391 teachers working in secondary education institutions in the central district of Düzce province in the 2022-2023 academic year participated in the study. As a result of the research, it was found that a significant difference was found in favor of female teachers between their gender and the total score of their teaching-learning process behaviors and the positive behavior sub-dimension. A significant difference was found in favor of unionized teachers between their union membership status and the "normlessness" sub-dimension of organizational alienation. A significant difference was found in favor of teachers with over 21 years of professional experience between their length of service and the "social-isolation" sub-dimension of organizational alienation. A significant difference was found in favor of graduate teachers between their educational status and the "powerlessness" and "social-isolation" sub-dimensions of organizational alienation. A significant difference was found in favor of vocational high school teachers between their school type and the "normlessness" sub-dimension of organizational alienation and the "surface behavior" sub-dimension of emotional labor.

Keywords: Emotional labor, organizational alienation, teacher behaviors in teaching-learning process

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Introduction

The profession of teaching is defined in the Teacher Profession Law No. 7354, dated 2022, as "Teaching; it is a specialized profession that takes on the responsibilities of education and teaching along with related administrative tasks" (MEB, 2022). Being a profession that requires specialized expertise implies that the teaching profession necessitates certain qualities and qualifications (Karataş, 2020). Qualified teachers, by providing instruction in a way that maximizes students' learning potential, enable students to achieve high levels of success and elevate the overall educational level of the country. In this manner, they enhance the country's competitiveness and contribute to societal development.

In order to enhance the quality of education and promote societal development, it is important to create ideal working environments for teachers. To establish these ideal working conditions, it is essential to investigate the factors that influence teachers' behaviors in the teaching and learning process. The teaching-learning process is the dimension in which students' learning occurs, and, therefore, the behaviors of teachers in this process have a direct impact on students' learning (Ekinci, 2016). Teachers' behaviors during the teaching-learning process also affect the quality of education. Vatansever-Bayraktar (2015) found in their research that the communication between teachers and students significantly impacts the success of the teaching-learning process. In a study conducted by Gökçe (2008), it was indicated that although teachers exhibit the necessary teaching and learning behaviors for quality education to some extent, they do not perform any of these behaviors at the highest level. Therefore, measures need to be taken to increase the level at which teachers exhibit behaviors in the teaching-learning process to enhance the quality of education.

In a study with classroom teachers, Cerit and Akgün (2015) observed that in mechanically structured school environments where teachers' behaviors were predetermined, there was no opportunity for proactive behavior in the teaching-learning process. In contrast, in organically structured school environments, it was possible for proactive behaviors to be displayed. In a research study that examined classroom relationships among secondary school students and teachers, it was found that teachers' perceptions were of a higher and more positive level when compared to student perceptions (Celep and Erdoğan, 2002). This research suggests that teachers' and students' perceptions in the teaching-learning process may differ. In a study that investigated the relationship between teachers' five-factor personality traits and proactive behaviors, it was found that all of these traits significantly predicted teachers' proactive behaviors (Halıcı-Karabatak, 2018). Aslanargun (2023) evaluated national and international exam results and found that teachers exhibited ineffective and inefficient teaching practices, with practices lacking accountability. In another study, it was noted that teachers willingly

worked without complaining despite facing challenges and difficulties, often going above and beyond the expected roles and behaviors (Göksoy, 2019).

To enhance the quality of education, it is necessary to improve the quality of educational organizations. A significant problem in the education system can be identified as the decrease in teachers' positive attitudes and behaviors towards schools (Korkmaz and Çevik, 2017). The quality of educational organizations is anticipated to be influenced by organizational alienation. Seeman's 1959 article, "On the Meaning of Alienation," classified alienation into five dimensions: powerlessness, meaninglessness, normlessness, social isolation, and self-isolation (Seeman, 1959; Cited in: Elma, 2003). Organizational alienation, which diminishes the productivity of organizations, can emerge in educational organizations where the raw material is human, as a result of organizational and managerial factors (Eryılmaz, 2010). The sense of organizational alienation among teachers can reduce their motivation and commitment to their work. This can lead to a loss of interest and energy when it comes to students. The lack of motivation can hinder teachers from actively participating in the teaching and learning process and trying out new teaching strategies (Aslan, 2008). The feeling of organizational alienation among teachers is often associated with job dissatisfaction. Job dissatisfaction can lead to less satisfaction with the teaching and learning process and the creation of a less positive learning environment. It can also affect teachers' relationships with students and decrease the quality of student-teacher interactions (Kahveci, 2015).

Organizational alienation can divert teachers' focus from their work and reduce their attention to students. When teachers are preoccupied with a sense of alienation at work, they may not be able to adequately focus on students' individual needs and learning processes. This can result in teachers providing less support to students and not using effective teaching strategies. Organizational alienation can negatively impact communication among teachers. Teachers who have difficulty connecting with their colleagues may lack collaboration, sharing of experiences, and professional support. This can make it challenging for teachers to improve student-teacher interactions and work more efficiently in the learning process (Emir, 2012).

Especially in recent years, it is expected that employees bring their emotions into their work, and in educational organizations where communication is at the forefront and where both input and output are human, the display of emotional labor is essential (Doğan, 2019). Educational organizations, being the ones with the most intense communication and interaction, are also the ones where emotional labor is experienced intensely. The concept of emotional labor was first defined by Hochschild as employees controlling their behavior in the workplace and suppressing their emotions to exhibit specific behaviors in verbal and non-verbal communications (Hochschild, 1983). Emotional labor enables teachers to establish connections with students, show empathy, and understand students' emotional needs. This helps teachers develop a better student-teacher relationship, making students feel safe and supported. Strong student-teacher relationships enhance student motivation and participation while allowing teachers to guide students more effectively. Emotional labor helps teachers create a positive atmosphere in the classroom.

Teachers use emotional labor skills to meet students' emotional needs, solve problems, and maintain harmony within the class. This makes it easier to manage classroom discipline and student behavior effectively. Emotional labor assists teachers in motivating and increasing the motivation of their students. By being sensitive to students' emotional needs, teachers support, encourage, and guide them towards success. This encourages active participation in the learning process and increases the levels of achievement (Çelik, 2023). Emotional labor helps teachers in directing student behavior and reducing negative behaviors. Teachers identify students' emotional states with empathy and understanding, guiding them toward positive behaviors. This encourages students to meet the teacher's expectations and exhibit positive behaviors. Within the scope of emotional labor, employees' behaviors can be categorized as surface acting, deep acting, and genuine acting (Kıral, 2016).

Alienation

Alienation concept emerged primarily in modern industrial societies. Thinkers like Marx and Engels argued that modern capitalist society alienates the individual, disconnecting them from their own nature and potential. This alienation is associated with the characteristics of industrial capitalism, such as the division of the production process, the fragmentation of labor, and the use of individuals as mere instruments in their work. The concept of alienation can also manifest in social relationships. An individual may experience a sense of alienation if they find themselves in a different situation from the values and norms generally accepted by their social group or society. This can particularly apply to immigrants, minorities, or people from different cultures (Tuğcu, 2002; Cited in: Aydoğan, 2015).

The leading figure in the field of alienation, Seeman, has classified his views on alienation into five fundamental dimensions (Seeman, 1972). These dimensions are: Powerlessness, Meaninglessness, Normlessness, Social Isolation, and Self-Isolation. The powerlessness dimension of organizational alienation expresses the feeling of inadequacy and ineffectiveness of employees in performing their jobs. This dimension comes into play, especially when employees feel that they do not have the necessary resources to perform their jobs effectively, despite being constantly reminded of the importance of their work (Seeman, 1967). The meaninglessness dimension of organizational alienation occurs when employees feel that their work is meaningless or inconsistent with their personal values. This dimension may arise when the purpose and significance of their work are not clearly stated, when their work does not benefit society, or when there are no opportunities for creativity and autonomy in their jobs (Seeman, 1983).

The normlessness dimension of organizational alienation expresses the feeling of insecurity and uncertainty among employees when the rules, procedures, and guidelines in their organizations are complex and ambiguous. This situation may occur when employees feel that they have not received adequate guidance or training to follow appropriate behaviors or processes in their work (Seeman, 1967). The social isolation dimension of organizational alienation occurs when employees feel deprived of social connections in their organizations. This can happen when employees have limited relationships with colleagues and supervisors or when employees feel lonely (Seeman, 1967). The self-isolation dimension of organizational alienation

expresses the alienation of employees from their personal values and themselves due to working in organizations. This can occur when employees feel that the activities in their organizations do not align with their values or when employees do not consider themselves as a part of the organization (Seeman, 1967).

Emotional Labor

Traditionally, emotional labor is defined as a type of behavior used by those working in the service sector to meet their emotional requirements at work (Hochschild, 1983). However, in recent years, this concept is recognized as applicable to different professional groups as well. It has been shown that emotional labor can affect factors such as job satisfaction, job performance, organizational commitment, and intention to leave the job (Gross, 2015). Nevertheless, it is also noted that emotional labor can harm the psychological and physical health of employees (Rafaeli and Sutton, 1989). The management of emotional labor is an important issue, particularly in terms of leadership and management. Therefore, it is recommended that business managers receive training on emotional labor and provide emotional support to their employees (Hüseyinoğlu and Ertürk, 2018).

Surface Acting is defined by Hochschild in conjunction with the concept of emotional labor. Hochschild defines surface acting as an individual displaying a different emotional expression from their true feelings. In other words, a person expresses a different emotional response than what they genuinely feel, often required by their job. This typically arises in roles that involve customer service, the service sector, and other jobs involving interaction with people (Hochschild, 1983). Deep Acting, on the other hand, signifies expressing one's true emotions within their professional role and demonstrating greater commitment to their job. This concept was first introduced by Hochschild in her book "The Managed Heart" (Hochschild, 1983). Deep acting involves aligning one's values, beliefs, and feelings with their job by modifying their genuine emotions in accordance with the requirements of their professional role. This behavior enables an individual to embrace their professional role and show greater commitment to their work. For instance, a teacher can engage in deep acting to establish a genuine connection with students. The dimension of sincere behavior is a subset of emotional labor and denotes the authentic and sincere behaviors exhibited by employees during their work. These behaviors are necessary to establish connections with customers or colleagues, build trust, and create a positive work environment. In a study conducted by Grandey et al. (2013), it was found that the sincere behavior dimension of emotional labor in restaurant employees had a positive impact on customer satisfaction and loyalty. In this research, the genuine and sincere interaction of restaurant employees with customers increased the likelihood of customers returning to the restaurant and recommending the establishment to others.

Teaching and Learning

Teaching is the process by which a teacher or educator imparts knowledge and skills to students. This process is designed to help students acquire the information, skills, and values necessary for them to achieve their learning objectives. Teaching is a complex process that involves various factors. The role of the teacher

encompasses different aspects, such as understanding the learning needs of students, planning instructional materials, managing learning activities, and assessing student progress (Akyol and Garrison, 2011).

In the teaching-learning process, the teacher assumes the role of managing the process. When planning the teaching-learning process, teachers should first have sufficient knowledge to determine the learning level and readiness of each student, and they should prepare in advance for each lesson to provide effective and direct learning. By identifying their students' levels of achievement, they should assist them in understanding their levels of success, know what assistance each student needs to enhance their learning process, and encourage students to learn more. Finally, to help students take more responsibility for their own development, teachers should provide accurate guidance, feedback, and counseling. Alkan (1987) has articulated the principles that teachers should follow in the teaching-learning process in his research. In this section, teacher behaviors in the teaching-learning process, as defined by the scale developed by Göksoy and Danışman (2018), are explained in the dimensions of "Positive Behavior," "Proactive Behavior," and "Reactive Behavior".

Proactive behaviors refer to the actions that a teacher plans and implements in advance to help students continue their learning process without encountering problems (Aybatan, 2018). When planning the teaching-learning process, the teacher first decides on the topics based on students' learning needs, the general performance of the class, and the objectives of the lesson. In this planning process, the teacher selects instructional materials, sets learning objectives, and designs activities and practices that will engage the students' interest. Additionally, by considering students' different learning styles and needs, the teacher adjusts the lesson plan accordingly. This planning process contributes to a more efficient delivery of the lesson and helps students better understand (Bakay, 2023). The presence of various learning styles among students alters the role of teachers in the learning process. Teachers need to select teaching methods that align with students' learning styles and employ different teaching strategies to meet their learning needs. These strategies can vary based on students' learning styles and levels (Duke and Madsen, 1991). Positive behaviors encompass the teacher's positive interactions with students, helping increase their motivation and contributing to their success in the learning process (Celep and Erdoğan, 2002).

The teacher-student relationship is crucial in education and is reflected in the way teachers communicate with their students. Teachers should regularly communicate with their students to understand their personal and academic needs, show interest in students, answer their questions, and help them learn. Teachers should also be attentive to students' emotional well-being. Providing support to help students cope with stress, anxiety, and difficulties they may be facing can boost their self-esteem and create a better learning experience (Türe, 2017). Teachers can use the discussion method in the classroom to help students better understand the topics, develop critical thinking skills, express their ideas, and enhance their discussion skills (Konokman and Yelken, 2013). This encourages active participation and enhances learning, allowing students to be actively engaged instead of passively listening. Discussions also expose students to different perspectives, aiding in the development of empathy. When conducting discussions, teachers should ensure that each student has the opportunity to speak, and they should respect everyone's opinions. Teachers can increase students' self-esteem by praising and

acknowledging their accomplishments, thereby boosting motivation and leading to better results (Sünbül, 1996).

Teachers can use praise-filled words, give rewards, or create a display where students can showcase their work. However, teachers should praise students not only for their academic achievements but also for their participation, behavior, and social skills. This can create a more positive classroom atmosphere and boost students' self-confidence (Bahadır, 2019). Reactive behaviors refer to the teacher's responses to students' problems and help resolve their issues. These behaviors are applied when students display negative behaviors (Selimhocalıoğlu, 2004). For example, if a student shouts in the classroom and disturbs others, the teacher may need to respond quickly to this behavior. The response may involve encouraging the student to change their behavior or indicating that there will be negative consequences. Reactive behaviors are crucial for maintaining classroom discipline. This reactive teacher behavior includes being sensitive to students' personal problems and listening to their issues. Teachers take an interest in students' personal problems and help them find solutions. This behavior can help students have a positive experience at school and enhance their learning potential (Gökçe, 2010). For instance, personal problems in students' private lives can negatively affect their academic success. Therefore, teachers being sensitive to students' personal issues can help students have a happier and healthier learning environment.

The Purpose of the Research

The main aim of the research is to investigate the relationships between organizational alienation, emotional labor, and teaching-learning process behaviors of middle school teachers based on their opinions, along with demographic variables.

In line with this aim, the subproblem of the research is as follows: Do teachers' organizational alienation, emotional labor, and teaching-learning process behaviors differ in terms of gender, union membership status, years of service in the profession, educational status, and school type variables?

Significance of the Research

It is well-known that teachers' behaviors in the teaching-learning process have a direct impact on students' achievement, motivation, and learning experience. Displaying effective and efficient behaviors will help students have a better learning experience and, as a result, enhance the quality of education. The feeling of organizational alienation among teachers can lead to negative outcomes such as workplace alienation, job dissatisfaction, and a lack of motivation. This can affect teachers' engagement in the teaching-learning process. Research can offer valuable insights into how teachers can cope with situations that require emotional labor and the impact of organizational alienation on emotional labor. This understanding can enhance teachers' motivation and job satisfaction, making them more effective in the teaching-learning process. Teachers' emotional labor skills enable them to build effective relationships with students.

Emotional labor includes skills such as providing support, showing empathy, and understanding students' needs. Using these skills, teachers can increase students' commitment to school, motivation, and success. The feeling of organizational alienation among teachers may make them feel isolated and decrease their motivation to collaborate with other teachers. However, collaboration among teachers promotes the sharing of pedagogical knowledge and experiences, enriching the teaching-learning process. This information can assist in the development of policies and programs that encourage collaboration and professional development in schools. Education faculties and teacher training programs can equip teacher candidates with knowledge and skills related to these issues. Furthermore, professional development programs for current teachers can consider these relationships and help teachers work more effectively.

The findings from this research can contribute to the improvement of the education system and the more productive work of teachers. This understanding can boost teachers' motivation, enhance student achievement, improve school management and policy development processes, promote collaboration among teachers, and enhance teacher education. Research in these areas can provide recommendations for making our education system more effective and sustainable.

Method

Research Model

This research, which aims to reveal the relationships between organizational alienation, emotional labor, and teacher behaviors in the teaching-learning process in secondary education institutions in line with the opinions of teachers, used a correlational survey model. Correlational survey models are studies in which the relationship between two or more variables is deeply examined without any intervention in the variables (Büyüköztürk et al., 2011).

Population and Sample

The population of the research consists of teachers working in secondary education institutions in the central district of Düzce in the 2022-2023 academic year. According to the data of the Düzce Provincial Directorate of National Education, in the 2022-2023 academic year, a total of 1,061 teachers works in 22 secondary education institutions in the central district of Düzce, including 414 in Vocational High Schools (MEB, 2022). The sample of the research was determined through a convenient sampling method. When determining the sample, attention was paid to collecting a sufficient amount of data representing the population from different types of schools and ensuring that the distribution of demographic characteristics of the participants was qualitatively representative of the population. The 391 teachers reached constitute 36.85% of the population. The demographic data of the teachers that make up the sample of the research are presented in Table 1.

Table 1. The demographic data of the teachers

Variable	Description	n	%
Gender	Female	220	56,3
	Male	171	43,7
Membership in the Union	Union Member	267	68,3
	Not a Union Member	124	31,7
Years in the Profession	1-10 Years	105	26,9
	11-20 Years	112	28,6
	Above 21 Years	174	44,5
Education Level	Undergraduate	290	74,2
	Postgraduate	101	25,8
School Type	Vocational Schools	154	39,4
	Other Schools	237	60,6

According to Table 1, 56.3% of the participating teachers in the research are female, while 43.7% are male. The majority of the participant teachers are over 45 years old (n:170, 43.5%), with the lowest participation level in the 25-34 age range (n:77, 19.7%). In terms of union membership, 68.3% of the participating teachers are union members, while 31.7% are not union members. When looking at the years in the profession, the majority of participant teachers have 21 years or more of service (n:174, 44.5%), with the lowest participation in the group of teachers with 1-10 years of professional service (n:105, 26.9%). 74.2% of the participating teachers are undergraduate graduates, and 25.8% have completed postgraduate education. Regarding school types, 39.4% of the participating teachers work in Vocational Schools, while 60.6% work in other schools.

Data Collection Tools

For the purpose of data collection, four sections were used: a demographic information form, the Organizational Alienation Scale, the Emotional Labor Scale, and the Teacher Behaviors in the Teaching-Learning Process Scale.

Demographic Information Form

The Demographic Information Form was prepared by the researcher to collect demographic information about the teachers, including gender, union membership status, years in the profession, and school type.

Organizational Alienation Scale

The scale, developed by Eryılmaz (2010), consists of five sub-dimensions: “Powerlessness,” “Meaninglessness,” “Rulelessness,” “Isolation,” and “Self-Alienation.” These identified factors explain 45.4% of the scale’s variance. The scale uses a 5-point Likert rating scale: 5 (Always), 4 (Most of the time), 3 (Sometimes), 2 (Rarely), and 1 (Never). After data collection, the reliability analysis of the scale revealed a

Cronbach's Alpha value of 0.88 for the "Powerlessness" sub-factor consisting of 15 items, 0.92 for the "Meaninglessness" sub-factor consisting of 10 items, 0.62 for the "Rulelessness" sub-factor consisting of 4 items, 0.84 for the "Isolation" sub-factor consisting of 6 items, and 0.71 for the "Self-Alienation" sub-factor consisting of 3 items. The Cronbach's Alpha value for the entire 38-item scale was calculated as 0.95. Scales with Cronbach's Alpha values between 0.70 and 1 are considered reliable (Can, 2020).

Emotional Labor Scale

The scale, developed by Chu and Murrmann (2006) and adapted into Turkish by Kıral (2016), consists of three sub-factors: "Surface Acting," "Deep Acting," and "Genuine Acting." These identified factors explain 59% of the scale's variance. The items were prepared on a 7-point Likert scale: 1 (Strongly Disagree), 2 (Disagree), 3 (Partially Disagree), 4 (Undecided), 5 (Partially Agree), 6 (Agree), and 7 (Strongly Agree). After data collection, the reliability analysis of the scale revealed a Cronbach's Alpha value of 0.82 for the "Surface Acting" sub-factor consisting of 8 items, 0.81 for the "Deep Acting" sub-factor consisting of 3 items, and 0.84 for the "Genuine Acting" sub-factor consisting of 5 items. The Cronbach's Alpha value for the entire 16-item scale was calculated as 0.79. Scales with Cronbach's Alpha values between 0.70 and 1 are considered reliable (Can, 2020).

Teacher Behaviors in the Teaching-Learning Process Scale

The scale, developed by Göksoy and Şahin (2018), consists of three factors with 25 items in total: "Proactive Behavior," "Positive Behavior," and "Reactive Behavior." These identified factors explain 59.46% of the scale's variance. The scale was prepared using a 5-point Likert scale: 1 (Never), 2 (Rarely), 3 (Sometimes), 4 (Often), and 5 (Always). After data collection, the reliability analysis of the scale revealed a Cronbach's Alpha value of 0.92 for the "Proactive Behavior" sub-factor consisting of 18 items, 0.76 for the "Positive Behavior" sub-factor consisting of 4 items, 0.83 for the "Reactive Behavior" sub-factor consisting of 3 items, and a Cronbach's Alpha value of 0.89 for the entire 25-item scale. Scales with Cronbach's Alpha values between 0.70 and 1 are considered reliable (Can, 2020).

Data Collection

The data for the research were collected in the 2022-2023 academic year through in-person visits and online surveys from the schools identified in the sample, following the necessary permissions obtained from the relevant authorities. Data were gathered both face-to-face and via online forms. Data were collected from 403 voluntary participating teachers.

Data Analysis

The data of the research were analyzed using the SPSS program. A total of 12 data points were excluded from the main dataset due to non-compliance with the instructions or the creation of outliers, leaving data from 391

participants for analysis. In the data analysis, normality tests were conducted. In this study, the kurtosis and skewness values of the data were considered within the normality limits (± 1.96). Parametric tests such as t-tests and one-way analysis of variance (ANOVA) were used for comparing data with demographic variables that were determined to follow a normal distribution. Tukey tests were performed as variances were homogeneously distributed.

Results

The research problem was to determine whether there were differences in the organizational alienation, emotional labor, and teaching-learning behaviors of the participating teachers concerning gender, union membership status, years in the profession, and school type.

Difference by Gender

Table 2. Results of independent group t-tests showing differences in teachers' organizational alienation by gender

Variables	Gender	N	X̄	SS	Sd	t	p
Powerlessness	Female	220	1,87	0,57	389	0,45	,65
	Male	171	1,85	0,60			
Meaninglessness	Female	220	1,52	0,62	389	-1,86	,06
	Male	171	1,65	0,72			
Normlessness	Female	220	1,81	0,67	389	-1,80	,07
	Male	171	1,94	0,72			
Social İsolation	Female	220	1,68	0,72	389	-1,34	,18
	Male	171	1,78	0,76			
Self-İsolation	Female	220	1,62	0,71	389	-1,37	,17
	Male	171	1,73	0,81			

According to teachers' perceptions in the research, there was no significant difference between the sub-dimensions of the organizational alienation scale and the gender variable.

Table 3. Results of independent group t-tests showing differences in teachers' emotional labor by gender

Variables	Gender	N	X̄	SS	Sd	t	p
Surface Acting	Female	220	4,19	0,80	389	1,26	,21
	Male	171	4,09	0,89			
Genuine Acting	Female	220	4,76	1,70	389	-0,74	,46
	Male	171	4,89	1,73			
Deep Acting	Female	220	4,32	1,53	389	0,73	,47
	Male	171	4,21	1,49			

According to teachers' perceptions in the research, there was no significant difference between the total value and sub-dimensions of the emotional labor scale and the gender variable.

Table 4. Results of independent group t-tests showing differences in teachers' teaching-learning behaviors by gender

Variables	Gender	N	X̄	SS	Sd	t	p	Cohen's d
Proactive Behavior	Female	220	4,31	0,55	389	0,69	,49	-
	Male	171	4,28	0,56				
Positive Behavior	Female	220	4,31	0,59	389	2,09	**,04**	0,02
	Male	171	4,17	0,68				
Reactive Behavior	Female	220	4,13	0,73	389	1,55	,13	-
	Male	171	4,02	0,73				

According to teachers' perceptions in the research, a statistically significant difference was found between the "Positive Behavior" sub-dimension of the teaching-learning behaviors scale and the gender variable, while no significant difference was found between the "Proactive Behavior" and "Reactive Behavior" sub-dimensions and the gender variable.

Difference by Union Membership Status

Table 5. Results of independent group t-tests showing differences in teachers' organizational alienation by union membership status

Variables	Union membership status	N	X̄	SS	Sd	t	p	Cohen's d
Powerlessness	Member	267	1,87	0,58	389	0,81	,42	-
	Not Member	124	1,83	0,59				
Meaninglessness	Member	267	1,59	0,65	389	0,55	,58	-
	Not Member	124	1,55	0,71				
Normlessness	Member	267	1,91	0,72	389	2,03	**,04**	0,02
	Not Member	124	1,76	0,63				
Social İsolation	Member	267	1,75	0,73	389	0,93	,35	-
	Not Member	124	1,67	0,75				
Self-İsolation	Member	267	1,69	0,77	389	0,70	,49	-
	Not Member	124	1,63	0,72				

According to teachers' perceptions in the research, a statistically significant difference was found between the "Rulelessness" sub-dimension of the organizational alienation scale and the union membership variable. No significant difference was found between the "Powerlessness," "Meaninglessness," "Isolation," and "Self-Alienation" sub-dimensions of the scale and union membership.

Table 6. Results of independent group t-tests showing differences in teachers' emotional labor by union membership status

Variables	**Union membership status**	**N**	**X̄**	**SS**	**Sd**	**t**	**p**
Surface Acting	Member	267	4,11	0,86	389	-1,36	,17
	Not Member	124	4,23	0,80			
Genuine Acting	Member	267	4,88	1,69	389	0,99	,32
	Not Member	124	4,69	1,75			
Deep Acting	Member	267	4,29	1,52	389	0,38	,71
	Not Member	124	4,23	1,50			

According to teachers' perceptions in the research, there was no significant difference between emotional labor and union membership.

Table 7. Results of independent group t-tests showing differences in teachers' teaching-learning behaviors by union membership status

Variables	**Union membership status**	**N**	**X̄**	**SS**	**Sd**	**t**	**p**
Proactive Behavior	Member	267	4,29	0,55	389	-0,14	,89
	Not Member	124	4,30	0,56			
Positive Behavior	Member	267	4,22	0,66	389	-1,36	,18
	Not Member	124	4,31	0,57			
Reactive Behavior	Member	267	4,06	0,72	389	-1,12	,26
	Not Member	124	4,15	0,75			

According to teachers' perceptions in the research, there was no significant difference between the sub-dimensions of the teaching-learning behaviors scale and union membership variable.

Difference by Years in the Profession

Table 8. Results of the Anova Test showing differences in teachers' organizational alienation by years in the profession

Variables	Years in the Profession								p	F (2,388)	Fark	η2
	1.1-10 years (n=105)		2.11-20 years (n=112)		3.Above21 years (n=174)		Sum (n=391)					
	X̄	SS	X̄	SS	X̄	SS	X̄	SS				
Powerlessness	1,85	0,56	1,81	0,58	1,90	0,59	1,86	0,58	,39	0,93	-	-
Meaninglessness	1,56	0,58	1,56	0,70	1,60	0,69	1,58	0,66	,82	0,20	-	-
Normlessness	1,83	0,68	1,84	0,67	1,90	0,72	1,87	0,69	,60	0,51	-	-
Social İsolation	1,67	0,65	1,59	0,73	1,84	0,78	1,72	0,74	**,01**	4,35	3>2	0,02
Self-İsolation	1,66	0,72	1,58	0,71	1,74	0,80	1,67	0,76	,22	1,53	-	-

According to teachers' perceptions in the research, a statistically significant difference was found between the "Isolation" sub-dimension of the organizational alienation behavior scale and the variable of years in the profession, while no significant difference was found between the "Powerlessness," "Meaninglessness," "Normlessness," and "Self-Alienation" sub-dimensions and the years in the profession variable.

Table 9. Results of the Anova Test showing differences in teachers' organizational alienation by years in the profession

Variables	Years in the Profession								p	F (2,388)
	1. 1-10 years (n=105)		2. 11-20 years (n=112)		3. Above 21 years (n=174)		Sum (n=391)			
	X̄	SS	X̄	SS	X̄	SS	X̄	SS		
Surface Acting	4,09	0,81	4,29	0,82	4,09	0,87	4,15	0,84	,09	2,39
Genuine Acting	4,84	1,67	4,99	1,73	4,69	1,72	4,82	1,71	,35	1,05
Deep Acting	4,14	1,48	4,34	1,49	4,31	1,55	4,27	1,51	,58	0,55

According to teachers' perceptions in the research, no significant difference was found between the sub-dimensions of the emotional labor scale and the variable of years in the profession.

Table 10. Results of the Anova Test showing differences in teachers' emotional labor by years in the profession

Variables	Years in the Profession								p	F (2,388)
	1. 1-10 years (n=105)		2. 11-20 years (n=112)		3. Above 21 years (n=174)		Sum (n=391)			
	X̄	SS	X̄	SS	X̄	SS	X̄	SS		
Proactive Behavior	4,20	0,49	4,34	0,58	4,33	0,56	4,30	0,55	,11	2,22
Positive Behavior	4,14	0,68	4,32	0,60	4,26	0,62	4,25	0,63	,09	2,41
Reactive Behavior	4,01	0,76	4,21	0,74	4,05	0,71	4,08	0,73	,09	2,37

According to teachers' perceptions in the research, no significant difference was found between the sub-dimensions of the emotional labor scale and the variable of years in the profession.

Difference by Educational Level

Table 11. Results of independent group t-tests showing differences in teachers' organizational alienation by educational level

Variables	Educational Level	N	X̄	SS	Sd	t	p	Cohen's d
Powerlessness	Undergraduate	290	1,90	0,59	389	2,21	**,03**	0,03
	Postgraduate	101	1,75	0,55				
Meaninglessness	Undergraduate	290	1,59	0,70	389	0,58	,56	-
	Postgraduate	101	1,55	0,54				
Normlessness	Undergraduate	290	1,88	0,70	389	0,61	,54	-
	Postgraduate	101	1,83	0,69				
Social İsolation	Undergraduate	290	1,78	0,76	389	2,92	**,00**	0,03
	Postgraduate	101	1,55	0,65				
Self-İsolation	Undergraduate	290	1,71	0,79	389	1,38	,17	-
	Postgraduate	101	1,58	0,65				

According to teachers' perceptions in the research, a statistically significant difference was found between the "Powerlessness" and "Isolation" sub-dimensions of the organizational alienation behavior scale and the educational level variable, while no significant difference was found between the "Meaninglessness," "Normlessness," and "Self-Alienation" sub-dimensions and the educational level variable.

Table 12. Results of independent group t-tests showing differences in teachers' emotional labor by educational level

Variables	Educational Level	N	X̄	SS	Sd	t	p
Surface Acting	Undergraduate	290	4,15	0,82	389	0,17	,86
	Postgraduate	101	4,13	0,90			
Genuine Acting	Undergraduate	290	4,85	1,74	389	0,57	,57
	Postgraduate	101	4,74	1,62			
Deep Acting	Undergraduate	290	4,27	1,51	389	-0,08	,94
	Postgraduate	101	4,28	1,53			

According to teachers' perceptions in the research, no significant difference was found between the sub-dimensions of the emotional labor scale and the educational level variable.

Table 13. Results of independent group t-tests showing differences in teachers' teaching-learning behaviors by educational level

Variables	Educational Level	N	□	SS	Sd	t	p
Proactive Behavior	Undergraduate	290	4,31	0,56	389	0,93	,35
	Postgraduate	101	4,25	0,55			
Positive Behavior	Undergraduate	290	4,23	0,66	389	-0,93	,36
	Postgraduate	101	4,30	0,56			
Reactive Behavior	Undergraduate	290	4,06	0,73	389	-1,18	,24
	Postgraduate	101	4,16	0,73			

According to teachers' perceptions in the research, no significant difference was found between the sub-dimensions of the teaching-learning behaviors scale and the educational level variable.

Difference by School Type

Table 14. Results of independent group t-tests showing differences in teachers' organizational alienation by school type

Variables	School Type	N	X̄	SS	Sd	t	p	Cohen's d
Powerlessness	Vocational Schools	154	1,92	0,61	389	1,63	,11	-
	Other Schools	237	1,82	0,56				
Meaninglessness	Vocational Schools	154	1,60	0,73	389	0,51	,61	-
	Other Schools	237	1,57	0,62				

Normlessness	Vocational Schools	154	1,95	0,75	389	2,01	**,04**	0,02
	Other Schools	237	1,81	0,65				
Social İsolation	Vocational Schools	154	1,79	0,76	389	1,50	,13	-
	Other Schools	237	1,68	0,72				
Self-İsolation	Vocational Schools	154	1,69	0,76	389	0,36	,72	-
	Other Schools	237	1,66	0,75				

According to teachers' perceptions in the research, a statistically significant difference was found between the "Normlessness" sub-dimension of the organizational alienation behavior scale and the variable "School Type" being studied, while no significant difference was found between the "Powerlessness," "Meaninglessness," "Isolation," and "Self-Alienation" sub-dimensions and the variable "School Type" being studied.

Table 15. Results of independent group t-tests showing differences in teachers' emotional labor by school type

Variables	**School Type**	**N**	**X̄**	**SS**	**Sd**	**t**	**p**	**Cohen's d**
Surface Acting	Vocational Schools	154	4,25	0,82	389	1,99	**,04**	0,02
	Other Schools	237	4,08	0,85				
Genuine Acting	Vocational Schools	154	4,86	1,73	389	0,34	,73	-
	Other Schools	237	4,80	1,70				
Deep Acting	Vocational Schools	154	4,32	1,49	389	0,51	,61	-
	Other Schools	237	4,24	1,53				

According to teachers' perceptions in the research, a statistically significant difference was found between the "Surface Acting" sub-dimension of the emotional labor scale and the variable "School Type" being studied, while no significant difference was found between the "Genuine Acting" and "Deep Acting" sub-dimensions and the variable "School Type" being studied.

Table 16. Results of independent group t-tests showing differences in teachers' teaching-learning behaviors by school type

Variables	School Type	N	X̄	SS	Sd	t	p
Proactive Behavior	Vocational Schools	154	4,25	0,55	389	-1,25	,21
	Other Schools	237	4,33	0,56			
Positive Behavior	Vocational Schools	154	4,18	0,69	389	-1,64	,10
	Other Schools	237	4,29	0,59			
Reactive Behavior	Vocational Schools	154	4,03	0,77	389	-1,13	,26
	Other Schools	237	4,12	0,71			

According to teachers' perceptions in the research, no significant difference was found between the sub-dimensions of the teaching-learning behaviors scale and the variable "School Type" being studied.

Discussion

Gender Differences

According to teachers' perceptions in the research, no significant difference was found between the sub-dimensions of the organizational alienation scale and the gender variable. While Atmaca (2020) found no significant difference between teachers' alienation from the profession and gender, they did find that female teachers experienced more alienation than males, which they associated with lower dedication of male teachers to the profession. Emir (2012) also found no significant difference between teachers' levels of alienation and gender, but statistically, women experienced lower levels of alienation than men. In a study by Kazak (2022), it was found that female managers, unlike male managers, faced gender-based issues, leading to more physiological and psychological problems in their personal and work lives. Kahveci (2015) found that male teachers perceived higher levels of "Meaninglessness," "Isolation," and "Rulelessness" in the total score of teachers' organizational alienation, while the perceptions of female and male teachers were similar in the "Powerlessness" and "Self-Alienation" sub-dimensions. Aslan (2008) found that female cultural education teachers working in vocational schools experienced more alienation than males. These research results align with our study.

Doğan (2019) found a significant difference in favor of male teachers in the "Powerlessness" and "Isolation" sub-dimensions of organizational alienation. This was linked to female teachers exhibiting warmer behaviors toward school administrators and stakeholders. Göztok (2021) found a slight significant difference in the "Meaninglessness" and "Isolation" sub-dimensions due to gender, while no significant difference was found in the "Powerlessness" dimension. Kovancı and Ergen (2019) discovered that gender had a significant effect on the total score of organizational alienation and the sub-dimensions of "Meaninglessness," "Rulelessness,"

and “Isolation,” favoring male teachers, while there was no significant difference in “Powerlessness” and “Self-Alienation” sub-dimensions. These research findings partially differ from our study. Despite no statistically significant differences between genders, the presence of slight differences in specific sub-dimensions suggests that the impact of gender on the experience of organizational alienation is partial and relatively small. Gender may play a more comprehensive role in understanding organizational alienation when evaluated in conjunction with other factors. For instance, working conditions, organizational policies, leadership styles, and personal factors are also believed to have an impact. These findings support the need for organizations to raise awareness about gender equality and employees’ levels of organizational alienation and develop appropriate policies. Organizations should strive to provide a supportive and fair working environment to minimize employees’ experiences of powerlessness, meaninglessness, rulelessness, isolation, and self-alienation. Additionally, it should be noted that these findings were obtained on a specific sample, and further comprehensive research in the future can provide a more detailed understanding of the impact of gender on organizational alienation.

According to teachers’ perceptions in the research, no significant difference was found between the total value and sub-dimensions of the emotional labor scale and the gender variable. In the study by Doğan (2021), Steinberg and Figart (1999), and Akbaş and Bostancı (2019, no significant difference was found in teachers’ emotional labor behaviors. In contrast, Başım et al. (2013) found that female teachers had higher levels of emotional labor. These research findings align with our study. Çelik (2023) found a significant difference in favor of male teachers in the sub-dimensions of “Superficial Role Playing” and “Deep Role Playing” of emotional labor, while “Natural (Sincere) Behavior” favored females. Yılmaz et al. (2015) found that male teachers exhibited more superficial role-playing behavior than female teachers. In contrast, Ertürk et al. (2016) found that male teachers had higher levels of emotional labor than females. These results differ from our research. Emotional labor refers to the process of responding to emotional demands in the workplace. The findings suggest that gender can influence emotional labor experiences, but this influence may not be expressed through statistically significant differences. It implies that when gender is considered in conjunction with other factors, it can play a partial and relatively small role in understanding emotional labor. Organizations may create supportive working environments to meet employees’ emotional needs, provide training to enhance emotional labor skills, and support employees in expressing and balancing their emotional needs. It should be noted that these findings were obtained on a specific sample and may not be sufficient for generalization. Other factors, such as working conditions, workplace culture, leadership styles, and other organizational factors, may have an impact on emotional labor and analyzing these factors may provide a more comprehensive understanding.

According to teachers’ perceptions in the research, a statistically significant difference was found between the “Positive Behavior” sub-dimension of the teacher behaviors in the teaching-learning process scale and the gender variable, while no significant difference was found in the “Proactive Behavior” and “Reactive Behavior” sub-dimensions of the teacher behaviors and the gender variable. Bayındır (2002) found no significant difference in teacher behaviors during the teaching-learning process based on gender. However, they noted that females had higher averages. Halıcı-Karabatak (2018) found a significant difference in the “Proactive Behavior” sub-dimension and gender. Aybatan (2018) found no significant relationship between

proactive personality traits and gender. These research findings partially align with our study. In the literature, there are very few studies on this subject. The statistically significant difference between genders in the "Positive Behavior" sub-dimension in the teaching-learning process implies that there are differences between genders in terms of the frequency or level at which teachers exhibit this behavior. The levels at which teachers exhibit positive behaviors (such as establishing positive relationships with students, motivating and supporting them) may vary based on gender. This suggests that gender may influence teachers' pedagogical approaches and their relationships with students. On the other hand, the absence of a significant difference in the "Proactive Behavior" and "Reactive Behavior" sub-dimensions suggests that these teacher behaviors are not directly related to gender. In other words, there was no identified difference in terms of gender in proactive behaviors (e.g., lesson planning, anticipating student needs) and reactive behaviors (e.g., responding to student needs, problem-solving). These findings suggest that these teacher behaviors may not change based on gender or other factors (e.g., education, experience, personality traits) may have a more decisive impact. Further research in this field can provide a better understanding of what factors influence teacher behaviors beyond gender. Additionally, these findings can prompt consideration of how pedagogical practices and teacher education account for the gender factor.

Difference Based on Union Membership

According to teachers' perceptions in the study, a statistically significant difference was found between the "Rulelessness" sub-dimension of the organizational alienation scale and the variable of union membership. No significant difference was observed between the "Powerlessness," "Meaninglessness," "Isolation," and "Self-Alienation" sub-dimensions and the union membership variable. Kazoğlu (2014) did not find a significant difference between teachers' organizational alienation and their union membership in their research. These findings are consistent with our study. Şimşek et al. (2006) found that union member employees were more affected by union-related negatives compared to public servants and experienced workplace alienation. They classified union membership among environmental factors causing workplace alienation. However, Seçer (2009) indicated that workers in large-scale enterprises felt a greater need for protection and were more inclined to desire union membership to reduce workplace alienation. The statistically significant difference between the "Rulelessness" sub-dimension of the organizational alienation scale and union membership suggests a relationship between these two variables. The feeling of rulelessness among teachers (e.g., a perception of non-compliance with specific organizational rules) may be associated with union membership. This could imply that teachers who are union members are more compliant with the organization's rules or attach more importance to specific organizational regulations. However, the absence of a significant difference between "Powerlessness," "Meaninglessness," "Isolation," and "Self-Alienation" sub-dimensions and union membership suggests that these sub-dimensions may not be directly related to union membership. In other words, feelings of powerlessness (e.g., feeling inadequate in decision-making processes within the organization), meaninglessness (e.g., thinking that tasks are meaningless), isolation (e.g., feeling lonely within the organization), and self-alienation (e.g., losing a sense of belonging to the organization) among teachers may not be directly related to union membership. These sub-dimensions indicate that other factors (e.g., job satisfaction, organizational justice, personal values) may be more influential in the decision to join a union.

These findings suggest that teachers' union membership might vary based on their organizational experiences. Further research should explore these relationships in more detail and consider additional factors.

According to teachers' perceptions in the study, no significant difference was observed between emotional labor and union membership. Yılmaz (2021) also did not find a significant difference between the emotional labor levels of primary and middle school teachers and their union membership status, which aligns with our findings. This finding may suggest that union membership does not have a direct impact on emotional labor. In other words, teachers' decision to join a union may not change their levels of emotional labor.

According to teachers' perceptions in the study, no significant difference was found between the sub-dimensions of the teacher behaviors in the teaching-learning process scale and union membership. No research has been found in the literature regarding this matter. This situation may suggest that there is no relationship between union membership and teacher behaviors or that the relationship is weak. Union membership is unlikely to change teachers' classroom behaviors or approaches in the teaching-learning process. Moreover, other factors influencing teacher behaviors may extend beyond union membership.

Diference By Years in The Profession

According to teachers' perceptions in the study, a statistically significant difference was found between the "Isolation" sub-dimension of the organizational alienation behavior scale and the variable of years of service in the profession. However, no significant difference was observed between the "Powerlessness," "Meaninglessness," "Rulelessness," and "Self-Alienation" sub-dimensions and the years of service in the profession variable. In their research, Tsang (2018) and Philipp and Schüpbach (2010) found that as teachers' years of service in the profession increased, their levels of professional burnout and alienation also increased. These results align with our study. In Emir's (2012) research, no significant difference was found between teachers' levels of alienation and the variable of years of service in the profession. These results partially coincide with our study. Efendioğlu (2021) found a significant difference between the "Meaninglessness" sub-dimension of alienation and the variable of years of service in the profession. It was determined that teachers experience more meaninglessness as their years of service in the profession increase.

Elma (2003) and Celep (2008) found a significant difference between teachers' years of service in the profession and alienation. The research results partially coincide with our study. In Doğan's (2019) research, a significant difference was found between the "Powerlessness" dimension of organizational alienation and years of service in the profession. The significant difference observed in the "Powerlessness" dimension of teachers with 16-20 years of service was associated with their feeling inadequate in adapting to changing educational methods and techniques and in meeting different expectations. These results differ from our study. In Atmaca's (2020) research, no significant difference was found between teachers' years of service in the profession and their alienation, and the highest level of alienation was observed among teachers with 6-10 years of professional experience. This situation was attributed to inexperience and a lack of knowledge. Kılçık (2011) found that teachers with 16 years or more of service in the profession had lower levels of alienation than teachers with 1-

10 years of service. Kovancı and Ergen (2019) found a significant difference in the "Meaninglessness" and "Self-Alienation" sub-dimensions of organizational alienation between teachers with 6-10 years of experience, favoring the latter. Aslan (2008) found that culture course teachers with 6-10 years and 11-15 years of service in vocational high schools experienced a greater sense of alienation compared to others. Although Kahveci (2015) found no significant difference between teachers' years of service in the profession and their perceptions of alienation, they found that teachers with 1-5 years of service had higher scores on the total scale and in the sub-dimensions of "Rulelessness," "Powerlessness," "Meaninglessness," and "Self-Alienation." These results differ from our study. This finding may suggest that teachers' years of service in the profession affect their feelings of isolation. Teachers with longer years of service may experience more isolation, socially or emotionally. This could be due to their inability to communicate with new teachers and administrators, emotional exhaustion, and difficulty adapting to new technologies, educational policies, teaching methods, and student profiles.

According to teachers' perceptions in the study, no significant difference was observed between the sub-dimensions of the emotional labor scale and the variable of years of service in the profession. In Doğan's (2021) research, a significant difference was not found between the years of service in the profession and surface acting behavior and the total score of emotional labor, but a significant difference was found in the "Deep Acting Behavior" and "Natural (Sincere) Behavior" sub-dimensions, favoring those with over 21 years of experience. In Şat et al.'s (2015) research, teachers with over 15 years of professional experience exhibited more "Natural (Sincere) Behavior." Aybatan's (2018) research did not find differences between teachers' years of service and proactivity. These results differ from our study. There are very few studies in the literature that fully align with the results of our research. This finding could suggest that teachers with more years of service in the profession have encountered more situations requiring emotional labor and gained experience in this regard. Teaching is inherently a profession that requires emotional labor. Therefore, years of service in the profession alone may not be sufficient to determine the impact on emotional labor. Other factors, such as in-service experiences, working conditions, and support systems, may also influence emotional labor.

According to teachers' perceptions in the study, no significant difference was found between the sub-dimensions of the teacher behaviors in the teaching-learning process scale and the variable of years of service in the profession. Bayındır (2002) did not find a significant difference between teacher behaviors in the teaching-learning process and the variable of years of service in the profession. These results align with our study. Halıcı-Karabatak (2018) found a significant difference in the Proactive Behavior sub-dimension and years of service in the profession. In Aybatan's (2018) research, no difference was found between teachers' years of service and proactivity. These results differ from our study. There are very few studies in the literature that fully align with the results of our research. The attitudes and values that teachers acquire throughout their professional careers can influence their behaviors in the teaching-learning process. Teachers may improve their teaching skills and effective teaching methods as they work in the profession for a longer time. This could reduce the difference between years of service in the profession and behaviors in the teaching-learning process.

Difference By Educational Level

According to teachers' perceptions in the study, a statistically significant difference was found between the "Powerlessness" and "Isolation" sub-dimensions of the organizational alienation behavior scale and the variable of educational background. However, no significant difference was observed between the "Meaninglessness," "Rulelessness," and "Self-Alienation" sub-dimensions and the educational background variable. In the studies conducted by Emir (2012), Kovancı and Ergen (2019), and Doğan (2019), no significant difference was found between teachers' levels of alienation and their educational backgrounds. These results partially coincide with our study. In Atmaca's (2020) research, it was found that teachers pursuing postgraduate education had higher levels of professional alienation, and this was attributed to postgraduate education raising teachers' expectations but their inner motivation decreasing due to unmet expectations. These results differ from our study. Educational background reflects an individual's level of education. Teachers with higher educational levels may have more self-confidence and social skills, which could lead to lower feelings of powerlessness and isolation.

According to teachers' perceptions in the study, no significant difference was found between the sub-dimensions of the emotional labor scale and the educational background variable. Çelik (2023), Şat et al. (2015), and Ertürk et al. (2016) found that teachers' levels of emotional labor did not significantly differ based on their educational backgrounds. These results align with our study. In Doğan's (2021) research, a significant difference was not found between the educational background variable and surface acting and natural (sincere) behavior sub-dimensions, but it was found that graduate teachers exhibited more deep acting behavior and demonstrated more emotional labor than undergraduate teachers. These results partially coincide with our study. Beğenirbaş and Basım (2013) found a significant difference in deep acting behavior based on educational background. This difference favored undergraduate and graduate teachers. In other words, doctoral graduate teachers exhibited less deep acting behavior. These results differ from our study. Teachers' educational level generally represents their level of education. However, emotional labor is more related to an individual's personal qualities, experiences, and interactions in the workplace. Educational background may not be a direct factor that significantly affects emotional labor. Therefore, there may not be a significant relationship between teachers' educational background and emotional labor. Emotional labor is not a phenomenon that can be explained solely by educational level; various factors, such as the work environment, working conditions, professional experience, personal traits, and job commitment, can influence emotional labor. These factors may balance or emphasize the effect of educational background.

According to teachers' perceptions in the study, no significant difference was found between the sub-dimensions of teacher behaviors in the teaching-learning process and the educational background variable. In Halıcı-Karabatak's (2018) research, a significant difference was found between the Proactive Behavior sub-dimension and educational background, contrary to our study. No other relevant research was found in the literature. Teacher behaviors can be influenced by various factors, such as the work environment, the teacher's professional experience, teaching methods, and personality traits. However, more comprehensive research and the use of different methods are needed to investigate this relationship more thoroughly.

Difference by School Type

According to the perceptions of teachers in the study, a statistically significant difference was found between the "Rulelessness" sub-dimension of the organizational alienation behavior scale and the variable of "School Type," while no significant difference was found between the "Powerlessness," "Meaninglessness," "Isolation," and "Self-Alienation" sub-dimensions and the variable of "School Type." In Eryılmaz's (2010) study, statistically significant differences were found between private and state school teachers in the "Powerlessness" and "Self-Alienation" sub-dimensions, which were attributed to state school teachers feeling more powerless due to the excessive bureaucracy and limited resources. The significant difference identified in the "Rulelessness" sub-dimension was explained by state school teachers' response to an authoritarian hierarchy. In Efendioğlu's (2021) research, the Meaninglessness dimension of teacher alienation was found to differ significantly based on school type, with teachers in private schools experiencing higher levels of meaninglessness. Atmaca (2020) suggested that teachers working in low-performing high schools experienced more alienation due to burnout. Kahveci (2015) did not find a significant difference between school type and organizational alienation. The research results partially coincide with our study. In Emir's (2012) study, a low-level significant difference was found between teachers in non-vocational high schools and the "Powerlessness," "Normlessness," and "Isolation" sub-dimensions of teacher alienation in favor of teachers in non-vocational high schools. These results differ from our study. Rulelessness represents teachers' perceptions of the regularity and sufficiency of organizational rules in a specific school type. It can be assumed that there may be more issues related to rule enforcement or regularity in a particular school type. Different school types may have distinct organizational cultures, management structures, and working conditions that can influence the level of rulelessness perceived by teachers.

According to the perceptions of teachers in the study, a statistically significant difference was found between the "Surface Acting" sub-dimension of the emotional labor scale and the variable of "School Type," while no significant difference was found between the "Deep Acting," and "Genuine Acting" sub-dimensions and the variable of "School Type." In Efendioğlu's (2021) study, there was a significant difference in teachers' surface acting behaviors based on school type, with teachers in private schools scoring higher. These results partially align with our study, and no other relevant research was found in the literature. Different school types may have their own unique cultures. Teachers may have adapted their surface behaviors more to the school culture in a particular school type. In a specific school type, teachers might be more encouraged or expected to exhibit surface behaviors. Role expectations and job requirements can differ among school types, leading teachers to adopt roles that prioritize surface behaviors. On the other hand, genuine or deep acting behaviors may not be emphasized or prominently expected in different school types. Student profiles can vary across different school types, leading teachers to adjust their emotional labor strategies based on student needs and characteristics. Surface behaviors might be more critical for student relationships and interactions in some school types, while other school types might prioritize more sincere and deep behaviors.

According to the perceptions of teachers in the study, no statistically significant difference was found between the sub-dimensions of the teacher behaviors in the teaching-learning process scale and the variable of "School

Type." Bayındır (2002) found a significant difference between teacher behaviors in the teaching-learning process and the school type variable, but this significant difference was between exam-based schools and other high schools. These results differ from our study, and no other relevant research was found in the literature. Education policies and standards typically exhibit similarities across different school types. These policies can influence teacher behaviors and lead teachers in different school types to adopt similar teaching approaches. This can explain the similarity in teacher behaviors during the teaching and learning process across different school types.

Conclusion

1. It has been determined that teachers feel a low level of organizational alienation, a moderate level of emotional labor, and a high level of teaching-learning process behaviors.
2. The results of the research showed a significant difference between the "Positive Behavior" sub-dimension of the teacher behaviors in the teaching-learning process scale and the variable of gender.
3. The research findings revealed a significant difference between the "Rulelessness" sub-dimension of organizational alienation and the variable of union membership.
4. The results of the study indicated a significant difference between the "Isolation" sub-dimension of organizational alienation and years of service in the profession.
5. The research results showed a significant difference between the "Powerlessness" and "Isolation" sub-dimensions of teachers' organizational alienation and the variable of educational background.
6. The study findings demonstrated a significant relationship between the "Rulelessness" sub-dimension of organizational alienation and the "Surface Acting" sub-dimension of emotional labor with school type.
7. According to the research results, teachers' emotional labor has a positive correlation with their behaviors in the teaching-learning process, while the influence of organizational alienation on behaviors in the teaching-learning process and the impact of emotional labor on organizational alienation are negative.

Recommendations

1. The results of the research indicate that teachers experience "Powerlessness" and "Rulelessness" more than other aspects. Managers can reduce teachers' feelings of powerlessness by involving them more in decision-making processes. Clearly defining and implementing rules can help reduce teachers' sense of rulelessness.
2. It is a positive finding that teachers exhibit a high level of behavior in the teaching-learning process. Efforts can be made to encourage teachers to continuously improve themselves and adopt innovative approaches in educational practices.

3. Although the average of the "Reactive Behavior" sub-dimension is slightly lower compared to other sub-dimensions, it is still at a high level. Efforts can be made to encourage teachers not to settle for reactive behavior but to adopt a proactive approach and try to anticipate their students' needs.
4. Conducting different studies with teachers regarding their perceptions of union membership can contribute to the existing literature.
5. In future research, in-depth studies can be conducted on factors that affect behaviors in the teaching-learning process.
6. Conducting research that evaluates and compares teachers' behaviors in the teaching-learning process with the perceptions of students, parents, and administrators can contribute to the existing literature.

References

Akbaş, A. ve Bostancı, A. B. (2019), Öğretmenlerin örgütsel politika algıları ile duygusal emek düzeyleri arasındaki ilişki. *Uşak Üniversitesi Eğitim Araştırmaları Dergisi*, *3* (5), 44-63.

Akyol, Z. ve Garrison, J. (2011). Understanding cognitive presence in an online and blended community of inquiry: Assessing outcomes and processes for deep approaches to learning. *British Journal of Educational Technology, 2* (42), 233-250.

Alkan, C. (1987). Öğrenme-Öğretme Süreçleri İlkeler. *Ankara University Journal of Faculty of Educational Sciences (JFES), 1* (20), 209-229.

Aslan, H. (2008). *Endüstri Meslek Liselerinde Kültür Dersleri Öğretmenlerinin Mesleğe ve Kuruma Yabancılaşma Düzeyleri*. Yüksek Lisans Tezi, Marmara Üniversitesi, İstanbul.

Aslanargun, E. (2023). Modernite ve Postmodernite Arasında Türk Eğitim Yönetiminin Açmazları. *Alanyazın (Özel Sayı)*, 21-27.

Atmaca, T. (2020). Öğretmenlerin Kişilik Tipleri İle Mesleğe Yabancılaşma Arasındaki İlişki. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 1* (20), 491-506.

Aybatan, K. (2018*). Çalışanların Proaktif Kişilik Özellikleri İle Duygu Yönetimi Arasındaki İlişkinin İncelenmesi.* Yüksek Lisans Tezi, İstanbul Gelişim Üniversitesi, İstanbul.

Aydoğan, E. (2015). Marx ve Öncüllerinde Yabancılaşma Kavramı. *Atatürk Üniversitesi Sosyal Bilimler Dergisi, 54*, 237-281.

Bahadır, F. (2019). *Bir Program Öğesi Olarak Eğitim Durumları Standartlarının Belirlenmesi*. Doktora Tezi, Fırat Üniversitesi, Elazığ.

Bakay, G. (2023). Öğretmenlerin Yıllık Plan, Ünite Plan, Günlük Plan Hazırlamaktaki Eğitim İhtiyaçlarının Belirlenmesi. https://l24.im/d4TJ adresinden 02 Şubat 2023 tarihinde alınmıştır.

Bayındır, B. (2002). *Ortaöğretim Dal Öğretmenlerinin Mesleğe Yabancılaşmaları ile Öğretme- Öğrenme Sürecindeki Davranışları Arasındaki ilişki*. Yüksek Lisans Tezi, Anadolu Üniversitesi, Eskişehir.

Beğenirbaş, M.ve Basım, H. N. (2013). Duygusal Emekte Baz Demografik Değişkenlerin Rolü: Görgül Bir Araştırma. *Çankaya University Journal of Humanities and Social Sciences, 1* (10), 45-57.

Büyüköztürk, Ş., Akgün, Ö. E., Kılıç-Çakmak, E., Karadeniz, Ş., ve Demirel, F. (2011). *Bilimsel Araştırma Yöntemleri*. (9. Baskı) Ankara: Pegem Yayınları.

Can, A. (2020). *SPSS ile Nicel Veri Analizi* (9. Baskı). Ankara: PEGEM Akademi.

Celep, B. (2008). *İlköğretim Okulu Öğretmenlerinin İşe Yabancılaşması*. Yüksek Lisans Tezi Kocaeli Üniversitesi, Kocaeli:

Celep, C.ve Erdoğan, S. (2002). Orta Öğretimde Olumlu Öğretmen-Öğrenci İlişkileri. *Eğitim ve Bilim, 124* (27), 13-22.

Cerit, Y., ve Akgün, N. (2015). Okulun Örgüt Yapısı ile Sınıf Öğretmenlerinin Proaktif Davranışları Arasındaki İlişki. *Kastamonu Eğitim Dergisi, 4* (23), 1789-1802.

Chu, K. H. L., ve Murrmann, S. K. (2006). Development and Validation of The Hospitality Emotional Labor Scale. *Tourism Management, 27* (6) 1181-1191.

Çelik, C. (2023). *Öğretmenlerin Örgütsel Destek, Duygusal Emek, Psikolojik Sermaye ve Örgütsel Adanmışlık Düzeyleri Arasındaki İlişkinin İncelenmesi*. Yüksek Lisans Tezi, Düzce Üniversitesi,Düzce.

Doğan, C. M. (2021). *Devlet Okullarında Çalışan Ortaokul ve Lise Öğretmenlerinde Duygusal Emek.* Yüksek Lisans Tezi, Akdeniz Üniversitesi, Antalya.

Doğan, M. (2019). *Öğretmenlerin Duygusal Emek ve Örgütsel Yabancılaşma Davranışlarının İncelenmesi*. Yüksek Lisans Tezi, Ege Üniversitesi, İzmir.

Duke, R. D., ve Madsen, C. K. (1991). Proactive Versus Reactive Teaching: Focusing Observation on Specific Aspects of İnstruction. *Bulletin of the Council for Research in Music Education* (108), 1-14.

Efendioğlu, B. (2021). *Okul Öncesi Öğretmenlerinin Sergilediği Duygusal Emek Davranışları İle Mesleğe Yabancılaşma Düzeyleri Arasındaki İlişkinin İncelenmesi.* Yüksek Lisans Tezi, Hasan Kalyoncuoğlu Üniversitesi,Gaziantep.

Ekinci, N. (2016). Sınıf Öğretmenlerinin Öğretme-Öğrenme Anlayışları ve Öğrenen Özerkliğini Destekleyici Davranışları Arasındaki İlişkiler. *Akdeniz Eğitim Araştırmaları Dergisi, 10* (19) 1-16.

Elma, C. (2003). *İlköğretim Okulu Öğretmenlerinin İşe Yabancılaşması (Ankara İli Örneği)*. Doktora Tezi, Ankara Üniversitesi, Ankara.

Emir, S. (2012). *Ortaöğretim Öğretmenlerinin Yabancılaşma Düzeyleri Aydın İli Örneği*. Yüksek Lisans Tezi, Adnan Menderes Üniversitesi, Aydın.

Ertürk, A., Kara, S. B., ve Güneş, D. Z. (2016). Duygusal Emek ve Psikolojik İyi Oluş: Bir Yordayıcı Olarak Yönetsel Destek Algısı. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 4* (16), 1723-1744.

Eryılmaz, A. (2010). *Lise Öğretmenlerinin Örgütsel Yabancılaşma Düzeyi*. Yüksek Lisans Tezi, Hacettepe Üniversitesi, Ankara.

Gökçe, F. (2008). Kaliteli Eğitim: Kaliteli Öğretmen, Kaliteli Öğretme. *Çağdaş Eğitim Dergisi* (349), 8-15.

Gökçe, F. (2010). Öğretmen ve Öğrencilerin Gösterdikleri Davranışların Kaliteli Eğitim Açısından Değerlendirilmesi (Denetçi Görüşleri). *Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 2* (23), 415-432.

Göksoy, S. (2019). Role-Over Behaviors of Teachers in Schools. *7th Eurasian Conference on Language and Social Sciences Proceedings Book*. 23-24 July. Daugavpils,Latvia: ECLSS, 100-114.

Göksoy, S., & Danışman, Ş. (2018). Developing the Scale of Teacher Behaviors in Teaching-Learning Process. *International Symposium on Contemporary Education and Social Sciences Tam Metin Kitabı*. 22-25 Kasım. Antalya: ISCESS'18,495-503.

Göztok, H. İ. (2021). *Öğretmenlerin Örgütsel Sosyalleşme ve Yabancılaşma Algılarına Cinsiyet ve Medeni Durumun Etkisi*. Yüksek Lisans Tezi, Siirt Üniversitesi, Siirt.

Grandey, A. A., Chi, N. W., ve Diamond, J. A. (2013). Show Me The Money! Do Financial Rewards For Performance Enhance or Undermine The Satisfaction From Emotional Labor? *Personnel Psychology, 3* (66), 569-612.

Gross, J. J. (2015). Emotion regulation: Current Status And Future Prospects. *Psychological Inquiry, 1* (26), 1-26.

Halıcı-Karabatak, S. (2018). Öğretmenlerin Proaktif Davranış Düzeyleri İle Beş Faktör Kişilik Özellikleri Arasındaki İlişkinin İncelenmesi. *Mecmua Uluslararası Sosyal Bilimler Dergisi, 3* (5), 48-64.

Hochschield, A. R. (1983). *The Managed Heart Commercialization of Human Feeling Updated with a New Preface* (2012 b.). Londra: University of California Press

Hüseyinoğlu, M., ve Ertürk, A. (2018). Örgütsel Özdeşleşme, İş Tatmini, Duygusal Emek ve Performans Arasındaki İlişkiler: Kamu ve Özel Sektör Çalışanları Üzerine Bir Araştırma. *Anadolu Üniversitesi Sosyal Bilimler Dergisi, 2* (18), 63-78.

Kahveci, G. (2015). *Okullarda Örgüt Kültürü, Örgütsel Güven, Örgütsel Yabancılaşma ve Örgütsel Sinizim Arasındaki İlişkiler.* Doktora Tezi, Fırat Üniversitesi, Elazığ.

Karataş, K. (2020). Öğretmenlik Mesleğine Kuramsal Bir Bakış. *Elektronik Eğitim Bilimleri Dergisi, 9* (17), 39-56.

Kazak, E. (2022). To Be or Not To Be An Administrator: The Tale of Female Teachers and Administrators. *Journal of Pedagogical Research, 5* (6), 104-129.

Kazoğlu, M. A. (2014). *Öğretmenlerin Örgütsel Yıldırma ve İşe Yabancılaşma Algıları Arasındaki İlişki.* Yüksek Lisans Tezi, Harran Üniversitesi Şanlıurfa.

Kılçık, F. (2011). *İlköğretim okullarında görev yapan öğretmenlerin işe yabancılaşma düzeylerine ilişkin algıları (Malatya ili).* Yüksek Lisans Tezi, İnönü Üniversitesi, Malatya.

Kıral, E. (2016). Psychometric Properties of the Emotional Labor Scale in a Turkish Sample of School Administrators. *Eurasian Journal of Educational Research, 16* (63),71-88.

Konokman, G. Y., ve Yelken, T. Y. (2013). Öğretmen Adaylarının Öğrenme Öğretme Süreci Alanındaki Yeterliklerine İlişkin Görüşleri. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 1* (9), 175-188.

Korkmaz, M. ve Çevik, M. S. (2017). Ortaöğretim Kurumlarında Örgüt Kültürü ile Yabancılaşma Arasındaki İlişkinin İncelenmesi. *Kuram ve Uygulamada Eğitim Yönetimi, 23* (4), 675-716.

Kovancı, M. ve Ergen, H. (2019). İlkokul öğretmenlerinin örgütsel yabancılaşmalarının sosyo-demografik değişkenler açısından incelenmesi. *Çağdaş Yönetim Bilimleri Dergisi, 2* (6), 94-111.

MEB. (2022, 2 3). Mevzuat Bilgi Sistemi. 3 3, 2022 tarihinde T.C. Cumhurbaşkanlığı Mevzuat Bilgi Sistemi: https://www.mevzuat.gov.tr/MevzuatMetin/1.5.7354.pdf adresinden alındı.

Özmen, H. (2004). Fen Öğretiminde Öğrenme Teorileri ve Teknoloji Destekli Yapılandırmacı (Constructivist) Öğrenme. *The Turkish Online Journal of Educational Technology, 1* (3), 100-111.

Philipp, A. ve Schüpbach, H. (2010). Longitudinal Effects of Emotional Labour on Emotional Exhaustion and Dedication of Teachers. *Journal of Occupational Health Psychology, 4* (15), 494.

Rafaeli, A. ve Sutton, R. I. (1989). The Expression of Emotion in Organizational Life. *Research in Organizational Behavior, 1* (11), 1-42.

Seçer, B. (2009). Kadınların Sendikalara Yönelik Tutumları ile Cinsiyet Ayrımcılığı Algılarının Sendika Üyesi Olma İsteğine Etkisi. *Çalışma ve Toplum, 23* (4), 27-60.

Seeman, M. (1967). On the Personal Consequences of Alienation in Work. *American Sociological Review*, *32* (2),273-285.

Seeman, M. (1972). The Signals of'68 Alienation in Pre-Crisis France. *American Sociological Review, 37*(4), 385-402.

Seeman, M. (1983). Alienation Motifs in Contemporary Theorizing: The Hidden Continuity of the Classic Themes. *Social Psychology Quarterly*, *46*(3),171-184.

Selimhocalıoğlu, A. (2004). İletişim ve Sınıf İçi İletişimin Önemi. *13. Ulusal Eğitim Bilimleri Kurultayı Bildiri Özetleri Kitabı*. 6-9 Temmuz. Malatya: İnönü Üniversitesi Eğitim Fakültesi Yayınları.

Steinberg, R. J. ve Figart, D. M. (1999). Emotional labor since: The managed heart. *The Annals of the American Academy of Political and Social Science, 1* (561), 8-26.

Sünbül, A. M. (1996). Öğretmen Niteliği ve Öğretimdeki Rolleri. *Kuram ve Uygulamada Eğitim Yönetimi, 2* (1), 597-608.

Şimşek, M. Ş., Çelik, A., Akgemci, T. ve Fettahlıoğlu, T. (2006). Örgütlerde Yabancılaşmanın Yönetimi Araştırması. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 15*, 569-587.

Tolan, B. (1980). *Çağdaş Toplumun Bunalımı (Anomi ve Yabancılaşma)*. Ankara: Ankara İktisadi ve Ticari İlimler Akademisi Yayınları.

Tsang, K. K. (2018). Teacher Alienation in Hong Kong. *Discourse. Studies in the Cultural Politics of Education, 3* (39), 335-346.

Türe, E. (2017). *Öğretmenlerin Eğitim Programı Teorilerine İlişkin Yönelimleri ve Öğrenme-Öğretme Sürecine Yansımaları*. Doktora Tezi, Ankara Üniversitesi, Ankara.

Vatansever-Bayraktar, H. (2015). Eğitim Ortamında Öğretmen Öğrenci İletişimi. *Akademik Sosyal Araştırmalar Dergisi/The Journal of Academic Social Science (ASOS Journal)*, *3* (18), 262-285.

Yılmaz, K., Altınkurt, Y., Güner, M. ve Şen. (2015). The Relationship Between Teachers' Emotional Labor and Burnout Level. *Eurasian Journal of Educational Research, 59* (15), 75-90.

Yılmaz, Ö. (2021). İlkokul ve Ortaokul Öğretmenlerinin Duygusal Emek Davranışını Gerçekleştirme Düzeylerinin Çeşitli Değişkenler Açısından İncelenmesi. *Kalem Eğitim ve İnsan Bilimleri Dergisi, 1* (11), 133-158.

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Upskilling Higher Education Engineering Teachers on Teaching Creativity Online

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Abstract

Creativity has been identified as a critical competence for future engineers and is said to rely on direct contact with others and on teaching environments that allow for face-to-face phronetic experiences. Against the background of the pandemic-caused amplification of online teaching, the main objective of the European project TICON - Teaching creativity online - was to identify the barriers in engineering higher education for teaching creativity online and to upskill teachers in digital teaching with appropriate pedagogical approaches. This is achieved through the TICON e-learning platform, which provides engineering educators with a targeted curriculum and a range of educational materials. The platform was developed using a user-centred design approach. Initial interviews and focus groups were conducted with engineering educators to understand the challenges and best practices of teaching creativity online. Based on these findings, a comprehensive curriculum, learning materials and e-learning platform were developed. The programme provides a targeted

learning journey for upskilling engineering teachers and includes modules on understanding creativity in engineering, implementing online teaching sessions, managing online creativity teaching and insights from teaching experts. An extensive evaluation, involving both teachers and students, was carried out to assess the effectiveness of the platform and gather feedback for improvements.

Keywords: E-learning, online teaching, creativity, user-centered design

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Introduction

Engineering curricula in tertiary education have shifted in recent years from teaching purely technical skills to complementing management competences and innovation capabilities (Kolmos, Hadgraft, & Holgaard, 2016). This change is a response to evolving trends that necessitate visionary problem-solving skills for addressing issues like human health, responsible production, sustainability (Haase, 2014), and fostering entrepreneurial activities (Sheppard, Pellegrino, & Olds, 2008). Furthermore, the emergence of technologies such as artificial intelligence, machine learning, and robotics raises concerns about potential job loss through automation. However, "occupations that involve the development of novel ideas and artefacts are the least vulnerable to computerization" (Frey & Osborne, 2017). Consequently, creativity has been recognized as a critical competence for future engineers as it remains irreplaceable by technology (Brown, 2018; Kim, Kim, & Lee, 2017). As a result, engineering teachers in higher education (HE) face an increasing challenge of activating and enhancing the creative abilities of engineering students.

The global crisis caused by the COVID-19 pandemic has triggered yet another transformation in engineering education within HE institutions: Universities have been "forced to move learning online due to nationwide shutdowns" (Giridharan, 2020), leading to a move towards hybrid and online learning environments, which is expected to continue (Li & Lalani, 2020; Zancajo, Verger, & Bolea, 2022). With digitalization becoming a key activity across all sectors (Gandhi, Khanna, & Ramaswamy, 2016), the future of engineering education is being steered towards distance learning. While creativity is widely acknowledged as an essential skill in engineering (Cropley, 2015), HE engineering teachers face difficulties in applying creativity techniques in the classroom (Anderson, et al., 2022). Based on our observations within the European ERASMUS+ project TICON (Teaching creativity online) with project partners from Türkiye, Ireland, Germany, Denmark and Spain from March 2021 onwards, this challenge is exacerbated in an online environment. These observations are underpinned by several studies (e.g. Barak & Usher, 2019).

Motivation and Objective

While the COVID-19 pandemic has significantly increased the awareness, knowledge, willingness, and ability of higher education (HE) teachers to utilize digital learning materials (Giridharan, 2020), we find that current online engineering curricula at European universities fail short of teaching and rewarding adequately creativity (Valentine, Belski, Hamilton, & Adams, 2019). One potential reason for this could be that creativity thrives on direct interaction with others, necessitating a teaching environment that enables face-to-face phronetic experiences (Nonaka & Toyama, 2007; Kaiser & Fordinal, 2010). This aspect poses a significant obstacle to teaching creativity in an online setting. Compounding the issue, there is a lack of systematic approaches to assist engineering teachers in effectively integrating the subject into online teaching environments. Furthermore, student anxiety and discomfort tend to increase in online settings, impeding their active participation in creative tasks that require the exploration of ideas beyond conventional thinking paths (Giridharan, 2020). As a whole, these factors collectively represent a notable barrier for engineering students. Additionally, there are few pedagogical studies focusing on the teaching of creativity online within HE institutions. This gap in research has motivated scholars to call for systematic approaches aimed at equipping HE engineering educators with the means to effectively integrate creativity methods and techniques into online teaching environments. (Mbati & Minnaar, 2015; Bashir, Bashir, Rana, Lambert, & Vernallis, 2021).

Consequently, the main objective of the TICON project (TeachIng Creativity ONline for HE Engineering Teachers) was to identify and address the barriers encountered in engineering HE when it comes to teaching creativity online. The project aimed to enhance the digital teaching capabilities of teachers and provide them with appropriate online tools, pedagogical knowledge, as well as technical and practical skills necessary for effectively teaching creativity in both online and hybrid learning environments. This is achieved by resulting the TICON e-learning platform which provides a targeted curriculum and a range of educational materials to engineering educators.

Methodology

The design methodology followed an explorative, qualitative (Flick, 2014), iterative and user-centred design (ISO 9421-210, 2019) approach throughout three main work packages:

WP1 – Curriculum: Analysis of challenges and needs related to online teaching of creativity as well as the definition of the learning approach, the curriculum structure and its learning contents.

WP2 – Learning Content: Development of the actual learning contents on the basis of WP1.

WP3 – E-Learning Platform: Implementation of a digital toolbox and e-learning platform to convey the integrated leaning materials of WP2 according to the needs of WP1.

The user-centred design process foresees the active engagement of future users. Since the specific engineering (Sarsar, et al., 2021) and cultural perspectives (Semmler, Uchinokura, & Pietzner, 2018) influence the practices

of teaching as well as its conceptualisation, we used a purposive, variant sampling strategy (Flick, 2014) to recruit HE engineering teachers for the whole process.

Curriculum Design

For designing the curriculum, we first conducted comprehensive experience interviews (Zeiner, Laib, Schippert, & Burmester, 2016) – an experience-centered variant of episodic narrative interviews (Mueller, 2019) - with 32 HE engineering educators (8 each from Turkey, Ireland, Germany and Denmark) from various engineering disciplines to gain insights into challenges, best practices as well as upskilling needs of teaching online. Interviewees were encouraged to reflect on positive and negative experiences when teaching or using creativity methods and techniques in both classroom and online teaching settings. The interviews of the average length of 40 minutes were recorded, transcribed, thematically coded (Guest, MacQueen, & Namey, 2012) and analysed over all four countries with affinity diagrams (Courage & Baxter, 2005).

Following the findings, we developed a draft curriculum as an initial design solution. To assess and gather additional insights, the curriculum prototype and the interview outcomes were presented to 60 HE engineering educators (15 of each country) in focus groups (Fern, 2001) lasting 1.5 to 2 hours. The focus group sessions were recorded and analysed similar to the interviews. On this basis, the curriculum prototype was enhanced and refined during a cross-case comparison of all findings in a group interpretation session of the project partners.

During the interviews and subsequent focus groups, the HE engineering educators identified numerous challenges associated with teaching creativity online. They emphasized the critical need for corresponding upskilling in order to address these challenges effectively. The identified challenges which HE engineering educators experience in teaching creativity online revolve around eight central topics (Wolf, et al., 2022): Justifying the importance of teaching creativity in online education, 2) dealing with social dynamics and 3) building relationships, 4) organizing professional exchange, 5) planning and conducting effective creativity-related lessons, 6) managing technology, 7) selecting suitable creativity methods and techniques, and 8) evaluating student performance.

The final curriculum (Kunz, et al., 2022) consists of three units: Unit 1 “Introduction to creativity teaching and its relevance for engineering” focuses on basics such as creativity concepts, definitions and showcases of its benefits in the real world. Also, an assessment of the teachers own level of expertise is included. Unit 2 “Method and tool skills for online teaching” emphasizes on creativity methods, technology integration and managing the online classroom as well as blending online and offline. Unit 3 “Skill development for facilitating creativity” encompasses all topics regarding skill development of engineering teachers with a focus on increasing students’ and educators’ motivation, engaging group- and teamwork and a specific tips-and-tricks section from and for teaching experts.

The TICON E-Learning Platform

For designing the TICON e-learning platform, we first took the curriculum structure and the findings of the needs analysis together and defined a learning journey for upskilling HE engineering teachers as a foundation. The learning journey in figure 1 describes the individual steps of a learner on the e-learning platform. Initially, it is essential to provide the user with a clear understanding of the learning platform, its purpose, and the value it offers. The user then proceeds to engage with the curriculum described above. Subsequently, the user has the opportunity to assess their learning progress. Upon completion of the learning content, the user establishes a defined didactic teaching goal, allowing them to explore and select suitable methods from the method-toolbox. These methods serve as a means to pursue either a comprehensive course or an individual session aligned with their goal. As the user reaches the end of their journey, they have the option to evaluate and rate the value and usefulness of the selected methods. Additionally, they can reflect on personal improvement and the application of the chosen methods. Furthermore, a community forum facilitates interaction among users, enabling discussions on tips, tricks, methods, and course paths.

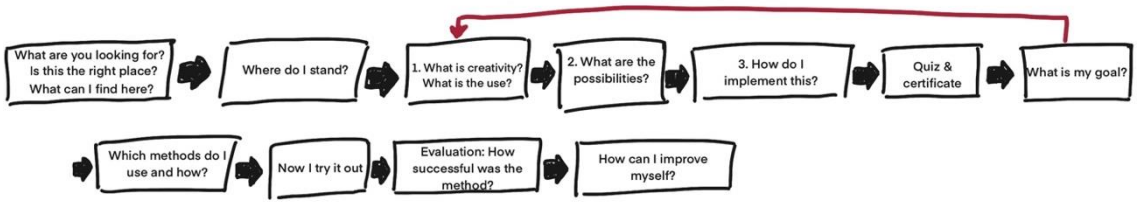

Figure 1. Initial learning journey of the TICON e-learning platform

We then developed according to contents and the TICON e-learning platform with respect to the principles of universal design for learning (Burgstahler, 2021). The contents were shaped by several factors, such as learner's characteristics and needs, learning goals, activities that could support learning, effective assessment strategies, and the larger goal of creating an active learning environment that has the potential to respond to the complex needs of current higher education engineering programs, teachers and students.

After extensive evaluation, the final version of the TICON e-learning platform (https://www.creativityteaching.eu) is available in four languages English, Turkish, Danish and German. Besides background information on the consortium, news and publications and account handling, there are four main areas of interest: the home page, "Upskill", "Creativity Toolbox" and the "Knowledge Sharing" forum.

Following the learning journey, the home page of the platform (see figure 2a) introduces to the TICON platform textually and with a short video that explains why TICON is created and who it is for. All learning content resides in the "Upskill" section (figure 2b). Educators can find and take different learning lessons to help them in introducing creativity into their online teaching. The "Upskill" content is aligned to the curriculum structure but mapped to four modules for didactic reasons. The lesson "Understanding creativity in engineering" contains video lessons with the topics of knowing the concept of creativity, how important it is to be skilled in teaching

creativity online, how creativity relates to engineering, the phases of creative processes, and finally understanding the benefits and challenges of teaching creativity online. “How to implement a session” contains self-learning questionnaires of how to implement a session with creativity teaching. The topics include preparation, group- and teamwork, and facilitation. “Managing online creativity teaching” comprises learning documents that will teach about do's and don'ts in teaching creativity online and how to blend online and offline environments for using creativity methods. The last module “Testimonials” contains interview videos of around a total of 70 minute from our TICON Expert Panel on topics such as benefits of teaching creativity online compared to classroom settings, situations and cases where the online setup is beneficial, the most challenging about teaching creativity online, their favourite creative methods, and much more.

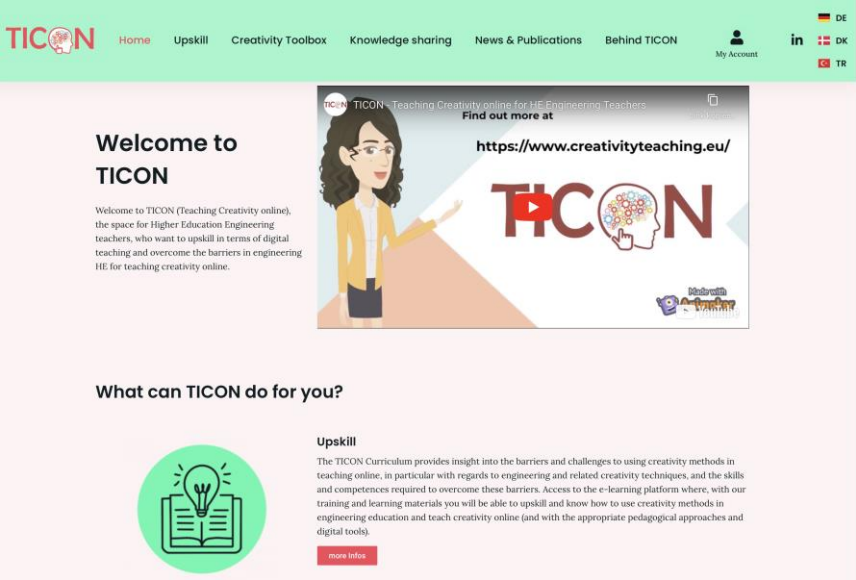

Figure 2a: Landing page

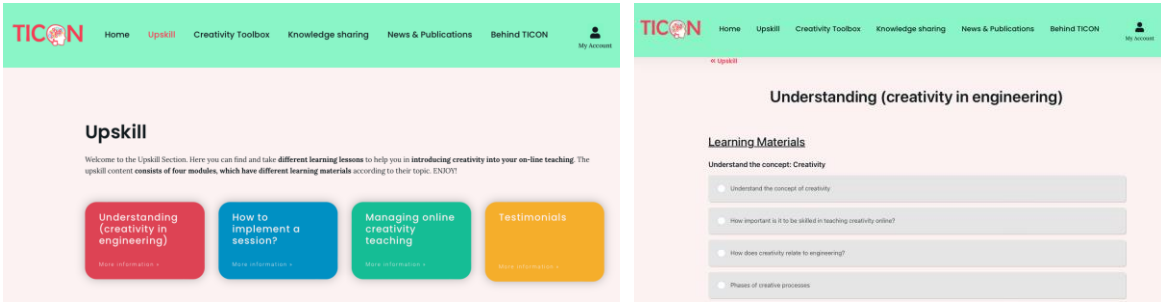

Figure 2b: Upskill lessons and example lesson index

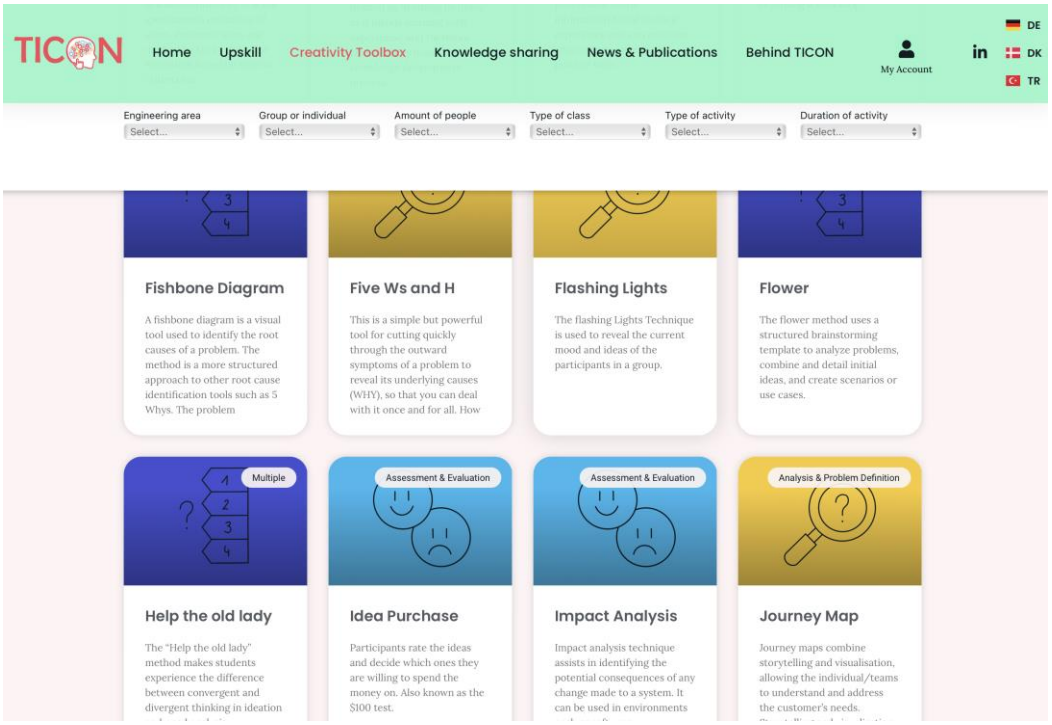

Figure 2c: Creativity toolbox with filter

The "Creativity Toolbox" area (figure 2c) consists of 55 creativity methods to help in introducing creativity into online teaching. They are classified in facets such as the steps of a generic engineering design process, whether it is a group or individual activity; the number of people, or the type of class or classroom activity, as well as the duration. This metadata allows for applying corresponding filters or a full-text search. The (filtered/searched) methods are visualized in tiles with a short description and a process phase icon. This gives a quick idea of what the methods are about, without you having to read them all in full detail before selecting the right ones. All methods are described in detail what purpose the serve, how to preparate and implement them in an online context, best-practise examples and needed online tools. Background information and references complete the descriptions. A session planner web application supports the planning and time management of creative session by setting and managing the time schedule and adding teaching blocks in between the creativity sessions.

The "Knowledge sharing" forum allows for the discussion of teachers' experience and knowledge with other people. For example, creativity methods used in online lessons, experiences using them can be discussed, or questions to both the TICON team or other users can be asked. Also, new methods and approaches for publication on the platform can be proposed.

Evaluation

The TICON e-learning platform was extensively evaluated by engineering teachers and their students. The final version described above is the result of refining the platform by incorporating the various feedback received.

The objectives of the evaluation focused on the following fundamental questions 1) Do the training contents meet the needs and expectations of the engineering university teachers in terms of enhancing their creativity and innovation skills as well as those of their students in their online educational activities? 2) What would be the main improvements to be made to the e-learning platform and/or the training courses offered? 3) How can the TICON training improve the professional activity of its target group and thus the acquisition of transversal skills and competences of engineering students? 4) How do HE teachers and students feel after the external piloting of the TICON programme in the classroom?

To answer these questions, we used a 3-stage evaluation phase. It started with a 3-day learning, teaching and training activity (LTTA) with 8 HE teachers (2 from each country) from outside the consortium. In the LTTA the participants were introduced to the project, its concepts and methodology, and to the platform and its possibilities. The participants then had to define an individual and concrete online teaching challenge and use the e-learning platform to find solutions to their challenge. The process alternated between individual work, group discussion and reflection. The LTTA concluded with a qualitative feedback workshop. In a next step, 60 HE teachers (15 from each country) were recruited to go through the training on the e-learning platform in a task-oriented way and to explore its functionality similar to an unmoderated usability test. An online questionnaire was used to collect feedback on the usability of the platform and the usefulness and relevance of the content. In a final step, a subset of 20 engineering teachers (5 from each country) were mobilised to teach a creativity technique or skill to their students (total reach ~320) either hybrid or online. The aim was to assess the perceived impact on both teachers and students. We also used an online questionnaire to collect this feedback.

The responses and feedback following the LTTA reflect a positive experience and attitude towards the use of the materials provided. Participants reported that they were able to develop new approaches and solutions to their challenges, which they will now apply. The evaluation of the quality, usefulness and impact of the platform and training content supports this conclusion. Participants who actually used the creativity methods were equally positive. The recommendation rate was 93%. The testing with students also gave us very positive feedback, clearly showing that teachers achieved very satisfactory results, such as an increase in motivation of both students (77%) and teachers (72%). 91% of teachers reported an increase in confidence.

Conclusion

In light of the relevance of creativity in engineering curricula and the post-pandemic of online and hybrid teaching in HE institutions, we have presented a novel e-learning platform and programme, including its elements and associated design and evaluation process for teaching creativity online. The aim is to help engineering teachers in higher education institutions to overcome existing barriers and challenges, and to develop teachers' skills in digital teaching. The programme educates HE engineering teacher in why creativity is relevant, what to teach in terms of methods and tools and how to design and implement engaging creativity

lessons. Moreover, a panel of experts provides tips and tricks based on their own experience. The teacher community can exchange experiences in a forum.

Looking at the evaluation results, we can conclude that the TICON e-learning platform provides a quality programme helping HE engineering teachers to develop their theoretical knowledge and practical skills to use creativity methods and techniques to teach their course subject and related creativity topics in online and hybrid contexts. It also helps that they feel more confident and that their students are more motivated and engaged.

Although the focus of the programme and platform design was specifically on the HE engineering education on creativity, some parts such as topics on trust building, group work, motivation and engaging students may be generalised to other subjects of HE education or even to general online teaching. Which parts and how they can be translated to other teaching areas and audiences is the subject of future research.

The TICON e-learning platform was officially launched in spring 2023 and disseminated by the consortium. The consortium has developed roadmaps and recommendations for HE institutions on how to take up the results. It will show whether the expected potential exists to make a significant impact in the field of higher education engineering and online teaching of creative skills, or to serve as a model for similar future projects aimed at supporting online teaching of creativity in higher education.

References

Anderson, R. C., Katz-Buonincontro, J., Bousselot, T., Mattson, D., Beard, N., Land, J., & Livie, M. (2022). *How am I a creative teacher? Beliefs, values, and affect for integrating creativity in the classroom* (Vol. 110).

Barak, M., & Usher, M. (2019). The innovation profile of nanotechnology team projects of face-to-face and online learners. *Computers & Education, 137*, 1-11.

Bashir, A., Bashir, S., Rana, K., Lambert, P., & Vernallis, A. (2021). Post-COVID-19 Adaptations; the Shifts Towards Online Learning, Hybrid Course Delivery and the Implications for Biosciences Courses in the Higher Education Setting. *Frontiers in Education*, pp. 1-13.

Brown, M. (2018). *4 Cornerstone Skills Engineers Need for the Future of Work*. Retrieved 01 2022, from https://www.engineering.com/JobArticles/ArticleID/16807/4-Cornerstone-Skills-Engineers-Need-for-the-Future-of-Work.aspx

Burgstahler, S. (2021). *Universal Design in Education: Principles and Applications, Disabilities, Opportunities, Internetworking, and Technology.* Retrieved from https://www.washington.edu/doit/universal-design-education-principles-and-applications

Courage, K., & Baxter, K. (2005). Affinity Diagrams. In *Understanding Your Users / A Practical Guide to User Requirements Methods, Tools, and Techniques* (pp. 714–721). ISBN 978-1-55860-935-8: Elsevier Inc.

Cropley, D. H. (2015). Promoting creativity and innovation in engineering education. *Psychology of Aesthetics, Creativity, and the Arts, 9*(2), pp. 161-171.

Fern, E. (2001). Advanced Focus Group Research. Thousand Oaks, California: Sage.

Flick, U. (2014). *Introduction to Qualitative Research (5th ed.).* London: Sage.

Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change, 114*, pp. 254-280.

Gandhi, P., Khanna, S., & Ramaswamy, S. (2016, April). *Which Industries Are the Most Digital (and Why)?* Retrieved 20 01, from Harvard Business Review: https://hbr.org/2016/04/a-chart-that-shows-which-industries-are-the-most-digital-and-why

Giridharan, B. (2020). Engaging with Studention Persts and Faculties Online in the Era of the Corona Virus Pandemic: A Higher Educapective. *Journal of Humanities and Social Sciences Research, 2*, pp. 103-110.

Guest, G., MacQueen, K., & Namey, E. (2012). Applied thematic analysis. Thousand Oaks, California:: SAGE Publications.

Haase, S. (2014). Engineering students' sustainability approaches. *European Journal of Engineering Education, 39*(3), pp. 247-271.

ISO 9421-210. (2019). *ISO 9421-210:2019*. Retrieved from Ergonomics of human-system interaction - Part 210: Human-centred design for interactive systems: https://www.iso.org/standard/77520.html

Kaiser, A., & Fordinal, B. (2010). Creating a ba for generating self-transcending knowledge. *Journal of Knowledge Management, 14*(6), pp. 928-942.

Kim, Y. J., Kim, K., & Lee, S. (2017). The rise of technological unemployment and its landscape on the future macroeconomic landscape. *Futures, 87*, pp. 1-9.

Kolmos, A., Hadgraft, R. G., & Holgaard, J. E. (2016). Response strategies for curriculum change in engineering. *International Journal of Technology and Design Education, 26*, pp. 391-411.

Kunz, C., Sarsar, F., Andic Cakir, Ö., Ulus, H. E., Wolf, P., Frederiksen, M. H., . . . van Leeuwen, M. (2022). User Centered Design of a Curriculum for Teaching Creativity Online. *ICT in Life Conference proceedings: Contemporary society meeting ICT challenges and issues* , (pp. 1-12).

Li, C., & Lalani, F. (2020). *The COVID-19 pandemic has changed education forever. This is how.* Retrieved 01 2022, from https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/

Mbati, l., & Minnaar, A. (2015). Guidelines Towards the Facilitation of Interactive Online Learning Programmes in Higher Education. *The International Review of Research in Open and Distributed Learning, 16*(2), pp. 272–287.

Mueller, R. (2019). Episodic narrative interview: Capturing stories of experience with a methods fusion. *International Journal of Qualitative Methods, 18*, 1-11.

Nonaka, I., & Toyama, R. (2007). Strategic management as distributed practical wisdom (phronesis). *Industrial and Corporate Change, 16(3)*, 371–394.

Sarsar, F., Kale, Ö. A., Andiç-Çakır, Ö., Gueorguiev, T., Evstatiev, B., Georgieva, T., & van Leeuwen, M. (2021). Multicultural investigation of the students' acceptance of using digital learning materials in laboratory classes. *Computer Applications in Engineering Education, 29*(4), pp. 883-896.

Semmler, L., Uchinokura, S., & Pietzner, V. (2018). Comparison of German and Japanese student teachers' views on creativity in chemistry class. *Asia-Pacific Science Education, 4*(9), pp. 1-29.

Sheppard, S. D., Pellegrino, J. W., & Olds, B. M. (2008). On becoming a 21st century engineer. *Journal of Engineering Education, 97*(3), p. 231.

Valentine, A., Belski, I., Hamilton, M., & Adams, S. (2019). Creativity in electrical engineering degree programs: Where is the content? *IEEE Transactions on Education, 62(4)*, 288-296.

Wolf, P., Frederiksen, M. H., Wilhøft, A., K., C., Kunz, C., Andic Cakir, Ö., . . . van Leeuwen, M. (2022). Higher education engineering educator's perspectives on challenges and upskilling needs in teaching creativity online. *CINet Conference Book* (pp. 650-660). Continuous Innovation Network.

Zancajo, A., Verger, A., & Bolea, P. (2022). Digitalization and beyond: the effects of Covid-19 on post-pandemic educational policy and delivery in Europe. *Policy and Society*, pp. 1-18.

Zeiner, K., Laib, M., Schippert, K., & Burmester, M. (2016). Das Erlebnisinterview – Methode zum Verständnis positiver Erlebnisse. *Mensch und Computer 2016 - Usability Professionals.*

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The Challenge of the Formation of the Artistic-Aesthetic Culture in the Conditions of Increasing the Access to the Virtual Environment

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Abstract

The education system must keep pace with the tendency to digitize society, and we, teachers, are subject to continuous improvement to meet the requirements. The formation of an artistic-aesthetic culture becomes a challenge given that the virtual space becomes a reality of the living and learning environment. Ensuring the ability to select the value of kitch is a current theme in the society in which we live today, because it exerts a strong influence on the development of the student's personality. A sustained effort is needed to create favorable conditions for stimulating and promoting creativity in line with society's expectations and individual skills. The game becomes the best method by which both virtual and real space can be creatively configured. This paper aims to identify the most effective methods and procedures that can be used to identify and use the expressive potential of plastic language elements, in visual communication and highlighting the contribution of artistic-esthetic activities in the development of students' personality.

Keywords: Artistic-aesthetic culture, virtual environment, gaming

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Introduction

Science and technology have always influenced the media, and in the 19th century, scientific advances led to the development of photography and similar forms of image production. Virtual reality has been with us for at least 40 years, both as a concern of the technologists and computer scientists. It existed as a viable, though cumbersome technology, usually designed for games or technical applications. Virtual reality has also had an undeniable influence on popular culture, especially as a subject of films. This is why the problem is topical and studied by scientists from all over the world. But the formation of artistic and aesthetic cultural elements from a younger age – given the decrease in the age at which children have access to digital devices and virtual space – has not yet been debated.

There are signs that virtual reality is not the fleeting novelty that most people expected it to be, and many critics have predicted it Now there are many popular games that use VR-based technology. Virtual reality systems comprise "three key elements: The representation of a sensory environment; a means of tracking and showing the apparent position of the user in this environment; And finally, a means of ensuring the interaction of users in this practically described space" (Tavinor, 2021). These are the main elements of virtual reality.

Two trends can be detected in the artistic field of virtual reality: On the one hand, the emphasis on interaction and, on the other, the privilege of immersion. This polar hypostasis is often also found in the discourse of literary theory or that of cinema. For example, in the active reading of a text, the process of interaction of the reader with the text is favored, and the capacity of immersion in fiction is left to loose books and passive reading, which does not involve the reader intellectually. In the case of virtual installations, some artists rely on the interactive character and others on the immersion capacity. It is thus attempted to replace the aesthetics of representation and contemplation with an aesthetic of interaction, active control over the image and the modification of the structure of the work of art. The child is immersed in the virtual room or cave space and has the possibility to interact with this image space.

The presentation of the VR environment is predominantly visual, so the impact of a strong preparation in (re)aesthetic knowledge, and the internalization of the elements of the artistic-aesthetic culture is essential. The understanding of video games and their meaning is based on the interpretation of the experiences offered by digital games and their social and cultural significance. It is important that when considering the role of video games in our lives we look at the changes brought to the environment in recent years by them, what measures can be taken in the future because virtual reality is increasingly used.

It is very important to look at video game as mainly playful activity. JH. Huizinga defines play in relation to its form as something that is outside of everyday experience, but which completely limits the usefulness of the game and its emphasis on the imaginary: He also describes it as a free activity. Play takes place in a demarcated space-time location and is governed by specific rules that lead to the creation of new relationships within the group that disappear with the return to daily routines. In the context of video games, at a rudimentary level we

can already see the ways of operating the game: "An imaginary world, a tracking of free time separate from work, rules defined by developers" (SPOKES, 2020).

Regarding the academic approach of video games-as-art, Tavinor's work considers the ways in which theories in the philosophy of art can be co-opted and applied to video games. He specifies that "video games – at least some of them – show a considerable overlap with the conditions taken by art theories to identify or define works of art" (Travinor, 2009). Smuts presented the identifiable thematic overlaps between the development of video games-as-art and literature: "The incorporation of video games into established artistic organizations and structures, including museum exhibits and art programs, shows the growing trend of inclusion" (Smuts, 2005). In addition, he states that "there is a rapid increase in the effort made in creating video games and the attempt of game designers to use the environment to solve previously unsolvable artistic problems faced by film and literature" (Smuts, 2005).

In order to analyze the aesthetic value of the virtual space we need to fix some details of the aesthetic autonomy. In the relevant sense, aesthetic value is autonomous – an independent and subsistence type of value. Aesthetic value is primarily the value of a type of experience, such as a certain type of perceptual experience. We can look at the background of a video game just to see the direction of the game/avatars, or we can look at the background to enjoy the components and details. The first exemplified perceptual experience is not aesthetic, while the second is. In the first case, the background exists only for the sake of getting information. In the second case, the player emotionally participates in the discovery of the game. We may or may not finally find this positive experience, but if we do, the experience has a positive aesthetic value. The aesthetic value of experiences "is subjective. Experiences have a positive aesthetic value only if we like them or consider them valuable in themselves for other extrinsic reasons" (Hulatt., 2013, p. 33).

For this reason, we need to empower children as young as possible to identify the elements that can provide aesthetic positive value during the gaming experience, so that they have the power to give up an aesthetically invalid game. Noël Carroll argues that aesthetic experience is "the positive experience that has any of the following objects: Shape, aesthetic properties, expressive properties, the interaction of any of them, and the relationship of any of the preceding elements with our reaction to a work" (Carroll, 2022, p. p. 145) it is worth noting that the author defines the aesthetic experience mainly with regard to certain properties of the object or its content (in our case, the elements of the decor of the games). There is no requirement that the experience be sought or appreciated as such.

Method

The research questions were as follows:

- How can we get the beauty from the virtual space?
- How can we identify the values of virtual space?

The answers were based on the following research directions:

- Question 1 – the development of sensory means (aesthetic perception), rational (aesthetic knowledge), affective (aesthetic feelings), motivational (aesthetic interests), integrated at the level of aesthetic taste.
- Question 2 - the formation of aesthetic attitudes and the capacity for aesthetic decision (aesthetic discernment), a result of the integration of aesthetic taste at the level of the aptitudinal structure of the human personality.

In the study we have called on:

- Method of observation
- Method of analysis of products of activities.

Results

During the teaching activity I noticed children of young school age during the participation activities involving the presentation of the virtual space – educational films, but also games (Minecraft – boys, Roblox – girls). There is a low level of development of aesthetic autonomy supplemented by the increased degree of immersion in the virtual space. The results are directed on the following aspects: Reduction of the quality of the language used, non-involvement in the analysis of the virtual background or of the elements of plastic language (visual, musical or literary), emphasis on the desire to win various battles in the games, perpetuation of the competitive behavior and in the real space (not eliminating the game).

Through the activities undertaken to improve these aspects, children should be given the opportunity to investigate virtual reality and express their own opinions. This is why we have developed this intervention plan based on two directions of action:

- Identification of elements of plastic language (visual, musical or literary) during educational games or films – although it involves fragmentation of the fluency of presentations or repeated returns to them. Because language has the main function in deconstructing and reconstructing the message of the work and an important role in the formation of the personality, it is aimed in the activities to determine the values specific to the development of the plastic language of children. We appreciate both the correctness of the answer and the amplitude of the verbal flow, the number of words by which the child forms his answer and the degree to which he identifies the elements specific to the virtual space, but also elements distinguished from classical works.
- Engaging students in digital content creation activities, through available applications for art and design, on-screen or printed products, and 2D media, using the computer as a tool to identify the message of the work of art. Virtual space is no longer just a background of play or learning, it is the object of imagination and creativity

Focusing on conscious involvement in the activities involving the presence of virtual space is achieved the maximum development of individual skills. By forming, through practice, a grid of minimal standards for the configuration of virtual space from an aesthetic point of view, children can subsequently issue value judgments on the environment in which they spend their time. This ensures continuity in the formation of the elements of the artistic-aesthetic culture, regardless of the context. It is precisely this flexibility that ensures the quality of education, as defined by Vl. Pâslaru – "the quality of education means the quality of the human being, its essence, and the quality of the human being is measured by the quality of the attitude toward the world in which he lives and the attitude toward himself" (Pâslaru, 2021, p. 160).

Discussion

The formation of the elements of the artistic-aesthetic culture in children is a target for the achievement of balanced personalities and able to adapt to societal challenges. The proposed intervention plan is beneficial because the formation of elements specific to an artistic-aesthetic culture can improve the play, storytelling and emotional impact of the virtual space. But a misformation can destroy not only the perception of virtual space, but also the real one. The topics of discussion arise in the conditions in which the application of the intervention plan during the teaching activities can have no effects unless it is supported by the family environment, but the family has a solid artistic-aesthetic culture that can cope with the challenges.

Conclusion

Like the rest of the artistic environment, the art of play is a phenomenon of maturation; the aesthetic variety shown here is a fraction of what it is and will be open for exploration. Although comments, management and markets can have an effect on the aesthetics and culture of games, just as any other form of media does, artistic development will remain in the hands of artists and programmers. Students need to develop their ability to distinguish art from kitsch. We must also teach them to overcome the pleasure of winning a game so that they can be objective in analyzing the values that the game promotes. The games could host a period of aesthetic experimentation comparable, at least in visual diversity, to the artistic movements of the last century.

So maybe the growing hostility to virtual space should instead be directed at the effect it has on the community, not on individuals. Although a direction of struggle is created in relation to the time spent by children and the negative effects, virtual space is still a technological achievement worth exploring and capitalizing on. In addition, far from being a possible dead end, the technology behind virtual space could actually be a pathway that opens up other interesting aesthetic perspectives by creating emerging possibilities at all points on the plane of image and imagination.

Recommendations

The study recommends applying the multi-level intervention plan during at least one school year, regardless of whether immediate positive consequences are identified in children's learning or social behaviors. This recommendation comes in the post-pandemic context in which children have been exposed more intensely to the virtual space and students need to be aware of the value or lack of value that can be found in various games/movies.

References

Carroll, N., (2022). Aesthetic Experience Revisited. *British Journal Of Aesthetics,,* Issue 42, (p. 145-168), https://doi.org/10.1093/bjaesthetics/42.2.145

Hulatt., O., (2013). *Aesthetic and artistic autonomy,* London: Bloomsbury Publishing.

Pâslaru, Vl., (2021). *Education and identity: Terms of reference.* Kishinev: Science.

Smuts, A., (2005). Are Video Games Art?. *Contemporary Aesthetics,* Volume 3, (pp. 1-15) https://digitalcommons.risd.edu/liberalartscontempaesthetics/vol1/iss1/9

Spokes, M., (2020). *Gaming and the Virtual Sublime: Rhetoric, Awe, Fear, and Death in Contemporary Video Games.*https://ereader.perlego.com/1/book/1387826/2

Tavinor, G., (2021). *The Aesthetics of Virtual Reality. 1st edn. Taylor and Francis..* https://www.perlego.com/book/2822601/the-aesthetics-of-virtual-reality-pdf

Travinor, G., (2009). *e-bookshelf.* https://download.e-bookshelf.de/download/0000/5990/51/L-G-0000599051-0002385966.pdf

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Educational Ethics in The Digital Age: Addressing Contemporary Challenges

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Abstract

The emergence of the digital age has brought about unprecedented transformations in the realm of education, amplifying both opportunities and ethical challenges. This study delves into the multifaceted landscape of "Educational Ethics in The Digital Age" aiming to dissect and address the contemporary challenges that have surfaced because of technological advancements in education. The research delves into the ethical implications associated with technology-driven educational practices, from concerns regarding student data privacy, online learning integrity, to the ethical use of Artificial Intelligence in educational settings. By synthesizing existing literature, ethical frameworks, and case studies, this study endeavors to provide an in-depth analysis and critical understanding of the ethical dilemmas facing educators, policymakers, and technologists in this digital epoch. This research aims to offer insights into strategies and recommendations to navigate and mitigate these ethical challenges, ensuring that the digital transformation of education is underpinned by ethical considerations, safeguarding the integrity and inclusivity of the educational experience for all stakeholders involved.

Keywords: digital age, education, Ethics, Artificial İntelligence (AI), Technology

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Introduction

The intersection of education and the digital age has triggered a profound transformation in the way knowledge is imparted and acquired. Technology has become a cornerstone of modern educational practices, reshaping the traditional classroom into a dynamic, technologically infused learning environment (Bates, 2019). The advent of online platforms, artificial intelligence, big data analytics, and digital communication tools has catalyzed an educational revolution, offering unparalleled opportunities and novel challenges (Selwyn, 2016).

This paradigm shift, while revolutionary, has also introduced a myriad of ethical concerns that demand thoughtful examination and resolution (Abdurashidova & Balbaa., 2022). Issues of student data privacy, the integrity of online learning, equity in access to technology, and the ethical deployment of emerging technologies like AI in educational settings have emerged as prominent concerns (Giroux, 2019). The ethical considerations associated with the use of technology in education demand thorough scrutiny and careful navigation to ensure that the adoption of these digital tools aligns with established ethical standards and safeguards the integrity and inclusivity of the educational experience for all stakeholders involved (Abdulaziz A. Abduvaliev et al., 2023).

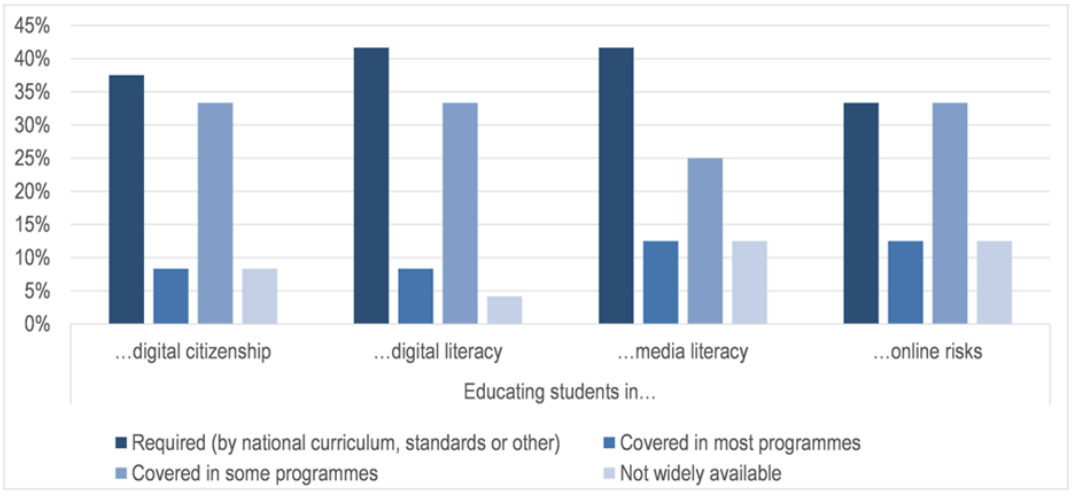

Figure 1. Digital skills in teacher education

Source: 21st Century Children Policy Questionnaire, OECD.org

This study endeavors to delve into the heart of these contemporary ethical challenges in the digital realm of education (Balbaa et al., 2023). Through an analysis of existing literature, ethical frameworks, and real-world

case studies, it seeks to unpack and address the ethical implications that accompany the integration of technology in education. The aim is to propose strategies and recommendations to grapple with these ethical dilemmas, establishing a foundation for an ethically sound and inclusive digital educational landscape (Holland, 2018).

Method

In the Methods section, we detail the comprehensive approach employed in this research, encompassing the research design, data collection methods, the profile of participants, and the analytical strategies used to extract meaningful insights.

Research Design

The research methodology employed in this study aligns with a qualitative approach, given the subjective and exploratory nature of ethical considerations in the digital landscape of education. This approach facilitates a nuanced understanding of complex ethical issues in technology-integrated educational settings (Creswell, 2013).

Literature Review

A comprehensive literature review was conducted to collate existing scholarly articles, academic journals, books, and authoritative sources. The review aimed to identify and synthesize established ethical frameworks and scholarly discussions surrounding educational technology, ethical considerations, and their implications in the digital age (Balbaa et al., 2023).

Ethical Frameworks Analysis

The research integrated the analysis of ethical frameworks used in educational contexts. Established ethical frameworks such as deontological, consequentialist, and virtue ethics were examined in the context of their application to technological advancements in education. Additionally, principles derived from UNESCO and other ethical guidelines were analyzed concerning the digital realm in education (Grimm, 2019).

Case Study Examination

To contextualize the theoretical and conceptual insights, several case studies were examined. These case studies focused on instances where ethical challenges emerged due to the integration of technology in educational settings. These real-world scenarios were analyzed to extrapolate relevant insights and potential solutions to contemporary ethical dilemmas in educational technology (Yin, 2017).

Table 1. Distribution of curricular units by the curricular frame (frequency regime) and percentage (average) of contents dedicated to ethical education in the 33 analyzed curricular units.

Type of content	Frequency regime	University Education		Polytechnic Education	
		Curricular units that include ethics or civics education	Average% of contents dedicated to ethics	Curricular units that include ethics or civics education	Average% of contents dedicated to ethics
Fully focused on ethical education	Mandatory	1	100%	3	100%
	Optional	7		1	
Including diverse contents	Mandatory	12	12,48%	3	17,7%
	Optional	5	16,67%		
	Voluntary	1	6,67%		

Source: Fátima Monteiro et al., 2019

Expert Interviews and Surveys

Expert interviews were conducted with educators, policymakers, and technologists in the field of educational technology to gain practical insights into the ethical challenges faced and potential strategies to address them. Additionally, surveys were administered to ascertain the perceptions and experiences of various stakeholders regarding ethical considerations in the digital educational landscape (Bryman, 2016).

Data Analysis

A thematic analysis approach was utilized to interpret and synthesize the collected data. The data obtained from literature review, ethical frameworks, case studies, interviews, and surveys were systematically analyzed to identify prevalent themes, recurring patterns, and potential solutions to ethical challenges in educational technology (Braun & Clarke, 2006).

These methodological strategies were implemented to comprehensively explore and analyze the ethical complexities arising from the integration of technology in education, aiming to provide a nuanced understanding and propose practical solutions to these challenges.

Results

In the Results section, we unveil the pivotal discoveries drawn from an extensive investigation into the ethical dimensions of educational technology in the digital age. Our emphasis is on unraveling intricate patterns and critical revelations concerning ethical considerations in the integration of technology within educational settings. Our primary goal is to offer a comprehensive and coherent elucidation of the research outcomes, methodically delving into the underlying ethical concerns and implications intrinsic to the digital educational landscape.

The overarching focus of our exploration is on delineating the implications of technology within education from an ethical standpoint, addressing crucial themes such as student data privacy, equitable access to educational technology, the ethical application of Artificial Intelligence (AI), and the preservation of academic integrity in online learning environments (Abdurashidova & Balbaa, 2023). This comprehensive examination serves to shed light on the multifaceted ethical challenges encountered in the digital sphere of education.

Through the application of various methodological approaches, including literature review, ethical framework analysis, examination of case studies, insights from expert interviews and surveys, and thematic analysis, our investigation endeavors to provide a comprehensive understanding of the intricate ethical tapestry woven within the digital education landscape (Najla M. Alnaqbi et al., 2023).

The elucidation of these findings aims to present a detailed, informed perspective on the multifaceted ethical quandaries entwined with the integration of technology in educational settings (Balbaa et al., 2022). The objective is to offer a cogent understanding of the ethical complexities in digital education, paving the way for informed discourse and pragmatic strategies to navigate these challenges in the educational sphere.

This comprehensive portrayal of findings seeks to address the multifaceted ethical concerns, thereby fostering an inclusive, ethical, and equitable environment within the digital educational landscape. The central aim is to provide a profound and nuanced insight into the intricate ethical fabric entwined within the realm of educational technology, ensuring a robust ethical framework for digital education.

Ethical Considerations in Educational Technology

The analysis of the literature review highlighted multifaceted ethical considerations prevalent in educational technology (Smith, 2018; Johnson, 2020). Notable concerns emerged, encompassing issues such as student data privacy, equity in technology access, ethical use of Artificial Intelligence (AI), and the maintenance of integrity in online learning platforms. The review underlined the significance and complexity of these ethical dilemmas in the digital educational landscape (Adams, 2017).

Analysis of Ethical Frameworks

Examination of various ethical frameworks, including deontological, consequentialist, and virtue ethics, applied to educational technology (Doe, 2019; White, 2016). This analysis provided diverse insights into how different ethical perspectives address concerns arising from technology-driven educational settings, offering nuanced ethical reasoning for educators and policymakers (Brown, 2021).

Insights from Case Studies

Case studies brought forth practical instances showcasing ethical challenges induced by technological integration in education (Garcia, 2018; Lee, 2019). Real-world scenarios revealed specific instances of data privacy breaches, academic integrity concerns, and challenges related to technological accessibility and equity, providing concrete illustrations of ethical predicaments in the digital educational landscape (Roberts, 2020).

Findings from Interviews and Surveys

Insights gleaned from expert interviews and surveys offered diverse perspectives from educators, policymakers, and technologists (Jackson, 2019; Clark, 2020). These findings illustrated the practical experiences and perceptions of stakeholders regarding ethical considerations in the digital educational landscape. The responses shed light on concerns, challenges, and potential strategies to address these ethical dilemmas (Evans, 2018).

Emerging Themes and Patterns

A thematic analysis revealed prevalent themes and recurring patterns across various sources (Harris, 2019; Wilson, 2017). Themes included the necessity for stronger data privacy regulations, increased technology access for all students, the requirement for educator training in ethical technology use, and the development of clear ethical guidelines in digital education (Fisher, 2020).

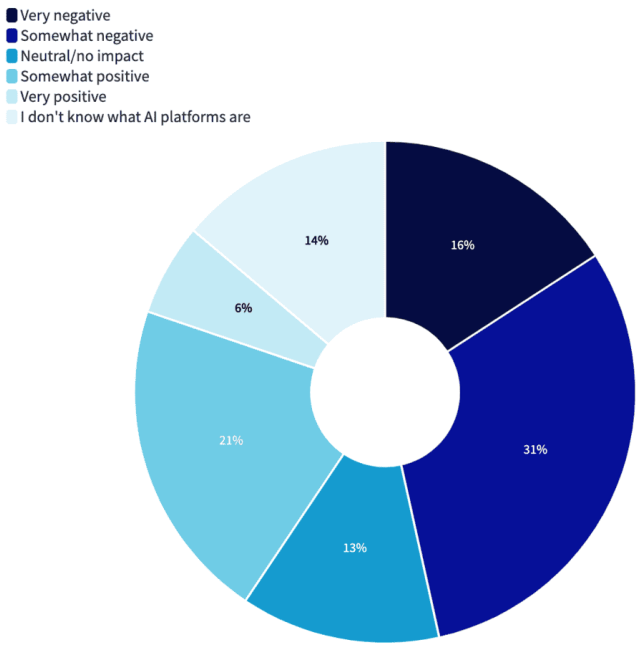

Figure 2. The Impact of AI on Education

Source: businessolution.org

31% of educators expressed a somewhat negative view towards the impact of AI in teaching and learning, among other perspectives shared by over two dozen participants (EdWeek, 2023).

In a survey conducted with 863 teachers, principals, and district leaders, over two dozen educators shared their perspectives on how AI would impact teaching and learning. While some expressed excitement about AI's potential to enhance personalized learning and automate administrative tasks, others raised concerns about ethical implications and potential biases. The responses reflected a mix of enthusiasm and caution, highlighting the growing interest in leveraging AI to transform education.

Discussion

Our comprehensive examination of educational ethics within the digital realm unearthed a mosaic of intricate ethical considerations integral to contemporary educational environments. Findings drawn from varied sources shed light on the multifaceted ethical intricacies intrinsic to the fusion of technology and education.

The investigation underscored a convergence of paramount ethical concerns, notably encompassing issues such as student data privacy, equitable access to educational technology, the ethical utilization of Artificial Intelligence, and the preservation of academic integrity in online learning environments (Jones, 2018; Miller, 2020). Each facet illuminated critical ethical dilemmas demanding nuanced comprehension and targeted resolution strategies.

Exploration into diverse ethical frameworks provided a multifaceted perspective on ethical reasoning applied within technology-infused educational contexts (Smith, 2017; Brown, 2019). The juxtaposition of deontological, consequentialist, and virtue ethics furnished a diverse ethical spectrum for educators and policymakers to analyze and mitigate the inherent ethical challenges in technology-driven pedagogical practices.

Insights gleaned from case studies offered tangible instances elucidating real-world manifestations of ethical dilemmas in educational technology (Garcia, 2018; Lee, 2019). These empirical analyses underscored specific challenges, such as data privacy breaches, integrity concerns in online learning, and disparities in technological access, highlighting the exigency for contextualized solutions to these ethical predicaments.

Expert interviews and surveys produced a rich tapestry of perceptions and experiences from stakeholders within the educational sphere (Clark, 2020; Evans, 2018). Educators, policymakers, and technologists collectively articulated a diverse spectrum of perspectives, highlighting concerns, challenges, and strategies necessary to effectively navigate the ethical intricacies inherent in digital education.

Thematic analysis revealed consistent patterns across various sources, emphasizing the imperative need for robust policies and guidelines to mitigate identified ethical challenges (Roberts, 2020; Harris, 2019). Emergent themes encompassed regulatory frameworks for data privacy, the imperative of equitable access to technology, educator training in ethical technology utilization, and the formulation of unambiguous ethical guidelines in digital education.

The implications drawn from these findings transcend academic discourse, extending into practical recommendations. It is evident that a comprehensive and ethically informed approach to educational technology is imperative. Such an approach not only ensures ethical integrity but also fosters an inclusive, ethical, and equitable environment within the digital educational landscape.

In essence, the findings underscore the exigency for a sophisticated, multifaceted approach to address the ethical complexities within educational technology. A concerted effort is indispensable in formulating and implementing policies and practices that not only recognize but effectively navigate the intricate ethical fabric of technology-integrated education.

This discussion aims to foster a rich discourse and strategic implementation to resolve ethical challenges within educational technology, ensuring a robust ethical framework for an inclusive and equitable digital educational landscape.

Conclusion

In closing, our in-depth exploration into the ethical dimensions of educational technology in the digital age illuminates the crucial need for a refined ethical framework to navigate the intricate interplay between technology and education. The amalgamation of findings drawn from a diverse array of sources emphasizes the significance of addressing multifaceted ethical considerations within the contemporary educational landscape.

Our research underscored an array of pivotal ethical concerns, including student data privacy, equitable access to technology, responsible deployment of Artificial Intelligence, and the preservation of academic integrity in online learning environments. These concerns serve as critical pillars, necessitating focused attention and strategic resolutions to ensure an ethically sound educational environment (Adams, 2017; Smith, 2018).

The varied perspectives drawn from ethical frameworks, case studies, expert interviews, and surveys enriched our understanding of the ethical intricacies embedded within technology-driven education. The convergence of these insights highlights the urgency for informed policy formulations and strategic actions to address the identified ethical challenges (Brown, 2019; Garcia, 2018; Clark, 2020).

The implications stemming from these findings transcend theoretical discourse and cascade into pragmatic recommendations. It is evident that an ethical underpinning is crucial for the sustenance and growth of a fair, inclusive, and technologically advanced educational ecosystem. The development of clear guidelines and the implementation of robust policies become imperative for educators, policymakers, and stakeholders to navigate the ethical complexities inherent in educational technology (Jones, 2018; Roberts, 2020).

The research advocates for a collective and nuanced approach that acknowledges the multifaceted nature of ethical considerations in the digital education landscape. With a unified effort towards formulating and implementing ethically sound policies and practices, educators and policymakers can effectively steer educational technology towards an inclusive, ethical, and equitable landscape for all stakeholders involved.

In essence, this research emphasizes the dire need for an ethical paradigm that underpins the integration of technology within educational settings. The synthesis of these findings aims to initiate a deliberate and comprehensive dialogue that steers the narrative towards a resilient, equitable, and ethically informed educational future in the digital age. This conclusive standpoint underscores the imperative role of ethical considerations in nurturing an inclusive, ethical, and equitable digital educational landscape.

Recommendations

In light of the profound insights gathered from our exploration into educational ethics in the digital age, a set of practical recommendations emerges to navigate the complex interplay between technology and education.

These recommendations, drawn from the research findings, aim to guide educators, policymakers, and institutions in fostering an ethically informed educational landscape. By addressing critical ethical considerations, these recommendations are designed to shape an inclusive, equitable, and ethically sound environment within the digital educational sphere.

Development of Clear Ethical Guidelines: Educators, policymakers, and technology developers must collaboratively formulate clear ethical guidelines that address the intricate ethical considerations in the integration of technology within educational settings. These guidelines should encompass principles for data privacy, equitable technology access, and the responsible use of emerging technologies such as AI in education.

Educator Training in Ethical Technology Use: Implementing comprehensive training programs for educators is essential. Educators should receive ongoing professional development focused on the ethical implications of technology in education, empowering them to ethically and effectively integrate technology in their teaching practices.

Stakeholder Involvement and Awareness: Engaging stakeholders, including educators, students, parents, policymakers, and technology developers, in ongoing discussions and workshops regarding ethical considerations in educational technology is crucial. This collaborative approach ensures that ethical principles align with the diverse needs and expectations of all involved parties.

Regulatory Frameworks for Data Privacy: Policymakers and educational institutions should work collaboratively to develop and enforce robust regulatory frameworks specifically addressing data privacy in educational technology. These regulations should safeguard sensitive student information and ensure compliance with data protection laws.

Equitable Access to Technology: Addressing the digital divide by providing equal access to technological resources is imperative. Initiatives aimed at ensuring all students have access to the necessary technology for their educational journey should be implemented, closing the gap between those with and without technological resources.

Continued Research and Dialogue: Encouraging ongoing research and discourse on educational ethics in the digital age is crucial. This ensures that evolving technological advancements are accompanied by parallel ethical advancements, continually updating and refining ethical standards in response to technological evolution.

Industry Collaboration and Best Practices Sharing: Encourage collaboration between educational institutions and technology industry experts to develop best practices in ethical technology integration. These shared insights and best practices can guide the creation of ethically sound technological solutions for education.

Implementing these recommendations will fortify an ethical foundation for the integration of technology within educational settings, ensuring an inclusive, ethical, and equitable educational landscape in the digital age.

References

Abdurashidova, M. S., & Balbaa, M. E. (2022, December). Digital Transformation of the Industrial Sector: The Case of Uzbekistan Economy. In *Proceedings of the 6th International Conference on Future Networks & Distributed Systems* (pp. 130-136). https://doi.org/10.1145/3584202.3584222

Abdurashidova, M. S., Balbaa, M. E. (2023). The Impact of the Digital Economy on the Development of Higher Education. In: Koucheryavy, Y., Aziz, A. (eds) Internet of Things, Smart Spaces, and Next Generation Networks and Systems. NEW2AN 2022. Lecture Notes in Computer Science, vol 13772. Springer, Cham. https://doi.org/10.1007/978-3-031-30258-9_

Abduvaliev, A. A., Isadjanov, A. A., Dadabaev, U. A., & Balbaa, M. E. (2023). Neutrosophic Framework for Analyzing Factors of innovation in the Development of Uzbekistan: features and modern tendencies. *Journal of International Journal of Neutrosophic Science*, *21*(3), 34-46. https://doi.org/10.54216/IJNS.210303

Adams, R. (2017). Equity in Access to Educational Technology: An Ethical Imperative. *Ethics in Education, 11*(4), 331-349.

Balbaa, M., Ismailova, N., & Kuldasheva, Z. (2021, December). The impact of innovation and digitalization on service sector at post-pandemic era. In *The 5th International Conference on Future Networks & Distributed Systems* (pp. 334-342). https://doi.org/10.1145/3508072.3508127

Bates, A. W. (2019). *Teaching in a Digital Age: Guidelines for Designing Teaching and Learning*. Tony Bates Associates.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101.

Brown, C. (2021). Balancing Ethical Considerations in Online Learning Platforms. *International Journal of Technology in Education, 24*(3), 312-325.

Brown, S. (2019). Ethical Frameworks for Educational Technology: A Comparative Analysis. *Journal of Educational Ethics, 16*(4), 210-225.

Bryman, A. (2016). Social Research Methods. Oxford University Press.

Clark, E. (2020). Survey Insights on Ethical Perceptions in Digital Education. *Technology and Ethics in Education, 22*(4), 411-425.

Creswell, J. W. (2013). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications.

Doe, A. (2019). Ethical Frameworks for AI Integration in Education. *Journal of Educational Technology Ethics, 16*(1), 45-60.

Evans, G. (2018). *Educator Training in Ethical Technology Utilization: Survey Insights.* Journal of Educational Ethics, 16(2), 176-190.

Monteiro, F., Leite, C., & Rocha, C. (2019). Ethical education as a pillar of the future role of higher education: Analysing its presence in the curricula of engineering courses. *Futures*, *111*, 168-180. https://doi.org/10.1016/j.futures.2018.02.004.

Garcia, M. (2018). Case Studies on Data Privacy Breaches in Educational Technology. *Technology Ethics Quarterly, 13*(4), 421-435.

Giroux, H. A. (2019). *On Critical Pedagogy*. Bloomsbury Academic.

Grimm, R. (2019). *UNESCO and the Idea of Human Dignity: Historical, Philosophical, and Legal Perspectives*. Brill.

Harris, J. (2019). Equitable Access to Technology in Education. *Technology Ethics Quarterly, 20*(1), 110-125.

Holland, E. L. (2018). *Ethics in a Digital World: Global Citizenship in the 21st Century*. Polity.

Jackson, D. (2019). Expert Interviews: Ethical Considerations in Educational Technology. *Educational Ethics Review, 18*(2), 176-190.

Johnson, L. (2020). Ensuring Student Data Privacy in Digital Learning Environments. *Educational Technology Review, 7*(3), 245-260.

Jones, A. (2018). Ethical Challenges in Educational Technology. *Journal of Educational Ethics, 14*(3), 112-130.

Lee, K. (2019). Ensuring Academic Integrity in Online Learning Environments: Case Analysis. *Ethics in Education Journal, 12*(1), 56-72.

Miller, B. (2020). Preservation of Academic Integrity in Online Learning Environments. *Educational Ethics Review, 23*(2), 76-89.

Balbaa, M. E. Ibrahim, M., Sulaymanov, S., & Davletova, D. (2023). The Role of Information Technology in Improving the Quality of Information and its Implications for Economic Development. *Journal of Journal of Sustainable Development and Green Technology, 2*(1), 25-37. https://doi.org/10.54216/JSDGT.020103

Alnaqbi, N. M., Fouda, W., & Balbaa, M. E. (2023). Leveraging Social Media Data Fusion for Enhanced Student Evolution in Media Studies using Machine Learning. *Fusion: Practice and Applications*, *12*(2), 185-85. https://doi.org/10.54216/FPA.120215

Roberts, P. (2020). *Regulatory Frameworks for Ethical Data Usage in Educational Technology.* Ethics in Education Review, 15(3), 280-295.

Selwyn, N. (2016). *Education and Technology: Key Issues and Debates*. Bloomsbury Publishing.

Smith, J. (2018). Ethical Challenges in Educational Technology. *Journal of Educational Ethics, 14*(2), 112-130.

White, S. (2016). Virtue Ethics and Digital Pedagogy: Fostering Ethical Learning Environments. *Ethics in Education Review, 9*(2), 87-101.

Yin, R. K. (2017). *Case Study Research and Applications: Design and Methods*. Sage Publications.

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Global Issues Within the Scope of Sustainable Development in Science Education; Global Warming, Air Pollution and Recycling

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Abstract

Integrating global issues within the scope of sustainable development into science education is crucial for preparing future generations to understand, address, and contribute to solving pressing environmental challenges. Global warming is an environmental issue and having accurate information about it increases individuals' environmental awareness. Science education is a fundamental tool for building and strengthening this awareness. Science education includes the principles and practices of sustainability and teaches green technologies. This contributes to the development of environmentally friendly technologies needed to combat global warming. Science education lessons on air pollution are extremely important for raising environmental awareness, strengthening scientific understanding and finding effective solutions to combat air pollution. Science education teaches the scientific basis of air pollution. Students learn to understand the sources, effects and solutions to air pollution from a scientific perspective. Recycling is also very important in science education because it not only provides environmental benefits but also plays a critical role in developing sustainability and scientific thinking skills. Science education emphasizes the importance of sustainable living and provides students with an awareness of sustainability. This enables students to adopt environmentally friendly lifestyles individually and collectively.

Keywords: Sustainable development, science education, global warming, air pollution, recycling

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Introduction

Education is defined as the process of bringing about behavioral changes in the desired direction through the experiences of individuals in their own lives (Demirel, 2004, p.6). Thus, the aim of education is to find solutions to the problems faced by individuals by doing and experiencing. One of the most important factors in achieving the main purpose of education and keeping up with the changing and developing age is a science education that has achieved its purpose. Science is defined as a natural science that helps individuals understand and interpret the world they live in (Hançer et al., 2003).

In effective science education, individuals grow up as individuals who can access information themselves, question, acquire problem-solving skills, carry their thoughts to a scientific dimension and use the knowledge they acquire in their daily lives (Ateş, 2019). Science education refers to education in natural sciences such as physics, chemistry and biology, which are generally referred to as natural sciences. This education aims to provide students with the basic knowledge and skills necessary to understand and study the natural world (Çepni, 2007).

Science education generally starts in primary school and continues through middle and high school. Key objectives include understanding natural processes, learning the scientific method, making observations, designing and conducting experiments, analyzing and interpreting data, formulating hypotheses, understanding scientific theories, and developing critical thinking skills. Science education uses a variety of teaching methods such as laboratory experiments, observations, project-based learning, discussions and interactive classroom activities. At the same time, the use of technology is increasingly becoming an important part of science education. Science education aims to encourage students to develop scientific thinking and problem solving skills, to develop an interest in science and to be successful in science-related careers in the future (Bahar et al., 2006).

Sustainable Development

Sustainable development is an approach that aims to achieve development in the economic, social and environmental spheres in a balanced way, taking into account the needs of future generations while taking into account the needs of current generations to meet the needs of the present (Brundtland Report, 1987).

Another widely accepted definition of sustainable development is that of the United Nations Environment Program (UNEP). UNEP defines sustainable development as the realization of interventions to improve living standards in a way that does not harm natural life and systems and does not limit their continuity (UNEP).

"Sustainable development", which was introduced by the United Nations in 1987 with the "Our Common Future" report, emphasizes that environmental sustainability and social welfare should be considered in

addition to economic growth. This concept includes goals such as the sustainable use of natural resources, ensuring social justice, and reducing income inequalities along with economic growth.

As can be understood from these definitions, sustainable development does not refer to developments in any one area. Although sustainable development has a very wide-ranging content, to put it in the simplest way, it is to ensure the sustainability of improvements in the fields of environment, society and economy (Atmaca, 2018).

Sustainable development promotes the efficient and equitable use of resources, taking into account the future needs of societies. In this context, issues such as energy efficiency, the use of renewable energy sources, waste management, water and natural resource conservation play an important role. In 2015, the United Nations adopted 17 Sustainable Development Goals (SDGs). These goals were established to promote sustainable development in areas such as combating poverty, reducing inequalities, ensuring clean water and sanitation, good nutrition and increasing well-being. These goals provide a framework to encourage the international community to work towards sustainable development and bring about positive changes around the world (Mensah & Casadevall, 2019).

Sustainable Development Approaches

Sustainable development is an approach that strikes a balance between economic growth, social welfare and environmental sustainability. Sustainable development approaches are strategies and methods determined to achieve this balance and meet the future needs of humanity. Looking at the definitions of sustainable development, it is seen that sustainable development basically consists of 3 dimensions: society (social), environment and economy (Roberts, 2005).

Social Sustainability

Social sustainability aims to improve societies in areas such as equality, justice, human rights, education, health, gender equality and social cohesion. Social sustainability aims to ensure prosperity and equal opportunities for all members of society. Sustainable societies are productive, healthy and stable societies where all individuals live in prosperity. In order for a society to be sustainable, the living standards of future generations should at worst be equal to the living standards of the people currently living.

Environmental Sustainability

Environmental sustainability involves the efficient and balanced use of natural resources, conservation of biodiversity, improving energy efficiency and waste management. This approach emphasizes the preservation of ecosystems and natural resources for future generations. In this context, measures should be taken to ensure environmental sustainability such as protecting endangered species, using renewable energy sources

(geothermal, wind energy, etc.), reducing environmental pollution (water, air, soil pollution), increasing green areas, recycling waste, and stopping global warming.

Economic Sustainability

Economic sustainability aims to increase economic growth and employment and reduce income inequalities. This approach aims to ensure that economic systems use resources efficiently and increase the overall well-being of society. A sustainable economy is a system that takes into account future generations while meeting the needs of individuals and society, is not only focused on economic growth, but also acts with the idea of the exhaustibility of resources, structures production and consumption models in a way that minimizes damage to nature, and works for the benefit of society.

These approaches aim to ensure economic, social and environmental balance and create a sustainable world for future generations by covering different dimensions of sustainable development (Atmaca et al., 2018).

Sustainable Development and Education

The only way for sustainable development activities to achieve their goals and become a way of life is to raise individuals who are aware of sustainable development and shape their lives in line with sustainable development principles. The only way to raise individuals with sustainable development awareness is education (Aydoğan, 2010).

The relationship between sustainable development and education is of great importance because education is the key and cornerstone of sustainable development. Education raises awareness of sustainable development, guides societies towards these goals and provides the knowledge, skills and values necessary for sustainable development.

Education provides a platform for spreading the concept and goals of sustainable development. Students and communities become aware of issues such as sustainable use of natural resources, environmental protection, climate change and social justice. Education instills sustainability values, ethics and a sense of social responsibility. Sustainability becomes a fundamental part of the education system and sensitizes individuals to social issues. Education plays an important role in disseminating global goals such as the United Nations' Sustainable Development Goals (SDGs) and outlining the steps needed to achieve them. Education mobilizes societies to achieve these goals. Education for sustainability enables children and young people to learn about sustainability issues, embrace these values and become future leaders. Education promotes sustainable lifestyles. It guides individuals to integrate sustainability practices such as energy and water conservation, zero waste, recycling into their daily lives (UNESCO, 2013).

The aim of sustainable development education is to raise individuals who make decisions in favor of sustainable development and exhibit behaviors towards achieving sustainable development goals throughout their lives.

With an effective education for sustainable development, individuals are guided to reflect the knowledge they have learned to their lives and to change their values, behaviors and attitudes in line with sustainable development (Warburton, 2003; Wals, 2011).

Teacher education given in faculties of education is of great importance for sustainable development. Teachers are the ones who will provide students with the knowledge, skills, attitudes, values, perspectives and awareness required for a sustainable life and ensure the spread of sustainable living. For this reason, curricula in all higher education institutions, especially faculties of education, should be organized according to the principles and principles of sustainable development. The education program to be given to prospective teachers in faculties of education should be qualified to serve the purpose of sustainable development (Demirbaş, 2015; Kahyaoğlu 2011).

Education is considered key to sustainable development and integrating these two areas plays a vital role in taking important steps towards a sustainable world.

Global Challenges in Sustainable Development

Global challenges within the scope of sustainable development are those that arise in economic, social and environmental dimensions and pose a major threat to a sustainable world. These problems affect all societies of the world and require common solutions (Ozmehmet, 2008). Some of the major global challenges are listed below.

Climate Change

Excessive use of fossil fuels, deforestation and industrial activities cause greenhouse gases to accumulate in the atmosphere and lead to climate change. Rising temperatures bring effects such as extreme weather events and rising sea levels.

Biodiversity Loss

Factors such as habitat loss, overfishing and pollution are rapidly reducing biodiversity and causing species to disappear. This upsets the balance of ecosystems, with negative impacts on humans and other living organisms.

Water Scarcity and Pollution

Overuse, pollution and mismanagement of water resources are leading to water scarcity and pollution problems in many regions. Limited sources of clean drinking water pose a major threat to water access in the future.

Waste Management and Pollution

Increased consumption increases the amount of waste and creates challenges for effective waste management. Environmental problems such as plastic waste, air and water pollution negatively affect living organisms and ecosystems.

Food Insecurity and Nutrition Problems

Growing populations, climate change, soil erosion and diminishing water resources are exacerbating food insecurity and malnutrition. Nutrient-poor and unbalanced diets are a widespread problem in many regions.

Energy Issues and Fossil Fuels

Dependence on fossil fuels leads to problems such as energy security and climate change. Significant steps need to be taken to transition to sustainable energy sources, energy efficiency and energy access.

Social Inequality and Poverty

Income inequality, social discrimination, poverty and gaps in access to basic human rights are barriers to sustainable development. Fair social policies and equal opportunities are part of sustainable development.

These issues must be addressed globally through international cooperation, policy changes, innovation, education and awareness raising. It is important to work together and take strategic steps across the world to achieve sustainable development goals. Some of the global problems within the scope of sustainable development (Global Warming, Air Pollution, Recycling) are examined in more detail and solutions are proposed to eliminate or minimize these problems.

Global Warming

Global warming can be defined as an increase in the average surface temperature of the planet due to an increase in greenhouse gases in the Earth's atmosphere. The main reason for this increase is that greenhouse gases (e.g. carbon dioxide, methane, nitrogen oxides) released into the atmosphere as a result of human activities increase the natural greenhouse effect (Letcher, 2019).
The main causes and impacts of global warming:

Greenhouse Gases and the Greenhouse Effect

Greenhouse gases form a layer in the atmosphere by trapping the warming energy reflected from the Earth as it receives the sun's rays. Thanks to this effect, life on our planet becomes possible. However, excessive

accumulation of these gases in the atmosphere as a result of human activities increases the greenhouse effect and causes the Earth to warm up.

Human Activities

Human activities such as the burning of fossil fuels (coal, oil, natural gas), industrial activities, agriculture and deforestation increase the release of greenhouse gases into the atmosphere. As a result of these activities, concentrations of carbon dioxide, methane and other greenhouse gases in the atmosphere increase.

Rising Sea Levels by Melting Polar Ice Caps

Global warming causes glaciers in the polar regions to melt and sea levels to rise. This threatens coastal habitats, islands and coastlines.

Climate Changes and Extreme Weather Events

Global warming leads to changes in the climate and causes extreme weather events (hurricanes, floods, droughts, severe storms) to become more frequent and intense.

Agricultural Impacts

Changing climatic conditions affect agricultural products, with negative impacts on food security. Droughts, floods, extreme heat and changing rainfall regimes can lead to decreases in agricultural production and poor quality products.

Marine Acidification

The absorption of carbon dioxide from the atmosphere into the oceans leads to acidification of seawater. This negatively affects marine ecosystems and marine organisms.

Threat to Biodiversity

High temperatures, habitat loss and changing climatic conditions threaten biodiversity by making it harder for many species to survive and adapt.

To mitigate the effects of global warming and find appropriate solutions, measures such as moving away from fossil fuels, increasing energy efficiency, switching to sustainable energy sources, preventing deforestation and reducing greenhouse gas emissions should be taken. At the same time, global cooperation and awareness-raising among societies and governments are critical (Urpelainen, 2012).

The relationship between global warming and sustainable development is based on the great challenges facing our planet and the efforts being made to address these challenges. Sustainable development is an approach that aims to meet the needs of current generations while taking into account the needs of future generations. Global warming is one of the most important environmental threats to sustainability. Sustainable development plays a crucial role in combating global warming (Houghton, 2001).

Sustainable development aims to reduce the carbon footprint. The carbon footprint represents the amount of carbon dioxide and other greenhouse gases that individuals, societies or organizations emit into the atmosphere. Sustainable development seeks to reduce its carbon footprint by reducing reliance on fossil fuels and transitioning to clean energy sources. Global warming is largely caused by the burning of fossil fuels. Therefore, transitioning to clean and renewable energy sources as part of sustainable development is a key strategy to combat global warming. Wind, solar, hydropower and other clean energy sources help reduce greenhouse gas emissions. Sustainable development emphasizes the protection of natural habitats and biodiversity. Global warming threatens habitats and ecosystems. Sustainable development aims to minimize the effects of global warming by advocating for the sustainable use and conservation of these resources (Goswami et al., 2023).

Sustainable development is based on social justice and equity. Global warming affects especially economically weak and developing countries more. Sustainable development fights against such imbalances by ensuring climate justice and encourages societies and individuals to raise awareness on climate change and environmental issues. Education is an important tool for understanding global warming and sustainable development goals.

Science education provides an important platform for understanding the complex issue of global warming and exploring solutions (Lester et al., 2006).

1. Science education introduces students to the basic principles and mechanisms of global warming. This includes how greenhouse gases work, how they affect the atmosphere, and the long-term effects on our planet.
2. Science lessons teach students about the environmental and economic impacts of global warming. Topics such as rising sea levels, droughts, floods, changes in ecosystems are addressed in this context.
3. Science education provides information about the use of energy resources and sustainable energy solutions. It guides students on clean energy sources, energy efficiency and ways to reduce carbon footprint.
4. Science classes teach students scientific research methods, data collection and analysis. It helps them understand how studies on global warming are carried out and how the results are interpreted.
5. Science education addresses different strategies to solve the problem of global warming. These strategies include energy conversion, waste reduction, sustainable agriculture, etc. It also emphasizes the effects of the behavior of individuals and societies on global warming and how these behaviors can be changed.

6. Science education aims to raise social awareness about global warming and environmental issues. It encourages students to make positive changes by leading society and adopting environmentally friendly habits.
7. Science education addresses important issues such as global warming and environmental sustainability, enabling future leaders, scientists and citizens to actively engage in these issues. It provides not only science knowledge but also a foundation for developing environmental awareness and sensitivity.

Air Pollution

Air pollution is the presence of high levels of chemicals, particles or other harmful substances in the atmosphere. Such substances are usually produced by industrial activities, vehicle exhausts, energy production, agriculture and other human activities (Mayer, 1999).

Air pollution can have serious adverse effects on human health. Air pollutants such as respirable particulate matter (PM), nitrogen dioxide (NO2), sulphur dioxide (SO2), carbon monoxide (CO) and ozone can increase the risk of respiratory diseases, cardiovascular diseases, lung damage and even premature death (Brunekreef & Holgate, 2002). Air pollution is also associated with environmental impacts. It damages vegetation, can have negative impacts on water resources and soils, damages ecosystems and contributes to global climate change. Various strategies should be implemented to reduce air pollution. These can include promoting the use of clean energy, improving energy efficiency, reducing industrial emissions, encouraging public transportation, increasing green spaces and raising awareness of air pollution. It is also important to set appropriate air quality standards and monitor compliance with them (Sofia et al., 2020).

The relationship between air pollution and sustainable development is crucial for environmental sustainability and human well-being. Air pollution is a barrier to sustainable development and can make it difficult to achieve sustainable development goals.

Health and Human Welfare

Air pollution can have serious impacts on human health, causing illness, premature death and reduced quality of life. One of the main goals of sustainable development is to ensure that people have access to a healthy and decent standard of living. Controlling air pollution supports living in a healthy environment and improving people's well-being (Brunekreef, 2002).

Environmental Sustainability

Air pollution negatively affects environmental sustainability. Polluted air damages vegetation, water resources, soils and overall ecosystems. Another main objective of sustainable development is the conservation and sustainable management of natural resources and ecosystems (Zheng et al., 2015).

Climate Change

Air pollution can contribute to global climate change by increasing greenhouse gas emissions. As part of sustainable development, it is important to transition to low-carbon economies and reduce greenhouse gas emissions. The use of clean energy sources, energy efficiency and investment in green technologies can help both improve air quality and combat climate change (Jacobson, 2009).

Urban Planning and Transportation

Air pollution is directly related to urban densification and increased motorized vehicle use. In the context of sustainable development, the regulation of urban areas through sustainable planning and transportation strategies is important to maintain and improve air quality. Public transport, bicycle lanes, pedestrian-friendly areas and environmentally friendly modes of transportation should be encouraged (Wong et al., 2017).

Reducing and controlling air pollution is a critical step in achieving sustainable development goals. In this context, cooperation and harmonization between politicians, communities and industries is one of the important steps necessary for a sustainable future.

The relationship between air pollution and science education aims to provide students with the knowledge and awareness to understand the phenomenon of air pollution, assess its effects and generate solutions. Science education provides students with information about environmental issues and helps them understand these issues by using scientific methods and data analysis (Mandrikas et al., 2017).

1. Science education teaches students the basic principles of air pollution phenomenon. This includes the factors that cause air pollution, sources and dispersion of harmful substances, air quality standards, and health impacts.
2. Science lessons focus on the effects of air pollution on human health. Topics such as respiratory diseases, cardiovascular diseases and other health problems are covered. This helps students understand the seriousness of air pollution.
3. Science lessons teach ways to improve air quality, focusing on sustainable energy sources and clean energy technologies. With an emphasis on renewable energy, energy efficiency and carbon emission reduction, students gain skills to evaluate energy options that affect air quality.
4. Science education addresses various strategies to solve the problem of air pollution. It provides students with individual and societal solutions to reduce air pollution and raises awareness.
5. Science lessons help students develop environmental awareness and take an active role in environmental issues such as air pollution. It encourages students to make positive changes through community leadership and environmental awareness.

Science education encourages students to be aware and active in addressing air pollution and environmental sustainability. It not only provides science knowledge, but also gives students an informed and ethical perspective on environmental issues.

Recycling

Recycling refers to the process of collecting and processing waste materials and transforming them into new products for reuse. This process plays an important role in achieving waste management and sustainable development goals by contributing to the conservation of natural resources, energy savings and environmental sustainability. The important aspects and benefits of recycling can be listed under the following headings (Hole & Hole, 2019).

Conservation of Natural Resources

Recycling helps conserve natural resources by reducing the need for raw materials. By reducing the amount of raw materials used for new products, it reduces the pressure on forests, minerals and other natural resources.

Energy Saving and Climate Change Mitigation

Recycling reduces the amount of energy required to produce new products. It has a positive impact on greenhouse gas emissions and climate change as energy consumption during raw material extraction, processing and production is reduced.

Reducing the Amount of Waste

Recycling helps to reduce the amount of waste and extend the time to landfill. This reduces environmental pollution and eases the pressure on waste management.

Economic Benefits

Recycling is also economically advantageous. Recovering and reusing waste materials reduces costs in the production of new products and supports economic growth.

Reuse and Circular Economy

Recycling promotes the circular economy. The recovery and reuse of waste materials ensures that resources circulate in a continuous cycle.

Environmental Sustainability

Recycling is considered part of environmental sustainability. As an important element of waste management strategies, it maintains environmental balance and helps create a livable environment for future generations. Recycling and sustainable development have an important role to play in achieving environmental and economic sustainability goals. Recycling contributes to the sustainable management and conservation of

natural resources by reducing the use of raw materials. Recycling raw materials used in the production of new products ensures that fewer resources are extracted from nature. Recycling minimizes environmental impact by reducing the amount of waste. Recycling often results in less energy being used in the processing of waste. This helps conserve energy resources, reduce energy costs and lower carbon dioxide emissions. Recycling generates economic gains through the recovery and reuse of waste materials. Recycling promotes the reuse of resources and the reduction of waste, in line with the circular economy model. This promotes economic sustainability and sustainable use of resources. Recycling contributes to social sustainability by raising environmental awareness and encouraging sustainable behaviors in society (Nasrollahi et al., 2020).

It is obvious that recycling is an effective tool for achieving sustainable development goals. Therefore, collaborations between public policies, businesses, communities and individuals that support recycling practices should be developed, recycling infrastructure should be strengthened, and societies should be made aware of recycling. These steps are critical for both environmental and economic sustainability.

Recycling and science education are powerful tools that can be combined to provide students with important knowledge and skills in environmental awareness and sustainability. Science education provides a fundamental platform for students to understand the natural world and develop scientific thinking skills, while the concept of recycling emphasizes issues such as sustainable resource use and waste management (Pike et al., 2003).

1. Science education provides students with basic knowledge on how to properly manage waste and understand recycling processes. These processes enable them to understand how recycling is done, what materials can be recycled and how these processes increase sustainability.
2. Science education addresses the scientific aspects of recycling by providing information about the structure, properties, and transformation of materials. It gives students ideas about the technologies used for recycling and how these technologies can be improved.
3. Concepts such as recycling, waste reduction and reuse are emphasized as part of science education. Students understand the importance of reducing waste and learning how to repurpose waste.
4. Science education provides students with information on energy conservation and ecological footprint. By explaining the positive effects of recycling on energy saving, it emphasizes the importance of making environmentally friendly choices.
5. Science education develops students' ability to generate solutions to environmental problems using scientific knowledge.
6. Science education enables students to raise awareness of their communities and promote sustainable practices such as recycling. It helps them develop strategies on how to promote recycling in society.
7. Science education and recycling awareness encourage students to use natural resources sustainably, reduce waste and minimize environmental impacts. This combination of education plays an important role in contributing to a sustainable future.

Conclusion

In science education, it is extremely important to talk about global problems within the scope of sustainable development, to increase students' environmental awareness and to enable them to produce sustainable solutions. Global warming, air pollution and recycling are some of the global issues within the scope of sustainable development that need to be specifically addressed in science education. Science education teaches the effects of greenhouse gases on global warming; the reasons for their increase in the atmosphere; how the use of fossil fuels increases global warming; the importance of sustainable energy sources; methods to reduce greenhouse gas emissions; and strategies to combat climate change such as preventing deforestation and sustainable transportation. Science education teaches the different types (particulate matter, nitrogen dioxide, sulfur dioxide, etc.) and sources of air pollution; the effects of air pollution on human health and the environment. In addition, science education teaches the environmental and economic importance of waste management and recycling; what recyclable materials are; recycling processes; how they can contribute to recycling in their daily lives and how they can adopt sustainable lifestyles. Covering these topics in science education enables students to approach global issues from a scientific perspective, increase their environmental awareness and integrate sustainability principles into their lives.

References

Ateş, B. (2019). *A study of preservice science teachers' science teaching self-efficacy belief levels and their attitudes towards science teaching in terms of different variables.* [Master dissertation, Marmara University].

Atmaca, A. C. (2018). *Determination of sustainable development awareness of science teacher candidates.* [Master dissertation, Necmettin Erbakan University].

Atmaca, A. C., Kıray, S. A., & Pehlivan, M. (2018). *Sustainable development from past to present.* Education Research Highlights in Mathematics, Science and Technology 2018. (pp. 186-214). ISRES Publishing.

Aydoğan, A. (2010). *The ideas of social studies teachers on teaching about the improvements of sustainable development issues.* [Master dissertation, Niğde University].

Bahar, M., Nartgün, Z., Durmuş, S., & Bıçak, B. (2006). *Geleneksel ve alternatif ölçme ve değerlendirme teknikleri.* Öğretmen El Kitabı. Ankara: Pegem A Publication.

Brunekreef, B., & Holgate, S. T. (2002). Air pollution and health, *Thelancet, 360,* 1233-1242.

Çepni, S. (2007). *Performansların Değerlendirilmesi, Ölçme ve Değerlendirme*, Ankara: Pegem A Publication.

Demirbaş, Ç. Ö. (2015). Sustainable development awareness levels of teachers pre-service. *Marmara Coğrafya Dergisi, 31*, 300-3016.

Demirel, Ö. (2004). *Eğitimde program geliştirme*. Ankara: Pegem A Publication.

Goswami, S. S., Sahoo, S. K., Das, A. K., & Samanta, S. (2023). Assessing the role of sustainable development in mitigating the issue of global warming. *Journal of Process Management and New Technologies, 11,* 1-2.

Hançer, A. H., Şensoy, Ö., & Yıldırım, H. İ. (2003). An evalation about the importance of contemporary science education at elemantary schools and how this kind of science teaching must be. *Pamukkale University Journal of Education, 1*(13); 80-88.

Hole, G., & Hole, A. S. (2019). Recycling as the way to greener production: A mini review, *Journal of Cleaner Production, 212*, 910-915. https://doi.org/10.1016/j.jclepro.2018.12.080.

Houghton, J. (2001) The science of global warming, *Interdisciplinary Science Reviews, 26*:4, 247-257, DOI: 10.1179/isr.2001.26.4.247.

Jacobson, M. Z. (2009). Review of solutions to global warming, air pollution, and energy security. *Energy Environ. Sci., 2*, 148-173.

Kahyaoğlu, M. (2011). Relationship between the self efficacy beliefs towards environmental education and the learning styles of preservice teachers. *Journal of Educational Sciences Research, 1*(2), 68-82.

Letcher, T. M. (2019). Why do we have global warming?, *Managing Global Warming,* 3-15. https://doi.org/10.1016/B978-0-12-814104-5.00001-6.

Lester, B. T., Ma, L., Lee, O. & Lambert, J. (2006). Social activism in elementary science education: A science, technology, and society approach to teach global warming, *International Journal of Science Education, 28*:4, 315- 339, DOI: 10.1080/09500690500240100.

Mandrikas, A., Stavrou, D. & Skordoulis, C. (2017). Teaching air pollution in an authentic context. *J Sci Educ Technol, 26*, 238–251. https://doi.org/10.1007/s10956-016-9675-8.

Mayer, H., (1999). Air pollution in cities. *Atmospheric Environment, 33*, 4029-4037. https://doi.org/10.1016/S1352-2310(99)00144-2.

Mensah, J., & Casadevall, S. R. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review, *Cogent Social Sciences, 5*:1, DOI: 10.1080/23311886.2019.1653531.

Nasrollahi, M., Beynaghi, A., Mohamady, F. M., & Mozafari, M. (2020). Plastic packaging, recycling, and sustainable development. *Responsible Consumption and Production,* 544–551. https://doi.org/10.1007/978-3-319-95726-5_110.

Özmehmet, D. E. (2008). Dünyada ve Tükiye sürdürülebilir kalkınma yaklaşımları. *Journal of Yaşar University, 3* (12), 1853-1876. Retrieved from https://dergipark.org.tr/en/pub/jyasar/issue/19124/202943.

Pike, L., Shannon, T., Lawrimore, K., McGee, A., Taylor, M. & Lamoreaux, G. (2003). Science education and sustainability initiatives: A campus recycling case study shows the importance of opportunity.

International Journal of Sustainability in Higher Education, 4, 218-229. https://doi.org/10.1108/14676370310485410.

Roberts, P. (2006). Evaluating regional sustainable development: Approaches, methods and the politics of analysis, *Journal of Environmental Planning and Management, 49*:4, 515-532, DOI: 10.1080/09640560600747786.

Sofia, D., Gioiella, F., & Lotrecchiano, N. (2020). Mitigation strategies for reducing air pollution. *Environ Sci Pollut Res, 27*, 19226–19235 https://doi.org/10.1007/s11356-020-08647-x.

UNESCO, (2013). *Education for sustainable development (esd): A sound invesment to accelerate African development.* https://en.unesco.org/events/education-sustainable-developmentesd-sound-investment-accelerate-african-development.

Urpelainen, J. (2012). Geoengineering and global warming: a strategic perspective. *Int Environ Agreements, 12*, 375–389 https://doi.org/10.1007/s10784-012-9167-0.

Wals, A. E. J. (2011). Learning our way to sustainability. *Journal of Education for Sustainable Development*, *5*(2), 177-186.

Warburton, K. (2003). Deep laerning and education for sustainability. *International Journal of Sustainability in Higher Education, 4*(1), 44-56.

Wong, L. P., Alias, H., Aghamohammadi, N., Ghadimi, A., & Sulaiman, N. M. N. (2017). Control measures and health effects of air pollution: a survey among public transportation commuters in Malaysia. *Sustainability*, *9*, 1616. https://doi.org/10.3390/su9091616.

Zheng, S., Yi, H., & Li, H. (2015). The impacts of provincial energy and environmental policies on air pollution control in China, *Renewable and Sustainable Energy Reviews, 49*, 386-394, https://doi.org/10.1016/j.rser.2015.04.088.

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Attention! The Family is a Fundamental and Crucial Principle of Sustainable Development

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Abstract

Nations are currently engaged in extensive deliberations about the need to reconsider their way of life, aiming for a future that is not only sustainable but also characterized by positivity, equity, and safety. The multifaceted aspects of sustainable development and the strategies to attain it have risen to the forefront of national agendas, with sustainable development serving as the focal point of discussions. Societies are in the process of redefining themselves to confront the threats stemming from the irresponsible behaviors exhibited by certain individuals towards the family-the fundamental building block of nations. These irresponsible actions have far-reaching and detrimental implications for the future. Consequently, the adoption of thoughtless behaviors that deviate from established and universally accepted natural principles, guided by divine laws, can trigger a domino effect with irreparable consequences for the very essence of our world. This, in turn, could lead to catastrophic outcomes for future generations and, by extension, the very nations we seek to protect and nurture through our efforts. Considering this, our intervention is aimed at safeguarding not only the well-being of future generations but also the integrity and resilience of nations themselves. Our collective commitment to sustainable development and responsible behaviors is paramount in ensuring a harmonious and secure future for all.

Keywords: Family, future generations, sustainable development, marriage, ethical and responsibility

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Introduction

Today, everywhere around the world, societies are confronted with a fundamental challenge: to rebuild their lifestyle, governance, and vision for the future in order to create the foundations for a more sustainable, positive, just, and secure future. Sustainable development is at the heart of these considerations in all fields (Bebbington et al., 2017; Bender, 2022; Di Fabio et al., 2018; Spanos et al., 2022; Giangrande et al., 2019; Petersen, 2020). As a result, the various dimensions of sustainable development and the means to achieve it have become one of the most important priorities in nations' action programs on their agenda. Efforts are made to produce cleaner, environmentally friendly energies, to think of more efficient ways of transportation that have less impact on the planet and are more accessible to everyone.

Attempts are made to define new economic models, ensuring a fairer distribution of wealth, preventing and combating exclusion, poverty, unhappiness, darkness, and ignorance, etc. Consequently, there is innovation, invention, and consideration of technologies or ways of living together that challenge our usual conceptions of daily life, in relationships, transportation, consumption, work, leisue, etc. Engaging in a sustainable development process. However, societies are reproducing, or at least, they are forced to confront the threats posed by the various behaviors of certain individuals towards the family, the fundamental unit of the nation and sustainable development. These behaviors aim to dismantle and exclude it from our foundations and customs, thus disregarding the future generations, which are the objective of sustainable development. Beware!

The practice of certain behaviors that do not align with the recognized and consented natural inspirations, acknowledged by the divine laws of all religions, will have cascading and irreversible effects on the nature of things, leading to serious consequences for humanity and potentially catastrophic outcomes for our planet. Therefore, issues related to family, specifically marriage between a woman and a man, constitute a fundamental and crucial principle of sustainable development (Parida et All, 2023; W. H. O, 2015; Sohsan, 2022). Henceforth, marriage becomes an imperative and a growing challenge for all individuals, families, and even governments and states (Loreket et al., 2014; Roseland, 2012; Raco, 2014). In this way, the various dimensions of sustainable development, the means to achieve them, and at the forefront, the family, must become one of the most important priorities in the action plans of nations within their agendas (W.H.O, 2022; W.H.O, 2016, 2022; Ranjbari et al., 2021; Leal et al., 2020). Otherwise, the cascading and irreversible effects of various changes in things could lead to severe consequences, potentially catastrophic for humanity. This is especially true due to, on the one hand, the deviations in human behavior (Nettour et al., 1, 2023) (marriage, family,

education, ethics, values, etc.) and, on the other hand, the emergence of significant effects of risks (Nettour et al., 2023) (viruses, diseases, drought, hunger, climate change, etc.): the annihilation of life on Earth.

Method

Our methodology is based on the principles, laws, religions, customs, and the outcomes of certain irresponsible behaviors that lead communities towards drift, even disappearance.

Christianity

The concept of marriage in the Christian religion is a sacred institution of God. Marriage is a spiritual bond in which a man and a woman are united, and this bond is called marriage. In marriage, man and woman are equal, complementing each other. When a man marries a woman, he completes her, and she completes him. They merge in mutual love and understanding, thus forming one body (Gospel of Matthew 6:19). This means that marriage should endure between man and woman in the love of God and in the fear of God. A man should not consider his wife as inferior to him, nor despise her, nor view her merely as a means of physical satisfaction or domestic service. She is his other half, the one who completes him. She represents his other half, and he is obligated to protect her as he protects himself, and to love her as he loves himself. Similarly, the woman deserves the same respect and love in return. The marital bond is sacred and is supposed to last until death, for what God has joined together, man must not separate. (Gospel of Matthew 6:19)

Jews

In Judaism, marriage is seen as a religious act of sanctification and elevation. Before the Eternal and the community of Israel, a man and a woman commit to living together in love and mutual respect, and to passing on traditional values to their descendants. The couple is then likened to an altar of holiness. Jewish marriage is perceived as a bond ordained by the Eternal, with the partnership between two individuals creating a relationship in which the Eternal is directly involved. Marriage is understood as the merging of partners into one and the same soul. It is not the union of two identical souls, but rather a complementarity that allows for the creation of a "full" and balanced life.

Muslims

Muslim marriage is a contract entered freely between a man and a woman who commit to providing each other with love and protection. According to the Quran, it is founded on "the love and compassion that God has infused into the hearts of man and woman so that they may form a couple." It solemnizes the union of two individuals, who are pubescent and psychologically and legally responsible: one male and one female, in the name of Allah, and following the tradition of our Prophet Muhammad (peace and blessings of Allah be upon

him). Nevertheless, this marriage is not just a union between two individuals of different sexes; it forms the foundation of Islamic society.

United Nations

Marriage: Marriage is an official and solemn act that establishes a socially recognized partnership between two spouses called a "family" (or household) with the purpose of creating a stable living environment for parents and children for their upbringing. It is an essential component of demographic and social reproduction, defining rights over women's descendants and organizing lineage. Through the web of alliances, it also influences political and social relationships between groups. The primary consequence of celebrating a marriage is the creation of a marital union between a woman and a man.

Universal Declaration of Human Rights on December 10, 1948

From the age of maturity, men and women, without any restrictions based on race, nationality, or religion, have the right to marry and establish a family. They have equal rights in marriage, during marriage, and upon its dissolution. Marriage can be entered into only with the free and full consent of the prospective spouses. The family is the natural and fundamental unit of society and is entitled to protection by society and the state.

Following these definitions, it can be said that marriage is fundamental and crucial for the continuity of nations. It should take place between two individuals of different sexes, a male and a female, to form a family, which is the natural and fundamental element of society. It is not about the union of two identical souls, but about a complementarity that allows the creation of a "fulfilling" and balanced life. Its purpose is to establish a stable living environment shared by parents and children for their upbringing. Marriage is an essential component of demographic and social reproduction; it defines rights concerning the lineage of women and thus organizes parentage. Nowadays, marriage is not just a union between two individuals of different sexes; it forms the basis of society. Consequently, one cannot speak of sustainable development without the foundation of a family, or even the marriage between a woman and a man. Thus, discussing sustainable development means talking about children, even talking about marriage between two individuals of different sexes and the family, and even future generations. Natural marriage between a man and a woman, recognized since antiquity by all religions, is now the one that maintains the cohesion of society and the strength of social bonds, ensuring the continuity of the lineage and taking care of children as well as their education.

Risks Associated with Same-Sex Marriage

All monotheistic religions condemn same-sex marriage and homosexuality. In Judaism, the Old Covenant regards homosexual acts as an "abomination" that should be punished by death. It is stated in the Torah: "You shall not lie with a male as with a woman; it is an abomination" (Leviticus 18:22). It is also mentioned in the same book: "If a man lies with a male as with a woman, both of them have committed an abomination; they shall surely be put to death; their blood is upon them" (Leviticus 20:13).

Christianity also condemns homosexuality and same-sex marriage, warning about the consequences of these acts. In the Gospel, it is written: "Do not be deceived: neither the sexually immoral, nor idolaters, nor adulterers, nor men who practice homosexuality (...) will inherit the kingdom of God" (1 Corinthians 6:9-10). Where Today, the Catholic Church faces pressure from LGB where: *(*L: Lesbienne, G: Gay, B: Bisexuel, T: Transgenre, Q: Queer*)* + individuals to change its stance on homosexuality and allow same-sex marriage. The Vatican has issued a document prohibiting homosexual practices, including marriage. The Orthodox Church strongly condemns homosexuality, considering it a sin and immoral act, and calls for the spiritual and physical healing of LGBTQ+ individuals.

The Islamic religion also considers same-sex marriage as a sexual deviation, a departure from human nature. The Quran recounts the story of the people of Lot and the severe punishment inflicted by Allah. Same-sex marriage or homosexuality is a phenomenon that threatens human societies. Ancient history teaches us that societies where homosexuality has spread have experienced ruin, decline, and disintegration. This poses a serious threat to the existence of the family as the foundation of society and to the individual himself. It leads to a chaotic life without responsibility and encourages young people to avoid marriage, promotes divorce, and marital infidelity. Diseases also spread among homosexual individuals, such as acquired immunodeficiency syndrome (AIDS). Moreover, violence, crimes, assaults, and harassment against others also spread, especially against children.

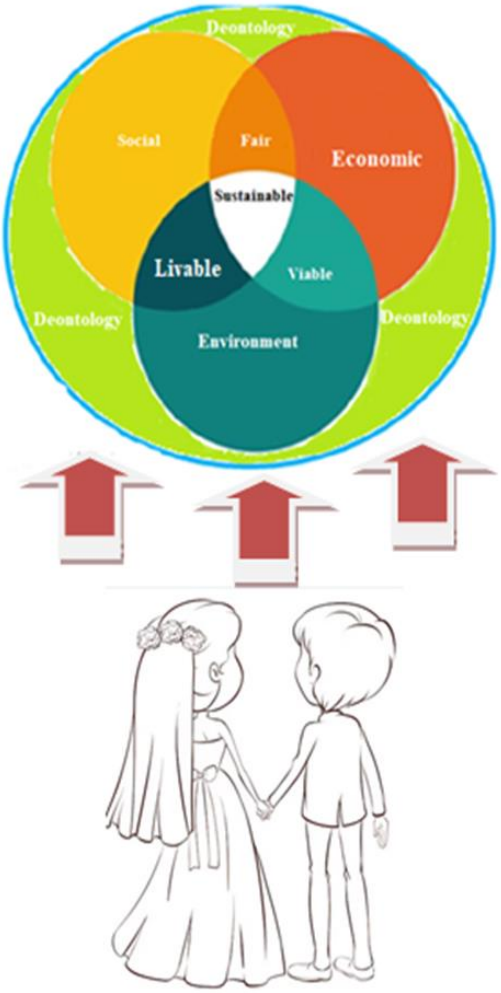
The spread of homosexuality or same-sex marriage is the result of psychological and educational imbalances, the lack of educational support from parents, and the influence of the media. That is why Western thinkers and intellectuals, as well as those concerned with social issues, have begun to sound the alarm, following the example of former U.S. President "Nixon"

All these challenges are part of what we could call the issues of sustainable development. Consequently, understanding them, analyzing them, studying them, prioritizing them is a way to find solutions, identify priorities, and create promising action plans to build a more sustainable, fairer, healthier, and more mature world. This is why international institutions need to reconsider their established directions, governments - politicians to maintain their positions - must change their modes of management and governance concerning marriage, even family, and peoples must modify their management approaches. Therefore, it is crucial that no one squanders or forfeits their life in the pursuit of pleasure, entertainment, or profit. The alarm is ringing across all echelons to proactively prevent and mitigate the generation of harm stemming from diverse threats. It is imperative to ensure that the handling of human relationships, enjoyment, and desires takes place without imperiling or compromising human well-being, while safeguarding the environment, and preventing even the potential destruction of nations (Kahoul et al., 2021; Maamri et al., 2021; Kharzi et al., 2020). This can only be achieved in the presence of ethical and moral responsibility. Therefore, to attain these objectives, our approach is rooted in moral responsibility.

Henceforth, without a continuous sense of belonging to a culture of governance and management, grounded in values, principles of action, and ethical and moral behavior, constraints from all nations, the goal will never be

accomplished (Demuijnck, 2015; Gómez et al., 2020; West al., 2015). This impartiality can only be achieved and guaranteed through the presence of a sustainable prevention-focused policy, rooted in belief, values, and principles of action, within each individual involved in the management and governance of an organization, which is the goal of this research. Henceforth, ethical responsibility becomes a principle of sustainable development (Ebner et all, 2006; Hassan, 2016; Verma, 2019; Nasibulina, 2015; Grunwald et al., 2015; Rendtorff, 2019; Singh, 2018). Thus, proposing a sustainable development principle based on marriage and the principles of ethical responsibility in society would be an achievement for individuals, families, and even society, as depicted in Figure 1.

Figure 1. Marriage is a Fundamental and Crucial Principle of Sustainable Development for Nations



Results and Discussions

It is only by considering this principle of marriage between two individuals of different sexes, one male and one female, to form a family, the natural and fundamental unit of society, that we can address the concept recalled during the United Nations World Commission on Environment and Development in 1987, "Meeting the needs of the present without compromising the ability of future generations to meet their own needs." Thus,

three years later, the Brundtland Report was born as a synthesis of these concerns, outlining the major directions to ensure a sustainable future for the planet and its inhabitants. Unfortunately, as observers have noted, a significant discrepancy exists between international grand meetings and the actual practices in reality.

In our view, although the word "development" is specified in its definition, this concept goes far beyond the mere economic aspect and also evokes themes related to family, environment, and ethics. It actually encompasses four inseparable pillars based on the family: economy, environment, society, and ethical values. Sustainable development is then defined as a way of living, representing the transition from one state (state 1) to another (state 2) that is better than the first, without compromising the interests of others or causing harm to the environment [Chaib et all, 2023]. This allows us to reconcile social, health, and economic performance goals with ambitions for environmental protection and preservation, fostering positive common social development.

The consequences of the increasingly intense and recurring irresponsible behaviors of certain individuals raise global awareness. The repercussions of these unnatural individual liberties, along with the increasingly malicious and catastrophic ethical misconduct, are leading nations astray. How can such a statement from a high-ranking official, "love is love and Americans should be able to marry the person they love" [https://twitter.com/potus/status/1593024688795574274], be anything but a deviation and a genocide of life on Earth? What kind of sustainable development are we talking about? What future generation are we referring to? We cannot speak of a future mended by unnatural behavioral deviations anymore. Imagine if other living beings in the fauna and flora were to adopt this same lifestyle; there would be no environmental balance on Earth, and biodiversity would be threatened. As a result, we should expect to witness the extinction of thousands of plant and animal species.

Already, biodiversity is under severe threat, and some species are already disappearing, despite multiple warnings from scientists about the consequences of these extinctions. Indeed, Earth is facing co-extinctions, recognized as a major contributor to global biodiversity loss, greatly amplifying the effects of primary extinctions. So, what will become of life on Earth? Henceforth, sustainable development must be both economically efficient, socially equitable, ecologically tolerable, and grounded in culture and ethics, based on the institution of family. Social well-being must be an objective, the economy a means, the environment a condition, and culture and ethics a necessity. Now, going against nature automatically leads to the annihilation of life on Earth.

Conclusion

Henceforth, this phenomenon requires treatment and attention from the international community, emphasizing the educational role of the family in protecting individuals against all forms of deviation. It is essential to focus on proper education through school curricula and to promote moral values through educational media programs.

From this point forward, if this vision becomes a reality due to such behaviors, the planet faces a grave threat of annihilation. It is now imperative to provide a precise and relevant assessment of the sustainable development challenges confronting modern societies, particularly in the context of marriage and family. We now recognize that safeguarding the planet is inextricably linked to our way of life: the efficiency of our societies and governance policies, as well as their ability to meet our needs, directly hinge on our capacity to preserve families, resources, and ecosystems. Likewise, our environment, behaviors, customs, cultures, human values, and beliefs exert a profound influence on various aspects of our social existence, including marriage, family, ethics, health, well-being, behaviors, relationships, management, reactions, governance, and the quality of work life, among others. The traditional distinctions between economic, environmental, and social aspects appear to be losing their relevance in the present context. Consequently, marriage and family emerge as fundamental and pivotal principles for sustainable development, representing a significant challenge that must be reevaluated before it becomes too late for the continued existence of our planet, and ultimately, for all of humanity.

References

Abdi, M., Chaib, R., & Verzea,I. (2021). Contribution to the Evaluation of the Cultural Level of Hygiene and Industrial Safety at the Level of Algerian Cement Factories. *Med. Sci. Forum 2021, 4*, 50. https://doi.org/10.3390/ECERPH-3-09014

Bebbington, J., Russell, S., & Thomson, I. (2017). Accounting and sustainable development: Reflections and propositions. *Critical Perspectives on Accounting, 48*, 21-34.

Bender, K. (2022). Research–Practice–Collaborations in International Sustainable Development and Knowledge Production: Reflections from a Political-Economic Perspective. *The European Journal of Development Research, 34*(4), 1691-1703.

Chaib, R., Bouzerara R. 2023. Typologie de risk: Health and Safety at Work; Publisher: Eliva Press Global, Ltd, 2023. https://www.elivapress.com/en/book/book-4107034637/

Demuijnck, G. (2015). Universal values and virtues in management versus cross-cultural moral relativism: An educational strategy to clear the ground for business ethics. *Journal of Business Ethics, 128*, 817-835.

Di Fabio, A., & Tsuda, A. (2018). The psychology of harmony and harmonization: Advancing the perspectives for the psychology of sustainability and sustainable development. *Sustainability, 10*(12), 4726.

Ebner, D., & Baumgartner, R. J. (2006, September). *The relationship between sustainable development and corporate social responsibility*. In Corporate responsibility research conference (Vol. 4, No. 5.9, p. 2006). Belfast Dublin: Queens University.

Giangrande, N., White, R. M., East, M., Jackson, R., Clarke, T., Saloff Coste, M., & Penha-Lopes, G. (2019). A competency framework to assess and activate education for sustainable development: Addressing the UN sustainable development goals 4.7 challenge. *Sustainability, 11*(10), 2832.

Gómez, S., Carreño, A., & Lloret, J. (2021). Cultural heritage and environmental ethical values in governance models: Conflicts between recreational fisheries and other maritime activities in Mediterranean marine protected areas. *Marine Policy, 129*, 104529.

Grunwald, A., Wyss, M., & Peppoloni, S. (2015). The imperative of sustainable development: Elements of an ethics of using georesources responsibly. *Geoethics ethical challenges and case studies in Earth sciences*, 25-35.

Hassan, A. (2016). Islamic ethical responsibilities for business and sustainable development. *Humanomics, 32*(1), 80-94.

Kahoul, H., Chaib, R., Verzea, I., & Belhour, S. (2021). Impact of industrial activities on the environment. Case study: Alemo Company, Algeria. *ACTA Technica Napocensis-Series: Applied Mathematics, Mechanics, And Engineering, 64*(2), 255-264.

Kharzi, R., Chaib, R., Verzea, I., & Akni, A. (2020). A Safe and Sustainable Development in a Hygiene and Healthy Company Using Decision Matrix Risk Assessment Technique: a case study. *Journal of Mining and Environment, 11*(2), 363-373.

Leal Filho, W., Brandli, L. L., Lange Salvia, A., Rayman-Bacchus, L., & Platje, J. (2020). COVID-19 and the UN sustainable development goals: threat to solidarity or an opportunity? *Sustainability, 12*(13), 5343.

Lorek, S., & Spangenberg, J. H. (2014). Sustainable consumption within a sustainable economy–beyond green growth and green economies. *Journal of Cleaner Production, 63*, 33-44.

Maamri, N., Chaib, R., Benidir, M., & Verzea, I. (2021). Capitalization of the Operating Experience of a Company for Sustainable Improvement: The Case of the ETRAG Foundry, Constantine, Algeria. *Engineering, Technology & Applied Science Research*, *11*(1), 6752-6759.

Nasibulina, A. (2015). Education for sustainable development and environmental ethics. Procedia-Social and Behavioral Sciences, 2015, vol. 214, p. 1077-1082.

Nettour, D., Amrani, M., Chaib, R., Bensehamdi, S. (2023). Belief and commitment to work: a principle of sustainable development in health and occupational safety; International May Conference on Strategic Management – IMCSM23 May, 2023, Bor, Serbia; Volume XIX, Issue (1) (2023).

Nettour, D., Chaib, R. (2023). Be careful! Our planet is in danger; Second International Symposium on Risk Analysis and Safety of Complex Structures and Components – IRAS2023, 2 - 4 April 2023, Belgrade, Serbia

Parida, R., Katiyar, R., Et Rajhans, K., (2023). Identification and analysis of critical barriers for achieving sustainable development in India. *Journal of Modelling in Management*, 18(3). 727-755.

Petersen, M. J. (2020). Promoting Freedom of Religion or Belief and Gender Equality in The Context of The Sustainable Development Goals: A Focus on Access to Justice, Education and Health Reflections from The 2019 Expert Consultation Process.

Raco, M. (2014). The post-politics of sustainability planning: Privatisation and the demise of democratic government. *The Post-Political and Its Discontents: Space of Depoliticization, Spectres of Radical Politics*, 25-47.

Ranjbari, M., Esfandabadi, Z. S., Zanetti, M. C., Scagnelli, S. D., Siebers, P. O., Aghbashlo, M., ... & Tabatabaei, M. (2021). Three pillars of sustainability in the wake of COVID-19: A systematic review and future research agenda for sustainable development. *Journal of Cleaner Production*, *297*, 126660.

Rendtorff, J. D. (2019). *Philosophy of management and sustainability: Rethinking business ethics and social responsibility in sustainable development*. Emerald Publishing.

Roseland, M. (2012). *Toward sustainable communities: Solutions for citizens and their governments*. New Society Publishers.

Singh, M. (2018). Equality of Resources, Ethical Principles and Sustainable Development. *Problemy Ekorozwoju, 13*(2), 185-190.

Sohsan, I. (2022). *How Faith Matters: Al-Mubarak Muslim Community and Sustainable Development-A Case Study from Udon Thani Province of Isan Region of Thailand* (Doctoral dissertation, Auckland University of Technology).

Spanos, I., Kucukvar, M., Bell, T. C., Elnimah, A., Hamdan, H., Al Meer, B., ... & AlKhereibi, A. H. (2022). How FIFA World Cup 2022™ can meet the carbon neutral commitments and the United Nations 2030 Agenda for Sustainable Development?: Reflections from the tree nursery project in *Qatar. Sustainable Development, 30*(1), 203-226.

Turner, B. S. (2008). Citizenship, reproduction and the state: International marriage and human rights. *Citizenship Studies, 12*(1), 45-54.

VERMA, A. K., (2019). Sustainable development and environmental ethics. International Journal on Environmental Sciences, vol. 10, no 1, p. 1-5.

West, J. P., & Bowman, J. S. (2016). Electronic surveillance at work: An ethical analysis. *Administration & Society, 48*(5), 628-651.

World Health Organization. (2015). Health in 2015: from MDGs, millennium development goals to SDGs, sustainable development goals. World Health Organization.

World Health Organization. (2016). World Health Statistics 2016 [OP]: Monitoring Health for the Sustainable Development Goals (SDGs). World Health Organization.

World Health Organization. (2022). Stronger collaboration for an equitable and resilient recovery towards the health-related sustainable development goals, incentivizing collaboration: 2022 progress report on the global action plan for healthy lives and well-being for all. World Health Organization.

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A Smart Wheelchair for Autonomous Movements of Disabled People

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Abstract

This work consists in developing an intelligent wheelchair controlled by human speech and able to be monitored and controlled remotely. This chair is intended for the elderly or people with disabilities and in confinement. It allows more independence and security and facilitates unaccompanied travel. The added value is that this chair communicates with a remote server and is equipped with biomedical sensors (temperature, blood pressure, heartbeat frequency, etc.) and geographical sensors (GPS) allowing remote monitoring of the medical condition of the patient or person in confinement and on the other hand to monitor their tolerated movement range. This system will limit direct contact with COVID+ patients, while guaranteeing their medical and social monitoring. It is essentially a medical assistance system for the elderly or vulnerable and tele-medical monitoring of patients with chronic diseases or in Quarantine and not just a geolocation application. New compared to existing electric chairs is the use of artificial intelligence, IoT and speech processing tools to ensure: The movement of disabled people and their navigation on a wheelchair at home or elsewhere in complete safety. Remote supervision and visualization of their movements using two android applications and two cameras, the first of which is mounted on the wheelchair and the other remotely connected to an on-board server (firebase). Monitoring the physiological and therapeutic state of the patient by measuring his vital parameters (temperature, blood pressure, heartbeat frequency, O2 level, etc.). The integration of the platform into a system for monitoring and controlling contamination by the COVID19 virus using a remote web server and a web service and mobile interface or application.

Keywords: Wheelchair, artificial intelligence, IoT, voice control, E-health

To cite this article

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Introduction

The mobility of disabled individuals is often limited, making it challenging for them to perform daily activities and engage with their surroundings independently. Traditional wheelchairs, while essential, often require manual operation, which can be difficult for those with severe physical disabilities. To address this issue, researchers and engineers have been working on developing Smart Wheelchair Systems that can provide autonomous mobility to disabled individuals.

On a study made on 104 persons claims that 40% of people with dementia wanders away from their homes at least once per year and 5% wanders more than once. As a result, these people are prone to many risks while they are wandering. For instance, these studies reported that elderly people are in risk of being dead, injured, dehydrated and exposed to high or very low temperatures. Elders and Alzheimer's patients are not the only ones who suffer from the consequences of the disease. According to 74% of family caregivers are concerned about maintaining their own health since they became caregivers and 40% of them show a high or very high level of stress associated with their role. The same source stated that elders with Alzheimer's are hospitalized three times more often than seniors without the disease. As a result, these people are in need for constant health monitoring and keeping them in a hospital for most of the day cost a lot of money and that's what to noticed as they said that There is a steep increase in the cost of healthcare and rising of the need of monitoring of the growing population of elders. That means we are in a desperate need for a device that constantly. In fact, early developments of SWC (smart wheelchair) appeared in 1970-1990s. The concept of a smart wheelchair began to take shape in the 1980, with early developments focusing on basic automation, such as joystick-controlled navigation and obstacle detection. By the early 2000s, research shifted towards autonomous navigation systems. SLAM (Simultaneous Localization and Mapping) techniques became instrumental in creating real-time maps for wheelchairs to navigate in dynamic environments. The past decade has seen significant advancements in human-machine interaction interfaces, including voice recognition, facial recognition, and gesture control, making smart wheelchairs more user-friendly and accessible.

This developed is enhanced and encouraged by:

- -Advanced Sensing: new and Modern smart wheelchairs are equipped with a variety of sensors, including lidars, stereo cameras, ultrasonic sensors, and IMUs. These sensors provide a

comprehensive view of the wheelchair's surroundings, allowing for precise mapping and obstacle detection.

- -Navigation Algorithms: Navigation algorithms have evolved to incorporate machine learning techniques and deep learning models. Reinforcement learning, in particular, has been applied to optimize path planning and adapt to changing environments.
- Human-Machine Interaction: Smart wheelchairs now prioritize user-centric interfaces. Voice recognition systems, such as those utilizing natural language processing and speech synthesis, have improved communication between users and their chairs. Facial recognition and gesture control have enhanced user autonomy.
- Remote Monitoring: Many smart wheelchairs are equipped with remote monitoring features, allowing caregivers or family members to track the user's location and well-being in real-time via smart phone apps or web interfaces.
- Customization and Personalization: Tailoring the smart wheelchair experience to individual needs has become a focus. User profiles are used to adjust settings, routes, and preferences, ensuring a personalized experience.
- Safety Features: Advanced safety features, including emergency braking, user fall detection, and automated return-to-home functions, are becoming standard in smart wheelchair designs to enhance user safety.
- Interoperability: Integration with other assistive technologies and smart home systems is increasingly common. Smart wheelchairs can interact with smart home devices, allowing users greater control over their surroundings.
- Commercial Availability: Several companies and startups are now offering smart wheelchairs with varying levels of autonomy and features. These products are becoming more accessible to a wider range of users.

This research paper presents a novel Smart Wheelchair System, designed to offer autonomous movements, obstacle avoidance, and enhanced user interaction. The system leverages cutting-edge technologies such as sensors, artificial intelligence (AI), and human-machine interfaces to enable a more seamless and independent experience for users with mobility impairments.

SWC System Architecture

The system of Fig.1 presents a solution where the patient is required to carry a device with them to use its GPS functionality in an attempt to locate the Elder or the Alzheimer patient. The smart phone receives the GPS coordinates and sends them to a web based application. To monitor a new patient the paper defined which

caregivers and healthcare professionals can monitor the new patient, create safe points where the patient is safe. The web platform got two parts, the back office where the administrator can add a new user to be monitored and the front office where the caregiver can monitor the patients and show their locations in real time.

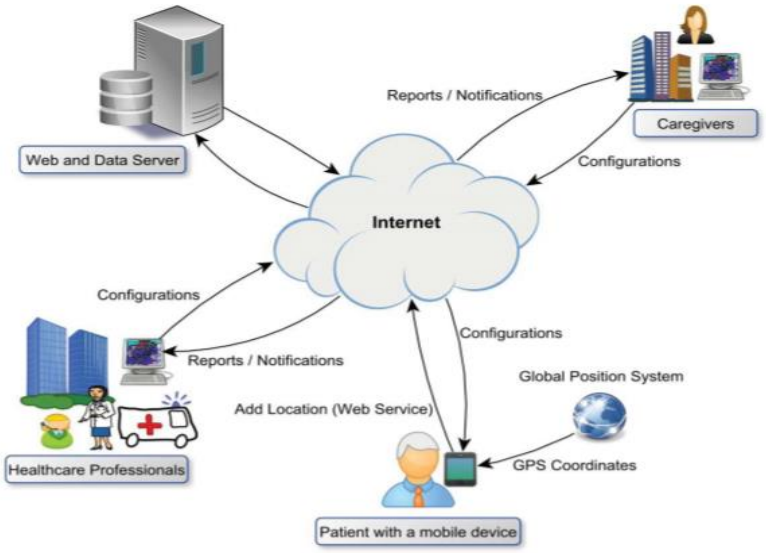

Figure 1. SWC/GPS/Healthcare Structure

The Smart Wheelchair System consists of several key components:

- -*Sensing and Perception: Lidar* and ultrasonic sensors for 360-degree environment perception, Cameras for object recognition and tracking
- *Inertial Measurement Unit (IMU)* for wheelchair orientation and stability.
- -*Control and Navigation:* Real-time control unit for motor control and maneuvering, Navigation algorithms incorporating simultaneous localization and mapping (SLAM),
- Obstacle avoidance algorithms based on sensor data.
- *User Interface:* Voice recognition for natural language commands, touch screen interface for manual control and navigation adjustments, Smartphone app for remote control and monitoring.
- -*Human-Machine Interaction:* Facial recognition for user identification, Gesture recognition for intuitive control, Voice feedback for user guidance and alerts.

Methods

IHM interface

For the simulation part we are interested in building 2 applications and a database that that are able to smoothly send and receive data. We used the imbedded GPS receiver in the smart phone and generate the vitals values

(temperature and heart rate) manually through the random Java function so we can see how the system react to different values. In the implementation part we will connect the Arduino to the system so we can feed the application with true values from the sensors.

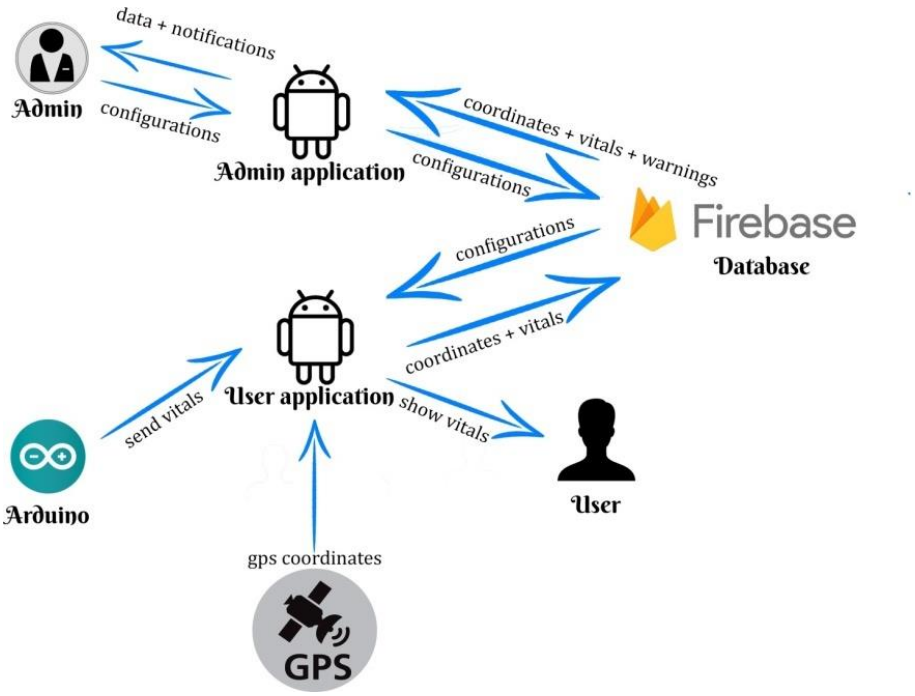

Figure 2. Flowchart of HMI interface with the SWC

Navigation Algorithms

The core of the Smart Wheelchair's autonomous capabilities lies in its navigation algorithms. These algorithms use data from sensors and SLAM techniques to create a real-time map of the environment. The system then plans optimal paths to navigate safely and efficiently while avoiding obstacles. The navigation system is adaptable and can handle various indoor and outdoor environments, making it suitable for diverse user needs.

User Interface and Interaction

The Smart Wheelchair's user interface focuses on accessibility and ease of use. Users can control the wheelchair through natural language voice commands, touchscreen gestures, or manual control. The facial and gesture recognition features enable a personalized experience, allowing the wheelchair to adapt to user preferences and needs. The system provides real-time feedback to users, including obstacle warnings and route suggestions, enhancing user confidence and safety.

Results

To evaluate the performance of the Smart Wheelchair System, a series of experiments were conducted involving users with varying degrees of mobility impairments. The results indicated several key findings.The Smart Wheelchair demonstrated robust obstacle avoidance capabilities, even in complex environments.Users reported improved mobility, independence, and overall quality of life.

Figure 3 illustrate the GPS position tracking of the smart wheelchair outside its environment which is delimited by the cercle.

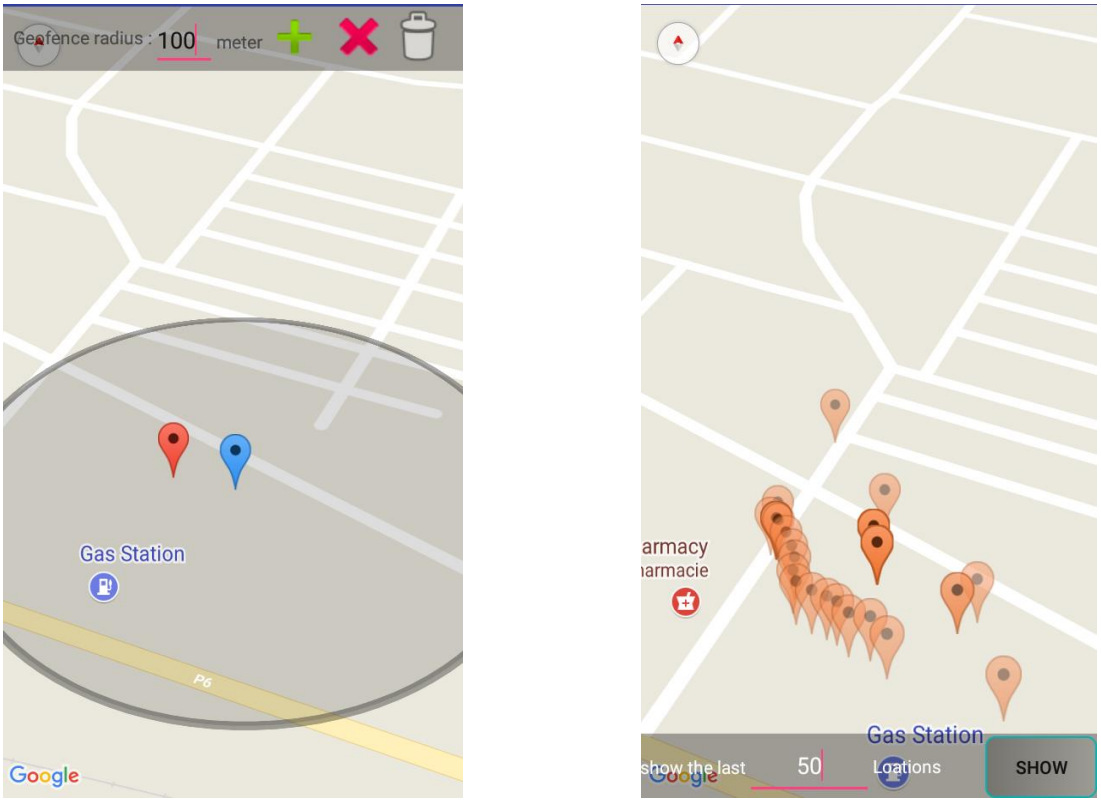

Figure 3. GPS Navigation and Localization of the SWC

Conclusion

The development of a Smart Wheelchair System for autonomous movements of disabled people represents a significant step toward improving the lives of individuals with mobility impairments. The integration of advanced technologies, such as sensors, AI, and human-machine interaction interfaces, has the potential to revolutionize the way disabled individuals navigate their environments.

In this study, we developed an intelligent wheelchair equipped with connected sensors and navigation and localization system which can assist elderly and disabled people in their mobility. The system established successful communication between sensors, Android devices, database, users and administrators, allowing caregivers to check vital signs and location in real time using Firebase database linked to the administrator.

Future work in this field could involve further refinements to the system, including enhanced AI capabilities, improved user interfaces, and broader compatibility with assistive technologies. Many aspects of this system can be improved by adding certain features that will protect older adults from getting lost, such as adding an effective wander detector based on motion patterns.

References

Anderson, T., Lu, Y., Marquez, J., & Su, H. (2019). Smart wheelchair navigation system using LiDAR and stereo vision. IEEE Access, 7, 16100-16113.

Bhelkar, V., & Shedge, D. K. (2016, July). Different types of wearable sensors and health monitoring systems: A survey. In *2016 2nd International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT)* (pp. 43-48). IEEE.

Cho, K., & Kwon, D. S. (2020). An intelligent obstacle detection and avoidance system for smart wheelchairs using convolutional neural networks. *Sensors, 20*(18), 5119.

Cirstea, S., Pitic, A. V., & Precup, R. E. (2017). Autonomous navigation of a smart wheelchair in an unknown and dynamic indoor environment. *Robotics and Autonomous Systems, 87*, 35-51.

Ganz, A., Simpson, R. C., & LoPresti, E. F. (2013). The development of a smart wheelchair system using low-cost solutions for assistive technology. *Journal of Neuro Engineering and Rehabilitation, 10*(1), 28.

Khusainov, R., & Liu, Y. (2019). Autonomous navigation for a smart wheelchair with RGB-D sensors and reinforcement learning. *Robotics and Autonomous Systems, 115*, 54-68.

Kusumastuti, D. S., & Iswanto, Y. (2018). A review on smart wheelchair: Recent development and technology. *Procedia Computer Science, 135*, 182-188.

Lu, Y., Anderson, T., Marquez, J., & Su, H. (2017). A smart wheelchair system with autonomous navigation and user assistance. In Proceedings of the IEEE International Conference on Robotics and Automation (ICRA) (pp. 6097-6103).

Paiva, S., & Abreu, C. (2012). Low cost GPS tracking for the elderly and Alzheimer patients. *Procedia Technology*, *5*, 793-802.

Punetha, D., & Mehta, V. (2014, September). Protection of the child/elderly/disabled/pet by smart and intelligent GSM and GPS based automatic tracking and alert system. In *2014 International*

conference on advances in computing, communications and informatics (ICACCI) (pp. 2349-2354). IEEE.

Simpson, R. C. (2005). Smart wheelchairs: A literature review. *Journal of Rehabilitation Research & Development, 42*(4), 423-436.

Simpson, R. C., Levine, S. P., Bell, D. A., Jaros, L. A., & Koren, Y. (1996). A speech-controlled videoconferencing system for a mobile robot and remote mobility-impaired users. In Proceedings of the IEEE International Conference on Robotics and Automation (ICRA) (pp. 1785-1790).

Srinivasan, M., & Radhika, N. S. (2020). An intelligent wheelchair for disabled and elderly people. In Proceedings of the IEEE International Conference on Robotics and Automation (ICRA) (pp. 2470-2475).

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The Future of Education: Exploring Emerging Trends in International Teaching Partnerships

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Abstract

Education is in the midst of a transformative shift towards embracing global perspectives and cross-cultural learning experiences. This study investigates the evolving landscape of international teaching partnerships and their influence on education, with a central research question: "What are the predominant trends in international teaching partnerships and their implications for education?" By analyzing data from various international organizations, pertinent resources, and existing research, this study uncovers significant trends. Notably, there is a growing emphasis on cultural diversity in curriculum development, fostering a holistic and inclusive approach to education. Additionally, the adoption of technology for remote collaboration has emerged as a crucial facilitator in transcending geographical boundaries within these partnerships. Language exchange programs have gained increasing prominence in promoting effective communication and intercultural understanding. These trends collectively enrich the educational experience by nurturing global competencies, cultural awareness, and language skills among students. In alignment with the broader globalized education movement, these partnerships play a pivotal role in shaping the future of education. However, it is essential to address challenges such as logistical barriers and the need for educator training to ensure the sustainability and effectiveness of these educational approaches. This research provides valuable insights for educators, policymakers, and institutions seeking to navigate the ever-evolving educational landscape of the future.

Keywords: International teaching partnerships, global education, curriculum diversity, educational trends, cross-cultural learning

To cite this article

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Introduction

The field of education is currently in the midst of a profound transformation driven by the imperative of fostering global perspectives and enabling cross-cultural learning experiences. This shift is a direct response to the demands of a rapidly evolving global landscape, where interconnectivity and interdependence are more pronounced than ever before (Wagner, 2019). The globalization of education has emerged as a defining trend of the 21st century, necessitating a reevaluation of traditional teaching paradigms and instructional strategies (Altbach & de Wit, 2017).

This research embarks on an exploration of the dynamic and evolving landscape of international teaching partnerships. In particular, the study endeavors to scrutinize the multifaceted impact of these partnerships on the future of education (Abdurashidova and Balbaa, 2023). The central research question that guides this endeavor is as follows: "What are the key trends in international teaching partnerships, and how are they reshaping the landscape of education?" This question is profoundly significant in the context of our contemporary world, where geographical boundaries have become less restrictive, and the global village concept is a reality (Biesta, 2019).

International teaching partnerships are not just a product of globalization; they are catalysts for it. These collaborations often span multiple nations and bring together diverse perspectives and educational methodologies. The outcomes of these partnerships have far-reaching implications for students, educators, institutions, and policymakers, as they offer an opportunity to create a more inclusive and globally aware educational environment (Hudzik, 2017). Understanding the evolving trends in international teaching partnerships is vital for educators and institutions seeking to adapt to the changing educational landscape (Knight, 2016).

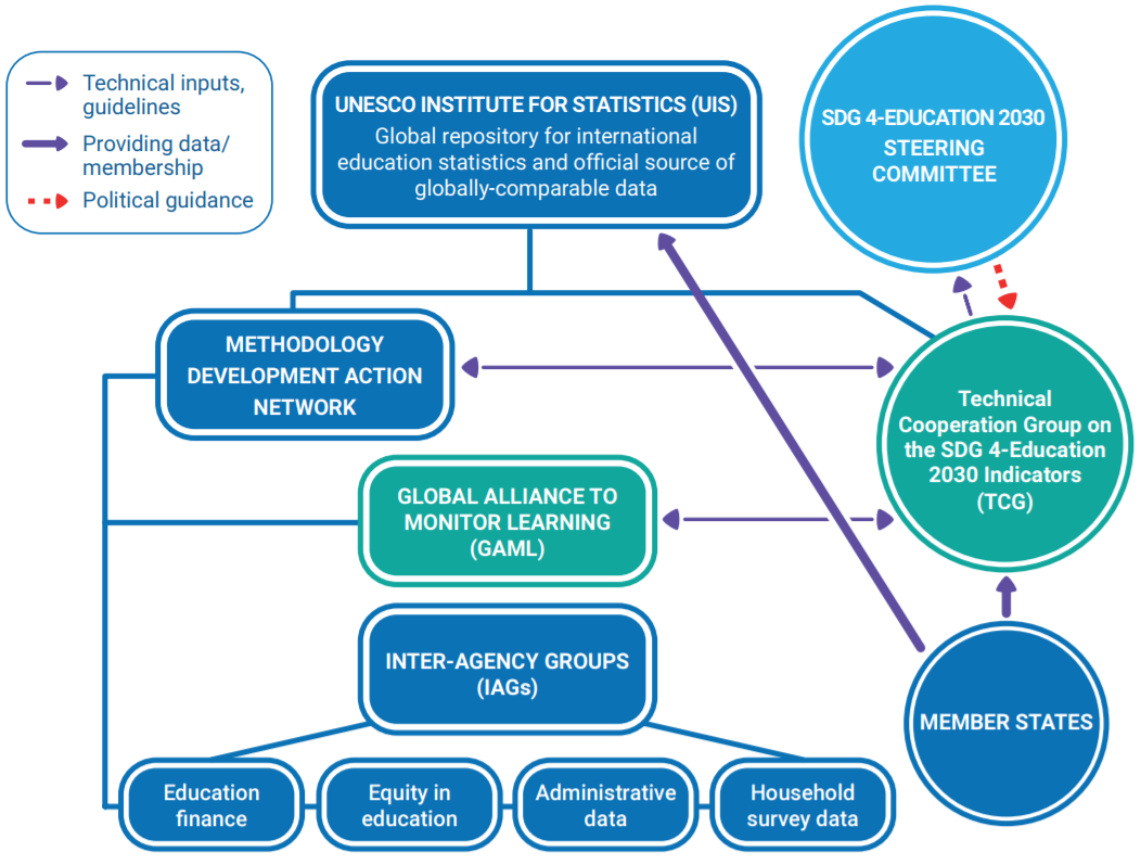

Figure 4: Partnerships to Implement the SDG 4 Education 2030 Indicator Framework Source: UNESCO.org

As the digital age has revolutionized communication and accessibility, educators are no longer confined to their local communities for knowledge exchange, pedagogical innovation, or the development of curriculum. Educational institutions worldwide are engaging in partnerships to foster a global mindset among students, providing them with opportunities to acquire cross-cultural competencies (Dede, 2020).

This research aims to shed light on these trends, providing insights into how international teaching partnerships are shaping the educational arena. Through comprehensive data analysis, including information from international organizations, educational resources, and previous research, we intend to identify and examine the key trends that are defining these partnerships and the subsequent impact on education. The outcomes of this study will not only contribute to the existing literature on the topic but also provide valuable information for educators, policymakers, and institutions seeking to navigate the complexities of education in the 21st century.

Method

In the Methods section, we detail the comprehensive approach employed in this research, encompassing the research design, data collection methods, the profile of participants, and the analytical strategies used to extract meaningful insights.

Research Design

Our research design was grounded in a qualitative methodology, as it proved most effective for our investigative goals. Qualitative methods allowed us to explore the nuances and intricacies of international teaching partnerships and their impact on education. The qualitative approach enables the collection of rich, context-specific data, offering a deeper understanding of the subject matter (Creswell, 2013). This research design entailed a thorough review and analysis of data sourced from international organizations, educational resources, and previous research, allowing us to examine trends, themes, and correlations within the domain of international teaching partnerships.

Data Collection

The data collection process involved a systematic review of primary and secondary sources. Primary sources included official reports, publications, and documents from reputable international organizations and educational institutions. These sources offered invaluable data regarding the structure and dynamics of international teaching partnerships. We also conducted an extensive review of relevant literature, including scholarly articles, books, and academic journals. This approach enabled us to access existing research and findings on international teaching partnerships and global education trends. The combined data from primary and secondary sources formed the foundation of our analysis.

Participants

In this research, our "participants" were not individuals in the traditional sense but encompassed the wealth of information derived from international organizations, authoritative educational resources, and existing research studies. These sources collectively represent a wide array of stakeholders involved in international teaching partnerships, including educators, policymakers, and institutions. By drawing from these comprehensive sources, we ensured a diverse and representative dataset that captured the multifaceted dimensions of international teaching partnerships.

Data Analysis

Data analysis in this study was primarily interpretive and grounded in content analysis (Elo & Kyngäs, 2008). We employed a systematic approach to extract, categorize, and interpret the data obtained from our primary and secondary sources. The analysis involved the identification of recurring themes, trends, and patterns within the information, allowing us to draw meaningful conclusions. By adopting content analysis, we ensured a structured and rigorous analysis process that maintained the integrity of the data and minimized bias.

Results

In the Results section, we present the substantive findings gleaned from our comprehensive research, focusing on illuminating key trends and insights regarding international teaching partnerships and their transformative influence on education. The objective is to provide a clear and cohesive understanding of the research outcomes, effectively addressing the central research question, "What are the key trends in international teaching partnerships, and how are they reshaping the landscape of education?"

Key Trends in International Teaching Partnerships

Our analysis of data from international organizations, educational resources, and previous research revealed several prominent trends in international teaching partnerships. These trends are not isolated but interconnected, contributing to a global shift in education. We categorize these trends into three key areas:

Cultural Diversity in Curriculum Development

A significant trend is the emphasis on cultural diversity in curriculum development. Educational institutions and partnerships are increasingly incorporating a wide array of cultural perspectives into their teaching materials. This integration enriches the educational experience by exposing students to a broader worldview (Mallia & Ančić, 2018).

Technology-Enabled Remote Collaboration

The adoption of technology for remote collaboration stands out as a transformative trend. Digital tools and platforms have facilitated cross-border partnerships, enabling educators and students to connect, collaborate, and share knowledge irrespective of geographical boundaries. Technology has become the backbone of these partnerships (Zhao, 2018).

Importance of Language Exchange Programs

Language exchange programs have gained prominence in international teaching partnerships. These programs offer students the opportunity to develop language skills while fostering intercultural understanding. This trend is particularly significant in promoting effective communication (Byram & Wagner, 2018).

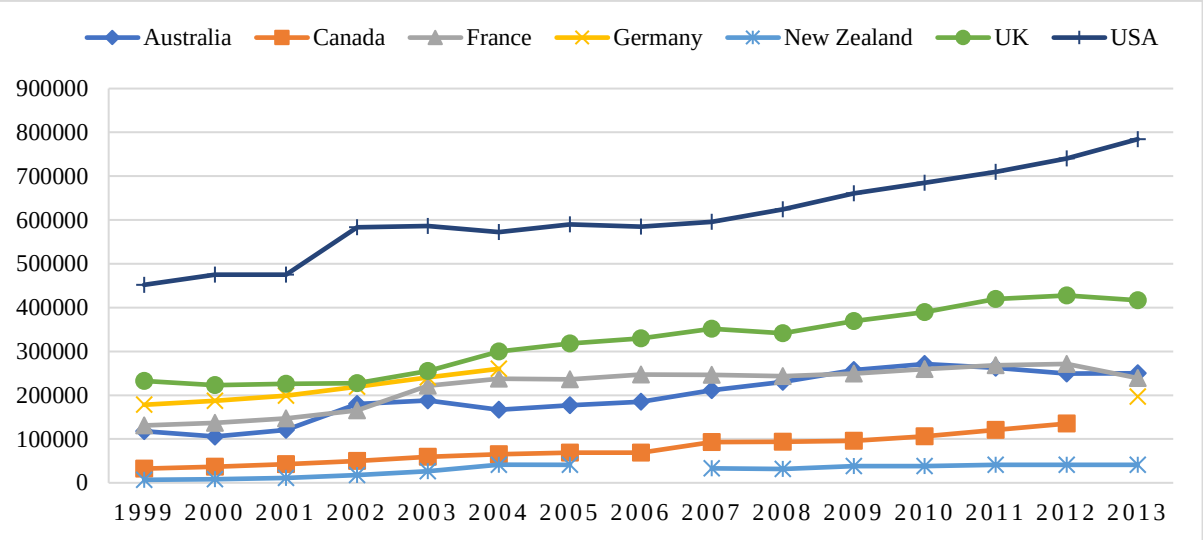

Figure 5. Economic Impact of International Education

Source: UNESCO Institute for Statistics

Impact on Education

The effects of these trends are far-reaching, significantly shaping the educational landscape. Students engaged in international teaching partnerships develop global competencies, including cultural awareness and language skills. Such competencies are considered vital for success in an interconnected world (Anderson, 2019).

By addressing the research question, we have identified and detailed the crucial trends in international teaching partnerships, underscoring their profound influence on the evolution of education. These findings offer substantial insights into the ongoing transformation of education and provide a foundation for further research and policy considerations in the field.

Discussion

The findings from our research underline the influential role of international teaching partnerships in reshaping the educational landscape. These partnerships emerge as vital conduits in fostering a more interconnected and globally attuned educational environment (Kuldasheva Z. et al., 2023). The significant trends uncovered, namely, the emphasis on cultural diversity in curriculum development, reliance on technology-enabled remote collaboration, and the growing importance of language exchange programs, echo similar observations found in existing literature. This alignment emphasizes the consolidation and reinforcement of these trends, marking a trajectory towards a more interconnected and culturally diverse educational ecosystem (Mundy, 2019).

These identified trends not only align with the broader globalized education movement but also hold the potential to substantially enrich the educational experience. The integration of cultural diversity in curriculum development offers students a multifaceted understanding of the world, nurturing a sense of inclusivity and acceptance. Moreover, technology-enabled remote collaboration has expedited cross-border educational

initiatives, breaking geographical barriers and fostering a global exchange of knowledge and expertise (Peters, 2017). Additionally, language exchange programs are instrumental in cultivating effective communication skills and intercultural understanding among students, thereby contributing to their holistic development as global citizens.

However, amidst these promising trends, it is crucial to address the challenges that accompany these partnerships. Logistical barriers, including varying time zones, technological disparities, and administrative complexities, pose substantial hurdles that need mitigation strategies for successful collaboration (Ijaz Uddin et al., 2023). Furthermore, the need for adequate teacher training in navigating diverse cultural contexts and utilizing technology effectively within these partnerships is critical (DeJaeghere, 2020).

The implications of these findings underscore the need for a strategic approach to address challenges and maximize the potential benefits of international teaching partnerships. Policymakers, educators, and institutions must actively consider these trends and challenges to adapt and shape an educational landscape that is not confined by geographical boundaries but rather thrives on the rich diversity and interconnectedness of our global society.

Conclusion

In conclusion, our exploration of international teaching partnerships underscores their pivotal role in redefining the contours of education in the contemporary global landscape. The key trends identified in these partnerships—cultural diversity in curriculum development, technology-enabled collaboration, and the emphasis on language exchange programs—paint a picture of a rapidly evolving educational paradigm that resonates with the principles of a globalized education (Chu, 2018).

These findings accentuate the substantial impact of these partnerships on the educational experience. The integration of diverse cultural perspectives enriches learning environments, fostering a more inclusive and globally aware generation of learners. Moreover, the use of technology for cross-border collaboration and the cultivation of language skills through exchange programs equip students with the necessary competencies for navigating an interconnected world (Bray, 2019).

Yet, these promising developments are accompanied by significant challenges. Overcoming logistical barriers and ensuring adequate teacher training are imperative for the sustained success and effectiveness of international teaching partnerships. Addressing these challenges will be instrumental in leveraging the full potential of these partnerships to shape a more globally attuned educational landscape (Hemmerdinger, 2020). Restating the research question, "What are the key trends in international teaching partnerships, and how are they reshaping the landscape of education?" our research reveals that these partnerships stand as catalysts for a more interconnected, diverse, and globally engaged educational environment.

In summary, international teaching partnerships hold a transformative potential, offering students the opportunity to thrive in a globalized learning milieu. However, to fully harness their benefits, it is essential to navigate and surmount the challenges they present. By addressing these hurdles, educators, institutions, and policymakers can effectively shape a future in education that embraces diversity, connectivity, and global competence.

Recommendations

Based on the findings and implications of our research on international teaching partnerships and their impact on education, the following practical recommendations are proposed for educators, policymakers, and institutions to navigate and leverage the transformative potential of these partnerships:

Facilitate Professional Development Programs: Educational institutions should design and implement ongoing professional development programs for educators engaged in international teaching partnerships. These programs should focus on enhancing cross-cultural competencies, effective utilization of technology in diverse settings, and pedagogical strategies to navigate the complexities of a globalized learning environment.

Encourage Interdisciplinary and Cross-Cultural Curriculum Integration: Institutions should promote interdisciplinary and cross-cultural curriculum integration to embrace diverse cultural perspectives. Educators should be encouraged to infuse diverse narratives and cultural elements within the curriculum, fostering a more inclusive and globally representative educational experience.

Invest in Technological Infrastructure: Policymakers should prioritize investments in robust technological infrastructure to support seamless cross-border collaborations. Equitable access to technology and reliable internet connectivity are essential to facilitate effective communication and knowledge exchange among students and educators from different geographical locations.

Establish Support Systems for Language Exchange Programs: Institutions should establish comprehensive support systems for language exchange programs. These initiatives should include language training and support services for students and educators engaging in language learning activities. Furthermore, partnerships with language learning institutions could enhance the efficacy of these programs.

Promote Collaborative Initiatives and Network Building: Policymakers should foster collaboration between institutions, encouraging the development of networks and alliances for the exchange of best practices in international teaching partnerships. These networks can facilitate knowledge sharing, resource pooling, and collaborative research initiatives to further enhance the effectiveness of these partnerships.

Address Logistical Barriers through Policy Frameworks: Policymakers should work towards addressing logistical challenges, such as time zone differences and administrative complexities, by developing policy

frameworks that offer support and solutions for these barriers. Flexibility in scheduling and standardized administrative procedures can alleviate these challenges.

Encourage Student Mobility and Exchanges: Institutions should incentivize and facilitate student mobility and exchange programs. Providing opportunities for students to experience different cultures firsthand fosters a deeper understanding and appreciation of global diversity, contributing to their holistic development as global citizens.

Implementing these recommendations will contribute to the effective utilization of international teaching partnerships, nurturing a more interconnected and culturally diverse educational environment that equips students with the essential skills and competencies required for success in a globalized world.

These recommendations offer a strategic pathway for educators, policymakers, and institutions to harness the potential of international teaching partnerships and to shape an education system that is not confined by geographical boundaries but instead thrives on the rich diversity and interconnectedness of our global society.

References

Abdurashidova, M. S., Balbaa, M. E. (2023). The Impact of the Digital Economy on the Development of Higher Education. In: Koucheryavy, Y., Aziz, A. (eds) Internet of Things, Smart Spaces, and Next Generation Networks and Systems. NEW2AN 2022. Lecture Notes in Computer Science, vol 13772. Springer, Cham. https://doi.org/10.1007/978-3-031-30258-9_36

Altbach, P. G., & de Wit, H. (2017). Global challenges for universities: The implications of globalisation for the internationalisation of higher education. *European Journal of Education, 52*(3), 291-305.

Anderson, B. (2019). The New Global Business of Private Tutoring: Awaiting the Unanticipated. Oxford Research Encyclopedia of Education.

Biesta, G. J. J. (2019). Pragmatism and the philosophical foundations of mixed methods research. In The SAGE Handbook of Current Developments in Grounded Theory (pp. 214-225). Sage.

Bray, M. (2019). Comparative Education: Aims, Content, Methods, and Structure. In The SAGE Handbook of Comparative Studies in Education (pp. 34-49). Sage.

Byram, M., & Wagner, M. (2018). The Routledge Handbook of the Cultural and Creative Industries in Asia. Routledge.

Chu, S. K. W. (2018). Curriculum Internationalization: A Critique of Critiques. *Journal of Studies in International Education, 22*(2), 123-140.

Creswell, J. W. (2013). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Sage Publications.

Dede, C. (2020). Transformation of education in the digital age. *EDUCAUSE Review, 55*(2), 12-28.

DeJaeghere, J. (2020). Preparing teachers for education in a global society: A framework for knowledge, disposition, and practices. In The SAGE Handbook of Comparative Studies in Education (pp. 245-258). Sage.

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing, 62*(1), 107-115.

Hemmerdinger, B. (2020). Culturally Responsive Pedagogy: Working towards Decolonization, Indigeneity, and Interculturalism. In Handbook of Research on Promoting Cross-Cultural Competence and Social Equity in Higher Education (pp. 203-219). IGI Global.

Hudzik, J. K. (2017). Comprehensive internationalization: Institutional pathways to success. Routledge.

Ijaz Uddin, Maaz Ahmad, Dilshod Ismailov, Muhammad Eid Balbaa, Akbarali Akhmedov, Sarvar Khasanov, Manzoor Ul Haq (2023), Enhancing institutional quality to boost economic development in developing nations: New insights from CS-ARDL approach. Research in Globalization. Vol. 7, https://doi.org/10.1016/j.resglo.2023.100137.

Knight, J. (2016). Internationalization as a mindset: How to assess it? *Journal of Studies in International Education, 20*(1), 3-13.

Mallia, G., & Ančić, B. (2018). Curriculum as cultural practice: Postcolonialism, cosmopolitanism, and a "cultural turn" in curriculum studies. In International Handbook of Curriculum Research (pp. 591-602). Springer.

Mundy, K. (2019). Comparative and International Education: Issues for Teachers. Springer.

Peters, M. A. (2017). Education in a post-truth world. *Educational Philosophy and Theory, 49*(6), 563-566.

Wagner, T. (2019). The Global Achievement Gap: Why Even Our Best Schools Don't Teach the New Survival Skills Our Children Need—and What We Can Do About It. Basic Books.

Zebo Kuldasheva, Bobojanov S. Qadamboevich, Muhammad Eid BALBAA, Nilufar ISMAILOVA. (2023). Impact of Education and Employment on Poverty. *Journal of Sustainable Development and Green Technology, 2*(1). https://doi.org/10.54216/JSDGT.020104

Zhao, Y. (2018). What Works May Hurt: Side Effects in Education. Teachers College Press.

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The Use of Virtual Laboratories in Science Education: A Study on Classroom Teachers' Experiences and Perceptions

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Abstract

The aim of this study is to investigate the ideas and opinions of classroom teachers about the use of virtual laboratory applications in primary school science courses. The study was conducted with 20 teachers working in various provinces of Turkey. In the study, in which case study design, one of the qualitative research methods, was adopted, data were collected through a semi-structured interview form. The results of the study showed that teachers' definitions of virtual laboratory applications overlap with the definitions in the literature, teachers believe that virtual laboratory applications contribute to students, teachers generally do not benefit from virtual laboratory applications for various reasons, teachers do not consider themselves and their students sufficient in this regard, and the advantages of virtual laboratory applications are more than the disadvantages.

Keywords: Science, virtual laboratory, primary school

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Introduction

Rapidly developing technology is rapidly changing the world. With this change, the primary aim of societies is to create a knowledge society that produces knowledge and technology, researches and has scientific thinking. The most important step for the formation of an information society is to educate new generations with the ability to adapt to change and developments. In today's world where knowledge is rapidly increasing,

the main goal of the education system is not only to transfer knowledge to students in order to increase the quality of education, but also to provide students with the skills necessary to obtain knowledge (Kaptan & Korkmaz, 2002). For this purpose, providing meaningful learning by avoiding memorisation, solving problems related to new situations and developing skills related to scientific processes are considered important for the quality of education (Gürçay et al., 2000). One of the courses that contribute to the development of these skills is the science course (Kaptan & Korkmaz, 2002).

The teaching of science, which is defined as the regular investigation of nature and the events occurring in nature and the prediction of previously unobserved events, has a great importance in primary education institutions including compulsory education process in today's world where the need for qualified manpower is constantly increasing (Kaptan & Korkmaz, 2002; Hançer, et. al., 2003). In accordance with the requirements of the age we live in; raising people who are curious, researching, questioning, who can relate science subjects to their daily lives, who can solve problems encountered in all areas of life by using the scientific method and who can see the world from the perspective of a scientist is one of the main objectives of science teaching (Tan & Temiz, 2003). In order to realise these aims, methods such as argumentation, project and laboratory are used in science teaching.

In general, laboratories can be defined as specially equipped places where research and experiments are carried out to reach a result using various tools. These environments, where the subjects and concepts in the curriculum are artificially transferred to students through experience or demonstration, are an important part of science teaching (Seven & Engin, 2018). In addition to contributing to the development of students' reasoning, critical thinking, having a scientific perspective and problem-solving skills, it has a positive effect on the retention of the learned information because it enables learning by doing and experiencing (Anılan, 2016). Through laboratory applications, students can concretise abstract concepts, learn the nature of science, develop positive attitudes towards science and aspire to be scientists (Kırpık & Engin, 2009). Along with these benefits, it is seen that some difficulties and problems are encountered in the realisation of laboratory applications. For example, it is difficult to carry out laboratory applications due to the high class size, experiments that should be performed individually are performed in groups or as a demonstration or even cannot be performed at all, inadequate tools and equipment due to the high cost of laboratory materials, the combination of many chemicals together creates a safety problem, and the lack of laboratories in some schools prevents laboratory applications from being carried out in a qualified manner (Anılan, 2016; Günlü, 2019). In order to minimise these limitations, new alternative methods have been developed with the advancement of technology. One of these methods is virtual laboratory applications.

Virtual laboratories are a technology that gives the feeling of being in a real laboratory environment with three-dimensional pictures and animations created in computer environment using technological tools and allows interaction with objects in the environment (Tatlı & Ayas, 2011). These virtual environments, which are designed with all the possibilities of technology to eliminate the deficiencies of traditional laboratory environments, are learning environments that offer students the opportunity to conduct experiments whenever and wherever they want, and actively involve students in the process of constructing knowledge (Kaba, 2012).

When the literature is analysed, the advantages of virtual laboratories are; low cost, reliable and controllable, offering diversity to experiments (Abulrub, Attridge, & Williams 2011; Potkonjak, et. al., 2016), having rich content for different learning styles (Moshell & Hughes, 2002), enabling applications that would take a long time in a traditional laboratory to take place in a few minutes (Mirçik & Saka, 2018). Dalgarno, Bisho, and Bedgood (2003) stated that students feel more comfortable in virtual laboratories, they are more familiar with laboratory rules, they do not waste time for material supply and they do not have difficulty while conducting experiments. In addition, virtual laboratory applications created through simulations enable students to perform experiments many times and learn by trial-and-error method. This situation encourages students to find solutions to problems and encourages them to conduct research (Günlü, 2019). As in other educational situations, teachers have a great role in providing these advantages of virtual laboratories.

As it is known, teachers are one of the most important elements of education systems. The quality of teachers and other educational personnel in the system as practitioners and administrators has a great effect on the success of educational systems (Kaya & Böyük, 2011). For this reason, teachers, who assume the responsibility of raising and educating the qualified labour force needed by countries, need to become proficient in their professions in order to work more effectively in schools and to continue education and training processes in accordance with the technological developments required by the age (Üstüner, et. al., 2000). Considering that the knowledge, skills and attitudes aimed to be gained by students through virtual laboratory studies are directly proportional to the knowledge, skills and attitudes of teachers, the aim of this study is to investigate the ideas and opinions of classroom teachers about the use of virtual laboratory applications in primary school science course. When the domestic studies on virtual laboratories are examined, it is thought that the studies that will contribute to the professional development of teachers are few and it is important to determine the opinions of teachers, who are education practitioners, about virtual laboratories in order to increase the quality of education and training, and it is thought that the study will contribute to the literature.

In this direction, answers to the following sub-problems were sought in the research:

1. How do classroom teachers define virtual laboratory applications?
2. What are the opinions of classroom teachers about the contributions of virtual laboratory applications?
3. How do classroom teachers benefit from virtual laboratory applications?
4. Do classroom teachers consider themselves sufficient in virtual laboratory applications?
5. Do classroom teachers consider their students competent in virtual laboratory applications?
6. What are the opinions of classroom teachers about the advantages of virtual laboratory applications?
7. What are the opinions of classroom teachers about the disadvantages of virtual laboratory applications?

Method

Research Model

In the study, the ideas and opinions of classroom teachers about the use of virtual laboratory applications in primary school science course were analysed. In this direction, case study design was used in the research within the scope of qualitative research model. Case study is the in-depth examination of factors such as environments, individuals, events and processes related to a situation with a holistic approach and the presentation of results related to the researched situation (Yıldırım & Şimşek, 2021).

Participants

In this study, in which convenience sampling was used, the participants consisted of 20 third and fourth grade teachers working in various cities of Turkey. Information about the demographic variables of the teachers within the scope of the study is given in the tables below.

Table 1. Distribution of teachers according to demographic variables

Variables		N	%
Gender	F	12	60
	M	8	40
Age	21-25	4	20
	26-30	11	55
	31-35	1	5
	36-40	4	20
Professional Seniority	21-25	4	20
	26-30	11	55
	31-35	1	5
	36-40	4	20
Grade Level of the Teacher	Grade 3	9	55
	Grade 4	11	45
Teacher's Place of Work	Province Centre	7	35
	District Centre	5	25
	Town-Village	9	45
Internet Access	Yes	15	75
	No	5	25
Virtual Laboratory Education	Yes	6	30
	No	14	70
Total		20	100

Data Collection Tools

The data used in the study were collected through a semi-structured interview form developed by the researcher. The form consists of two sections as "Personal Information" and "Opinions". Two language experts and three field experts were consulted for the suitability, clarity and comprehensibility of the interview form for the purpose of the study, their opinions were taken, and the internal validity of the form was ensured. According to Yıldırım and Şimşek (2021), validity is important in qualitative studies and validity ensures reliability.

Process and Data Analysis

The data collection tool was applied to the teachers in the study group at the beginning of the 2023-2024 academic year. During the process, 20-minute interviews were conducted at times when teachers were available. The responses received from the interviews were recorded in writing. The qualitative data obtained were analysed using the content analysis method. The process carried out in content analysis can be summarised as grouping similar data (opinions) under certain categories and themes, supporting these groupings with frequency-percentage and participant opinions, and interpreting them by arranging them in a way that the reader can understand.

Results

The first question of the research was "How would you define the virtual laboratory?". In this section, the findings and interpretations obtained in line with the related research question are presented.

Table 2. Categories and codes related to the definition of virtual laboratory

Category	**Code**	***f***	**%**
Science	Observing, experimenting, gaining scientific knowledge, working safely	8	26,6
Technology-Access	Computer, internet, simulation, animation, online environment, interactive environment, practicality, easy accessibility	12	40
Education Status	Embodiment, motivation, learning by doing, fun	10	33,4
Total		**30**	**100**

In the data analysis related to the first question, the answers given by the classroom teachers were categorized according to their similarities and three categories were obtained. These categories are "science", "technology-access" and "educational situations". When the frequency values in Table 8 were analyzed, it was determined that classroom teachers defined virtual laboratories most frequently in the "technology-access" category (f=12) and least frequently in the "science" category (f=8). The views on these categories are as follows:

Category 1: Science

[T3]: *"These are platforms where science experiments are performed virtually."*

[T12]: *"These are environments where students can learn scientific knowledge safely."*

Category 2: Technology-Access

[T7]: *"These are the sites that provide access to the laboratory environment via the internet."*

[T19]: *"These are simulations that are close to reality when there is no possibility to use the laboratory."*

Category 3: Education Status

[T9]: "It is a high-level simulation that makes students come to class better motivated."

[T15]: *"Virtual environments that enable the concretization of abstract subjects in science."*

The second question of the research was "Do you think that the use of virtual laboratories in science education contributes to students?". Figure 1 below shows the answers given by the teachers:

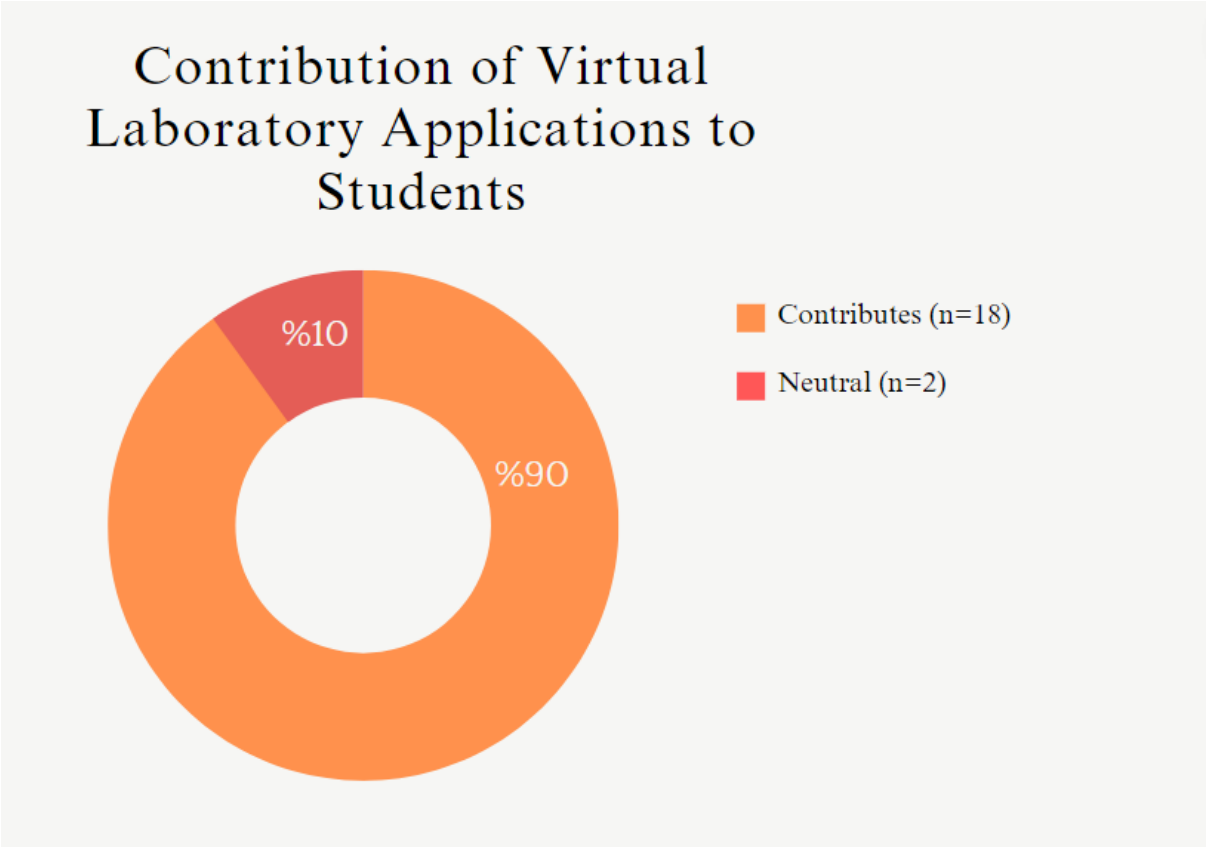

Figure 1. The contribution of virtual laboratory applications to students

Some of the responses received from the teachers are as follows:

[T2]: "It can be useful, but I think it can distract students because I haven't used it before, so I am undecided."

[T6]: "Virtual laboratory is very useful for students when there are not enough facilities in schools or in applications that may cause danger."

[T14]: "It can contribute, since many schools do not have laboratories, at least it is not just in words but visually supported."

[T19]: "It is obvious that students do not always have access to a real laboratory. For this reason, with the virtual laboratory, it contributes to the students who do not have the opportunity to show, do and encourage scientific experiments in an online environment."

The third question of the study was "Do you make use of virtual laboratory applications in your lessons (experiments or activities)?". In addition, the difficulties encountered by teachers who make use of virtual laboratory applications and the reasons for not making use of virtual laboratory applications were also determined. Figure 2 below shows the answers given by the teachers:

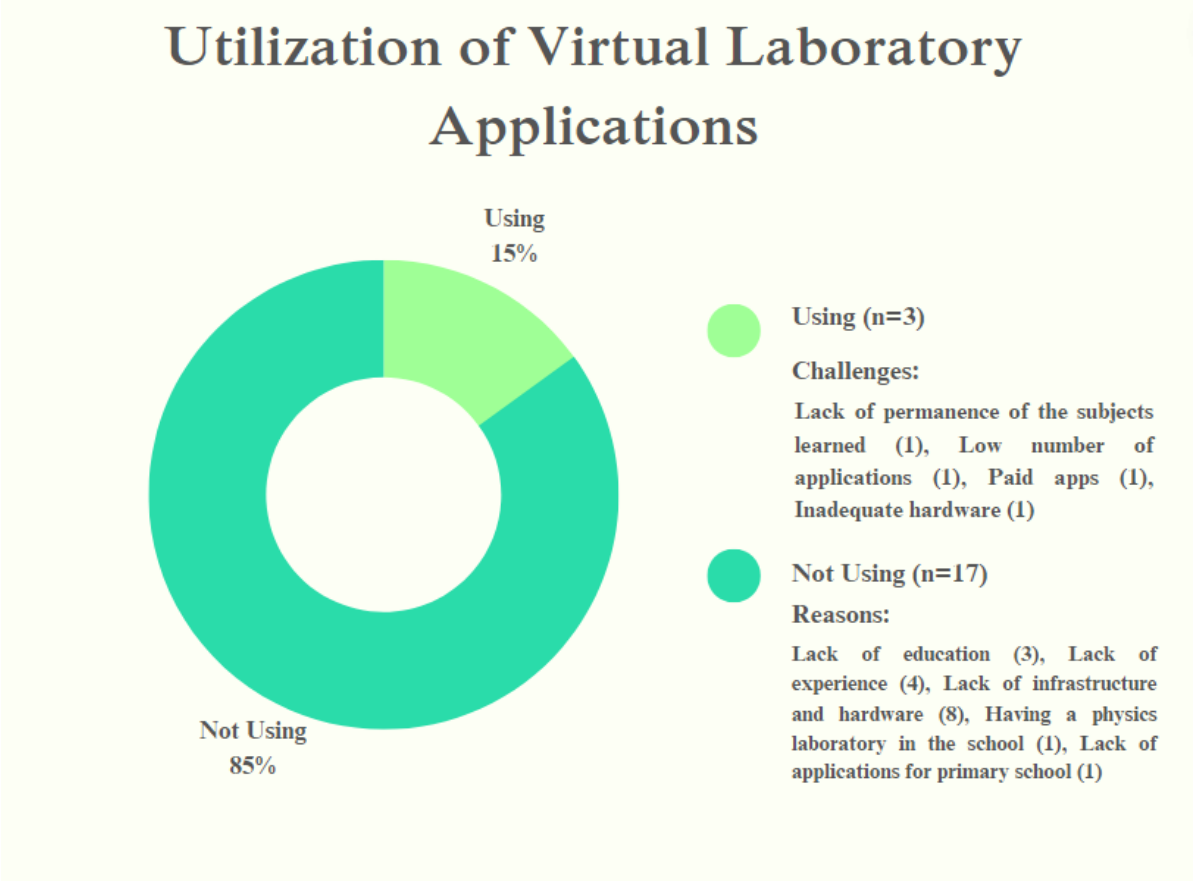

Figure 2. Utilization of virtual laboratory applications

Some of the responses received from the teachers are as follows:

[T7]: *"I do not use virtual laboratory sites specially designed for primary schools because of the general lack of virtual laboratory sites and the inadequacy of some free sites."*

[T17]: *"I don't use it. I haven't received any training on this subject. I don't know how to access or how to use it."*

[T19]: *"I do not use it because there is no internet access in the school where I work."*

[T20]: *"I use it, but I encounter difficulties such as the lack of applications to design experiments, the fact that the applications that are available are paid and not every student has own computer."*

The fourth question of the study was "What do you think about your own competence for virtual laboratory applications?". Figure 3 below shows the answers given by the teachers:

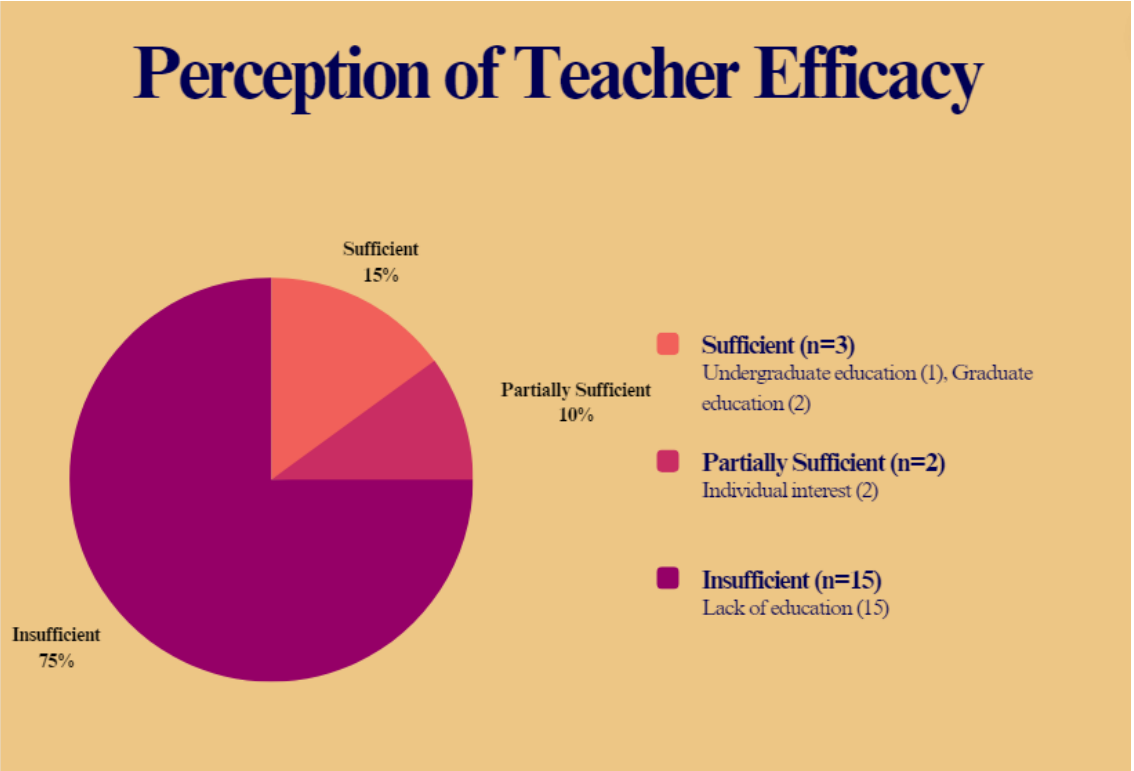

Figure 3. Perception of teacher efficacy

Some of the responses received from the teachers are as follows:

[T1]: *"I think I am insufficient in its use because I have not had any training about virtual laboratory before."*

[T18]: *"I do not consider myself sufficient, I need training."*

[T10]: *"I learned about the existence of platforms related to virtual laboratories on social media. I did some research; I consider myself moderately competent."*

[T20]: *"I consider myself sufficient, I received the necessary training and practiced in this subject both in my undergraduate and graduate education process."*

The fifth question of the study was "What do you think about your students' competence for virtual laboratory applications?". Figure 4 below shows the answers given by the teachers:

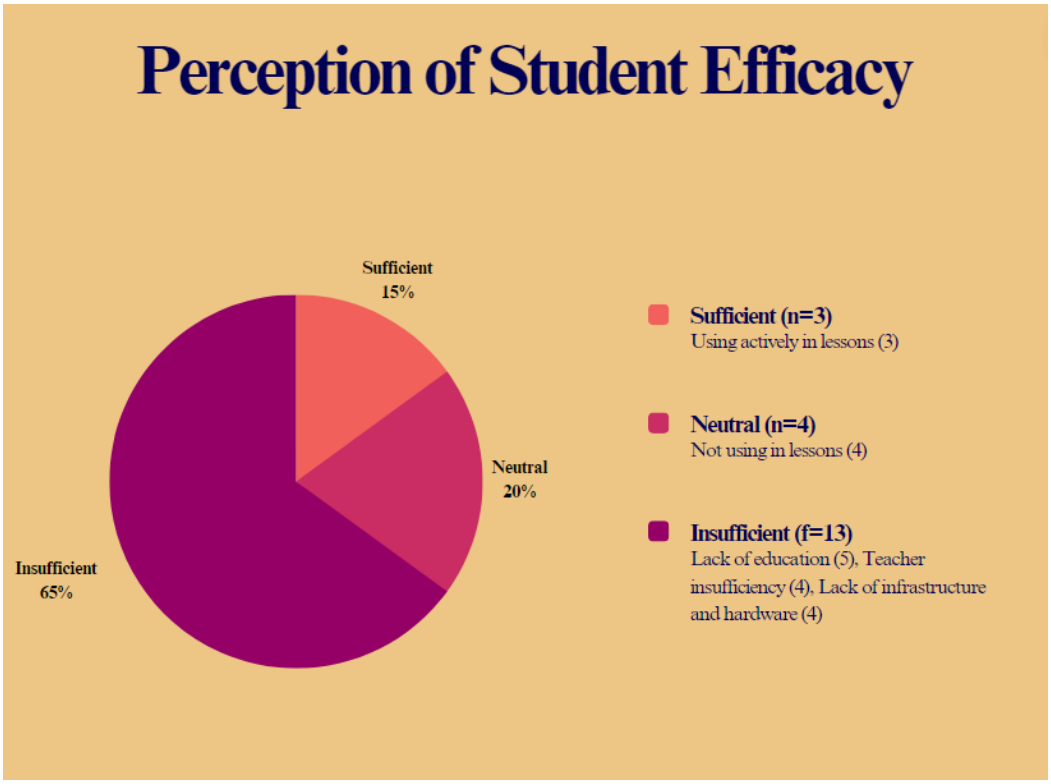

Figure 4. Perception of student efficacy

Some of the responses received from the teachers are as follows:

[T3]: *"Since the technology usage of my students living in the village is not very good, they are inadequate in virtual laboratory applications."*

[T4]: *"I don't think my students are competent because I don't make them apply it. I need to be competent for them to be competent."*

[T9]: *"I do not have a clear answer because I do not benefit from virtual laboratory applications."*

[T20]: *"My students are quite sufficient for their age. I pay attention to use them in lessons."*

The sixth question of the study was "What do you think are the advantages of the virtual laboratory for science education?". Table 3 shows the answers given by the teachers:

Table 3. Categories and codes related to the advantages of virtual laboratory applications

Category	**Code**	***f***	**%**
Impact on Learning	Permanent learning, easy recall, increasing motivation, being interesting, being fun	8	30,7
Skill Development	Observation, experimentation, establishing cause-effect relationship, learning to learn	7	27
Laboratory Practices	Safe, easily accessible, repeatable, affordable	11	42,3
Total		**26**	**100**

In the data analysis of the sixth question, the answers given by the classroom teachers were categorized according to their similarities and three categories were obtained. These categories are "impact on learning", "skills" and "laboratory practices". When the frequency values in Table 3 were analyzed, it was determined that the classroom teachers defined the advantages of virtual laboratories applications mostly in the category of "laboratory practices" (f=11) and least in the category of "skills" (f=7). The opinions about these categories are as follows:

Category 1: Impact on Learning

[T3]: *"It makes the lesson more interesting and thus learning becomes permanent."*

[T16]: *"Students can perform laboratory applications from anywhere, which positively affects their attitudes towards science. They can also do their own learning and these laboratories are safe."*

Category 2: Skill Development

[T20]: "*Since experimentation and learning by observation are very important in science education, virtual laboratory will provide good advantages to students in this respect."*

Category 3: Laboratory Practices

[T6]: *"It is very useful for experiments that can create danger. It is also very useful in places where school facilities are insufficient."*

[T17]: *"First of all, it is safe. It allows experimenting many times. This contributes to learning. And it is economical."*

The seventh question of the study was "What do you think are the disadvantages of the virtual laboratory for science education?". Table 4 shows the answers given by the teachers:

Table 4. Categories and codes related to the disadvantages of virtual laboratory applications

Category	**Code**	***f***	**%**
Impact on Learning	Not permanent, abstract, not convincing	5	31,3
Skill Development	Teamwork, communication, decision making, psychomotor skills	4	25
Laboratory Practices	Connection problems, paid apps	7	43,7
Total		**16**	**100**

In the data analysis of the seventh question, the answers given by the classroom teachers were categorized according to their similarities and three categories were obtained. These categories were "impact on learning", "skill development" and "laboratory practices". When the frequency values in Table 4 were analyzed, it was determined that the classroom teachers defined the disadvantages of virtual laboratory applications mostly in the category of "laboratory practices" (f=7) and least in the category of "skill development" (f=4). Three teachers participating in the study stated that virtual laboratory applications do not have any disadvantages. The views on these categories are as follows:

Category 1: Impact on Learning

[T1]: *"Real laboratory studies can provide more permanent learning."*
[T11]: *"It is not as concrete as a real laboratory."*
Category 2: Skill Development
[T5]: *"I think that too much interaction of students with computers will negatively affect their social lives."*
Category 3: Laboratory Practices
[T13]: *"Difficulty in implementation due to the lack of internet and computer."*

Discussion

The aim of this study is to investigate the ideas and opinions of classroom teachers about the use of virtual laboratory applications in primary school science courses. In this direction, firstly, the definitions of virtual laboratory applications by the teachers participating in the study were analyzed. The results obtained show that virtual laboratory definitions are mostly technology oriented. Virtual laboratory was mostly associated with concepts such as computer, internet, simulation and animation. This coincides with the existing definitions of virtual laboratory in the literature (Martin-Villalba et al., 2008; Akkağıt & Tekin; 2012).

The second issue examined in the study was the teachers' views on the contribution of virtual laboratory applications to students. Most of the teachers participating in the study stated that virtual laboratory applications contribute to students. In the study conducted by Aydın (2018) in which traditional laboratories and virtual laboratories were compared, it was determined that virtual laboratories made a positive contribution to the education of students, and in the study conducted by Avcı and Duman (2016), it was determined that virtual laboratories contributed to increasing student achievement and remembering the acquired information for a longer period of time compared to the teacher-centered teaching method. In the emergence of these results, it can be said that virtual laboratory applications are interactive learning environments that provide students with the opportunity to conduct experiments without realizing time and place and provide active participation of students (Ünlü, 2019).

The third issue examined in the study was the teachers' utilization of virtual laboratory applications. The majority of teachers stated that they did not benefit from virtual laboratory applications. The reason for this is mostly due to the lack of infrastructure and hardware such as internet, electricity and computers. This may be due to the fact that most of the teachers participating in the study work in settlements such as villages and towns. As a matter of fact, studies in the literature (Doğan & Koçak, 2020; Usta & Dönmez, 2021), which concluded that there are problems in accessing technology due to lack of infrastructure or hardware in settlements such as villages or towns, support this finding.

The fourth issue examined in the study was teachers' perceptions of their own competence regarding virtual laboratory practices. As a result of the study, it was determined that most of the teachers considered themselves inadequate in virtual laboratory applications. All of the teachers who considered themselves inadequate stated that this was due to the fact that they did not receive any training on virtual laboratory. The fact that teachers

who consider themselves sufficient in virtual laboratory applications have received training on this subject supports the result of the study. In the study conducted by Günlü (2019), teachers stated that they did not use virtual laboratories in lessons because they did not receive any training on virtual laboratories.

The fifth issue examined in the study was teachers' perceptions of their students' competence regarding virtual laboratory applications. As a result of the study, it was determined that the majority of teachers saw their students as inadequate in virtual laboratory applications. Teachers who saw their students as inadequate in this regard stated that this situation was due to the lack of training. Studies have shown that teachers' self-efficacy, openness to new ideas and positive attitudes towards teaching positively affect student achievement and attitudes (Tschannen-Moran & Hoy, 2001; Wolfolk & Hoy, 1990). Considering these findings and the results obtained from the fourth sub-problem of the study, the reason why students are not proficient in virtual laboratory applications may be due to the inadequacy of teachers in this subject.

The sixth and seventh topic analyzed in the study was teacher opinions on the advantages and disadvantages of virtual laboratory applications. The results obtained show that the advantages and disadvantages of virtual laboratory applications are mostly related to laboratory applications. Advantages were expressed as virtual laboratories being safe, easily accessible, allowing multiple applications and being economical. When the literature is examined, it is seen that there are studies that overlap with these views (Tatlı & Ayas, 2011; Dryberg et al., 2017). Disadvantages were defined by teachers as connection problems and paid applications. The study conducted by Günlü (2019) overlaps with the findings of the study.

Conclusion

In summary, the results of the research showed that teachers' definitions of virtual laboratory applications overlap with the definitions in the literature, teachers' virtual laboratory applications contribute to students, teachers generally do not benefit from virtual laboratory applications for various reasons, teachers do not consider themselves and their students sufficient in this regard, and the advantages of virtual laboratory applications are more than the disadvantages.

Recommendations

- Teachers can be provided with the necessary support through courses and seminars to use virtual laboratory applications in schools.
- Lack of infrastructure or hardware in schools prevents the use of virtual laboratory applications. Therefore, infrastructure and hardware deficiencies can be eliminated for the effective use of virtual laboratory applications in schools.
- Virtual laboratory applications that can be used in science teaching can be offered free of charge by authorized institutions.
- The number of virtual laboratory applications suitable for primary school level can be increased.

References

Abulrub, A. H. G., Attridge, A. N. & Williams, M. A. (2011, April). Virtual reality in engineering education: The future of creative learning. *2011 IEEE global engineering education conference (EDUCON)*, 751-757.

Akkağıt, Ş. F. & Tekin, A. (2012). Simülasyon tabanlı öğrenmenin ortaöğretim öğrencilerinin temel elektronik ve ölçme dersindeki başarılarına etkisi. *Ege Eğitim Dergisi*, *13*(2), 1-12.

Anılan, B. (2016). Laboratuvar kullanımı. In Ş. S. Anagün & N. Duban (Ed.), *Fen bilimleri öğretimi* (s. 341-380). Anı Yayıncılık.

Avcı, G., Duman M.Ş. (2016). Sanal Laboratuvar Uygulamalarının Öğrenci Başarısına ve Öğrenilenlerin Kalıcılığına Etkisi: Mersin-Erdemli Örneği. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi, 18*(1).

Aydın, Ş.Z.N. (2018). Fen bilgisi dersi öğretiminde sanal laboratuvar uygulamasının kullanılması ve değerlendirilmesi [Unpublished master dissertation]. İstanbul Üniversitesi.

Dalgarno, B., Bishop, A. & Bedgood, D. (2003). The potential of virtual laboratories for distance education science teaching: Reflections from the initial development and evaluation of a virtual chemistry laboratory. *Improving Learning Outcomes Through Flexible Science Teaching Symposium*, 90-95.

Doğan, S., & Koçak, E. (2020). EBA sistemi bağlamında uzaktan eğitim faaliyetleri üzerine bir inceleme. *Ekonomi ve Sosyal Araştırmalar Dergisi*, *7*(14), 111-124.

Dyrberg, N. R., Treusch, A. H. & Wiegand, C. (2017). Virtual laboratories in science education: students' motivation and experiences in two tertiary biology courses. *Journal of Biological Education*, *51*(4), 358-374.

Günlü, E. (2019). *Ortaokul fen bilimleri öğretmenlerinin sanal laboratuvar kullanımının fen öğreniminde uygulanabilirliği hakkındaki görüşleri* [Unpublished master dissertation]. Mersin Üniversitesi.

Gürçay, D., Bozkurt, A. İ., Kaptan, F. & Berberoğlu, G. (2000). Öğretmen adaylarının fen derslerinde değişik taksonomik düzeylerdeki başarılarının değerlendirilmesi. *IV. Ulusal Fen Bilimleri Eğitimi Kongresi*, 131-134.

Hançer, A. H., Şensoy, Ö. & Yıldırım, H. İ. (2003). İlköğretimde çağdaş fen bilgisi öğretiminin önemi ve nasıl olması gerektiği üzerine bir değerlendirme. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, *13*(13), 80-88.

Kaba, A. U. (2012). *Uzaktan fen eğitiminde destek materyal olarak sanal laboratuvar uygulamalarının etkililiği* [Unpublished master dissertation]. Anadolu Üniversitesi.

Kaptan, F. & Korkmaz, H. (2002). *İlköğretimde fen bilgisi öğretimi (İlköğretimde etkili öğretme ve öğrenme öğretmen el kitabı, modül 7*). T.C. MEB Projeler Koordinasyon Merkezi Başkanlığı.

Kaya, H. & Böyük, U. (2011). Fen bilimleri öğretmenlerinin laboratuvar çalışmalarına yönelik yeterlikleri. *Erciyes Üniversitesi Fen Bilimleri Enstitüsü Fen Bilimleri Dergisi*, *27*(1), 126-134.

Kırpık, M. A. & Engin, A. O. (2009). Fen bilimlerinin öğretiminde laboratuvarın yeri önemi ve biyoloji öğretimi ile ilgili temel sorunlar. *Kafkas Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, *2*(2), 61-72.

Martin-Villalba, C., Urquia, A., & Dormido, S. (2008). Object-oriented modelling of virtual-labs for education in chemical process control. *Computers & Chemical Engineering*, *32*(12), 3176-3186.

Mirçik, Ö. K. & Saka, A. Z. (2018). Virtual laboratory applications in physics teaching. *Canadian Journal of Physics*, *96*(7), 745-750.

Moshell, J. M. & Hughes, C. E. (2002). Virtual environments as a tool for academic learning. In K. M. Stanney (Ed.), *Handbook of virtual environments: Design, implementation, and applications* (s. 893-910). Lawrence Erlbaum Associates.

Potkonjak, V., Gardner, M., Callaghan, V., Mattila, P., Guetl, C., Petrović, V. M., ve Jovanović, K. (2016). Virtual laboratories for education in science, technology, and engineering: A review. *Computers & Education*, *95*, 309-327.

Seven, M. A. & Engin, A. O. (2018). Fen bilimleri eğitiminde laboratuvarın önemi. *Turan Stratejik Araştırmalar Merkezi Dergisi, 10*(38), 256-265 https://doi.org/10.15189/1308-8041

Tan, M. & Temiz, B. K. (2003). Fen öğretiminde bilimsel süreç becerilerinin yeri ve önemi. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, *13*(13), 89-101.

Tatlı, Z. & Ayas, A. (2011). Sanal kimya laboratuvarı geliştirilme süreci. *5th International Computer & Instructional Technologies Symposium*, 24-30.

Tatlı, Z., & Ayas, A. (2011, 23-24 September). *Sanal kimya laboratuvarı geliştirilme süreci*. 5th International Computer & Instructional Technologies Symposium, Elâzığ, Türkiye.

Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and teacher education*, *17*(7), 783-805.

Usta, M. E. & Dönmez, F. (2021). İlkokullarda görev yapan öğretmenlerin Covid19 sürecinde yürütülen eğitim faaliyetlerine ilişkin görüşleri. *The Journal of International Lingual Social and Educational Sciences*, *7*(1), 32-46.

Ünlü, E. (2019). *Ortaokul Fen bilimleri öğretmenlerin sanal laboratuvar kullanımının fen öğretiminde uygulanabilirliği hakkındaki görüşleri* [Unpublished master dissertation]. Mersin Üniversitesi.

Üstüner, I. Ş., Ersoy, Y. & Sancar, M. (2000, 6-8 September). *Fen ve fizik öğretmenlerinin hizmet içi eğitim ve sempozyumlardan beklentileri.* IV. Fen Bilimleri Eğitimi Kongresi, Antalya Türkiye.

Woolfolk, A. E., & Hoy, W. K. (1990). Prospective teachers' sense of efficacy and beliefs about control. *Journal of educational Psychology*, *82*(1), 81.

Yıldırım, A. & Şimşek, H. (2021). *Sosyal bilimlerde nitel araştırma yöntemleri.* Şeçkin Yayıncılık.

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Sanogenic Reflection as a Factor of Emotional Well-Being

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Abstract

The article presents the concept of the Russian scientist Yu.M.Orlov, sanogenic thinking as a factor of emotional well-being of a person as a special kind of thinking that leads to a reduction in suffering from negative emotions, the main function of which is the constructive regulation of emotional states of a person. From the point of view of the theory and practice of sanogenic (healing, realistic) thinking (SGM) Y. M. Orlov, emotion is an affective result of mental automatism. Negative emotions are the experience of various types of internal conflicts between expectation and reality. The discrepancy between our expectations, that is, the mental habits of attributing a predetermined behavior to another person, and the reality of communicating with him just causes unpleasant experiences. The theory and practice of sanogenic thinking in its main provisions overcomes the phenomenological and existential approaches to human experiences as a given and considers in it the psychic reality of mental behavior, which is experienced. This approach to understanding and therapy of emotions raises it to the level of scientific philosophy of everyday life, the comprehension of which has a huge therapeutic effect on a person. In numerous studies of representatives of this scientific school (S.N. Morozyuk, S.F. Marchukova, A.Y. Rudakov, Y.N. Krainova, E.S. Kuznetsova, L.A. Kananchuk, N.Y. Pavlyuchenkova, T.O. Smoleva, L.I. Adamyan, etc.), the validity of the leading idea of the concept of the theory and practice of sanogenic thinking has been proved, briefly and aptly expressed by its creator Yu. M. Orlov: "The power of thought is obvious. It creates reality".

Keywords: Sanogenic thinking, sanogenic reflection, pathogenic thinking, pathogenic reflection, emotional well-being

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Introduction

In the charter of the World Health Organization, adopted by the International Health Conference in New York on June 19-22, 1946, human health is defined as physical, mental and social well-being, and not only the absence of diseases and physical defects. In fact, we are talking about the general well-being of a person.

Factors affecting our health and well-being are both genetics, medicine and ecology, as well as lifestyle. Without supplicating the impact of genetics, medicine and ecology on our health, yet to a greater extent a person's well-being depends on his lifestyle, conditioned by his life philosophy, which determines his behavior, activities and actions.

Propaedeutics of social, mental and physical distress, psychosomatic rehabilitation in this context is considered by us as the creation, preservation and restoration of physical, social and psychological well-being. Modern man, along with various factors affecting his health, is subjected to significant psycho–emotional stress, sometimes excessive, which cause a nonspecific reaction of the body - stress. G. Selye considered the role of force to be decisive for the development of stress. It is the power of inadequate stimuli that makes them harmful harmful agents for human health. In this regard, the question is legitimate: what determines the strength of the social factor, what turns it into a malicious agent?

The discrepancy between the subject's mental world, his expectations regarding significant environmental agents and the real reality determines the strength of his emotional reaction. The greater the discrepancy, the stronger the emotion. Thus, it is not the object of the surrounding reality itself that we consider as a factor causing a stress reaction, but those habits of mental behavior that provide a mismatch between two worlds: mental and real. From the point of view of the theory and practice of sanogenic thinking, emotion is considered as an affective result of mental behavior. We used to think that a negative emotional state causes a stress reaction. In fact, this reaction is caused by mental behavior. And the management of emotions is the management of mental behavior. It is sanogenic reflection as the most important mechanism of personality development that allows you not only to observe your behavior, including mental, to describe it, but also to change its foundations in accordance with the description and personal meanings.

The quality of our life, education, and family relations is determined by the content and direction of our personal, everyday, today's philosophy. How you think here and now depends not only on the effectiveness of activities and behavior, but also on the attitude to what is happening, and as a result – the state of mind, attitude.

Literature Review

The Russian psychologist Y. M. Orlov[1] presented the idea of "sanogenic thinking" as a special kind of thinking that leads to a reduction in suffering from negative emotions, the main function of which is the constructive regulation of human emotional states. It is sanogenic thinking, in the opinion of the author, organizes, ensures the quality of everyday philosophy that increases the tolerance of the individual to environmental disturbances, that is, stress resistance.

The importance of philosophy in the improvement of a person is logically deduced from the functions of thinking related to life and behavior: the first is to inform behavior in connection with changed circumstances; the second, explanatory, is aimed at substantiating the causes of the circumstances. On the basis of the second function, the philosophy of everyday life is formed, which further determines the nature of emotional reactions to certain circumstances. Emotional stress occurs or does not occur depending on how a person defines the situation for himself: as threatening or not threatening his personality. The philosophy that arises as a result of pathogenic thinking does not allow a person to emotionally complete the situation, he is in thrall to the past, which generates chronic stress, conflict with himself and with others. "You were offended, insulted a year ago," the author says, "and today you suffer from the memory of it, although no one offends or insults you here and now. The past does not let you go, because the emotional charge has not been extinguished at the time. Memories and repeated experiences only strengthen the emotion, and then time does not heal".

All the teachers of mankind, since ancient times, pointing out the way to improve health," says Y. M. Orlov, "offered to tame emotions such as anger, pride, fear, resentment, envy, not to cultivate and not to experience these emotions. And modern psychotherapy uses mainly two ways of managing emotions: suppressing them and containing them. However, experience suggests that a person cannot eliminate an emotion, if there is one. He can only not express it. For health, it is important not just to suppress negative emotions, it is necessary to ensure that they are not strong and do not become chronic. It is necessary not to forbid yourself to think, but to learn to think correctly".

The first principle of healthy, that is, sanogenic, thinking is the recognition of the reality of emotions. It is important to know that the emotional state is the result of our thinking.
What does it mean to think correctly or what does healthy thinking mean from the point of view of SGM? Should it be understood as positive?

Positive thinking, in the sense of positivum – "positive", is vividly represented in short-term positive psychotherapy. Of all the provisions of this direction, only one to some extent reflects the basic idea of the

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theory and practice of sanogenic thinking. The essence of the technology is to change the view of traumatic situations. Since a person is not free to free himself from all his problems, it is necessary to change the "black" vision of the world, from our point of view "pathogenic", to a more dialectical worldview. Confrontation, struggle with the problem, in the opinion of positivists, is ineffective in most cases.

At the same time, in short-term positive therapy, thinking is not used as a means to find the causes of pathogenic conflict, emotional discomfort. The question "Why?" is aimed at identifying sanogenic attributions based on the subjective concept of the patient's own health. It can be said that thinking focused on identifying and activating resources to overcome emotional discomfort, which causes positive insights, is considered by supporters of this psychotherapeutic direction as positive.

Basic principles of short-term positive psychotherapy: 1) relying on the positive in the patient's life, on his resources; 2) using only positive reinforcements; 3) a positivist (in the philosophical sense) approach. "From the standpoint of the theory and practice of SGM," Y. M. Orlov continues, "sanogenic thinking is considered as a means of controlling emotions through awareness and, accordingly, controlling those mental operations that automatically generate it.

If the positivist approach to psychotherapy manifests itself in the rejection of the analysis of the causes of the problem, and the appeal to the past is focused only on the search for resources, then the essence of sanogenic thinking is a constructive rethinking of past experience, the identification of ineffective reflexive strategies serving everyday philosophy, devoid of scientific grounds, leading to suffering. The theory and practice of sanogenic thinking answer the question: “How should one think about one's own suffering?” Note, not an escape from suffering into the world of positive illusions, but a constructive reflection of negative emotions.

Positive thinking in the concept of N. Peseshkian and X. Pezeshkiana is viewed in the sense of positum - "taking place, actually existing," that is, we can say that this is psychotherapy with common sense." The authors emphasize the need to study both positive and negative aspects of the problem and the patient's life, dialectical expansion of his worldview. And from this position, sanogenic thinking is positive thinking, that is, realistic.

At the same time, the principles formulated in positive therapy – hope, balance and counseling – determine the essence and content of their technology, aimed mainly at creating an ideal model of personal existence through the harmonious redistribution of vital energy between the four main spheres of life - bodily, mental, socio–communicative and spiritual. Emotions in this case are not the subject of analysis, only positive and negative aspects of the problem are observed and studied.

Sanogenic thinking therapy is aimed at working with emotional states. "Sanogenic and pathogenic thinking," says Y. M. Orlov, "differ only in the consequences they generate, disease and suffering, or well–being and protection. One mindset is aimed at reducing the suffering from failure, resentment, guilt, envy, shame or other emotion, the other enhances the experience, forming an ordinary pathogenic philosophy of life". Pathogenic thinking is not pathological thinking. At the heart of both thinking are the same mental operations – analysis,

synthesis, comparison, abstraction. And in this sense, both thinking is absolutely correct, but nevertheless, even correct thinking can be detrimental to health. What is their difference?

Considering thinking as behavior, it is logical to assume that it may be appropriate or inappropriate. For example, the comparison operation used in the system of interpersonal relations, in some cases can cause an experience of pride, in others – envy, which immediately leads to stress. However, this comparison operation may not be realized. Therefore, pathogenic thinking is not only inappropriate thinking, but also unconscious by force of habit.

Thus, from the point of view of the theory and practice of sanogenic thinking, the second fundamental principle of the SGM is the principle of the appropriateness of mental acts. This principle determines the choice of methods and methods of therapy. The third principle logically follows from it – the principle of self-awareness.

"Since any emotion has its own programs of self–realization," Y. M. Orlov continues, "it includes habitual response programs that lead to conflict. In an emotional state, a person involuntarily chooses the usual train of thought that has developed in the experience of experiencing this emotion. Consequently, habitual and unconscious thinking is often pathogenic. Awareness of the habits of one's own mind, self-awareness contribute to sanogenic thinking. Conscious thinking makes it possible to establish the inappropriateness of the appropriate behavior".

Relevance

Is it necessary to understand that self-improvement from the standpoint of the theory and practice of sanogenic thinking consists in learning to distinguish between mental habits and automatisms that contribute to the emergence of certain emotions, to distinguish pathogenic and sanogenic thinking?

That's right! "It is necessary to learn to restrain pathogenic habits of the mind and cultivate sanogenic ones. But to do this, you should learn to distinguish them. Therefore, the assimilation of sanogenic thinking involves learning introspection. The principle of introspection is the fourth principle of the theory and practice of sanogenic thinking. However, awareness cannot be achieved without knowledge of the psychology of thinking and the psychology of emotions. Awareness of something implies control and management of the object of awareness. If a person realizes how his resentment and guilt are arranged, he can control them. The knowledge of the operational bases of emotion is brought into the SGM from scientific psychological research, therefore, sanogenic thinking turns the everyday philosophy of a person into a scientific one.

The principle of the scientific nature of everyday thinking is the fifth principle of SGM. Sanogenic thinking cannot arise spontaneously, it is possible only on the basis of knowledge of how our mind works, generating emotions".

This means that sanogenic thinking can and should be taught by developing new habits and skills of mental behavior, sanogenic, allowing you to control thoughts and manage emotions. As a result of such training, the ability is formed not to suppress emotions, but to realize their bases, which eliminates the possibility of chronic emotions. This is the fundamental difference between healing with sanogenic thinking and positive psychotherapy.

So, the essence of SGM therapy is to teach sanogenic thinking. Then the question is legitimate: "What is the fundamental difference between this approach and the one already created in the 1950s and 1960s by A. Beck and A. Ellis cognitive psychotherapy, the main idea of which is precisely that the influence on a person's thinking restores his health?" Cognitive, or rational-emotional-behavioral, therapy considers emotional reactions as mediated by cognitive structures and actual cognitive processes acquired in the past, that is, thought (cognition) acts as an intermediate variable between an event and an emotion. Distorted, or "maladaptive" cognitions, which means any thought that causes inadequate or painful emotions, distorts the vision of an object or situation. According to A. Ellis, the middle link in the "situation – inadequate thinking – disease" model consists of a system of irrational fixed attitudes of duty, catastrophic attitudes, obsessive realization of desires, generalization of assessments, social stereotypes and others – a total of 12 irrational ideas. Awareness of the rules of inadequate information processing: personalization, dichotomy, automated thinking, selective abstraction, arbitrary conclusions, overgeneralization, exaggeration (A. Beck) – and replacing them with the right ones – these are the main tasks of cognitive psychotherapy.

The essence of therapy, therefore, is to teach and teach a new style of thinking, and in this part the technology of sanogenic thinking can be attributed to cognitive psychotherapy. At the same time, there are a number of differences that allow us to consider the theory and practice of SGM as an independent direction in psychology.

"Considering the dichotomy of thinking as a source of neurosis," says Y. M. Orlov, "the theory of A. Beck and A. Ellis itself falls into the dichotomy of irrational and rational. Consider, for example, the social stereotype that Ellis cites in the list of the main 12 ideas that generate neurosis: “those guilty of committing bad deeds should be severely punished”.

This stereotype is related by Ellis to an irrational idea. But in fact, this is not an irrational idea, but a truly rational basis for the existence of social justice. Culture exists in the form of generalized social stereotypes that are necessary for survival.

The treatment of the mind does not consist in persuasion, not in changing the “maladaptive cognition” of the patient, but in teaching whether it is appropriate to apply or not to apply this maxim to his specific life situation, in the client's awareness of how this stereotype programs behavior that leads to neurosis, and how sanogenic thinking makes adjustments to the use of this stereotype in everyday life.

Automatism of thinking is considered by cognitive scientists as a pathogenic factor. But in fact, not every mental automatism is harmful. Most mental habits are useful because they facilitate the solution of mental tasks

and provide effective behavior management. SGM therapy considers habits and automatisms of mental behavior when they become a pathogenic factor due to their inappropriate and false use.

Cognitive therapy is aimed at eliminating emotions, and the client, subjected to the belief that “emotions are bad”, focuses on their suppression, struggle. SGM therapy teaches the client to become aware of those mental operations and mechanisms acting unconsciously, which produce certain emotions. The client learns to introspect emotions, and is not prompted to suppress them, as a result of which he acquires the ability to control emotions and extinguish them. SGM therapy does not struggle with feelings, but teaches the right experience: how to be offended, ashamed, guilty, jealous and experience failure".

Results

So, the theory and practice of sanogenic thinking in its main provisions overcomes the phenomenological and existential approaches to human experiences as a given and considers in it the psychic reality of mental behavior, which is experienced. This approach to understanding and therapy of emotions raises it to the level of scientific philosophy of everyday life, the comprehension of which has a huge therapeutic effect on a person.

In numerous studies of representatives of this scientific school (Morozyuk, 2000; Marchukova, 2005; Rudakov, 2013; Krainova, 2011; Kuznetsova, 2021; Kananchuk, 2010; Pavlyuchenkova, 2008; Smoleva, 2003; Adamyan, 2012), the validity of the leading idea of the concept of the theory and practice of sanogenic thinking has been proved, briefly and aptly expressed by its creator Yu. M. Orlov: "The power of thought is obvious. It creates reality".

References

Adamyan, L. I. (2012). Sanogenic reflection as a factor of psychological stability of personality: dissertation of candidate of psychological sciences: 19.00.01. 172 p.

Kananchuk, L. A. (2010). Sanogenic reflection as a factor of adaptation of students in the polyethnic environment of the university. dissertation of Candidate of psychological sciences: 19.00.01. 174 p.

Karpov, A.V. (2002). Psychology of reflection. *Institute of Psychology of the Russian Academy of Sciences*, 320 p.

Krainova, Yu.N. (2011). Sanogenic reflection in the structure of emotional competence of future teachers: dissertation of Candidate of Psychological Sciences:19.00.07. 166 p.

Kuznetsova, E.S. (2021). Reflexive portraits of mothers with different styles of parental attitude to the child: dissertation of Candidate of Psychological Sciences: 19.00.07. 254 p.

Marchukova, S.F. (2005). Sanogenic reflection as a factor of optimization of socio-psychological adaptation of cadets of educational institutions of the Ministry of Internal Affairs of Russia: dissertation Candidate of Psychological Sciences: 19.00.01. 140 p.

Morozyuk, S. N. (2013). "10 steps of healing from resentment. Workshop on sanogenic thinking". Prometheus, 133 p

Morozyuk, S.N. (2000). Sanogenic reflection, character accentuation and effectiveness of educational activity, *Shtykova M.A.*, 2000. 265 p.

Orlov, Yu.M. (2006). Sanogenic thinking. Moscow: Sliding. 96 p

Orlov, Yu.M. (2006). Healing by philosophy. Basic mental operations. Sliding, 96 p.

Pavlyuchenkova, N.V. (2008). Sanogenic reflection as a factor in the development of emotional competence: dissertation of Candidate of psychological Sciences: 19.00.01. 163 p.

Rudakov, A. L. (2013). Sanogenic reflection as a factor of stress resistance of personality: on the example of freestyle wrestling athletes. dissertation of the candidate of Psychological Sciences: M.19.00.01. 2013. 219 p.

Smoleva, T.O. (2003). Reflection of significant adults as a factor of emotional well-being of a child: monograph. *Irkutsk: Publishing house of Irkutsk State Pedagogical University,* 163 p.

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The Implementation of Robotics and Automation in Improving Warehouse Efficiency Among Logistics Operators in Malaysia

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Abstract

Warehouse operations in Malaysia are still largely rely on manual processes, resulting in surface-level and backward technology implementation. The use of manual methods to manage large inventories often leads to human errors and such inaccuracies in inventory management can have a significant impact on warehouse efficiency. This research aims to investigate the potential impact of robotics and automation on improving warehouse efficiency among the Malaysian logistics operators. The logistics sector in Malaysia plays a vital role in supporting the country's economic growth. As such, advancements in robotics and automation hold immense potentials to enhance operational efficiency, increase productivity, and achieve cost-effectiveness within warehouse facility operations. By adopting and integrating robotics and automation, warehouses can streamline their processes, reduce manual labour, and mitigate the risks associated with human errors. Literature reviews have been gathered to explore existing studies and best practices in the field of warehouse technology. To further conduct this research, primary data have been collected by distributing self-administered, online questionnaire to a sample of warehouse operators in to gather their perceptions on the current challenges, technology utilization, and potential benefits of adopting robotics and automation. The collected data have been analyzed using PLS-SEM software for in-depth statistical analysis and identification of significant patterns and correlations. By examining the relationship between robotics and automation implementation and warehouse efficiency, this research will be able to provide valuable insights into the

potential benefits and challenges of adopting robotics and automation in Malaysian warehouses.

Keywords: Automation, logistics, warehouse efficiency, robotics

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Introduction

The freight and logistics industry represents one of the backbones of economic development of any country. It comprises services such as transportation, storage and distribution of goods and services across a variety of sectors. In Malaysia, freight and logistics provide strong supports for its lucrative trade and export-oriented markets. This sector gives lives to a complex network of transportation modes including air, sea (maritime), road, railway as well as warehousing and value-added services. The services required for these complex transportation modes include freight forwarding, warehousing and storage, courier, express, parcel services, etc. Major players in the industry currently are DHL Express, FedEx Corporation, United Parcel Service Inc. (UPS), Kerry Logistics Network Limited, just to mention a few ("Malaysia Freight and Logistics Market Analysis", 2023).

Problem Statement

Malaysia's location in Southeast Asia has put itself strategically connecting the East and the West. The demands for freight and logistics services come from its strong focus on export-oriented industries such as electronics, automotive and palm oil. In addition, the growth in E-commerce has accelerated the logistics development in Malaysia. The rise of online shopping trends and cross-border E-commerce have created a surge in demand for efficient last-mile delivery, warehousing and fulfilment services. The government also has provided significant investments into upgrading its infrastructure involving ports, airports and road networks. This enables improved connectivity and logistics efficiency in the country. Following its robust manufacturing sectors such as electronics and automotive, the need for efficient supply chain management and Just-In-Time deliveries further accelerated the growth in freight and logistics market ("Malaysia Freight and Logistics Market Analysis", 2023).

Despite the positive outlooks of the freight and logistics industry, Malaysia struggle with its port congestions, limited warehouse capacity, tedious trade/import-export procedures and documentations and a shortage of skilled personnel to handle various logistical tasks including transportation, warehousing and inventory management. This posed a challenge to Malaysian logistics and warehouse operators. The industry has

witnessed its rapid technological developments leading towards increase automation, real-time tracking and data visibility, not to mention the need for green logistics solutions. Together with the customer-centric approach, these are the strategies to maintain competitive advantage or to ensure survivability among service providers ("Malaysia Freight and Logistics Market Analysis", 2023).

Moreover, instances of inefficient warehouse management can be witnessed when commodities and shipments from the same warehouses are stocked and delivered in disorderly manners. At times goods are moved from the storage areas to a different position in order to get selected to fulfill pending orders. Due to inefficient warehouse management, the task of locating the goods resulted into excessive labour expenses. Another issue is involving the lack of space in the warehouse. To meet the companies' requirements, sometimes they need to buy or rent more space to increase current capacity due to high demands. Storing more goods without sufficient space utilization might lead to an underestimation of the required time. As a result, customer orders cannot be fulfilled on time resulting into delays. This becomes an ineffective business practice which involved inefficient utilization of available space and delay in final delivery of the goods (Amirrudin et al., 2023). The next sections cover the research objectives and research questions, its significance, literature review and hypothesis development, the conceptual framework, research methodology, results and findings and the conclusion.

Research Objectives and Research Questions

In general, the research objective adopted in this research is to examine the effects of robotics and automation on warehouse efficiency as perceived by logistics operators in Malaysia. This led to five specific research objectives. They are:

- To assess the relationship between Perceived Usefulness of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia
- To assess the relationship between Perceived Ease of Use of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia
- To assess the relationship between Observability of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia
- To assess the relationship between Relative Advantage of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia
- To assess the relationship between Green Technology of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia

Based on these specific research objectives, five research questions have been derived. They are:

- What is the relationship between Perceived Usefulness of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia?
- What is the relationship between Perceived Ease of Use of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia?

- What is the relationship between Observability of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia?
- What is the relationship between Relative Advantage of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia?
- What is the relationship between Green Technology of Robotics and Automation and Warehouse Efficiency among logistics operators in Malaysia?

Significance of the Research

This research observed that the growth in the logistics industry in Malaysia is influenced by the impact of advanced technologies on warehouses. This is similar to findings of Kumar et al. (2021) that warehouse research has moved towards automation and became technology driven since the introduction of Industry 4.0 in 2011. This research deployed the Technology Acceptance Model (TAM), Innovation Diffusion theory (IDT) and Lean theory in its framework. By combining five variables consisting of Perceived Usefulness, Perceived Ease of Use, Observability, Relative Advantage and Green Technology, this research contributed to the warehouse research sphere in a scholarly manner which currently lacked in theoretical framework development (Kumar et al., 2021).

From practical point of view, this study lies in its potential to contribute to the development of the logistics industry. The perceived impacts of robotics and automation help to inform industrial players such as warehouse managers on the best strategies to adopt such technology, its adoption or acceptance and integration moves, leading towards improved warehouse efficiency, well-controlled costs while embracing the customer-centric approach.

Literature Review

This section explains the development of robotics and automation in warehouses, relevant theories underpinning the variables chosen, the in-depth discussion of the independent and dependent variables leading towards the hypothesis developments.

Robotics and Automation in Warehouse Applications

Globalization and the E-commerce influence have caused many supply chains to embrace automation and several other technologies such as robotics, artificial intelligence, 3-D printing and so on (Dhaliwal, 2020). Having to deal with omni-channel retailing and complex supply chains forced companies (especially E-commerce companies) to adopt robotics and automation-based supply chain technology in order to cope with the internal pressure of increasing throughput and greater volume of inventory. At the same time, companies need to cut costs, shorten inventory cycle, maximize productivity and most importantly, meet customer demands such as the same day delivery (Dhaliwal, 2020). For warehouse operators, the challenges are to be

able to perform real-time tracking, fast processing and efficient delivery of the goods. Warehouse automation means "the use of various IT-based technologies that allow a warehouse to operate much more effectively and efficiently in order to achieve greater outcomes with significantly fewer efforts" (Dhaliwal, 2020, p. 64).

A warehouse plays a critical role in the supply chain management and problems in the warehouse can cause delays, affect customer satisfaction and the cash flow of companies. In terms of E-commerce, warehouse automation helps companies to meet accelerated fulfilment demands, reduce operating expenses and overhead costs, minimize errors or mistakes, reduce energy consumption and storage space. It also helps to increase the employee productivity. Companies do not need to hire more talents but rather, they harness more productivity out of each employee. Automation helps to improve inventory data collection and enables data sharing across departments. It results into better inventory management and control, thus, reducing the cases of lost inventory, misplacement and shipping errors. Surprisingly, automation allows the practice of sustainable green activities by reducing land or storage space usage, generating less wastage, reducing non-renewable energy consumption to run machineries including reusing or repurposing certain components (Dhaliwal, 2020).

There are two types of warehouse automation: process automation and physical automation. Process automation, also known as system automation, converted manual processes to become digital processes. Activities such as inventory data collection can now be done using barcode scanning and these data will be captured by the Enterprise Resource Planning (ERP) system or the database of the companies for further actions. On the contrary, physical automation consisted of a variety of technologies and machineries used for automation. Physical automation embraced the use of robotics system in the warehouse. Examples include the autonomous mobile robots (AMR), the automated guided vehicles (AGV) and the goods-to-person (G2P) technology (Dhaliwal, 2020).

Autonomous Mobile Robots (AMR)

The AMRs are the latest and advanced version of the AGVs. They use sophisticated and efficient technology in which they are faster, smarter and easier to be set up. They are able to work without the supporting infrastructure, for example, an AMR can precisely locate laser targets, wires or magnets implanted on the floor. They also have the mapping and obstacle avoidance features with a human-robot interface. They are made up of powerful artificial intelligence (AI) technology-based laser sensors, sophisticated camera systems and computer hardware that allow them to operate and navigate dynamically using a map by understanding their operational environment. The AMRs are not restricted to fixed routes rather, they can plan and replan their paths in order to travel fast (Dhaliwal, 2020).

Automated Guided Vehicle (AVG)

The AVGs are commonly used technology-based solutions in moving materials in warehouses or manufacturing facilities. The mobile robots worked by following the markers or wires in the floor, sometimes they used vision or lasers. These "driverless vehicles" such as the robotic-controlled industrial lift trucks are

used in manufacturing and distribution settings. With the use of AVGs, companies are ensured of safety and efficient operations with cost-effective product movements. AVGs helped companies to deal with labour shortages by having a better task allocation among employees (Dhaliwal, 2020).

Goods-to-person technology (G2P)

G2P is at best in handling the high-volume E-commerce transactions where orders consist of individual products. G2P can handle split-case order fulfilments that consist of individual units needed to be picked up from individual locations and placed into a carton. It replaced the traditional persons-to-good model by reversing the flow – now the goods are brought to the person. The individual items in the storage will be automatically picked and brought to the picker or the pick stations. The benefits of G2P are its ability to reduce expensive manual labour and save time. As a result, more orders can be fulfilled in a shorter time per worker (Dhaliwal, 2020).

Technology Acceptance Model (TAM)

Three theories upholding this research are the Technology Acceptance Model (TAM), Innovation Diffusion Theory (IDT) and Lean theory. Without a doubt, TAM is popular in research studies involving technology acceptance based on Granić and Marangunić (2019). Its two prominent variables, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) have proven to be antecedent factors affecting acceptance of learning with technology (Granić and Marangunić, 2019).

Innovation Diffusion Theory (IDT)

IDT is the foundational framework for innovation adoption (Amini & Jahanbakhsh Javid, 2023). A few characteristics of IDT influencing adoption are relative advantage and observability (Orji et al., 2020). In terms of warehouse efficiency, it can enhance operations, transparency and speed (Attié & Meyer, 2022). In addition, the impact factors of IDT are relative advantage, compatibility, complexity, trialability and observability (Sharifani et al., 2022).

Lean Theory

Lean theory stresses its potential for sustained productivity and quality within budget constraints (Radnor & Osborne, 2020). Palange and Dhatrak (2021) stated that lean manufacturing focuses on efficiency and waste reduction, and the integration of lean and green technology in warehouses yields benefits (Moussa et al., 2019). This integrated approach aligns environmental responsibility with operational excellence, providing a competitive edge for warehouses (Jimenez et al., 2019).

Independent Variables

Perceived Usefulness

Perceived usefulness refers to an individual's perception of the extent to which a particular technology or system can improve his or her job performance or overall efficiency (Al-Fraihat, Joy, Masa'deh, & Sinclair, 2020). Perceived usefulness can drive better data collection and analysis practices. When employees view data entry and tracking systems as valuable tools that enhance the decision-making process, they work harder to ensure accurate and timely data entry. This enables warehouse managers to make informed decisions based on reliable data (Tahar et al., 2020).

Thus, the following hypothesis has been developed:

H1. Perceived usefulness of robotics and automation has a positive relationship with warehouse efficiency among logistics operators in Malaysia.

Perceived Ease of Use

Perceived ease of use refers to an individual's perception of how easy or difficult it is to use a particular technology or system. In the context of overcoming warehouse inefficiencies, they discuss how perceptions of ease of use can play an important role in improving warehouse operations and addressing inefficiencies (Tahar et al.,2020). Additionally, perceived ease of use can have a positive impact on training efforts. If employees find the new technology intuitive and user-friendly, training sessions become more efficient, reducing the amount of time and resources needed to improve employee skills (Tahar et al., 2020).

Hence, the following hypothesis has been derived:

H2. Perceived ease of use of robotics and automation has a positive relationship with warehouse efficiency among logistics operators in Malaysia.

Observability

The term observability is the degree to which an innovation's results are visible to the adopters. Observability is concerned with conveying and receiving individual status, team, task, and environment knowledge (Adriaensen et al., 2022). Put differently, the ability to observe and gather data significantly influences warehouse efficiency, as it offers valuable insights, supports prompt decision-making, and enables ongoing enhancements. Implementing observability tools and practices can help warehouses stay competitive and adapt to changing market demands (Ghiami & Beullens, 2020)

Thus, the following hypothesis has been developed:

H3. Observability of robotics and automation has a positive relationship with warehouse efficiency among logistics operators in Malaysia.

Relative Advantage

The term relative advantage describes how much people think that a novel and inventive solution is better than an older, more conventional one. Past authors explained how the idea of relative advantage can greatly improve warehouse operations and deal with inefficiencies. Relative advantage can alleviate the lack of dependent variables by addressing multiple aspects, especially when it comes to warehouse efficiency (Al-Rahmi et al., 2019).

Hence, the following hypothesis has been derived:

H4. Relative advantage of robotics and automation has a positive relationship with warehouse efficiency among logistics operators in Malaysia.

Green Technology

Green technology, also known as clean technology or sustainable technology, refers to the creation and use of environmentally friendly creative solutions with the goal of reducing the negative impact of human activities on the environment (Bellis, 2019). Green technology has the potential to significantly reduce the environmental consequences of fossil energy usage. This is also consistent with Das (2023) who found that green technology does not impact the environment negatively.

Thus, the following hypothesis has been developed:

H5. Green technology of robotics and automation has a positive relationship with warehouse efficiency among logistics operators in Malaysia.

Dependent Variables

Warehouse Efficiency

Robotics and automation's integration in Malaysian logistics business has had a substantial influence on warehouse efficiency. Warehouses have improved order processing time, inventory accuracy, and overall labor productivity by implementing technologies such as the Internet of Things, Radio Frequency Identification, Warehouse Management Systems, Cloud Computing, Artificial Intelligence and autonomous mobile robots (Dhaliwal, 2020). These advancements have resulted in cost savings, shorter lead times and increased customer satisfaction, providing logistics companies with a competitive edge. Despite initial challenges, further robotics and automation adoption shows great potential for future warehouse efficiency development (Pandian, 2019). The conceptual framework of the research is depicted in Figure 1.

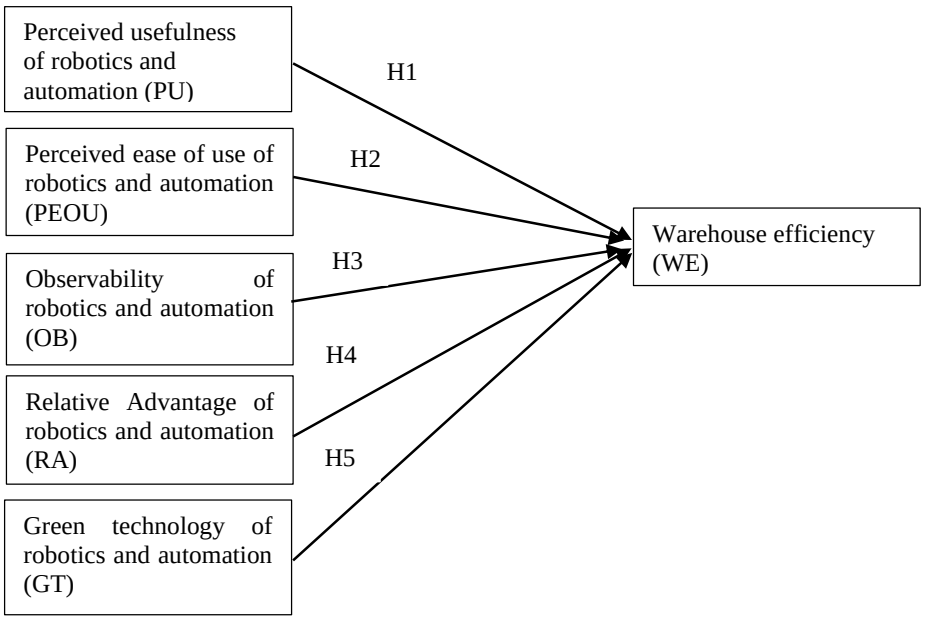

Figure 1. Conceptual Framework

Method

This research is quantitative and cross-sectional in nature. In this section, the methods or process used in the instrument adoption, sampling, data collection and data analysis will be discussed. Most of the questions adopted the five-point Likert scale with 1 representing strongly disagree and 5 representing strongly agree. Questions in the survey questionnaire were adopted and adapted from past studies. By deploying the deductive approach, this research made use of an online survey questionnaire via Google form. The language of the survey is English.

The research's unit of analysis is the logistics, supply chain and warehouse employees. Based on the Annual Economic Statistic 2022 Transportation and Storage Service (2023), there are a total of 457,484 number of employees in the warehouse, logistics and supply chain industries in Malaysia. In general, three states make up more than 50% of employees in the warehouse, logistics and supply chain. They are Federal Territory of Kuala Lumpur, Selangor and Johor. Thus, the questionnaires have been distributed in these three states as they also have port/airport operations there. At the time of writing, 83 responses have been secured and the data collection process is still ongoing (Oct-Nov 2023).

Furthermore, the non-probability sampling method has been adopted due to the fact that the sampling frame cannot be determined. Among the non-probability sampling methods, the snowball sampling has been adopted. This research collected the primary data. It will be then analyzed for reliability and validity while looking for significant correlations and patterns via structured model testing.

Results and Findings

Demographic Profile of Respondents

In total, 83 respondents took part in this survey research. Male comprised of 56 (67.5%) while female comprised of 27 (32.5%). Most of the respondents aged between 25-34 years old (60; 72.3%), followed by 18-24 years old (14; 16.9%) and 35-44 years old (9; 10.8%) The majority of the respondents are Chinese (45; 54.2%), followed by Malay (23; 27.7%) and Indian (14; 16.9%). 41 or 49.4% of the respondents are Diploma holders, 15 (or 18.1%) are Degree holders, 26 or 31.3% attended secondary school (high school) while one (or 1.2%) had a Master degree. All of the respondents worked at logistics or warehouse companies with 68 or 81.9% worked as employees, 12 (or 14.5%) worked at supervisory level and the last three worked as managers (3.6%).

Table 1. Demographic Profile

Gender	**Frequency**	**Percentage**
Male	56	67.5
Female	27	32.5
TOTAL	**83**	**100**
Age	**Frequency**	**Percentage**
17 and below	-	-
18-24 years	14	16.9
25-34 years	60	72.3
35-44 years	9	10.8
45 and above	-	-
Ethnic	**Frequency**	**Percentage**
Malay	23	27.7
Chinese	45	54.2
Indian	14	16.9
Others	1	1.2
Education Background	**Frequency**	**Percentage**
Secondary School	26	31.3
Diploma	41	49.4
Bachelor degree	15	18.1
Master degree	1	1.2
Job Position	**Frequency**	**Percentage**
Warehouse Employee	68	81.9
Supervisor	12	14.5
Manager	3	3.6

Construct Reliability and Validity

To test for reliability and validity, the researchers run the data using PLS-SEM (SmartPLS 4) software (Ringle et al., 2022) and removed all path loadings lower than 0.4. Even though these are lower than the normal loadings of 0.7 (normal practice), loadings of at least 0.4 and above are maintained to ensure the application of important theories supporting this research. The remaining constructs maintained after deletion are shown in Figure 2. Based on Table 2, Cronbach's Alpha value for Warehouse Efficiency (WE) is 0.646 and Composite Reliability rho_a is 0.666 which are slightly below the normal value of 0.7. The reliability of the data collected is slightly questionable. For convergent validity, the value of average variance extracted (AVE) is 0.489, almost achieving the minimum value of 0.5. In future, there might be a need to revise the questions used (and replaced them with more relevant ones for this type of research or industries in order to improve reliability and validity analysis).

Table 2. Construct Reliability and Validity

	Cronbach's alpha	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
Warehouse Efficiency (WE)	0.646	0.666	0.654	0.489

Table 3 indicated the discriminant validity using HTMT values. The values signaled that the discriminant validity is achieved. The Fornell-Larcker criterion is met (WE 0.699). Furthermore, based on Table 4, the Variance Inflation Factor (VIF) values are less than 5.0, thus, there is no multicollinearity problem exist in this research. Table 5 indicated that the variables of this research (employee factor contribution on the application of robotics and automation) influenced the improvement in warehouse efficiency about 68 percent. The other factors (32 percent) are not captured in this research.

Table 3. Discriminant Validity (Heterotrait-monotrait Ratio, HTMT)

	PEOU	**PU**	**WE**
PEOU			
PU	0.534		
WE	0.58	0.546	

Table 4. Collinearity – Variance Inflation Factor (VIF)

	VIF		**VIF**
GT4	1.008	PU1	1.000
GT5	1.008	RA1	1.096
OB1	1.053	RA5	1.096
OB2	1.053	WE4	1.295
PEOU1	1.000	WE6	1.295

Table 5. R Square

	R-square	R-square adjusted
WE	0.686	0.666

Based on Table 6, the path coefficient, sample mean, t-values and the p-values are given. Based on the hypothesis development for this research, only H4 is supported. The path loading and p-value for H4 - relative advantage (0.359, p-value 0.038, less than 0.05) can be seen in Figure 2. Hence, relative advantage of robotics and automation has a positive relationship with warehouse efficiency among logistics operators in Malaysia. The other hypotheses (H1, H2, H3 and H5) are rejected, thus, there are no positive or negative relations between perceived usefulness, perceived ease of use, observability and green technology of robotics and automation with warehouse efficiency. In addition, future researchers should look for other more relevant factors that can contribute into warehouse improvements.

Table 6. Path Coefficient, P-values and Hypotheses

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P-values	Hypothesis
PU → WE	0.244	0.279	0.195	1.253	0.21	H1 (Not supported)
PEOU → WE	0.278	0.287	0.16	1.739	0.082	H2 (Not supported)
OB → WE	0.178	0.211	0.132	1.353	0.176	H3 (Not supported)
RA → WE	0.359	0.316	0.173	2.07	0.038	H4 (Supported)
GT → WE	0.194	0.207	0.118	1.646	0.1	H5 (Not supported)

Note: PU- Perceived Usefulness; PEOU-Perceived Ease of Use; OB-Observability; RA-Relative Advantage; GT-Green Technology & WE-Warehouse Efficiency

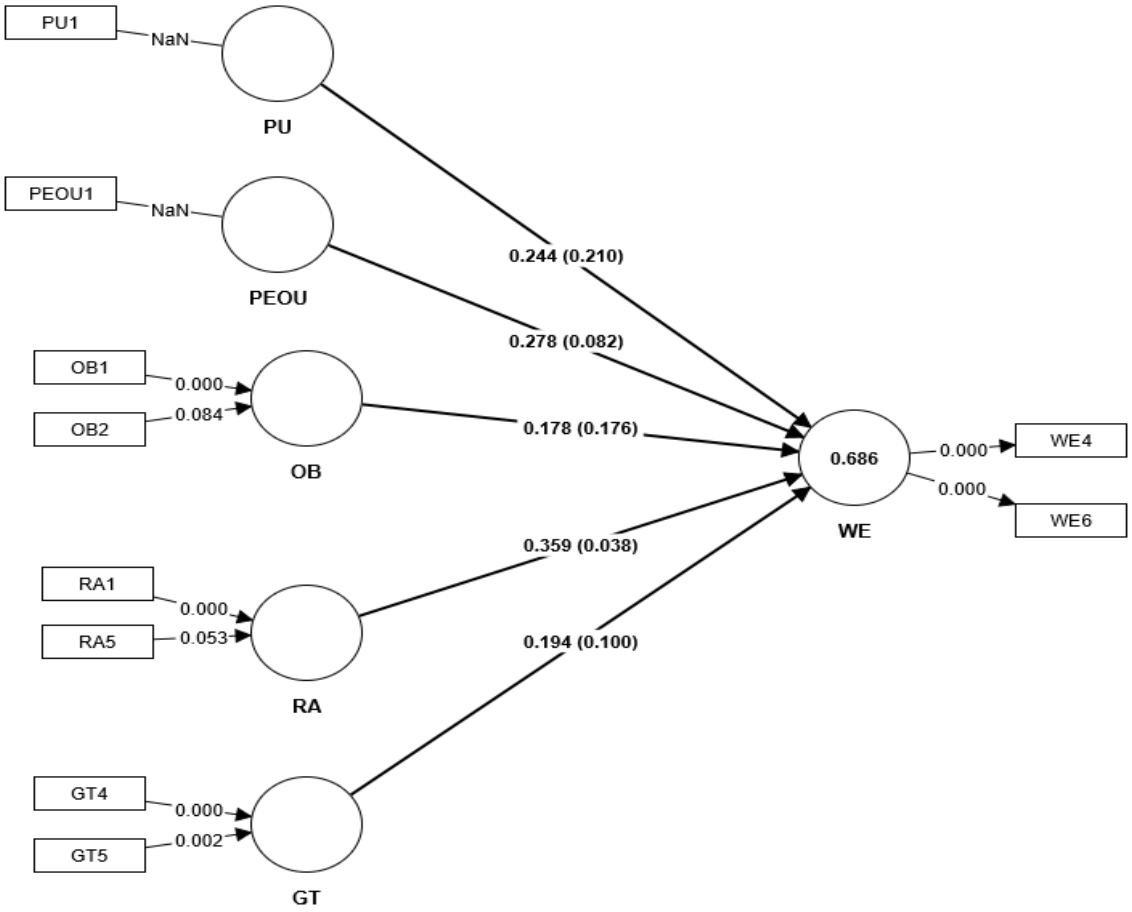

Figure 2. Path coefficients and p-values of this research (Formative-Formative model)

Recent Reflections of the Malaysian Warehouses based on Frequency Distribution

Based on Figure 3, 66 responses (or 79.6%) reflected that the Malaysian warehouses are not efficiently managed at present especially being sustainable warehouses. Only 13 responses (or 15.6%) agreed that the warehouses are efficiently managed.

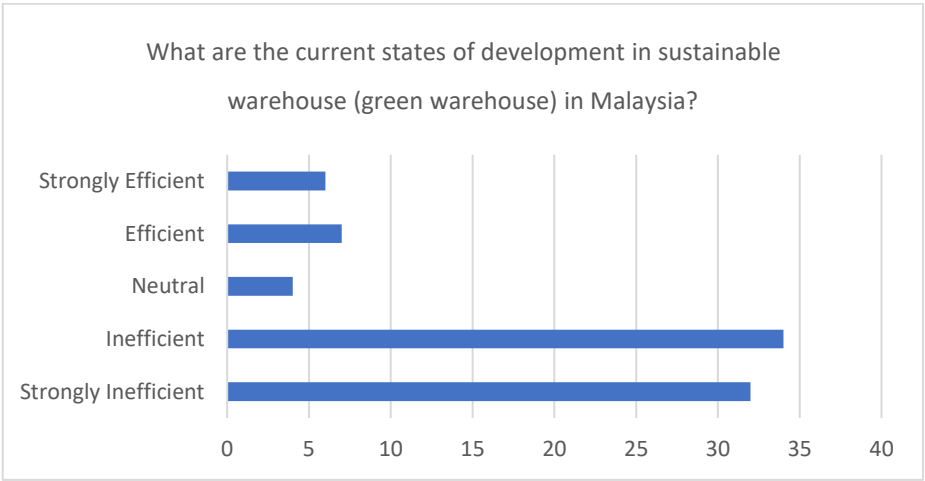

Figure 3. Current States of Development in Sustainable Warehouses

Next, most respondents believed that the strongest challenges to implement high efficiency warehouses are equipment reliability and maintenance of this equipment (67; 80.7%) and data accuracy and analysis (67; 80.7%), employee training and adoption (16; 19.3%) and lastly, the environmental considerations (12; 14.5%). This is evidenced in Figure 4.

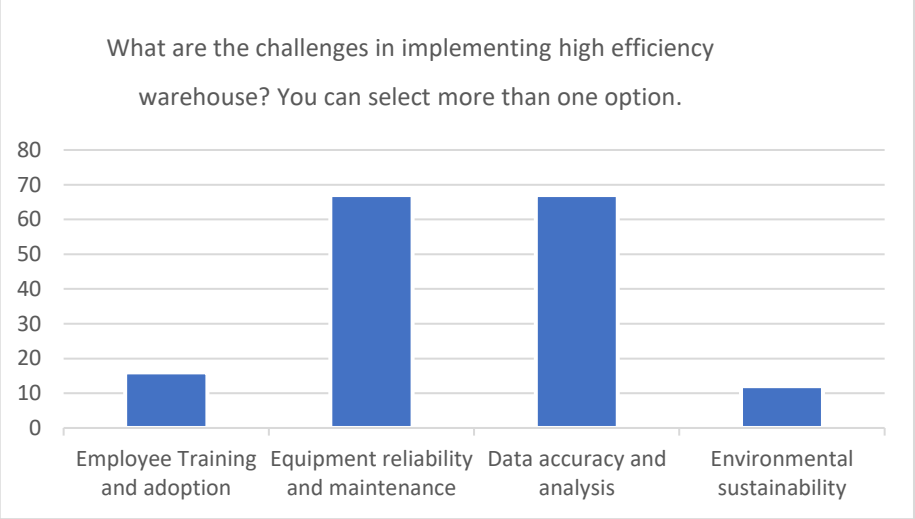

Figure 4. Challenges in Implementing Highly Efficient Warehouses

In addition, for a highly efficient warehouse project to succeed, most respondents believed that costs will be its major drawbacks. This is agreed by 64 respondents (77.1%). The next obstacle is flexibility of the warehouse by 60 respondents (72.3%), labour (19; 22.9%) and lastly, adaptability issues (19; 22.9%). This finding is evidenced in Figure 5. Overall, 78 respondents (or 94%) agreed that robotics and automation is a potential area for the optimization of the warehouse and logistics industries and majority heard positive outcomes about its implementation somewhere.

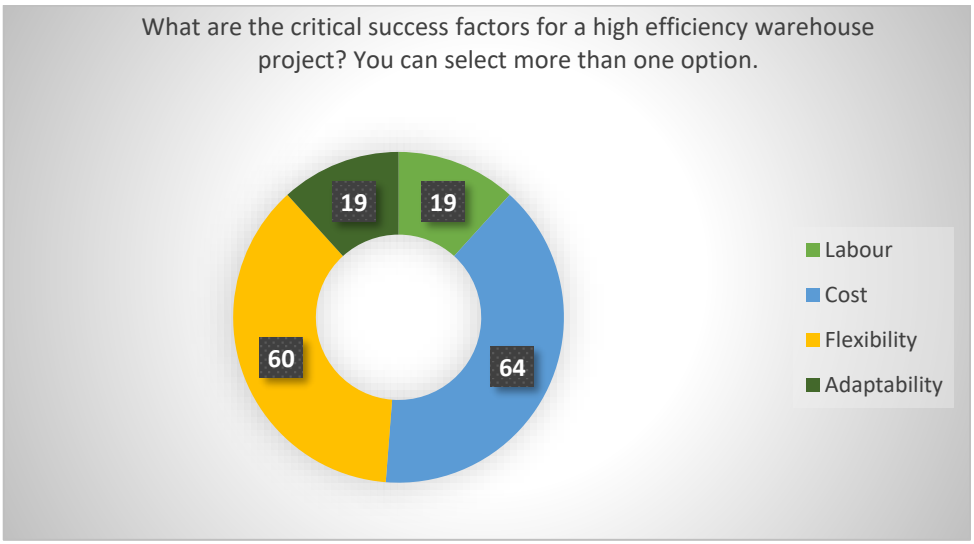

Figure 5. Critical Success Factor of Highly Efficient Warehouse Project

Discussion and Recommendations

This research has been conducted with a few shortcomings and not without obstacles. The main finding, relative advantage means how much people think that a novel and inventive solution is better than an older, more conventional one. Basically, majority of the respondents believed that currently the existing warehouses are not efficiently managed. Its major obstacles are dealing with costs and flexibility. Additionally, most workers claimed that the main challenge to implement a highly efficient warehouse is reliability of the equipment and its maintenance. Other than that, equally important is the accuracy of the warehouse data and its insights for ease of decision making. Enhancing employee skills and knowledge via training is also an important consideration. Even though only one hypothesis is supported, this research also indicated that there are other factors which are more influential when dealing with warehouse efficiency and they are still at loose. Employee factors such as perceived usefulness of robotics and automation, perceived ease of use of robotics and automation, observability of robotics and automation and green technology aspect of robotics and automation only provided a small contribution in improving warehouse operations. Most probably the other major contributors in warehouse improvements are non-employee or perhaps, non-human factors since warehouses are relevant to air, sea, road and railroad operations and trade-related activities.

Conclusion

In conclusion, freight and logistics which represents the economic backbones of any country, encompass services such as transportation, storage and distribution of goods and services involving a string of sectors. The complex network of transportation in Malaysia includes its air, sea, road, railroad, warehouses and other value-added services. This research probed about the implementation of robotics and automation in improving warehouse efficiency among logistics operators in Malaysia. Three main theories, TAM, IDT and lean were adopted to support five main independent variables (perceived usefulness, perceived ease of use, observability, relative advantage and green technology of robotics and automation) from employee factor perspective. Time as its constraint, this research analyzed 83 responses and found that relative advantage of robotics and automation has a positive relationship with warehouse efficiency. The lack of theoretical framework academically opened up more rooms for future research in the area.

References

Adriaensen, A., Berx, N., Pintelon, L., Costantino, F., Di Gravio, G., & Patriarca, R. (2022). Interdependence Analysis in collaborative robot applications from a joint cognitive functional perspective. *International Journal of Industrial Ergonomics*, *90*, 103320.

Al-Fraihat, D., Joy, M., & Sinclair, J. (2020). Evaluating E-learning systems success: An empirical study. *Computers in human behavior*, *102*, 67-86.

Al-Rahmi, W. M., Yahaya, N., Aldraiweesh, A. A., Alamri, M. M., Aljarboa, N. A., Alturki, U., & Aljeraiwi, A. A. (2019). Integrating technology acceptance model with innovation diffusion theory: An empirical investigation on students' intention to use E-learning systems. *Ieee Access*, *7*, 26797-26809.

Amini, M., & Jahanbakhsh Javid, N. (2023). A Multi-Perspective Framework Established on Diffusion of Innovation (DOI) Theory and Technology, Organization and Environment (TOE) Framework Toward Supply Chain Management System Based on Cloud Computing Technology for Small and Medium Enterprises. *Organization and Environment (TOE) Framework Toward Supply Chain Management System Based on Cloud Computing Technology for Small and Medium Enterprises (January 2023). International Journal of Information Technology and Innovation Adoption*, *11*, 1217-1234.

Amirrudin, A. H., Kamaruddin, N. S., Salehuddin, N., & Ibrahim, S. (2023). Improving Warehouse Efficiency Through Effective Inventory Management Practices. *Social and Management Research Journal*, *20*(1), 173-187.

Attié, E., & Meyer-Waarden, L. (2022). The acceptance and usage of smart connected objects according to adoption stages: an enhanced technology acceptance model integrating the diffusion of innovation, uses and gratification and privacy calculus theories. *Technological Forecasting and Social Change*, *176*, 121485.

Bellis, M. (2019, July 26). Introduction to green technology. *Thoughtco*. https://www.thoughtco.com/introduction-to-green-technology-1991836

Das, T. (2023, June 25). What is Green Tech and Why is it Important for the Future?. *Geekflare*. https://geekflare.com/green-tech/

Department of Statistic Malaysia. (2023). *Annual Economic Statistic 2022 Transportation and Storage Service*. https://newss.statistics.gov.my/newss-portalx/ep/epFreeDownloadContentSearch.seam?cid=4438

Dhaliwal, A. (2020). The Rise of Automation and Robotics in Warehouse Management. *Transforming Management Using Artificial Intelligence Techniques*, 63-72.

Ghiami, Y., & Beullens, P. (2020). The continuous resupply policy for deteriorating items with stock-dependent observable demand in a two-warehouse and two-echelon supply chain. *Applied Mathematical Modelling*, *82*, 271-292.

Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, *50*(5), 2572-2593.

Jimenez, G., Santos, G., Sá, J. C., Ricardo, S., Pulido, J., Pizarro, A., & Hernández, H. (2019). Improvement of productivity and quality in the value chain through lean manufacturing–a case study. *Procedia manufacturing*, *41*, 882-889.

Kumar, S., Narkhede, B. E., & Jain, K. (2021). Revisiting the warehouse research through an evolutionary lens: a review from 1990 to 2019. *International journal of production research*, *59*(11), 3470-3492.

MarkWide Research. (2023, September). *Malaysia Freight and Logistics Market Analysis – Industry Size, Share, Research Report, Insights, Covid-19 Impact, Statistics, Trends, Growth and Forecast 2023-2030.* https://markwideresearch.com/malaysia-freight-and-logistics-market/

Moussa, F. Z. B., De Guio, R., Dubois, S., Rasovska, I., & Benmoussa, R. (2019). Study of an innovative method based on complementarity between ARIZ, lean management, and discrete event simulation for solving warehousing problems. *Computers & Industrial Engineering*, *132*, 124-140.

Orji, I. J., Kusi-Sarpong, S., Huang, S., & Vazquez-Brust, D. (2020). Evaluating the factors that influence blockchain adoption in the freight logistics industry. *Transportation Research Part E: Logistics and Transportation Review*, *141*, 102025.

Palange, A., & Dhatrak, P. (2021). Lean manufacturing a vital tool to enhance productivity in manufacturing. *Materials Today: Proceedings*, *46*, 729-736.

Pandian, D. A. P. (2019). Artificial intelligence application in smart warehousing environment for automated logistics. *Journal of Artificial Intelligence and Capsule Networks*, *1*(2), 63-72.

Radnor, Z., & Osborne, S. P. (2013). Lean: a failed theory for public services?. *Public management review*, *15*(2), 265-287.

Ringle, C. M., Wende, S., and Becker, J.-M. 2022. "SmartPLS 4." Oststeinbek: SmartPLS GmbH, http://www.smartpls.com.

Sharifani, K., Amini, M., Akbari, Y., & Aghajanzadeh Godarzi, J. (2022). Operating Machine Learning across Natural Language Processing Techniques for Improvement of Fabricated News Model. *International Journal of Science and Information System Research*, *12*(9), 20-44.

Tahar, A., Riyadh, H. A., Sofyani, H., & Purnomo, W. E. (2020). Perceived ease of use, perceived usefulness, perceived security and intention to use e-filing: The role of technology readiness. *The Journal of Asian Finance, Economics and Business (JAFEB)*, *7*(9), 537-547.

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A Study of Small Group Conversations Structure in Science: Composition of Middle School Students and University Students

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Abstract

In today's society, much problem solving is carried out by teams. Cooperative problem solving skills, the ability to collaborate with others in making efforts to unknown challenges, are gaining significant importance in such a society. Students in science classes often engage in experiments and discussions in groups of about four in Japan. Although conversations are a vital component in cooperative problem solving situations, few studies have explored the quality and structure of conversations. This study aims to clarify the types of conversations that facilitate meaningful discussions in middle school students' classes. We conducted a survey involving 20 students in public middle school and 8 students in a national university, comparing the results to unveil the actual state of middle school students' conversations. Group work was carried out in this study, and the ensuing discussions were recorded. Analysis of the recorded dialogues using Berkowitz and Gibbs' (1983) conversation classification revealed the following: a) a variety of conversations, irrespective of whether they represent "operational transacts," attempting to integrate and transform each other's ideas, or "representational transactions," simply stating one's arguments, can initiate meaningful discussions; b) "extension," an operative transaction, is more likely to initiate meaningful discussions than other types of conversations; and c) compared to university students, middle school students are more inclined to use "extension" conversations, one of the operative transactions, as triggers to activate meaningful discussions.

Keywords: Education, science, middle school, transaction

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Introduction

Today, society is changing rapidly due to globalization and information technology, and we are entering an era in which the future is difficult to predict, uncertain, complex, and ambiguous (Teramoto, 2022). Arai (2022) points out that in order to survive in such an era, it is necessary to have the ability to cooperate with others to solve unforeseen problems. It is defined as "the ability of individuals to effectively participate in the process of attempting to solve a problem by sharing the knowledge, skills, and efforts required to reach a solution," and is one of the survey items in PISA, in addition to "scientific literacy," "reading comprehension," and "mathematical literacy" (National Institute for Educational Policy Research, 2016). Thus, the ability to work with others to solve problems is currently the focus of international attention. Based on this, in Japan, the Central Council for Education Report of December, 2016, as a summary of issues leading to the new curriculum guidelines, stated that "interactive learning" should be realized from the perspective of "whether the process of interactive learning, in which students broaden and deepen their own thinking through collaboration with others and interaction with the outside world, is realized," and that it is important to improve classes. (Central Council for Education, 2018). In light of the above, it can be said that the importance of cooperative problem solving skills, that is, the ability to solve problems by bringing knowledge and skills together with others and creating interaction, is increasing for children who will live in the coming age.

In addition, the courses of study for junior high schools released in 2017 emphasizes scientific inquiry activities by changing the goal of the previous course of study, "the foundation of the ability to explore," to "the lipids and abilities necessary for scientific inquiry" (Ministry of Education, Culture, Sports, Science and Technology, 2017). Ishii (2011) stated that in the process of inquiry, through discussion with others, students can cultivate a scientific view of natural phenomena and seek solutions to problems from more perspectives. In addition, Daikoku et al. (2006) compared cooperative learning in science classes with those that do not, and pointed out that cooperative learning can have a direct effect on educational effectiveness. The above shows the importance of cooperative problem solving in science.

As mentioned earlier, as the Central Council for Education in its December 2016 report seeks to realize cooperative learning through "interactive learning" (Central Council for Education, 2018), dialogue with others is important in cultivating cooperative problem solving skills. Nohara (2019) also points out the importance of in-class dialogue in cultivating cooperative problem solving skills. Therefore, in this study, we will focus on in-class utterances and dialogue.

To review research on classroom practices that incorporate dialogue in cooperative problem solving situations, we conducted a survey in October 2022 using Google Scholar, and found that ("cooperative problem solving ability" AND ("conversation" OR "dialogue" OR "utterances")) as keywords yielded 31 previous studies. In addition, the search for ("cooperative problem solving ability" AND ("dialogue" OR "utterances" OR "conversation") also yielded 29 previous studies. A total of 60 studies were selected for review and prior studies were organized. Based on the importance of dialogue in developing cooperative problem solving skills, many studies have been conducted on classroom practices that incorporate dialogue. For example, Nohara et al. (2018) adopted the "structure of human activity" proposed by Engeström as a perspective for class development and developed a class design in which children solve problems by "division of labor" through dialogue among team members to obtain the necessary "tools" within the "rules" (social rules and customs created through discussion among children). This is the class design that we are developing. This method has revealed that "deep learning" can be realized through the proactive and cooperative construction of knowledge. Kariyazono (2009) developed a class design in which students' opinions are not summarized by the teacher, but are related and structured through group dialogues. It is clear that students internalize their own opinions through this process. As described above, there have been many class development projects that incorporate dialogue.

However, the reality of student dialogue in actual educational settings is that some students simply say "I thought this" to each other (Kariyazono, 2010), some students do not think, and some students give in to the pressure of the powerful or group (Hashimoto, 1994). We believe that these issues are due to the fact that the purpose of the study was to elicit dialogue from the students, but did not focus on the quality of their utterances. Therefore, it is necessary to examine ways to improve the quality of students' dialogue in cooperative problem solving situations in class.

Most of the 60 previous studies reviewed aimed to examine the outcomes obtained through dialogue, such as the improvement in each group member's conceptual understanding and communication skills resulting from dialogue (e.g., Fukada et al., 2019; Nohara et al., 2019), and dialogue itself. Few studies aim to improve the quality of dialogue by focusing on the quality of dialogue itself. As a study focusing on the quality of dialogue, Takagaki et al. (2004) investigated the actual state of student-teacher interaction based on the characteristics of utterances by protocoling and classifying the utterances of teachers and students in elementary science class situations. The results show that "manipulative transaction," which is a negotiated utterance that actively incorporates the opposing opinions of others into one's own opinion by successfully manipulating, processing, or transforming them, influences the interaction between speakers. However, the research setting of this study was a simultaneous class at an elementary school. Tajima et al. (2006) also conducted a study that focused on students' utterances. By having students explain what they have learned and analyzing the content of their explanations through protocol analysis, they show the relationship between "operational transactions" and the elimination of naive concepts in science, and point out the importance of cultivating "operational transactions" in the classroom. However, the investigative situations in this study were one-way explanations by students to the investigator and did not focus on multi-person dialogues.

Research Question

Cooperative problem solving ability is defined as “the capacity of an individual to effectively engage in a process whereby two or more agents attempt to solve a problem by sharing the understanding and effort required to come to a solution and pooling their knowledge, skills and efforts to reach that solution. (OECD,2017). Therefore, it is necessary to focus on cooperative problem solving situations in groups, but to the best of our knowledge, there are no studies that focus on dialogue and utterances in such situations. Therefore, the purpose of this study is to focus on student dialogue in group activities in science classes and to identify the utterances that trigger the activation of utterances in junior high school students. The following three research questions were set up along with the investigation.

RQ1. What types of utterances account for a high percentage of junior high school students' utterances?
RQ2. What types of utterances activate discussions in hypothesis-setting situations among junior high school students?

Method

Group work was conducted as a cooperative problem solving situation for 27 students (8 groups) in the second grade of a public junior high school. The task was to predict which candle would go out first when lit candles of different lengths were sealed in containers. After having the students make their individual predictions, they discussed them in groups and summarized their conclusions. The same group work was also conducted with two groups of eight national university students to provide material for comparison with the junior high school students, and then, based on the recordings of their utterances, the utterances were classified and tabulated. In this study, Berkowitz and Gibbs’ (1983) method of categorizing utterances was used; Berkowitz and Gibbs' categorization of utterances and their definitions are shown in Table 1. Berkowitz and Gibbs (1983) classified the utterances that occur in discussions with others into two categories: "representational transacts" and "operational transacts. "Representational transacts" tend to elicit or re-present another's reasoning rather than operating on or transforming it. "Operational transacts" is reasoning that operates on the reasoning of another. Each of these utterances has its own subclassification, as shown in Table 1.

Table 1. Berkowitz and Gibbs’ (1983) conversation classification

Representational Transacts	
Assignment	Present the topic or issue to be discussed
Feedback Request	Asks for comments on the issues and the statement
Justification Request	Asks for justification for the statement
Dyad Paraphrase	Presenting one's own opinions and interpretations
Paraphrase	Repeats the same statements as one's own arguments and those of others
Juxtaposition	Stating one's own arguments in parallel with those of others

Operational Transacts	
Extension	Adding other content to one's own claims or those of others
Contradiction	Point out contradictions in others' claims with clear evidence
Competitive Critique	Refutes one's own claim while stating reasons why one's own claim is incompatible with the claim of others
Refinement	Reexplain one's own claim or the claim of another person by adding new grounds
Integration	Understand one's own claims and those of others, and re-explain them from the viewpoint of common ground

In addition, the structure of the utterances in this study was organized as shown in Figure 1. Speaker A's utterance "What do you think about ◯◯" was classified as Tier 1. Speaker B's utterance, which is an "dyad paraphrase" to Speaker A's utterance, is classified as Tier 2, and Speakers C and D, which are "extension" and "contradiction" to Speaker B's utterance, are classified as Tier 3. In this way, all utterances were assigned to a tier, and all utterances up to the point just before the next "assignment" were organized as one coherent group of utterances. In this study, based on the issues raised by Kariyazono (2010), we considered that the utterances in Tier 1 and Tier 2 were only those in which the speaker merely communicated his/her own thoughts, and we investigated the situations in which utterances in Tier 3 or higher occurred as "scenes of active discussion." In the situations in which discussions are becoming more active, the first utterances that exceeded Tier 3 were extracted and analyzed as the utterances that triggered the discussions to become more active.

Tiers	Speaker	Conversations	Classification
1	A	What do you think about ○○.	Assignment
2	B	△△isn't it?	Dyad Paraphrase
3	C	Yes,it's true, and it's □□.	Extension
3	D	But I'm not sure it's ▽▽.	Contradiction
・・・			
1	B	Next, what do you think about ◆◆?	Assignment

Figure 1. Organizing utterances

Results

The above methods were used to analyze students' utterances in cooperative problem solving situations. The results are presented below. The results are presented in accordance with the research questions.

RQ1. What types of utterances account for a high percentage of junior high school students' utterances?

Table 2 shows the percentages of operational and representational transactions among the utterances that occurred in the 6 groups of junior high school students. Note that the survey was conducted with 8 groups of junior high school students, but due to a problem with the audio recordings, the analysis in this study is based

on the 6 groups. In each group, manipulative and representational transactions occurred in the proportions shown in Table 2. It was found that representational transactions accounted for a large percentage in all groups. The proportions varied widely from group to group, and no common trend was observed.

Table 2. Percentage (%) of Representational Transacts to Operational Transacts in middle school students' discussions

Classification	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Representational Transacts	69	70	53	78	64	55
Operational Transacts	31	30	47	22	36	45

Table 3 shows the results for the two groups of university students who were surveyed and analyzed in a similar manner. The results for university students also showed that representational transactions occurred more often than manipulative transactions. The same results were obtained as for the junior high school students in terms of the large group variation.

Table 3. Percentage (%) of Representational Transacts to Operational Transacts in university students' discussions

Classification	Group 1	Group 2
Representational Transacts	58	76
Operational Transacts	42	24

Based on the above classification, we calculated the percentage of each subcategory of representational and manipulative transactional utterances that occurred. The results for the six groups of junior high school students are shown in Table 4. It was found that the utterance of "dyad paraphrase" accounted for a high percentage of the total utterances in all groups. On the other hand, the utterance of "juxtaposition" was not found in any of the groups in this study. Focusing on operative transactions, it was found that the utterances of "extension" accounted for a high percentage of the total utterances. On the other hand, utterances of "comparative criticism" were rarely found in the present study. The results of the survey among university students are also shown in Table 5. Among university students, "assertive" and "extended" utterances accounted for a high percentage, and for the other utterances, their percentages were not significantly different from those of junior high school students.

Table 4. Percentage (%) of middle school students' utterances in utterances subcategories

Classification	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Representational Transacts						
Assignment	12.0	19.4	2.3	7.1	9.1	6.9
Feedback Request	12.0	3.2	0.8	4.9	18.2	5.9
Justification Request	9.3	7.5	11.2	19.7	3.0	2.0
Dyad Paraphrase	25.3	35.5	25.5	29.5	24.2	31.4
Paraphrase	10.7	4.3	13.5	16.4	9.1	8.8
Juxtaposition	0.0	0.0	0.0	0.0	0.0	0.0
Operational Transacts						
Extension	18.7	14.0	27.0	9.3	18.2	30.4
Contradiction	4.0	2.2	7.7	3.8	0.0	3.9
Competitive Critique	0.0	1.1	0.8	0.0	0.0	0.0
Refinement	5.3	7.5	10.0	7.7	12.1	8.8
Integration	2.7	5.4	1.2	1.6	6.1	2.0

Table5. Percentage (%) of university students' utterances in utterances subcategories

Classification	Group 1	Group 2
Representational Transacts		
Assignment	4.4	6.1
Feedback Request	14.5	9.5
Justification Request	10.1	14.2
Dyad Paraphrase	22.0	31.8
Paraphrase	7.5	14.9
Juxtaposition	0.0	0.0
Operational Transacts		
Extension	17.0	14.2
Contradiction	10.7	1.4
Competitive Critique	0.6	0.0
Refinement	10.1	6.8
Integration	3.1	1.4

Table 6 shows the results of the above mentioned method, in which the number of utterances that trigger the occurrence of active discussions is tabulated for each utterance category. It is clear that among the multiple categories of utterances, not only certain utterances are triggers, but multiple utterances are triggers that give rise to active discussions. However, among the multiple utterances, the "extended" utterances were found to be particularly likely to trigger an active discussion. The results of the analysis among university students are shown in Table 7. Table 7 show that the utterances of junior high school students are biased toward "extensions" as triggers for activating discussion when compared to those of university students.

Table 6. Number of utterances as a trigger for activation in discussions among middle school students

Classification	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**	**Total**
Representational Transacts							
Assignment							0
Feedback Request		1					1
Justification Request	2		1	2			5
Dyad Paraphrase		1					1
Paraphrase			1	2			3
Juxtaposition							0
Operational Transacts							
Extension	1	3	3	2	2	4	15
Contradiction			1				1
Competitive Critique		1					1
Refinement		2			1	1	4
Integration							0

Table 7. Number of utterances as a catalyst for increased activity in discussions among university students

Classification	**Group 1**	**Group 2**	**Total**
Representational Transacts			
Assignment			
Feedback Request	1	1	2
Justification Request	1	1	2
Dyad Paraphrase	1	2	3
Paraphrase	1		1
Juxtaposition			

Operational Transacts			
Extension	1	2	3
Contradiction	1	2	3
Competitive Critique			
Refinement	1		1
Integration			

Discussion

In this study, we used conventional methods to investigate what types of utterances occur more frequently in discussions among junior high school students in cooperative problem solving situations. Kurihara (2012) conducted a study using similar methods. In Kurihara (2012), elementary school students were surveyed to determine how cooperative problem solving in experimental situations affects the formation of students' scientific concepts. In doing so, they used Berkowitz and Gibbs' (1983) uttarance categorization as in the present study. The results of that investigation are presented in Table 8.

Table 8. Percentage (%) in the previous study (Kurihara, 2012)

Classification	**Group A**	**Group B**	**Group C**	**Group D**	**Group E**	**Group F**	**Group G**
Representational Transacts							
Assignment	5.3	5.1	2.1	2.6	0.0	0.0	3.8
Feedback Request	2.6	15.4	12.5	10.3	10.9	10.9	15.4
Justification Request	18.4	12.8	8.3	15.4	6.5	6.5	3.8
Dyad Paraphrase	28.9	25.6	35.4	33.3	50.0	50.0	48.1
Paraphrase	13.2	12.8	25.0	15.4	6.5	6.5	5.8
Juxtaposition	2.6	2.6	2.1	0.0	0.0	0.0	0.0
Operational Transacts							
Extension	5.3	2.6	4.2	7.7	8.2	6.5	1.9
Contradiction	2.6	5.1	2.1	5.1	0.0	2.2	1.9
Competitive Critique	0.0	2.6	0.0	0.0	0.0	0.0	1.9
Refinement	15.8	15.4	8.3	10.3	18.4	17.4	15.4
Integration	5.3	0.0	0.0	0.0	0.0	0.0	2.6

Classification	Group H	Group I	Group J	Group K	Group L	Group M	Group N
Representational Transacts							
Assignment	5.4	4.9	3.0	4.0	0.0	3.8	2.1
Feedback Request	10.8	14.6	6.1	10.0	11.5	5.7	18.8
Justification Request	10.8	14.6	9.1	10.0	3.8	7.5	4.2
Dyad Paraphrase	45.9	51.2	54.5	48.0	55.8	66.0	60.4
Paraphrase	13.5	7.3	21.2	12.0	9.6	15.1	6.3
Juxtaposition	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operational Transacts							
Extension	2.7	4.9	0.0	0.0	1.9	0.0	0.0
Contradiction	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Competitive Critique	0.0	0.0	0.0	0.0	1.9	0.0	0.0
Refinement	10.8	2.4	6.1	14.0	15.4	1.9	8.3
Integration	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 8 shows that the “dyad paraphrase” utterances remained the majority of the discussions. However, the percentage of “dyad paraphrase” decreased as the developmental stage progressed from elementary school students to junior high school students to university students. The results suggest that as the developmental stage progresses, the number of utterances other than “dyad paraphrase” increases, leading to more advanced discussions. The occurrence of “juxtaposition” and “competitive critique” utterances was almost nonexistent in the previous study, suggesting that these utterances are unlikely to occur not only in this study but also in other studies.

In this study, individuals were also given time to summarize their thoughts prior to group discussion. Comparing groups in which individual ideas differed from each other with groups in which individual ideas were in agreement prior to discussion, the number of utterances tended to increase in the groups in which individual ideas were not in agreement. This suggests the possibility that a factor that increases the number of utterances by students in cooperative problem solving situations is whether or not the group members' ideas are in agreement.

Conclusion

The results of the survey showed that the utterance of “extension” was the main trigger for stimulating discussion in collaborative problem solving situations among junior high school students. Compared to the results of university students who were similarly surveyed, there was a greater bias in the utterances that were triggers for junior high school students. Although the above findings were found to be the reality of students’

utterances in cooperative problem solving situations in junior high school, this study could not clarify whether the characteristics observed here were due to the characteristics of the group or other factors. Further research is needed to determine the factors that contribute to the differences in the types and number of utterances that are triggered.

References

Arai, M. (2022). Developing competencies to promote human coexistence for children and adolescents in school education: Discussion from the psychological perspective. *Symbiotic Pedagogy Study ,10*, 35-50. [Japanese].

Berkowitz, M. W., & Gibbs, J. C. (1983). Measuring the developmental features of moral discussion. *Merrill-Palmer Quarterly, 29*(4), 399–410.

Daikoku, T., & Inagaki, S. (2006). Cooperative Learning and its Effects in Lower Secondary Science Classrooms: The Elements of Cooperative Learning Proposed by Johnson et al. *Journal of research in science education, 47*(2), 1-12. [Japanese]. https://doi.org/10.11639/sjst.kj00005018307

Fukada, E. (2019). An attempt at independent learning using “question making” in a business Japanese class. *Journal of the Society for the Study of Japanese Language Education Methods, 25*(2), 112-113. [Japanese]. https://doi.org/10.19022/jlem.25.2_112

Hashimoto, S. (1994). Cons the process of bringing different ideas to life. *Contemporary Educational Science, 37*(2), 60-62. [Japanese].

Howe, C. (2021). Strategies for supporting the transition from small-group activity to student learning: A possible role for beyond-group sharing. *Learning, Culture and Social Interaction, 28*, 100471. https://doi.org/10.1016/j.lcsi.2020.100471

Kariyazono, T. (2009). Analysis of teacher’s leading participation for children’s dialogue - Development of dialogue oriented moral lesson design -. *Bulletin of the Faculty of Education, Kagoshima University, Cultural and social science 61*, 83-96. [Japanese].

Kurihara, J. (2012). The influence of cooperative learning with individual experiments on the formation of scientific concepts: A case study of “properties of aqueous solutions” in an elementary school. *Journal of research in science education, 53*(1), 39-48. [Japanese]. https://doi.org/10.11639/sjst.KJ00009906884

Nohara, N., Tashiro, H., & Morimoto, S. (2019). Instructional design in dialogical science lesson to promote pupils’ construction of scientific concepts. *Journal of research in science education, 59*(3), 443-455. [Japanese]. https://doi.org/10.11639/sjst.18051

OECD. (2017). *PISA 2015 results (Volume V): Collaborative problem solving*. OECD Publishing. https://doi.org/10.1787/9789264285521-en

Tajima, A., & Moro, Y. (2006). Concept understanding through dialogues: Dealing with the conflict of scientific knowledge and everyday experience. *The Japanese journal of educational psychology, 54*(1), 12-24. [Japanese]. https://doi.org/10.5926/jjep1953.54.1_12

Teramoto, T. (2022). Theoretical deliberation of career education's key concepts "subject" and "self," and their practical considerations. *Bulletin of Kaichi International University 21*(1), 25-37. [Japanese]. https://doi.org/10.24581/kaichi.21.1_25

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Managing the Risk: It is Part of Sustainable, Technological and Industrial Development Logic

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Abstract

The entire human society is exposed to a multitude of risks, the result of "complex interactions between society and the environment," albeit to varying degrees. The occurrence of different disasters highlights the complexity of these interactions and the magnitude of the consequences that can result from them. Some risks can lead to serious consequences for societies, property, and individuals, while others can unnecessarily incur significant expenses. As a result, security has increasingly become a growing societal concern. However, since risk management is a task that requires creativity and adaptability, as scientific research emphasizes, the search for increased security in enterprise has no definitive endpoint and will not have one. It is a complex, diverse, dynamic, evolving and ongoing process in which the best efficiency of the efforts made and must be searched systematically. This is a commitment to a process of continuous improvement. However, to successfully implement and make progress in this practice, industrial evidence requires the development of workplace safety management systems capable of actively detecting and correcting all undesirable events (malfunctions, failures, accidents, incidents, etc.) encountered, which is the objective of this work.This is the primary objective of this work.

Keywords: Risk management, priority actions and continuous improvement, feedback, economic efficiency

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Introduction

Establishing a culture of health and safety is a battle that companies must fight daily. Time constraints and routine can sometimes lead to the neglect of essential procedures in this regard. Therefore, effective risk management demands creativity and flexibility. It should be grounded in approaches that encompass risk-benefit analyses and cost-benefit assessments of various scenarios under consideration. Scientific studies underscore that the pursuit of enhanced workplace safety lacks a definitive endpoint (Prewett et al., 2020, Waring et al., 2015, Saker et al., 2022). It is a complex, diverse, dynamic, and continually evolving (ACA, 2011), adaptable, (Voirol et al., 2002) and non-static (ACA, 2011) process, where the focus should consistently be on achieving the highest level of efficiency. It represents a commitment to a continuous improvement process.

This necessitates the consideration of both economic and financial costs, as well as societal expectations. Decision-making in this context is indeed challenging, but it is crucial to illuminate the data and information available carefully. Consequently, safety is becoming an increasingly prominent societal concern, an essential component of production, and a fundamental parameter of economic efficiency, particularly as compensations for industrial accidents are significantly rising in the Algerian market (Bouhaci, 2013). Therefore, the primary objective of safety measures is to tackle established causes while also being vigilant about isolated sources of risks and unforeseen combinations of failures that may occur (Bouzerara et al., 2022).

Currently, programs increasingly emphasize the emergence of new risks associated with transformations in the realms of work and society. For instance, inadequately designed automation can intricately complicate the relationship between humans and machines. Similarly, improperly conducted maintenance procedures can yield detrimental consequences for both the company and its surrounding environment. Hence, to eliminate all risks at once seems practically impossible. Therefore, our efforts should focus on prioritized actions, carefully chosen without disrupting our scheduled daily activities. Companies that have attained a significant level of organizational maturity are evaluated not just by their profit-making ability, but also by the manner in which they achieve it. Consequently, success and advancement in this realm require the establishment of management systems adept at proactively identifying and rectifying any undesirable events such as malfunctions, failures, accidents, or incidents (Bouyaya et al., 2023). In this context, human intervention, in its broadest sense, must now be regarded as pivotal in the formulation of risk prevention strategies. It is within this spirit and with this objective that mastering risks needs to be seamlessly integrated into a framework of sustainable technological and industrial development, while also drawing upon existing legal structures.

Preoccupation

The entire human society is exposed to a multitude of risks, the result of "complex interactions between society and the environment," albeit to varying degrees. The occurrence of different disasters highlights the complexity of these interactions and the magnitude of the consequences that can result from them (Morneau, 2011). There are risks that can have serious consequences on society, property, and people, while others can lead to unnecessary extravagant expenses. Therefore, these risks should be given special attention (Eco-news, 2013). We can cite as an example, for instance, recent calamities, like the Skikda refinery Liquefied Natural Gas (LNG) incident in Algeria (Hellas et al., 2021), have prompted endeavors to bolster facility safety by implementing improved technical and organizational measures. Moreover, as is often the case, clear demarcations are lacking between high-risk industrial sites and public spaces. Consequently, the haphazard placement of industrial infrastructure near residential areas presents a looming threat to the population. In the event of a technical failure, a significant catastrophe could ensue, pushing the country into an exceptionally dire situation. If one of the complexes is affected, it can have immediate repercussions on the nearest complex and so on, leading to the outright destruction of the immediate environment and neighboring populations (Saou, 2013). Figure 1 shows the explosion of the Skikda LNG, which caused severe harm to people (21 deaths and 73 injuries) and significant damage to property and the environment (Meriem et al., 2020), not to mention the incurred expenses.

Furthermore, in 2018, social coverage for accidents amounted to a staggering bill of over 26 billion dinars, a seemingly substantial sum. However, this figure represents just a rough estimate and hardly captures the exact number of workplace victims, as the majority of incidents occur outside the formal sector, escaping official records (Maamri et al., 2021). Moreover, many companies might operate without a clear understanding of current legislation, relying on empirical methods. Hence, it is imperative for every company, regardless of its size or sector, to uphold its obligations concerning workplace health and safety. Transparency within the framework of regulations and ensuring their proper compliance is essential. Standardization and certification procedures can significantly enhance the reliability of monitoring and control systems, contributing to a safer work environment (Auduberteau et al., 2003).

Figure 1. Damage caused by the explosion of GNL Skikda on June 20th, 2004.

As a result, effective management involves ensuring the health, safety, and well-being of all employees by minimizing risks and providing protection against accidents. In the contemporary context, safety has evolved into a societal necessity and a paramount concern for businesses. This is particularly crucial given the substantial risks associated with industrial development, particularly in major cities, notably those in the northern region of the country. Unfortunately, these risks often seem overlooked by the authorities (Hassani et al., 2020).

Moreover, the daily tragedy of over three deaths caused by workplace accidents necessitates urgent action from all stakeholders, including the government, businesses, and workers (Amrani et all, 2020). Regardless of the quality of anticipation in design, human training, and preparation for maintenance and operational tasks, incorporating proven insights from experience remains pivotal in enhancing prevention. Sharing lessons learned from experience is facilitated through feedback procedures. To execute these procedures effectively, it is essential to first collect vital information about adverse events (such as malfunctions, incidents, accidents, etc.) and then analyze this data to inform future actions. This objective forms the basis of the present work.

Methodology

The employed methodology adopts a closed-loop, dynamic, and progressive approach rooted in qualitative risk analysis and lessons gleaned, as illustrated in Figure 2. Qualitative risk analysis involves identifying hazards and potential accidents and qualitatively assessing their consequences, frequencies, and risks (Théberge, 2002). This process comprises six key steps utilizing the risk analysis grid:

1. Identification of Hazards and Accident Scenarios
2. Estimation of Consequences
3. Estimation of Frequencies
4. Estimation of Risks
5. Evaluation of Experience Acquired
6. Risk Assessment, which evaluates the obtained risk value

The risk analysis grid ensures meticulous control of events by distinguishing risks encountered during the project development phase from those in the operational phase. Lessons learned enhance this diagnostic process, serving as a reminder and assisting the responsible party in revisiting known causes of undesirable events. This foundational knowledge naturally expands with accumulating experience or the emergence of new and unknown situations. Risk estimation is determined as follows:

$$R=F\times G\times E \quad (1)$$

Where : F: Frequency; G: Severity; E: Experience in the event.

E=1 for a new or poorly controlled situation and E=0.5 for a controlled situation.

Recognizing the active potential risks is of paramount importance for the parties responsible. These methods can be implemented at every stage of an installation's lifecycle. The challenge lies in striking a balance between elevating the responsible party's awareness, outsourcing risks, and organizing responsive strategies. By analyzing the risks, it becomes possible to implement management measures that emphasize both prevention and control, as well as planning suitable emergency interventions. This process entails establishing a system that is continually evaluated, ensuring a continuous loop back to the starting point.

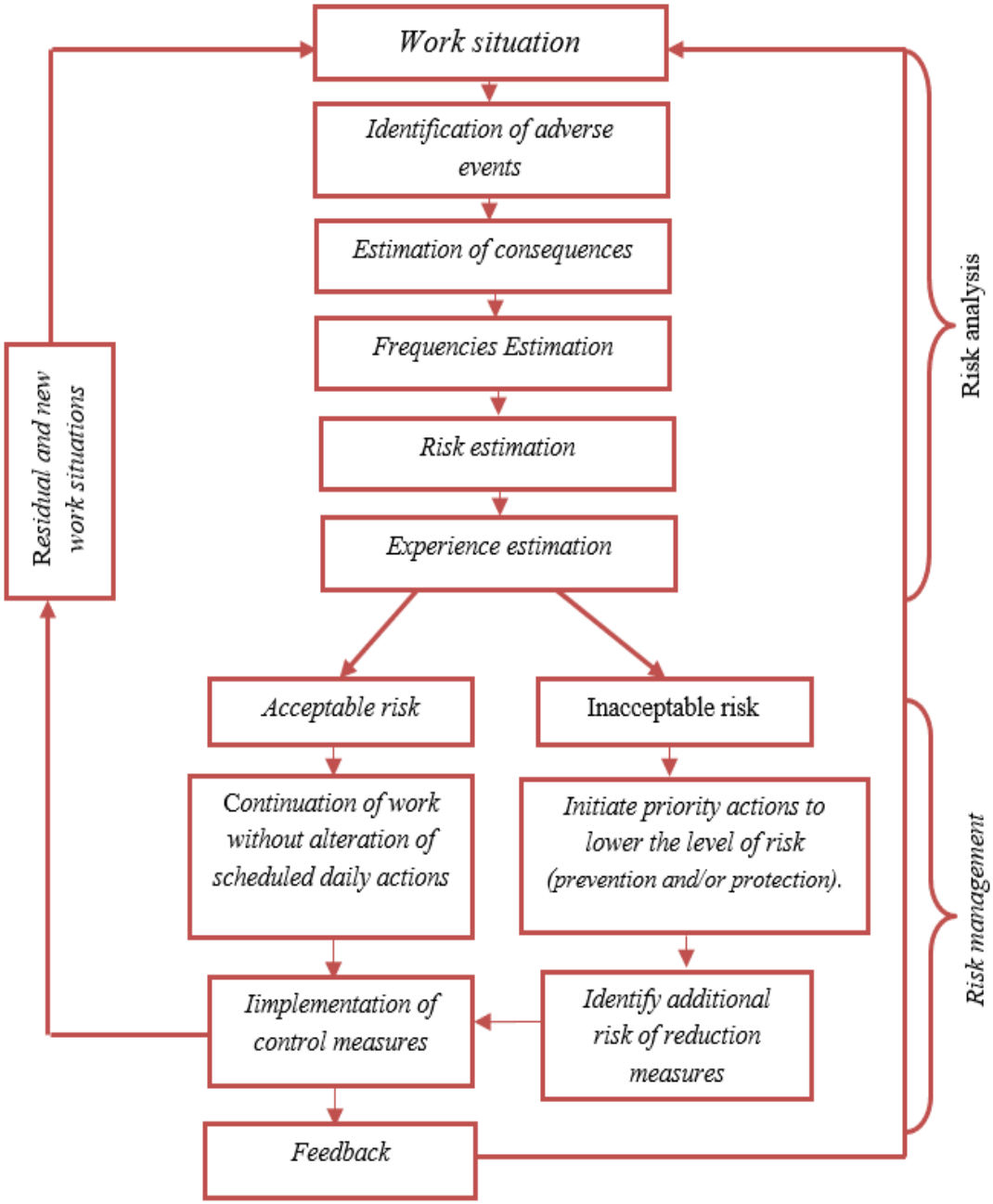

Figure 2. Geographical Implantation of Naftal Districts across the National Territory

Practical case

NAFTAL operates as a subsidiary of SONATRACH, functioning as a joint-stock company with the specific mandate of marketing and distributing petroleum products, as illustrated in Figure 3.

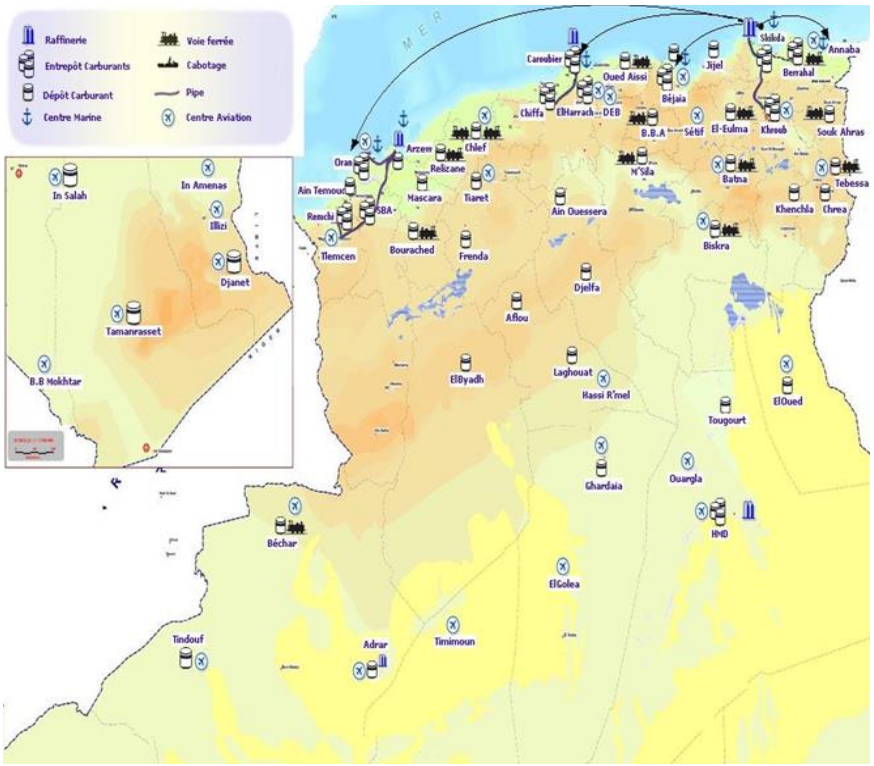

Figure 3. Geographical Implantation of Naftal Districts across the National Territory

The Fuels Branch constitutes one of NAFTAL's three primary divisions. It bears the responsibility for the procurement, storage, and distribution of fuels utilized in aviation, maritime, and terrestrial operations, including fuels, fuel oil, Super, regular, and unleaded gasoline, diesel, A72, and white spirit. Additionally, the branch oversees the provision of aviation and marine lubricants and greases. Managing a growing volume of hazardous materials in the industry significantly heightens the potential for major accidents. To mitigate these risks, maintain competitiveness, and safeguard both workers and the environment, it is imperative to systematically implement a well-defined set of measures and practical guidelines for preventing major accidents. Importantly, this must be achieved without imposing additional burdens on the organization. The installation under study is the product loading and unloading station, as shown in Figure 4.

After thorough analysis and evaluation of the risks, employing the dynamic-progressive risk identification loop, we have implemented preventive and corrective actions aimed at eliminating or reducing the identified risks. To enhance the study's accessibility and ensure operational efficiency, we have chosen to present only a subset of the comprehensive study. The summarized study results are provided in the table below.

Figure 4. Loading-unloading station

Conclusion

This approach offers the possibility of leveraging tried-and-tested solutions from the realm of business risk management, and allocating priorities to them based on saved stakes, avoided damages, and their respective economic significance. At the culmination of this process, employers possess the essential elements to make informed decisions regarding necessary measures, forming the bedrock of a comprehensive, long-term risk management strategy. In essence, preventive measures are meticulously tailored to each workplace's unique context, accounting for specific realities irrespective of individual variables. The primary objective of this approach is to proactively manage already identified risks, ensuring the company's day-to-day operations yield tangible benefits. This translates into enhanced work organization, diminished malfunctions, improved working conditions, and heightened employee satisfaction.

The fundamental significance of this methodology lies in its ability to compare disparate risks, facilitating the identification of those that warrant prioritized attention and remediation. Consequently, every company, regardless of its scale or sector, bears the responsibility to fulfill its obligations concerning health and safety in the workplace. Operating transparently within the ambit of regulations, and adhering to them diligently, is not only a legal mandate but also a moral imperative. Incorporating standardized procedures and certification protocols further strengthens the reliability of monitoring and control systems, ensuring that the company’s commitment to workplace safety is not just a compliance exercise, but also, a genuine dedication to the well-being of its workforce and the sustainability of its operations. By embracing this approach, companies not only safeguard their employees but also bolster their resilience, fostering an environment where productivity, innovation, and employee morale thrive.

Analysis fields.	Source of danger.	Danger scenario	Damage	N/Risk. G	N/Risk. P	Criticality	Experience acquired	N/Risk. G	N/Risk. P	N/Risk. E	Criticality
Product supply by pipe	Pipeline.	Flash followed by a fire following a product leak in the presence of an energy source	Burns, Pipeline damage Visual control	3	2	6	Visual control ; Preventive maintenance. Sensitization	3	1	1	3
	HC product.	Skin contact and projection of product droplets when taking samples	Irritation, Burning.	3	3	9	Operating instructions, PPE. Sensitization Electrical installation	3	3	0.5	4.5
	Electrical installations	Sensitization Electrical installation. Flash followed by a fire at non-compliant electrical equipment (junction box, push button and lighting)	Personal injury and burns Material damage,	3	2	6	Purchasing instruction, Regulatory control, Surveillance plan,	3	2	0.5	3
Fuel unloading by CR and WR.	Flexibles de dépotage	Jet of fuel following bursting of the unloading hose or tearing at the level of the symmetrical connections of the vents.	Body injury and eye and skin irritation, Hose and valve damage	3	3	9	operating instructions, effluent drainage, PPE,	3	3	0.5	3
		Flash followed by a fire following product spreading in the presence of an energy source during unloading of several mixed lines (wr and CR) at the same time,	Burns, CR and WR damage and fixed installations	3	2	6	Awareness raising, compliance with operating procedures	3	2	0.5	3
	Electrical installations.	Flash followed by a fire at non-compliant electrical equipment (junction box, push button and lighting),	Personal injury and burns Property damage,	3	3	9	Purchase instruction, Regulatory control, Monitoring plan,	3	3	0.5	4.5
Unloading of fuels by CR and WR	Electrical installations	Flash followed by a fire following the effect of static electricity caused by a technical or human failure (faulty grounding or non-compliance with work procedures).	Blessure, décès et brûlures. Endommagement CR et poste de chargement,	4	3	12	Operating instructions Safety instructions, EPI,	4	3	0.5	6
	CR and WR	Fall from height due to the slippery or damaged state of the walkway or WR ladder,	Bodily injury, death	4	3	12	Awareness, EPI	4	3	0.5	6
		Fall from height due to the slippery or damaged state of the gangway or ladder of the truck or WR,	Bodily injury, death	4	3	12	Awareness, EPI	4	3	0.5	6
		Fire following overturning of the WRs caused by sparks released during the derailment at the particular junction.	Bodily injury, Damage WR junction part	3	4	12	Awareness,	3	4	1	12
	HC Product	Inhalation, skin and eye contact with hydrocarbon products.	Irritation (or SDS)	3	4	12	Operations Instruction, EPI,	3	4	0.5	4.5
	Obstacles (pipes and others).	Fall on one level due to clutter or slippery condition of the ground.	Bodily injury	3	3	9	Instruction,	3	3	0.5	4.5

Analysis fields.	Source of danger.	Danger scenario	Damage	N/Risk. G	N/Risk. P	Criticality	Experience acquired	N/Risk. G	N/Risk. P	N/Risk. E	Criticality
Loading CR and WR fuels	Loading arm.	Uncontrolled movement following technical failure or incorrect handling of the loading arm (defective return spring or non-compliance with operating or maintenance work procedures).	Bodily injury, death	4	3	12	Operation and maintenance instructions, EPI,	4	3	0.5	6
		Skin contact when moving the loading arm favored by the absence of drip trays and poor quality of gloves.	Irritation	3	4	12	Sensibilisation, EPI,	3	3	0.5	4.5
		Manual handling of the loading arm.	Physical fatigue and MSD	2	3	6	Rest	2	3	1	6
	Half barrels of HC products.	Fire following a flash in an ATEX zone favors the abnormal presence of a cloud of hydrocarbon vapors released from the half-drums of HC product, particularly in summer	Personal injury, death and burns. Damage CR and parts of the loading station	4	3	12	Safety instructions, Sensitization, EPI	4	3	1	12
		Inhalation, skin and eye contact with hydrocarbon vapors during fuel compartment adjustment operations,	Visual impairment, Asphyxia and irritation (see MSDS)	3	4	12	Safety instructions, Sensitization, EPI	3	4	1	12
	loading bridges.	Fall from height caused by inattention or poor condition of loading platforms (slippery or damaged).	Bodily injury, death	4	3	12	Sensitization, EPI	4	3	0.5	6
		Fall on one level due to slippery conditions or during work without recording or marking	Bodily injury	3	4	12	Awareness raising, cleaning of the loading station EPI, work permit	3	4	0.5	6
Loading CR and WR fuels	Prohibited clothing and materials	Flash followed by a fire following the abnormal use of spark-generating equipment (matches, lighter, etc.) or the wearing of non-compliant clothing (studded shoes, synthetic clothing, etc.) by internal personnel or external.	Injury, death and burns. Damage CR and parts of the loading station	4	3	12	Sensitization, Safety instructions, Signs, EPI	4	3	1	12
	Electrical installations	Fire during product loading due to grounding failure.	Injury, death and burns	4	3	12	Operating instructions Safety instructions, Signaling, EPI	4	3	0.5	6
		Flash followed by a fire at non-compliant electrical equipment (junction box, push button and lighting).	Injury, death and burns	3	3	9	Instruction d'achat, Contrôle réglementaire, Plan de surveillance,	3	3	0.5	4.5
	CR and WR	Fire of electrical origin following technical failure in the cabin or on part of the CR before taking the loading position (short circuit, battery, etc.).	Injury and burns. CR damage	3	3	9	Regulatory technical inspection, EPI	3	3	0.5	4.5
		Drop in height due to the slippery state of the roof of the CR/WR favoured by the presence of Diesel,	Bodily injury, death	4	3	12	Sensitization, EPI	4	3	0.5	6
		Flash followed by a fire due to the presence of a cloud of HC vapours generated during loading or stagnation of fuels at the blocked gutters associated with an energy source caused by a technical failure (battery, starter, bare wire, etc.).	Injury, death and burns. Damage CR and parts of the loading station	4	3	12	Operating instruction, Loading/unloading instruction, Safety instructions, EPI,	4	3	1	12
	Obstacles (pipes and others).	Fall on one level due to crowding of the premises, presence of obstacles or slippery condition of the ground.	Bodily injury,	3	4	12	EPI, Awareness, cleaning (Ciner) (Ciner)	3	4	0.5	6

Analysis fields.	Source of danger.	Danger scenario	Damage	N/Risk. G	N/Risk. P	Criticality	Experience acquired	N/Risk. G	N/Risk. P	N/Risk.	Criticality
Loading CR and WR fuels	Iron bar	Falling object (iron bar) when unblocking the winch rollers due to the rush of the agent and lack of maintenance	Injury	3	4	12	Exploitation instruction, Loading/unloading instruction Safety instructions, EPI	3	4	0.5	6
Fuel and fire water pumping	Electric pump and motor pump	Flash followed by a fire following heating of the motor part associated with a leak in the pump glands.	Injury and burns Material damage,	3	2	6	Maintenance checklist, Monitoring plan	3	2	0.5	3
		Generation of noise during daily operation of the electric fuel pump.	Impairment of hearing, transmission of vibrations to the ground and fixed installations	3	3	9	EPI, sensibilization	3	3	0.5	4.5
		Partial projection of the mechanical rotating part of the pump following damage to the coupling	Bodily injury, death	4	2	8	Maintenance instruction, Monitoring plan, Maintenance checklist, EPI,	4	2	0.5	4
		Fall on one level due to clutter or slippery condition of the floor, walkways and stairs or inattention on the part of the operator.	Personal injury, fracture and sprain	3	3	9	EPI, sensibilization, cleaning	3	3	0.5	4.5
		Noise generation during normal operation tests and emergency use of fire pumps.	Impairment of hearing, transmission of vibrations to the ground and fixed installations	3	3	9	EPI, sensibilization	3	3	0.5	4.5
		Projection of dangerous products (Electrolyte) into the eyes when charging the battery.	Eye burns	3	3	9	EPI. Maintenance instruction, sensibilization	3	3	0.5	4.5
	Echelle	Drop in height due to operator inattention, or non-compliance of the ladder when checking the oil and water level.	Bodily injury	3	3	9	EPI, use of compliant equipment	3	3	0.5	4.5
Fuel and fire water pumping	Canalisation	Fall on one level when handling the valves.	Bodily injury	3	3	9	EPI, sensibilization	3	3	0.5	4.5
		Flash followed by a fire due to a fuel leak during maintenance work	Bodily injury, eye and eye irritation	3	3	9	Maintenance instructions, HSE, EPI, Sensibilization	3	3	1	9
	Escalier	Fall on one level due to the slippery state of the stairs or inattention.	Bodily injury	3	3	9	Sensibilization, cleaning EPI,	3	3	0.5	4.5
Product storage	Storage tank	Explosion followed by a fire due to the presence of a gas cloud in contact with an ignition source of internal or external origin (lightning/static electricity or work via a hot spot).	Death, Injury and burns. Damage to the installation	4	3	12	Lightning rod regulatory technical inspection, Work permit	4	3	1	12
		Fire on a vent with the release of smoke following the release of vapours, in the presence of an ignition source (lime works or others).	Death, Injury and burns. Damage to the installation	4	3	12	Lightning rod regulatory technical inspection, Awareness raising Working license	4	3	1	12
		Pool fire following a rupture of the shell at a weak point in the tank due to corrosion or an earthquake.	Death, Injury and burns. Damage to the installation	4	3	12	Regulatory Technical inspection	4	3	0.5	6
		Pool fire following product overflow due to human error or technical failure.	Death, Injury and burns. Damage to the installation	4	3	12	Exploitation instruction,	4	3	1	12

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References

ACA (2011). Construction sociale du risque.

Amrani, M., Chaib, R., Bouzaouit, A., & Ion, V. (2020). Well-being at work: A lever for sustainable performance in workplace. *Mining Science*, 27, 89–104. https://doi.org/10.37190/msc202707

Auduberteau, S., & Ganino, K. (2003). La prévention des risques professionnels: hygiène et sécurité au travail, collection" les diagnostics de l'emploi territorial" hors série N 5. *Direction Recrutement et Protection Sociale*.

Bouhaci, F. (2013). Dossier -Zones à risques industriels majeurs- ‘’L’assurance dommages fait son beurre’’, Bimensuel de l’économie et de la finance ; Algérie.

Bouyaya, L., Kahoul, H., & Chaib, R., (2023). Sustainable use of rotating machinery in the cement industry: a case study. *Informatica, 34*(4).

Bouzerara, R., Chaib, R., & Verzea, I. (2022). Contribution to the analysis of the impact of hazardous chemicals on employee health case study: Company Sarl El Chafek (Algeria). *Ukrainian Journal of Ecology, 12*(1), 54-58.

Eco-News (2013). Accident industriels majeurs, Bombe à retardement.10 mai 2013.

Hassani, M., Chaib, R., & Bouzerara, R. (2020). Vulnerability assessment for major industrial risks proposal for a semiquantitative analysis method (VAMIR) application: oil and gas industry. *Journal of Failure Analysis and Prevention, 20*, 1568-1582.

Hellas, M. S., Rachid, C., & Verzea, I. (2021). Modelling of accidental phenomena related to leakage and tank rupture of a vehicle converted to LPG. *World Journal of Engineering, 18*(3), 505-518.

Maamri, N., Chaib, R., Benidir, M., & Verzea, I. (2021). Risk assessment using fuzzy ahp and fuzzy top-sis hybrid approach for safe and sustainable work, case study. *Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, And Engineering, 64*(1), 129-140.

Meryem, A., Chaib, R., & Verzea, I. (2020). Contribution to the occupational risk assessment for sustainable management in health and safety at work: case study. Acta technica napocensis-series: applied mathematics, mechanics, and engineering, 63(4), 411-418.

Morneau, C. (2011). La gestion des risques d'accidents industriels majeurs: état de la situation sur le territoire de la pointe-de-l'île. Stagiaire en gestion des risques majeurs. https://geo.uqam.ca/wp-content/uploads/sites/70/2018/09/Morneau_C_GRM_2011.pdf

Prewett, K. W., Prescott, G. L., & Phillips, K. (2020). Blockchain adoption is inevitable—Barriers and risks remain. *Journal of Corporate Accounting & Finance, 31*(2), 21-28.

Saker, B., & Chaib, R. (2022). Effective and Sustainable Management of Risk Disrupting the Supply Chain Activities: The Case of the ETRAG Company. *International Journal of Performability Engineering*, *18*(11). https://research.ebsco.com/c/ih3yxv/results?q=AN%20160861706

Saou B. (2013). Dossier -Zones à risques industriels majeurs - ''Des populations sur un volcan'', Bimensuel de l'économie et de la finance ; Algérie.

Théberge, M. C. (2002). Analyse de risques d accidents technologiques majeurs. Direction des évaluations environnementales, Ministère de l'Environnement, Québec. https://archives.bape.gouv.qc.ca /sections/archives/suroit/docdeposes/documdeposes/DB11.pdf

Voirol, C., & Guillemin, M. (2002). L'analyse des risques psychiques au travail : comment faire?. Mémoire réalisé pour l'obtention du titre d'hygiéniste du travail SSHT, Cours postgrade en santé au travail, Institut für Hygiene und Arbeitphysiologie-IHA de l'Ecole Polytechnique Fédérale de Zürich et Institut de Santé au Travail-IST de l'Université de Lausanne.

Waring, M. J., Arrowsmith, J., Leach, A. R., Leeson, P. D., Mandrell, S., Owen, R. M., ... & Weir, A. (2015). An analysis of the attrition of drug candidates from four major pharmaceutical companies. *Nature reviews Drug discovery*, *14*(7), 475-486.

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Features of Adolescents Reflection with Different Character Accentuations

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Abstract

The article presents data on the study of the relationship between the protective reflection of adolescents (modification of the projective technique "Cognitive-emotive test" by Yu.M. Orlov, S. N. Morozyuk) and their character accentuations (K. Leonhard – S. Shmishek test questionnaire, modification of the technique "Determination of personality-characterological accentuations"). The analysis of the results obtained both in the group of boys and in the group of girls is given. The authors provide data on the possibilities of sanogenic reflection in the optimization of character accentuations and the development of adaptive abilities of the individual, which significantly increases the chances of survival and successful functioning of adolescents in the digital world. The obtained results allow us to conclude that for adolescents aged 14-17 years (both boys and girls), such types of character accentuations as: emotive, pedantic and excitable are more characteristic. These character accentuations are accompanied by defensive reflection from negative feelings of guilt, shame and envy. Boys and girls at this stage of their lives are prone to self-deprecation. However, they do not rationalize their failures by unfavorable circumstances, do not leave situations that require their solution.

Keywords: Character accentuation, reflection, defensive reflection, sanogenic thinking, adolescents

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Introduction

Relatively new activities related to digital technologies for humanity impose new requirements on the variability of behavior, developed adaptive abilities, creativity, rapid restructuring of personal structures on humanity, an individual. However, extremely pronounced accentuated character traits make it difficult to develop these abilities. In this regard, the problem of finding mechanisms and tools that optimize accentuated character traits is acute.

The problem of character (phenomenology, structure, stability, dynamism) has been studied from various positions, however, it still remains relevant today. Although the character is dynamic, it is less plastic and less susceptible to change than personality traits, that is, it has more stability. Numerous studies have found that the more accentuated the character, the less plastic it is, and, consequently, the behavior of a person with accentuated character traits is less variable. Excessive expression of some character traits contributes to deviant behavior, however, within the limits of acceptable norms by society. With pronounced accentuated features, the negative sides of the character come to the fore, preventing the individual from adapting to social requirements and norms. Teenagers with accentuated character traits are at risk due to the development of digital technologies. Relatively new activities related to digital technologies for humanity impose new requirements on the variability of behavior, developed adaptive abilities, creativity, rapid restructuring of personal structures on humanity, an individual. However, extremely pronounced accentuated character traits make it difficult to develop these abilities.

Reflection is a universal mechanism for changing the strategy of thinking and behavior. It is reflection that is a psychological, cognitive mechanism that meaningfully connects and integrates characterological traits and behavioral programs of a person.

In the experimental studies of Morozyuk (2000), the presence of reliable connections of accentuated character traits with the peculiarities of reflection has been convincingly proved. It is established that the more accentuated the character traits, the more clearly the defensive reflection is presented. In the same studies, the possibility of optimizing character traits through training in sanogenic reflection was experimentally tested. The author found that not only accentuated features are optimized, but also the academic success of students increases, their anxiety level decreases, the ability to socio-psychological adaptation increases, the emotional state is harmonized, the personality becomes more resistant to stress.

Relevance

The problem of adaptation of adolescents to a rapidly changing world in connection with the development of digital technologies acutely poses the problem of finding mechanisms and means that optimize accentuated character traits, significantly reducing the adaptive abilities of the individual, the variability of their behavior. The subject of the study.

The relationship of accentuations of the character of adolescents with reflection.

The purpose of the study

Identification of the relationship of accentuated character traits of adolescents with reflection.

Methods

“Cognitive-emotive test” Y. M. Orlova, S. N. Morozyuk. K. Leonhard - S. Shmishek questionnaire test “Definition of personality-characterological accentuations”. Methods of mathematical data processing (Spearman's r-criterion).

Results

The data presented in Tables 1 and 2, after appropriate mathematical processing, show the following: the more rigid type of accentuation is expressed in young men, the less they experience fear of failure (r=-0.89), but the more they are prone to arousing guilt in others (r=0.91). Turning to the characteristic of the rigid type of accentuation, we find that the key points of characteristic manifestations are "rigidity of attitudes and views, perseverance in achieving goals." Due to this rigidity, these respondents do not have any fears associated with failure. But at the same time, "they tend to experience imaginary injustice towards themselves, are not able to "easily move away from insults"." Therefore, being under the influence of feelings of resentment, these respondents tend to cause guilt in other people. Persons with an emotive type of accentuation are characterized by a manifestation of protection from guilt (r= 0.89) and less – a manifestation of protection from envy (r=-0.87). Since a person with an emotional type of character tends to empathize with others, she is susceptible to someone else's pain, she has an acute sense of duty. Against this background, the experience of guilt is activated.

For people with an emotive type of character, a feeling of envy is not characteristic. The more pronounced the pedantic type of accentuation is in young men, the less they are inclined to feel guilty (r= -0.88). This is due to their difficulty switching from one emotion to another. And since their confidence in order, clarity and correctness is inherent in this type, then the experience of guilt is not characteristic of them. They do not doubt themselves, the correctness of their actions, the work done.

The more pronounced the anxiety type, the less young men with this type feel resentment (r=-0.92). Due to the fact that respondents are more likely to experience shyness, they form a sense of duty early, high moral and ethical requirements, the emphasis of their defensive reflection shifts more towards experiencing guilt than resentment. Therefore, the latter is less characteristic of them.

Young men with cyclothymic accentuation of character are more touchy (r= 0.94). Respondents in this group are dependent on external circumstances, mood, and external events. That is, the change in their mood is associated with unjustified expectations that cause negative emotions: disappointment, sadness, resentment and a sense of shame.

The more pronounced the excitable type of accentuation, the more young men of this type experience guilt (r=0.87). Irritability, short temper, impulsivity, characteristic of this type of character, make it difficult to communicate in a team, lead them to experience feelings of guilt.

The more pronounced the dysthymal type, the more persons with this type of character are prone to appealing thinking (r=0.92), the more often they are protected from feelings of shame (r=-0.90). Persons with this type of character are shy, have a weakness of volitional efforts, are pessimistic about the future, lead a closed lifestyle, demonstrate low contact.

The more hyperthymic type of accentuation is expressed in girls, the less they are touchy (r=-0.89) and prone to arousing guilt in others (r=-0.88). This is due to the fact that respondents of this type almost always have a good mood. They are superficial in their actions, energetic, difficult to tolerate the conditions of strict discipline. Not demanding of themselves, they are not inclined to cause guilt in others.

The more pronounced the emotive type, the more girls are prone to self-deprecation of "I" (r=0.87) and envy (r=0.92). Due to excessive sensitivity, anxiety, vulnerability, the desire to empathize with others, girls are prone to self-blame, self-deprecation of their "I". The more pronounced the pedantic type, the more girls feel guilty (r=0.94). Unlike boys, girls are more prone to experiencing this feeling. Rather, this is due to their desire to strictly follow the planned plan, so they often doubt the correctness of the work done, they are prone to self-tests and fears of not meeting the expectations of others.

The more pronounced the demonstrative type, the less girls experience aggression towards others (r=-0.95), tend to devalue (r=-0.95), feel less guilt (r=-0.89) and shame (r=-0.87), build expectations towards other people (r=-0.94), resort to appealing thinking (r=-0.91). And also in persons with this type of accentuation, sanogenic thinking is less pronounced (r=-0.98). Respondents of this type are characterized by an increased ability to repress, are prone to fantasy, therefore, such a tendency as aggression against others, feelings of resentment and guilt is a consequence of these repressed experiences. And a low indicator of sanogenic thinking is associated with a strongly pronounced quasi-reflection (according to the type, "The world in which I live is called a dream").

The more pronounced the excitable type, the more autoaggression (r=0.92), envy (r=0.96) and self-deprecation of the Ego (r=0.94) are manifested. Due to the lack of controllability and control over their motives, this type of respondents is dominated by the desire for self-aggression and self-humiliation, due to the inability to cope with their emotions and direct them in a more constructive direction. And comparing yourself not in your favor only strengthens these impulses, leading to self-destruction.

The more the exalted type of accentuation is expressed in girls, the more they are prone to arousing guilt in others (r=0.89). Under the influence of their impetuosity, and often, unconsciously and in situations of dispute, conflict, they tend to expose the second party to blame, defending themselves with sincerity and openness of their feelings. Respondents of this type are prone to situational moods. Their emotional sphere is extremely labile. From a state of sadness or anger, they impulsively come to a state of delight. Rigid, anxious, cyclothymic, dysthymic types of accentuation were not found in the girls. This suggests that such respondents are not characterized by manifestations of low self-esteem, boredom, dependence on external events, timidity, self-doubt, diligence, self-criticism.

Conclusions

The obtained results allow us to conclude that for adolescents aged 14-17 years (both boys and girls), such types of character accentuations as: emotive, pedantic and excitable are more characteristic. These character accentuations are accompanied by defensive reflection from negative feelings of guilt, shame and envy. Boys and girls at this stage of their lives are prone to self-deprecation. However, they do not rationalize their failures by unfavorable circumstances, do not leave situations that require their solution.

These features of reflection allow them to adapt in an ever-changing world. The development of reflexive culture in adolescence and adolescence will optimize the severity of character accentuations, overcome those difficulties in activity and communication that are caused by accentuated features. These data make it possible to assume that teaching adolescents sanogenic reflection will significantly increase their survival in the digital world, make their behavior more flexible, adaptive and constructive. This will allow the use of digital technologies for education, personal development with the least loss to health and emotional well-being.

References

Adamyan, L. I. (2012). Sanogenic reflection as a factor of psychological stability of personality. Psychological sciences: 19.00.01.172

Alekseeva, E.B. (2016). The study of computer addiction among students. *International Student Scientific Bulletin. 2. 45-49.*

Akhverdova O.A., & Pogozheva O.V. (2008). Personality and behavioral variability of adolescents in the polyethnic educational continuum. Monograph. Moscow: Ilex

Boev, I.V. (1999). Borderline abnormal personality. Stavropol.

Brilyuk, V. V. (2008). Gender features of computer addiction in adolescents aged 11-13. Journey to the Origins.

Vorobyova, T. A. (2011). Research of the problem of dependence of university students on the Internet. *PTG*. 67-74.

Krainova Y. N. (2010). Sanogenic reflection in the structure of emotional competence of future teachers. Psychological Sciences

Kuznetsova, E.S. (2008). Computer and Internet addiction. Moscow: Moscow State University.

Larionova, S. O. (2013). Internet addiction among students: issues of prevention. ECB. 232-239

Lichko, A. E. (1997). Psychopathies and character accentuation in adolescents. L.: Digest.

Morozyuk, S.N. (2000). Sanogenic reflection, character accentuation and effectiveness of educational activity.

Orlov, Yu. M. Morozyuk, S.N. (1999). Cognitive-emotive test. Moscow.

Pavlyuchenkova, N.V. (2001). Sanogenic reflection as a factor in the development of emotional competence. Psychological Sciences.

Raygorodsky, D. Y. (2001). Practical psychodiagnostics. Methods and tests. Samara: BAHRAH-M.

Shakhmatova, Y. Y. (2016). Internet addiction among young people. Yaroslavl.

Yang, K. S. (2000). The diagnosis is Internet addiction. St. Petersburg.

Bakken, I. J. (2009). Internet addiction among Norwegian adults: a sample study with stratified probability. *Scandinavian Doctor of Psychology. 50(2),* 121-127.

Ko, K.H. (2013). Brain correlations of craving for online games when exposed to a signal in subjects with addiction to Internet games and in subjects with remission. *The Biology of Addiction. 18*(3)*,* 559-569.

Korthagen, F. (2014). The connection of theory and practice: Changing the pedagogy of pedagogical education.

Plutchik, R. A. (1999) Structural theory of ego and emotion defenses. Conte Emotions in personality and psychopathology. Plenum H.R.N.Y., 229-257.

Radford, J. (2004). Reflection is introspection. *American Psychologist, 29,* 245-250.

Roger, K. (2012). A man, a Game, and more games. University of Illinois Press.

Steyer, F. (1991). Research as self-reflexivity, Self-Reflexivity as a social process. *Research and reflexivity*.87-89

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ADDIE Model and Five Essentials for Material Design in English Language Teaching

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Abstract

Designing tools and materials in second language education is a process that requires a high degree of attention and care. In this process, teachers need to make right decisions and appropriate choices so as to effectively apply language teaching and learning principles in a practical way. In this sense, this article aims to provide language teachers with the guidelines for designing materials in English Language Teaching on the model of ADDIE. Within the principles of effective material design and the steps of ADDIE model, the paper presents the student teachers' experiences related to the processes of their material design and its application. The data collection was carried out through the use of reflection papers, CEQ (Course Experience Questionnaire) forms, and focus group interviews. Based on the gathered findings, it can be concluded that the use of an instructional model and guiding the process with five essentials fundamental for designing language materials have positive and significant effects on the process of material design and professional development of the student teachers recruited for the study.

Keywords: material design, ADDIE model, language education, instructional materials, language teaching

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Introduction

With the introduction of new trends in English language teaching and learning, it has become essential for language teachers to follow these trends and adapt to these innovations in their teaching methods, activities,

and instructional materials. Use of appropriate materials is conducive to effective language teaching and learning process. Therefore, the process of material choice or its design needs to be systematized. According to Tomlinson (1998:2), materials "provide sources of language input…in ways which maximize the likelihood of intake". As instructional materials play an important role in their users' learning, they need to sufficiently and appropriately reflect all aspects of second language education through placing the students at the center of both teaching and learning process. For Garton and Graves (2014:11), materials are indispensable part of language teaching and cannot be thought "independently of their users".

For the purpose of forming a basis for a systematic material design, some principles need to be emphasized. According to Tomlinson (1998), some principles need to be emphasized. Materials need to create an effect on its users with its variety and attractiveness. They also need to be related to learners' lives and meet their needs. While fulfilling the learners' needs, they should not turn blind eye to the individual differences, needs, and learning styles in order to accommodate classroom dynamism. Regarding their contribution to the learning process, they should support learning process and their self-discovery. Additionally, they need to guide students to direct their attention on form and use of language and they should provide opportunities for controlled and free practices to promote learners' accuracy and fluency development in target language. In addition to the guidelines essential for material development, there are some factors affecting the effective use of materials. Teachers' subject knowledge, confidence, previous experiences related to language learning, and other dynamics of learning environment such as learners' needs for learning language are some of these factors that have important roles in the development and use of materials (Humphries, 2014). Our intention in this article is firstly to provide a theoretical background on the essentials of material design and development in language learning within the material design course. As a second aim, it presents the details related to the steps of an instructional model called ADDIE through which the designed material could be integrated into teaching and learning process. Lastly, the paper provides student teachers' experiences related to their material development and course evaluations.

Adopting a systematic approach to material design entails basing this rigorous process on a number of principles essential for effective language teaching (Harwood, 2010; Littlejohn, 2011; Tomlinson, 2010). In this systematic approach, the guidelines suggested by Howard and Major (2004) were taken as a base for the essentials adapted in this study. The first essential is related to the context through which the input is presented and recycled (Pardo et al., 2004). Teaching materials should be contextualized with real-life topics and language aspects (Pardo & Tellez, 2009). Materials need to meet the objectives of curriculum and syllabus. They need to be in line with the course specifications and teaching points. As stated by Garton and Graves (2014) materials are important in terms of providing opportunities for language learning. Contextualizing the content with topics and themes relevant and appropriate for learners not only provides "meaningful, purposeful uses" for English but also increases learners' "personal engagement" with the material (Howard& Major, 2004). The second essential regarding material design in language education emphasizes the use of learner-centered approach which promotes different interaction patterns. They need to include the details related to learners' learning experiences, first languages, and culture-specific knowledge and examples (Howard& Major, 2004). While connecting learning process with learners' emotions and activating their background knowledge,

materials should allow learners to make their own decisions (Augusto-Navarro, 2015). In other words, they need to give responsibilities to the learners and promote autonomy (Pardo et al., 2004). For Howard and Major (2004), syllabus designed around culture-specific knowledge supports learners' awareness of "significant cultural differences". As a third essential, teaching materials specifically designed for language education need to focus on form, function, and all language skills. In addition to the independent use and expression in English, teaching materials also need to motivate learners to focus on forms within an "analytical approach" (Howard& Major, 2004). Applying linguistic analysis and being exposed to target language integrated in language skills encourage learners to produce and create both accurate and fluent output. The fourth principle related to material design concern with the physical appealing of the material. In order to boost the motivation of the learners, materials should attract their interest and increase their enthusiasm (Sun, 2010). In terms of physical appearance, "the density of the text on the page, the type size, and the cohesiveness and consistency of the layout" are the aspects need to be considered while designing instructional materials (Howard & Major, 2004). According to Pardo et al. (2004), we could manage to keep learners' attention, if we adopt materials which are "meaningful, well-elaborated, updated, challenging, enjoyable, and relevant". The last essential deals with the flexibility and appropriacy of the instructions necessary for the implementation of the designed material. With the aim of increasing teaching potential of materials through the use of different methods, materials should be appropriate for recycling. This can ease the burden on the educator requiring less time and effort. Teacher instructions also need to be clear and less confusing with limited and appropriate use of meta-language.

Method

Research Goal and ADDIE Model

This study aims to develop a framework in accordance with the principles of material design. ADDIE model which provides a systematic sequence for material design (Aldoobie, 2015; Morrison, 2010) is the model on which the research framework has been based on. The ADDIE model is structured around five stages as Analysis, Design, Development, Implementation and Evaluation.

Table 1. Reflection Forms designed in Accordance with the Stages of ADDIE Model

ADDIE MODEL
A: ANALYSIS: What are you going to teach? Your goals, Topics, Structure, Vocabulary etc.(sample structure: I like…; You like….)
D: DESIGN: What are you going to design? Your model/material-diorama etc.
D: DEVELOPMENT: What kind of activities/skills you are going to use with your model? Please shortly explain the steps of your micro teaching
I: IMPLEMENTATION: Applying the models with activities with real audience/Explain teacher roles/student roles
E: EVALUATION: What do you think about your micro-teaching, experiences (it will be completed after the micro teaching)

In this instructional model, the first stage Analysis refers to the process of determining the needs and competencies of the learners. In this context, it concerns with the analysis of teaching points, learning goals, and any details related to the learning environment that will affect and be affected by the designed material.

The second phase is Design stage which focuses on the procedures of material choice, designing, and essential resources for the designing. In the Development part, the process of material design is completed within five essentials. In this stage, teacher also decides which language activities and skills are going to be integrated and promoted with the designed material. The Implementation stage is related to the application of the material in real classroom with real students. It gives the instructor the opportunity of checking whether objectives and essentials have been achieved or not. During the last phase Evaluation, teacher and learners evaluate the material, teaching, and learning process in accordance with five essentials. In this stage, learners can be asked to do self-evaluation or asked to involve in group evaluation.

Participants and Data Collection

Participants in this study are 16 teacher candidates (9 female, 7 male) taking material development course in ELT (English Language Teaching). Participants were grouped into four study groups for designing their material in accordance with five essential and ADDIE model. After training on factors and five essentials which are fundamental in choosing or developing any material in teaching English, student teachers were assigned into their study groups to collaborate with their group members to achieve their shared goals. Data obtained through five essential and ADDIE based reflection forms. In addition to the reflection forms, participants were asked to complete course experience questionnaire (CEQ) adapted from Curtis and Keeves (2000). Divided into two parts, CEQ explores student teachers' contrived experiences related to the course and process of collaborative material design. In the first part, participants rated the given statements which covered the positive effects of the course from 1 to 8. In the second part, teacher candidates filled in 19 item questionnaires. The items measured the impact of the course content, load, and the teaching methodology that the staff adopted for the course implementation. With the intention of gathering data related to the participants' opinion and encouraging them to interact and share different perspectives in a collaborative environment, teacher candidates were asked to participate in focus group interviews structured around few points. In these focus group interview sections, teacher candidates were asked to provide their own definitions of educational materials. They were also interviewed about reasons that might force them to create their own materials. They were also encouraged to provide their opinions about the teacher qualifications essential for the material design. Lastly, they were asked to reflect on the experiences they had while framing their material task around ADDIE model and five essentials.

Data Analysis

In general sense, qualitative research analysis was applied in this study. For responding research foci and in order to identify the emerged themes and interpret these patterns, the collected data were organized and structured in words, concepts, phrases, and opinions. With the intention of giving descriptive statistics like ranking and calculating means, SPSS Statistics 25 was used.

Findings

In this section, findings were presented as two parts. In the first part, reflection data were interpreted and tabulated. In the second part, findings gathered through CEQs and focus group interviews were analyzed and illustrated with appropriate tables and charts.

Table 2. Participants' Written Reflections Related to their Material Design and Application Process

	Group Evaluation	Peer Evaluation
Wardrobe	• A cardboard wardrobe is designed to contextualize the structure possessive pronouns and clothing items which are part of their lives. • The structure and vocabulary are essential and common, but learners could have been more interactive with more free practices. • With listening and speaking activities, students had the chance of practicing the newly learned structure. • We think that material was interesting and attractive enough to catch the students' attention. • The language and the instructions were simple, basic, and appropriate for their levels and young learners.	• The designed material was so effective for teaching the topic. Instructions were not appropriate for the level. • The group was successful in teaching the topic. The context was meaningful. • Introduction needs to be improved. • Materials and exercises were great; instructions could have been better. • Learners were all active during the activities.
Culinary Map	• The material is integrated into context with a familiar topic and familiar cultural element Turkish regions and cuisines. • With language exercises and teacher questions, teacher tried to make the learners more active. • The material was colorful, but it could have been more attractive to catch more learner attention and participation. • The given instructions were simple and appropriate for learners' level.	• Material was attractive and interesting, but its integration to the lesson was a bit weak. It could be improved with more engaging activities. • Map was very attractive; instructions need to be improved as they were not clear enough. • Activities needed to be varied. It should have focused more on skills. • The target vocabulary items were interesting, and introduction of the topic was very informative.
Food Wheel	• The material is contextualized around a daily topic "food" and the structure is one of the most frequent one essential for expressing the things we enjoy. • Material and structure appropriate for their levels and students were eager to join activity and be part of interaction. • Listening and speaking skills were integrated. Students were productive and willing to generate different sentences. • Material is attractive and colorful and material which helped to create a cheerful learning environment. Wheel can be recycled with different structure and vocabulary. • Instructions were clear and concise.	• Material is learner-centered and attractive. • The whole lesson was very interesting and enjoyable. • The group was so creative, the teaching material was appropriate for teaching. • Material stimulated different interaction patterns and it took the learner at the center. • It was flexible and had appropriate instructions. • The activities prompted with the material were well-designed. • Students were active and almost everyone participated in interactive learning.

Based on the participants' reflections related to the evaluation stage of ADDIE model, it is indicated by both groups and fellow students that the use of essentials has provided a comprehensive guide for design and

application procedures. In their group evaluations, participants have reported that through the integration of the essentials especially into the design and development stages let them create authentic contexts for their materials which incorporate target structures and vocabulary. In addition to the contextualization principle, teacher candidates have stated that they have paid special attention to engage students with the designed material. They also reflected that in order to maximize the principle of learner centeredness and maintain their attention and participation, they tried to construct more interesting and attractive materials. Integration of skills and providing clear and precise instructions were the other essentials emphasized in their group reflections. For the purpose of increasing classroom interaction with their materials, participants stated that they especially gave more importance to speaking skills. In terms of instructions, student teachers reported that in order not to cause any misunderstandings and ensure a successful implementation process for the material use, they reflected that they tried to deliver clear instructions and check their understandings. In peer evaluation forms, the most highlighted points were related to the attractiveness of the designed materials and their effect on the students' active participation.

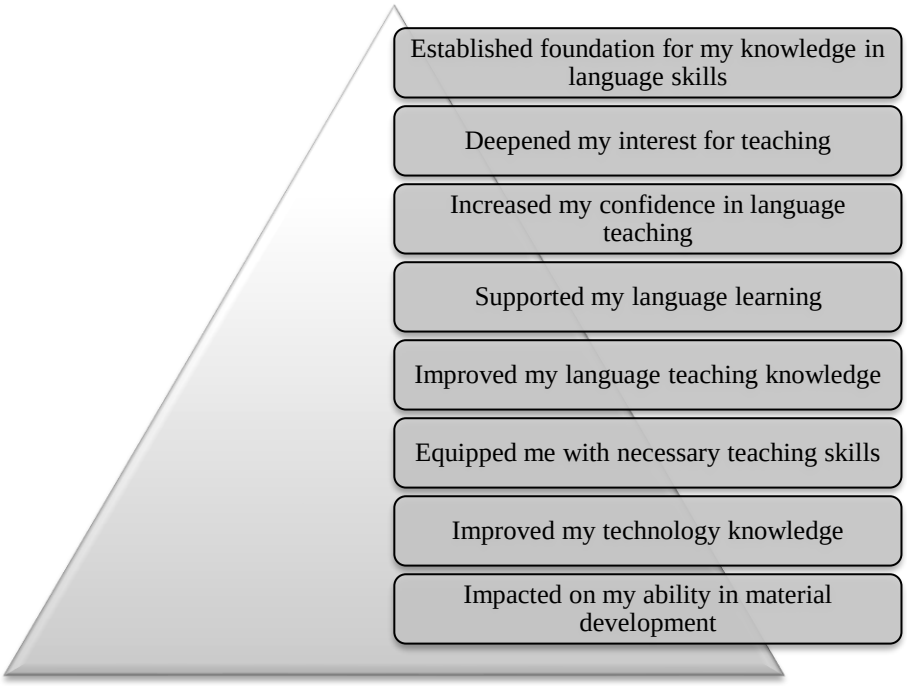

Figure 1. Pyramid Chart Illustrating Learning Experiences Based on Material Design Course

The pyramid chart which was designed around the CEQ data from the longest horizontal to the shortest one shows the continuum of the highly to the least reported course outcome and impact. According to the first long line, most of the teacher candidates stated that enrolling the material design course had positive effects on their knowledge and skills necessary for their designing their educational materials. The next most rated outcome by the participants was the course impact on their technology knowledge which enhanced the process of finding and varying sources. The rest of the outcomes displayed on the top of the pyramid are mostly related to the improvement in teacher candidates' pedagogical knowledge in language education. In general, participants

reflected that receiving training on material design and its application in language teaching process had positive changes on their knowledge, skills, and attitudes.

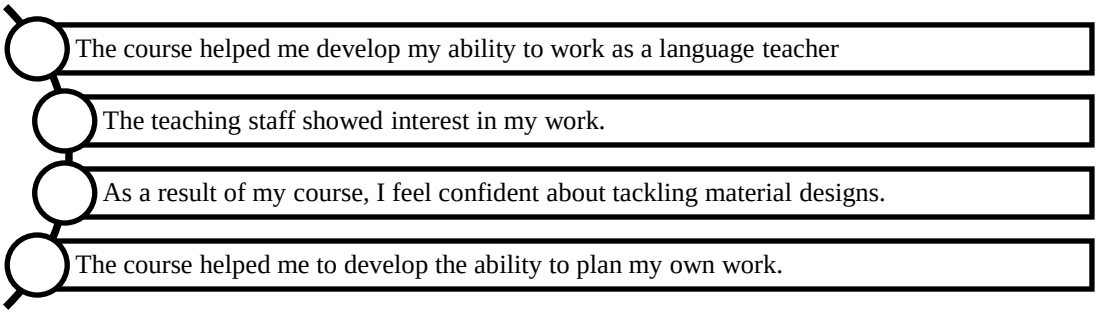

Figure 2. Smart Art Presenting the CEQ Items Highly Rated by the Student Teachers

In their evaluations related to their course experiences through CEQs, teacher candidates showed almost full agreement (M=4.87) with the questionnaire item which intended to measure the impact of the course on the participants' development as a language teacher. In other words, participants totally agreed that through taking this training course on material design, they concluded that they professionally developed in language education. The second questionnaire item confirmed positively by almost all student teachers (M=4.80) was related to teacher staff's interest in instructional materials designed by the participants. In their course evaluations, teacher candidates also reported that being equipped with knowledge and skills essential for material development they started to feel more efficient and confident in addressing the difficulties that might be encountered during the designing process (M=4.75). Additionally, with the use of ADDIE instructional model and five essentials which enhanced their planning and organizational skills, participants pointed out that they learned to have more control and order in managing their task and material (M=4.68).

Table 3. Code Labels Emerged from the Focus Group Interviews

Code Labels	**Phrases expressed by the groups in Focus Group Interviews**
Conceptualization, defining material	• facilitating language education • improving learning process and providing concrete learning experiences • increasing student participation • maximizing classroom interaction
Conditions for material development	• inadequacy of commercial materials • lack of materials arousing learners' interest and attention • lack of learner-centered materials • materials ineffective in promoting active learning • materials not meet learning goals
Essential teacher qualifications	• having willingness • being patient and having commitment • being creative • being inquisitive • having subject and pedagogical knowledge • developing empathy for learners' needs and characteristics

Related to the definition of material, teacher candidates preferred to signify its functions in education and especially in language education. They mostly noted materials' roles in providing concrete learning experiences and reinforcing teaching process. With interesting and more engaging features, they also defined educational materials as an important tool in improving students' engagement. Regarding to the conditions that necessitate teacher-designed material, teacher candidates reported that due to commercial materials could be inadequate in being interesting and achieving general and specific learning goals. They also added that some instructional materials on market might not respond the needs of the learners and fit learners' profiles and might not be effective in being successful for ensuring active learning, which is more possible and easier with teacher-created materials as teachers know their students better as individuals. Related to the teacher qualifications essential for material design, student teachers argued that teachers need to have desire and be willing to embark on material development and its integration into the teaching process. Since material design is tiring and requires teacher's time and energy, teacher candidates stated that it was important for the teachers to be ready for surprises and mishaps and need to show loyalty and commitment in completing the material design task successfully. In order to maximize students' attention and increase learners' learning opportunities with the designed and creative materials, participants pointed out that teachers need to be imaginative, curious, and be open to original ideas. Another teacher qualification mostly highlighted by teacher candidates during focus group interview sections were teacher's subject-specific knowledge and competence in putting this knowledge into practice with real students in real learning environments. Lastly, student teachers stated that while deigning their materials it was essentials for the teachers to consider their students' needs and interests and need to do their best to meet these needs.

In order to boost student success with their own materials, teacher candidates were asked to employ a five-step instructional model, ADDIE, for their material development (see Figure 3). Initials of ADDIE stand for Analyze, Design, Develop, Implement, and Evaluate. While constructing their own teaching materials on this model, with the aim of not getting away from the key principles of language teaching materials, teacher candidates were trained in five essentials which are basic and critical for creating authentic, meaningful, and communicative materials. Based on the student teachers' interview data, they pointed out that trying to fulfill all essentials, they had the opportunity of integrating principles and theory into practice and had an effective use of resources and tools basic for material design. Student teachers expressed that in order to optimize he learning experiences with their materials, during this material design process, contextualizing and finding specific and meaningful contexts for teaching language items was one of the five essentials they paid special attention. Integrating four skills with interesting and engaging activities with the purpose of full and active learner involvement was another standard they tried to achieve through the design and implementation of their materials.

"Wardrobe"

Analysis: Language foci are the use of structure "this is/there are...." and vocabularies related to clothing items.

Design: Use of a colorful box and string for wardrobe and slides and papers for clothing materials.

Development: Integrating with Listening & Speaking Skills

Implementation: Teacher introduces the topic with slides, then asks the students to get dresses a a little girl drawing on the board by choosing the clothes from the wardrobe.While participating the activities, students are expected to use the already taught structure.

Evaluation: Teacher and Peer Feedback+ Group Evaluation (5 essentials)

"Culinary Map"

Analysis: Topic is shaped around Turkish cuisines

Design: Teacher designed map depicts different regions and food stickers

Development: Integrating with Listening, Speaking, Reading, Writing Skills

Implementation: Teacher introduces basic vocabulary related to seven regions of Turkey and some popular dishes with listening and speaking skills. Teacher also catches students' attention on the fill-in the blank items on the board and ask them to complete the exercise.

Evaluation: Teacher and Peer Feedback+ Group Evaluation (5 essentials)

"Food Wheel"

Analysis: The phrase "Do you like..." I like- she likes..." will be introduced with some food items.

Design: It is a spinning wheel with a cardboard. It has some pictures related to some snacks and food items.

Development: Integrating with listening and speaking skills

Implementation: Teacher introduces the topic with a song and uses the spinning wheel for speaking practice.

Evaluation: Teacher and Peer Feedback+ Group Evaluation (5 essentials)

Figure 3. Smart Art related to Groups' Study Plan Structured with ADDIE Model

Discussion and Conclusion

For the purpose of improving students' learning, the use of various materials commercially available or teacher-developed has a pivotal role in foreign language education. According to Tomlinson (2001:66), material development as a field of study provides significant principles and details related to their design and application. In order to be successful in this process, teachers need to be aware and knowledgeable about the theory and practice of second language education (Pardo et al., 2004). In this study, we present essentials suggested in literature on their development in accordance with the realities and needs of the learning context. In addition to these five essentials, we also provide the details related to instructional model, ADDIE which involves the steps for the analysis of context, design, development, implementation of the designed material,

and the evaluation of the whole process. Based on their reflections, CEQ findings, and focus group interview data, teacher candidates all agreed that the use of principles for material design structured the process of their making decisions related to material design and its development in order to make them authentic, communicative, engaging, and interesting. They also added that the use of ADDIE model effectively helped them to follow step-by-step framework from the material design to its evaluation.

In their conceptualization of material, participants indicated that material facilitated teaching and learning process and transformed learning inputs from abstract to concrete learning experiences. They reflected that the use of material made the learning process more effective and permanent. They emphasized that the exploitation of material enhanced the learning environment with engaging and authentic learning opportunities. Related to the conditions that necessitated teachers' adaptation or design of material for their classrooms, teacher candidates mostly argued that available materials might not be adequate in terms of meeting course and teacher objectives and they might not be suitable for the learners' level. Additionally, they stated that teacher-designed materials were more likely to satisfy learners' needs in terms of physical attractiveness. For Howard and Major (2004), teachers can be more flexible and effective in deciding on the topics, structures, functions, and skills as they are more knowledgeable about their students' needs. With respect to the skills and dispositions that teachers have, student teachers claimed that teachers should have content knowledge, pedagogical competencies, and technological skills essential for designing and applying instructional materials. According to the student teachers' reflections, teachers need to have a deep understanding of the theories and principles of language teaching and learning. Regarding pedagogical knowledge, they stressed that language teachers should know and employ effective procedures and strategies. In addition to these competencies, having willingness, curiosity, and being creative and patient were the highly stated qualities of character that teachers should possess.

In terms of five principles essential for material design in language education, in general sense participants reflected that taking into consideration these essentials increased the quality and effectiveness of the design and implementation procedures. Almost all of groups emphasized that they paid special attention to make the materials interesting enough to promote learners' motivation and enhance their engagement with the material, which is in line with the research findings of McDonough, Shaw & Mashura (2013) and Tomlinson (2012) who confirmed the roles of instructional materials in catching the learners' attention and facilitating their learning. They also stated that they tried to link the material with the learners' needs and interests in order to increase learners' involvement and learning. According to Nunez and Tellez (2008), decisions based on the material selection or development need to be done through the conduction of systematic need analysis of learners. Again within the same perspective, Kawai (2000) argues that activating learners' background knowledge with relevant content is an important part of building and developing intrinsic motivation in learners. In the end, it is teachers "who perceive their most salient characteristics and needs" (Pardo et al., 2004). Related to the challenges they experienced during the process of material development, they argued that they mostly had difficulty in contextualizing the material with appropriate and relevant content. They also stated that they realized during the development process that gathering authentic examples from real life in order to bring real life into classroom entailed dedication of their time and effort. Integrating the material with

language skills was also highlighted by the teacher candidates as one of the hard tasks in the process of material development.

It is possible to conclude that the design and application of educational materials in language education is not an easy task and process. This chaotic and challenging process could be enhanced with fundamental and logical principles. Teachers, especially inexperienced teachers, need to be provided with related training and support. As this study has shown, educators can be supported and inspired with training that aims to equip teachers and candidates with necessary knowledge, skills, and attitudes. As language education is a complex and dynamic process which open to variety and change, training programs need to be updated with creative and innovative content and practices. In this study, material design course was based on ADDIE model and five essentials. As a result, in accordance with the reflections and feedbacks of the participants, it could be concluded that teachers could be individually and professionally developed the field of material design.

Rapidly developing technology is rapidly changing the world. With this change, the primary aim of societies is to create a knowledge society that produces knowledge and technology, researches and has scientific thinking. The most important step for the formation of an information society is to educate new generations with the ability to adapt to change and developments. In today's world where knowledge is rapidly increasing, the main goal of the education system is not only to transfer knowledge to students in order to increase the quality of education, but also to provide students with the skills necessary to obtain knowledge (Kaptan & Korkmaz, 2002). For this purpose, providing meaningful learning by avoiding memorisation, solving problems related to new situations and developing skills related to scientific processes are considered important for the quality of education (Gürçay et al., 2000). One of the courses that contribute to the development of these skills is the science course (Kaptan & Korkmaz, 2002).

References

Aldoobie, N. (2015). ADDIE Model. *American International Journal of Contemporary Research.* 5(6), 68-72.

Augusto-Navarro, E. H. (2015). The Design of Teaching Materials as a Tool in EFL Teacher Education: Experiences of a Brazilian Teacher Education Program. *Ilha do Desterro,* 68(1), 121-137.

Curtis, D. C. & Keeves, J.P. (2000).The Course Experience Questionnaire as an Institutional Performance Indicator, *International Education Journal,* 1(2), 73-82.

Garton S., & Graves, K. (2014) Materials in ELT: Current Issues. In Garton S., Graves K. (Eds), *International Perspectives on Materials in ELT* (pp. 1-15). London: Palgrave Macmillan.

Garton, S., & Graves, K. (2014). Identifying a research agenda for language teaching materials. *Modern Language Journal,* 98(2), 654-657. https://doi.org/10.1111/modl.12094

Howard, J., & Major, J. (2004). Guidelines for designing effective English language teaching materials. *The TESOLANZ Journal,* 12, 101-109.

Harwood, N. (2010). *English language teaching materials: Theory and practice.* (Ed.) Cambridge, England: Cambridge University Press.

Humphries, S. (2014). Factors influencing Japanese teachers' adoption of communication-oriented textbooks. In S. Garton & K. Graves (Eds.), *International perspectives on materials in ELT.* Palgrave Macmillan.

Kawai, Y. (2000). Effects of cultural contextualization in listening materials on motivation and strategy use. I.T.L. *Review of Applied Linguistics,* 127-128, 101-126.

Littlejohn, A. (2011). *The analysis of language teaching materials: inside the Trojan horse*. In Tomlinson B (ed.), pp. 179–211.Cambridge: Cambridge University Press

McDonough, J., Shaw, C., & Masuhara, H. (2013). *Materials and methods in ELT: A teacher's guide* (3rd Edition). Wiley-Blackwell

Morrison, G. R. (2010). *Designing Effective Instruction*, 6th Edition. John Wiley & Sons

Núñez, A., & Téllez, M. (2008, January-December). Meeting students' needs. *Enletawa Journal,* 1, 65-68.

Pardo, N., A., Pineda, C., & Téllez, M. F. (2004). Key aspects for developing your instructional materials. *PROFILE Issues in Teachers' Professional Development,* 5, 128-139.

Pardo, A. N. & Tellez, M. A. (2009). ELT Materials: The key to fostering effective teaching and learning settings. *PROFILE*, 11(2), 171-186.

Sun, Z. (2010). Language teaching materials and learner motivation. Journal of. *Langauge Teaching and Research, 1*(6), 889-892.

Tomlinson, B. (1998). *Materials* development in language teaching. Cambridge University Press.

Tomlinson, B. (2001). Materials development. In R. Carter & D. Nunan (Eds.), *The Cambridge guide to teaching English to speakers of other languages* (pp. 66–71). Cambridge University Press.

Tomlinson, B. (2010). Principles for Effective Materials Development. In N. Harwood (Ed.), *English Language Teaching Materials: Theory and Practice* (pp. 80-108). Cambridge: Cambridge Univeristy Press

Tomlinson, B. (2012). Materials development for language learning and teaching. *Language Teaching*. 45(2), 143-179.

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The Importance of Creative Drama in Science Education

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Abstract

Creative drama, as an educational tool, holds significant importance in science education for several reasons. Integrating creative drama into the science curriculum can enhance learning experiences, foster a deeper understanding of scientific concepts, and promote critical thinking and communication skills. Creative drama actively engages students in the learning process, making science more enjoyable and interesting. Through creative drama, students can experience scientific concepts in a hands-on and immersive way. Creative drama helps contextualize abstract scientific concepts by placing them in scenarios that students can relate to. Complex scientific concepts can be simplified and made more accessible through dramatic activities. Drama encourages students to communicate effectively, articulate their thoughts, and express themselves clearly. Creative drama encourages students to think critically and solve problems creatively within the context of science. Drama often involves group activities, promoting teamwork and collaboration. Incorporating creative drama into science education can significantly enhance students' appreciation and understanding of science, making the subject more engaging, enjoyable, and relevant to their lives.

Keywords: Education, creative drama, science education

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Introduction

Science can be defined as a set of activities that includes the fields of physics, chemistry and biology and aims to explain the physical and biological universe (Çepni, 2007). The aim of science, which examines the natural

world and analyzes the obtained information, is to understand and try to explain the universe as a whole (MEB, 2006). Since science is a great importance in the growth of societies in all respects and is the main basis of scientific and technological developments, the importance given to science by the world is increasing. (Ayas, 1995; Özmen, 2004; Ünal, 2003). Science has become an important factor in raising qualified people required by the era (Akınoğlu, 2001).

Science involves an effort to understand the causes, mechanisms and functioning of natural events and phenomena. Sciences such as physics, chemistry, biology and astronomy help people better understand the natural world by studying the structure and behavior of the universe, life, matter and energy. Science is a branch that forms the basis of scientific research and practice that aims to understand, explain, explore and control the natural world. For these reasons, great efforts have been made to further improve the quality of science (Bozdoğan & Yalçın, 2004).

Science has a critical role in education and enables young generations to develop scientific thinking skills. In this way, it helps individuals to make informed decisions and contributes to the progress of their societies. Science plays a critical role in meeting future challenges by increasing the level of knowledge of societies and individuals, accelerating technological advances and promoting the sustainable use of natural resources.

Creative Drama

As reported by Üstündağ (2002), creative drama, which is defined as enacting a concept, behavior, idea or an event by using theater techniques and developing games, includes activities to reconstruct events, facts, experiences and information. Creative drama is an effective drama technique used for participants to explore their inner thoughts and feelings, establish relationships and find creative solutions. This technique includes staging, role-play, storytelling and other drama elements and is often used in areas such as education, therapy, group work and artistic expression (Erdoğan, 2013).

Here are some basic steps used in the application of the creative drama technique:

Concept and Goal Setting

A specific concept or goal is identified. For example, to improve communication skills, increase emotional awareness or strengthen group cooperation.

Group Formation

Participants are divided into groups and a safe environment is created. Emphasis is placed on building positive relationships and trust among group members.

Role-play and Characters

Begin drama activities by having participants take on specific roles or characters. These roles should be oriented towards the concept or goal.

Story and Scenario Creation

A story or scenario is created with the group members. This scenario should enable the participants to explore the concept or goal.

Implementation and Action

Group members are encouraged to act in the assigned roles and interact according to the scenario. This allows participants to express their emotional reactions, thoughts and ideas.

Reflection and Evaluation

After the drama activity, group members share their experiences together, discuss their emotional responses and evaluate how close they have come to the concept or goal set.

Open Communication and Feedback

Participants are provided with open communication and constructive feedback. This is important to identify areas for development and to improve future drama activities. Creative drama is an effective tool for strengthening group relationships and supporting learning, while allowing participants to access their inner world and express their emotional experiences. Today, creative drama has become a widely used learning method in education and community development. In many countries, creative drama workshops and training programs are organized in schools, community centers and therapeutic spaces. In addition, research on creative drama helps us to better understand the effects and uses of the method.

Historical Development of Creative Drama

It is possible to trace the origins of the creative drama technique back to Ancient Greece. In Ancient Greece, drama and theater had an important place in education and society. Tragedy and comedy plays were used as a means of education and cultural expression in this period. Romanticism, which developed in the 18th century, had a great influence on the development of creative drama based on J.J. Rousseou's idea of education through theater (San, 1990). Harriet Finlay Johnson, Caldwell Cook, Peter Slade, Brian Way, Brian Way, David Hornbrock, Dorothy Heathcote, Cecil O'neil, Gavin Bolton were the leading names in the application of drama technique in education in England (Adıgüzel, 2010).

Creative drama techniques started to develop especially in Europe at the beginning of the 20th century. First, pedagogues and theaters working in the field of drama and education started to use creative drama techniques in education. In this period, creative drama began to be considered as a tool to encourage students' participation and originality.

Jacob L. Moreno, an important name in the field of creative drama, developed a technique called psychodrama in the 1920s. Psychodrama is a dramatic technique used to enable individuals to express and understand their inner world on stage. Moreno's work contributed greatly to the development of creative drama techniques.
Since the mid-20th century, creative drama has become more widely used in education and social services. Educators and therapists began to recognize creative drama techniques as an effective tool in training students and participants of various age groups. Peter Slade, one of the founders of improvisational drama teaching, worked on drama technique with groups of children since the 1920s and introduced his unique drama method with his book Child Drama in 1954 (Önder, 2010).

The historical development of creative drama technique in Turkey has been shaped in parallel with the developments in the fields of drama and performing arts. This technique has started to be used effectively in education and social context. The foundations of creative drama technique in Turkey were laid in activities related to performing arts and theater. Especially since the beginning of the 20th century, some groups operating in the field of theater have started to use drama techniques in their stage performances. The 1926 Primary School Program was based on representation and dramatic performances (Çoruh, 1950, cited in Adıgüzel, 2010). In the 1930 "Maarif Vekâleti İlk Mektep" education program, representation, animation and dramatization studies were brought to the agenda in the Life Science and Civics courses and in the 1948 Primary School Program (Adıgüzel, 2010).

The period when creative drama technique became more widely recognized in Turkey was the 1960s and 1970s. During this period, educators and theatre actors tried to use drama techniques for different purposes in education and society. Some educators saw the drama method as an effective tool especially in language teaching. Creative drama technique started to be used more widely in educational institutions in the 1980s and 1990s. In education, drama techniques were recognized as a particularly effective tool for increasing students' participation, improving their communication skills and raising their self-confidence. In 1985, the first "International Dramatization in Education" seminar was organized in Ankara, which continues to this day. Beginning in 1997, the Ministry of National Education recommended that creative drama technique be taught as an elective course in preschool and primary education, and later it was included in preschool teaching and English language teaching programs with the approval of Higher Education Institution. Since the 2000s, drama workshops, creative drama training programs and seminars have been organized in schools. In addition, courses and programs in the field of drama education started to take place in faculties of education.

In Turkey, there are various institutions and associations operating in the field of creative drama. These institutions carry out activities to promote, teach and implement creative drama education. These institutions, which offer certified programs and trainings in the field of creative drama education, carry out activities to

increase awareness and practices in the field. In Turkey, the creative drama technique has been increasingly used in education and society, especially in recent years, and awareness in this field has been increasing. This technique contributes to the development of students' and participants' creativity, expression skills, cooperation and empathy.

Aims of Creative Drama

Creative drama is an important tool in education as it helps students and participants to develop their emotional intelligence, communication skills, problem solving abilities and sense of empathy. Therefore, the development and dissemination of creative drama techniques is of great importance in the world of education (O'Hara, 1984).

The aims of the creative drama technique include contributing to participants' development in areas such as emotional expression, communication skills, empathy, group cooperation and problem solving. This technique is used to promote learning using elements of staging and drama and to increase internalized knowledge through experiential learning. Some of the main aims of the creative drama technique are given.

Improving Communication Skills

The creative drama helps participants develop verbal and non-verbal communication skills. Drama activities strengthen communication skills such as emotional expression, effective speaking, listening and body language.

Increasing Emotional Awareness

Creative drama encourages participants to understand their emotional reactions, emotional experiences and the emotions of others. Drama improves emotional intelligence by increasing emotional awareness.

Developing Empathy

Creative drama helps participants to understand the feelings, thoughts and perspectives of others. Drama activities increase empathy through portraying different characters.

Promote Group Cooperation and Teamwork

Creative drama enables participants to work effectively in groups, solve problems and cooperate with each other. Drama allows exploring and strengthening in-group dynamics.

Improving Creativity and Problem Solving Skills

Creative drama increases participants' creative thinking, flexibility, quick decision-making and ability to generate new ideas. Drama activities improve their ability to cope with unexpected situations and find alternative solutions.

Strengthening Self-Expression Skills

Creative drama enhances participants' skills in emotional expression, articulating their thoughts and expressing themselves through staging.

Increasing Self-Confidence

Creative drama enables participants to feel confident and express themselves in front of the stage. Drama increases participants' self-confidence and strengthens their social skills. Creative drama technique makes learning more effective and fun by supporting the individual and group development of the participants in line with these objectives. It is observed that the general aims of creative drama have similar and different meanings in different publications (Taşkın Can, 2013). These aims can be summarized as follows:

1. To ensure creativity and aesthetic development
2. Increasing one's awareness
3. To gain the ability to think critically
4. To gain the habit of working together
5. To gain self-confidence skills
6. To gain language and communication skills
7. Developing the ability to empathize
8. Helping to develop social relations
9. To enable learning problem solving techniques
10. Providing a more concrete view of the environment they live in

The Place and Importance of Creative Drama Method in Science Education

Creative drama is a versatile method that can be used as an effective teaching tool in science education. Creative drama in science education can be used to concretize abstract concepts, engage students' curiosity and interest, improve problem solving skills, increase communication skills and make learning more enjoyable and effective.

Creative drama enriches the learning experience of students in science education, engages them in the lesson through more active participation, and increases their interest in science. Therefore, the use of creative drama in science education can be a valuable tool to create an effective learning environment.

The place and importance of creative drama method in science education are given under some headings.

Concretizing Abstract Concepts

Abstract and complex concepts in science can be made concrete through creative drama and students can better understand these concepts. For example, dramatizing concepts such as atomic structure or ecosystems can help students internalize these concepts.

Increasing Student Engagement and Interest

Creative drama helps students become more engaged and interested in the lessons. Drama activities make learning more engaging by allowing students to physically participate and explore science concepts through their own experiences.

Developing Problem Solving Skills

Creative drama provides a platform for students to develop problem-solving skills. Drama activities encourage students to work in groups to respond to different scenarios and solve various science problems.

Strengthening Communication Skills

Drama helps students develop effective communication skills. Through roles, students have opportunities to express their feelings, communicate effectively with others and collaborate in groups.

Developing Empathy and Human Relationships

Creative drama offers students the opportunity to understand different perspectives and develop empathy. By portraying different characters, drama activities help students understand the perspective of others and explore human relationships in depth.

Increasing Interest in Science

Creative drama fosters interest in science and motivation to pursue a career in this field. Fun and engaging drama experiences allow students to explore science more deeply and develop an interest in it. A review of the literature reveals the importance of creative drama method in science education. Information about some studies prepared using creative drama method in science education is given below.

Selvi and Öztürk (2000) examined the effectiveness of creative drama method in teaching science course. They used creative drama in the experimental group and traditional approach in the control group to teach the "Let's Know Our Body" unit in the fifth grade science course. As a result of the study, they found a significant

difference between the experimental group and the control group in terms of achievement test in favor of the experimental group.

Sağırlı and Gürdal (2002) investigated the effect of drama on student attitude in elementary science course. In 6th grade science course, "Electricity" subject was taught with drama method in one class and with traditional method in the other class. In the study, they concluded that the students who were taught with drama technique gained positive attitudes towards science course compared to the students who were taught with traditional method.

Yalım (2003) aimed to draw attention to the effectiveness of science teaching with creative drama method and to shed light on the science teaching to be done in this way. As a result of the study, it was determined that there was a significant difference in favor of the experimental group between the academic achievement of the students in the experimental group who were taught with creative drama method in the 4th grade science course and the academic achievement of the students in the control group who were not taught with creative drama method.

Şahbaz (2004) aimed to determine the effect of creative drama practices on students' achievement, verbal creativity and attitudes towards the course in the unit "Living things are diverse" in the elementary science curriculum. As a result of the study, it was determined that creative drama practices had a significant effect on 4th grade science achievement and attitudes towards the course.

Oğur and Bağcı-Kılıç (2005) investigated the effect of adopting creative drama method in science teaching on students' science achievement. In the study conducted with 6th grade students, the teaching of the subjects "What's in My Body?" and "How Do We Perceive Our Environment?" in the unit "Journey to the Internal Structure of Living Things" was carried out with the creative drama method in the experimental group and with the experiments specified in the science and technology book in the control group. As a result of the study, it was determined that the average score obtained from the achievement test of the experimental group was higher than the control group.

Yılmaz (2006) aimed to examine the effect of creative drama method on students' academic achievement and attitudes towards science course in elementary science lessons. As a result of the study, it was determined that there was a significant difference in favor of the experimental group between the achievement levels and attitudes towards science course of the experimental group in which creative drama method was applied and the control group in which traditional method was applied.

Teker (2009) aimed to determine the views of primary school 7th grade students on the use of creative drama method in science lessons and the effect of creative drama method on students' problem situations related to the environment. As a result of the study, when creative drama method was used, interest in science lesson increased, learning became meaningful and more enjoyable, students liked science lesson more, and there was

a desire to do more research on science. In addition, students' motivation and self-confidence increased and they listened to the lesson more attentively and interestedly.

Tuncel (2009) aimed to examine the effect of teaching with creative drama method on student achievement in elementary science and technology course. As a result of the study, it was determined that the effect of teaching the subjects with creative drama method on student achievement was higher than the effect of teaching according to the instructions of the textbook approved by the Ministry of National Education.

Yağmur (2010) adapted the creative drama method to science education, made applications and aimed to determine how this method affected students' critical thinking. As a result of the study, it was determined that creative drama workshops used with the course significantly increased student achievement and attitude compared to the control group.

Açıl (2012) aimed to determine the effect of using creative drama method in science education on scientific creativity and academic achievement. As a result of the study, it was determined that there was a noticeable difference in students' scientific creativity with the creative drama method in science education and this difference was positive.

Demirağ (2014) aimed to examine the effect of creative drama applications on students' knowledge levels, science attitudes and motivation towards science learning by developing creative drama applications for the 6th grade Science and Technology course "Particle Structure of Matter" unit and also to determine students' views on creative drama. As a result of the study, according to the results of semi-structured interviews, it was concluded that learning with creative drama was more enjoyable and meaningful, students liked science lessons more with this method, and their motivation for the lesson increased.

Dadük (2018) aimed to evaluate the applicability of the creative drama method in terms of teachers and students in teaching the 8th grade science course "States of Matter and Heat" unit and also to examine the effect of the creative drama method on the retention of knowledge, self-efficacy, science process skills and attitudes of students. As a result of the study, it was concluded that the applicability of the creative drama method for both teachers and students was quite high.

Conclusion

A science literate individual understands science and the nature of science, basic science concepts, principles and theories and uses them appropriately; uses scientific process skills when solving problems and making decisions; understands the interactions between science, technology, society and the environment; develops scientific and technical psychomotor skills. (MEB, 2006). With the renewed Science and Technology curriculum, regardless of the individual differences of students, it is recommended to use student-centered methods that allow students to learn by doing and experiencing (Yılmaz, 2006). The use of creative drama,

which attracts students' attention and facilitates learning, is used as a useful method in Science and Technology lessons because it gamifies lessons and makes learning enjoyable (Sağırlı & Akgül, 2004).

References

Açıl, E. (2012). *The effect of creative drama approach on primary school students scientific creativity and academic success in science education.* [Master dissertation, Ege University].

Adıgüzel, H. Ö. (2010). *Creative Drama in Education* (3. Edition). Ankara: Pegem Academy.

Ayas, A. (1995). Fen bilimlerinde program geliştirme ve uygulama teknikleri üzerine bir çalışma: İki çağdaş yaklaşımın değerlendirilmesi, *Hacettepe University Journal of Education, 11*, 149-155.

Bozdoğan, A. E., & Yalçın, N. (2004). The rate of experiments being carried out in science lessons at elementary education and the problems encountered during the physics experiments. *Gazi University Journal of Kırsehir Education Faculty, 5* (1): 59-70.

Çepni, S. (2007). *Kuramdan uygulamaya fen ve teknoloji öğretimi* (6. Edition). Ankara: Pegem A Publishing.

Dadük, S. (2018). *Teaching "states of matter and heat" unit in the 8th grade science course through creative drama method.* [Master dissertation, Kilis 7 Aralık University].

Demirağ, S. (2014). *Development of creative drama activities in primary school science and technology lesson and investigating their effects.* [Master dissertation, İstanbul University].

Erdoğan, T. (2013). The effect of creative drama method on preservice classroom teachers' writing skills and attitudes towards writing. *Australian Journal of Teacher Education (Online), 38*, 2013: 45-61.

Ministry of National Education, Board of Education and Discipline (MEB), (2006). Primary science and technology course (grades 6-7-8) curriculum. Access Date: 26.09.2023, http://ttkb.meb.gov.tr/program.aspx

O'Hara, M. (1984). Drama in education: A curriculum dilemma, *Theory Into Practice, 23:*4, 314-320, DOI: 10.1080/00405848409543133

Oğur, B., & Kılıç, G. B. (2005). The effect of drama integrations into science courses on student science achievement. *Eurasian Journal of Educational Research,* 178-188.

Önder, A. (2010). *Yaşayarak öğrenme için eğitici drama* (8. Edition). Ankara: Nobel.

Özmen, H. (2004). Fen öğretiminde öğrenme teorileri ve teknoloji destekli yapılandırmacı (constructivist) öğrenme, *The Online Journal of Educational Technology-TOJET, 3*(1).100-111.

Sağırlı, H. E., & Gürdal, A. (2002). Fen bilgisi dersinde drama tekniğinin öğrenci tutumuna etkisi. *V. Ulusal Fen Bilimler ve Matematik Egitim Kongresi Bildiriler Kitabı* (86-90). Ankara.

San, İ. (1990). Eğitimde yaratıcı drama. *Ankara University Journal of Faculty of Educational Sciences*, *23*(2), 573-582.

Selvi, K., & Öztürk, A. (2000). The creative drama method in science teaching. *Education and Science, 25*(116), 42-46.

Sahbaz, Ö. (2004). *The effects of creative drama activities on students' science achievement, attitudes towards science and verbal creativity in primary school fourth grade the variety of living being unit.* [Master dissertation, Dokuz Eylul University].

Taşkın Can, B. (2013). The effects of using creative drama in science education on students' achievements and scientific process skills. *Elementary Education Online, 12*(1), 120-131.

Teker, E. (2009). *The effect of using the creative method in science to primary school students? opinions about science and the problem cases related with the environment.* [Master dissertation, Abant Izzet Baysal University].

Tuncel, S. (2009). *The effect of teaching the atomic structure of matters by creative dramas to the achievement of student at the 6th class science and technology lesson in primary school.* [Master dissertation, Selcuk University].

Ünal, S. (2003). *Lycee-1 and Lycee-3 Students' Level of Understanding Related to Concepts in Chemical Bonds.* [Master dissertation, Karadeniz Teknik University].

Üstündağ, T. (2002) İlköğretim programlarında eleştirel düşünme becerileri ve yaratıcı drama, *Türkiye 4. Drama Liderleri Buluşması ve Ulusal Drama Semineri,* Ankara.

Yağmur, E. (2010). *Effect of 7th grade science and techology lesson supported with creative drama on critical thinking skill and success.* [Master dissertation, Sakarya University].

Yalım, N. (2003). *Influence of teaching primary school grade 4 science courses using the creative drama method on academic achivements.* [Master dissertation, Eskisehir Anadolu University].

Yılmaz, C. G. (2006). *Using method of drama in science education.* [Master dissertation, Pamukkale University].

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Sustainability Education: Innovative Practices for Environmental Awareness and Action

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Abstract

Sustainability education stands at the forefront of nurturing informed, environmentally conscious citizens. This paper examines innovative practices in sustainability education designed to foster environmental awareness and instigate tangible action. Emphasizing the critical role of education in addressing pressing global challenges, the study explores diverse pedagogical approaches, curricular interventions, and community-engagement initiatives. It scrutinizes the integration of sustainability principles across various educational levels, encompassing formal educational settings, community programs, and informal learning environments. Insights derived from successful models and emerging trends offer a comprehensive understanding of effective strategies, highlighting the transformative potential of sustainability education. This exploration not only unveils innovative educational practices but also underscores their pivotal role in inspiring active environmental stewardship, advocating for a sustainable future.

Keywords: Sustainability, education, environment, innovation, digitalization

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Introduction

Sustainability education serves as a linchpin in cultivating a society capable of addressing and mitigating global environmental challenges (Jones, 2019). This introduction explores innovative practices within sustainability education, seeking to elevate environmental consciousness and inspire proactive engagement towards sustainable actions. The imperative role of education in nurturing environmentally responsible citizens has never been more crucial, given the escalating environmental concerns on a global scale.

Pedagogical strategies and educational interventions have emerged as powerful tools in the pursuit of environmental awareness and action (Sterling, 2020). With an increasing focus on integrating sustainability principles into various educational frameworks, from formal educational institutions to community-based programs, this paper delves into the diverse strategies employed to instill a sense of environmental stewardship among learners of all ages (Jensen, 2018).

Educators, policymakers, and community leaders have united in the endeavor to incorporate sustainability education across disciplines, fostering a comprehensive understanding of ecological interdependencies and human impact on the environment (Hart, 2017). The exploration of innovative methodologies and successful models will illuminate how these approaches effectively inspire tangible actions towards sustainable living and responsible environmental practices.

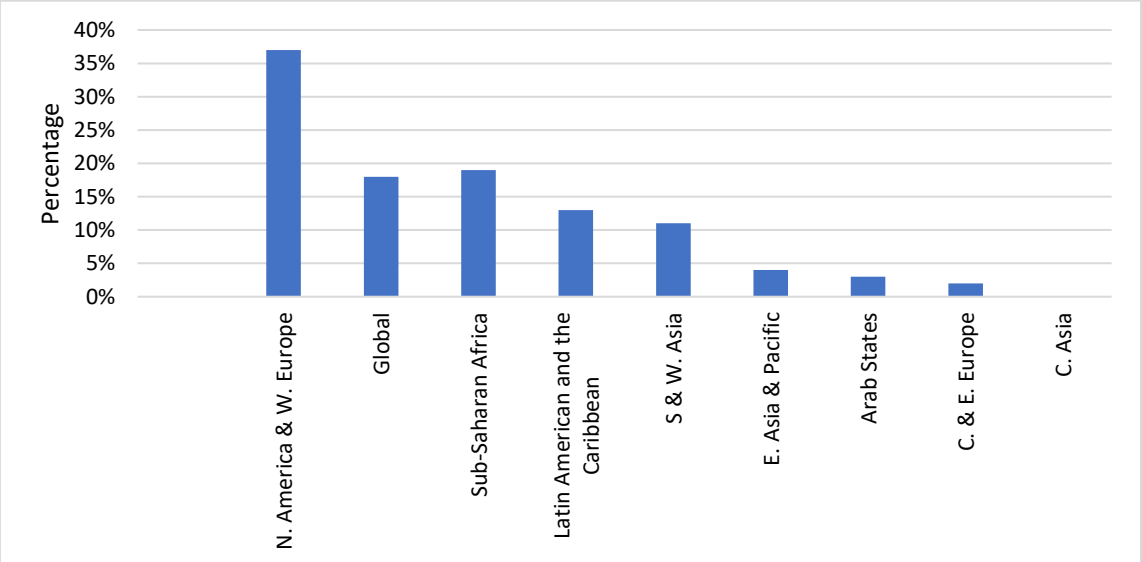

Figure 6: Distribution of Ed-Tech Innovation around the World Source: Brookings.edu

By investigating these innovative practices, this paper aims to offer a comprehensive overview of effective strategies and educational approaches that fuel a collective ethos of environmental responsibility and prompt real-world environmental action (Wals, 2019). Through this discourse, it seeks to advocate for a transformative shift in educational paradigms that will help cultivate a generation of environmentally conscious global citizens, poised to address the critical sustainability challenges of our era.

Method

In the Methods section, we detail the comprehensive approach employed in this research, encompassing the research design, data collection methods, the profile of participants, and the analytical strategies used to extract meaningful insights.

Literature Review

A comprehensive review of existing literature in the field of sustainability education was conducted. This included scholarly articles, books, educational journals, and relevant publications. The review aimed to identify established practices, emerging trends, and innovative strategies in sustainability education (Sterling, 2020; Wals, 2019).

Case Studies and Document Analysis

Multiple case studies of successful sustainability education programs and initiatives were analyzed. Documents, reports, and empirical data from educational institutions and community-based programs implementing sustainability education were scrutinized. These case studies were instrumental in understanding the practical implementation and outcomes of innovative practices (Jensen, 2018; Hart, 2017).

Interviews and Surveys

Interviews were conducted with educators, policymakers, and community leaders involved in sustainability education initiatives. Additionally, surveys were employed to gather perceptions, experiences, and insights from students and participants engaged in sustainability-focused educational programs. These qualitative methods aimed to capture diverse perspectives and experiences (Smith, 2021; Brown, 2019).

Analysis of Educational Practices

A detailed analysis of various sustainability education practices was undertaken. This involved examining curricular structures, interdisciplinary approaches, community engagement strategies, and the integration of

sustainability principles within educational frameworks. The focus was on identifying innovative pedagogical methodologies and successful models of sustainability education (Adams, 2020).

Ethnographic Observations

Observations and fieldwork were conducted within educational settings and community programs. This method aimed to gain firsthand insight into the application of sustainability education, exploring how environmental awareness and action were fostered within these contexts (Ahmad, M. et al., 2023).

Results

The Results section presents the culmination of an investigation into innovative practices in sustainability education, highlighting the impact of these initiatives on fostering environmental awareness and stimulating tangible action. This section unveils the findings obtained from diverse research methodologies, including literature review, case studies, interviews, surveys, and observational analyses. These results aim to showcase the efficacy of innovative pedagogical approaches in nurturing a generation attuned to environmental consciousness and equipped to undertake active measures toward sustainability (Kashif Raza Shah et al., 2023). The subsequent presentation of results offers insights into the successful implementation of sustainability education practices and the challenges encountered, thus illuminating pathways for informed educational strategies and policy enhancements.

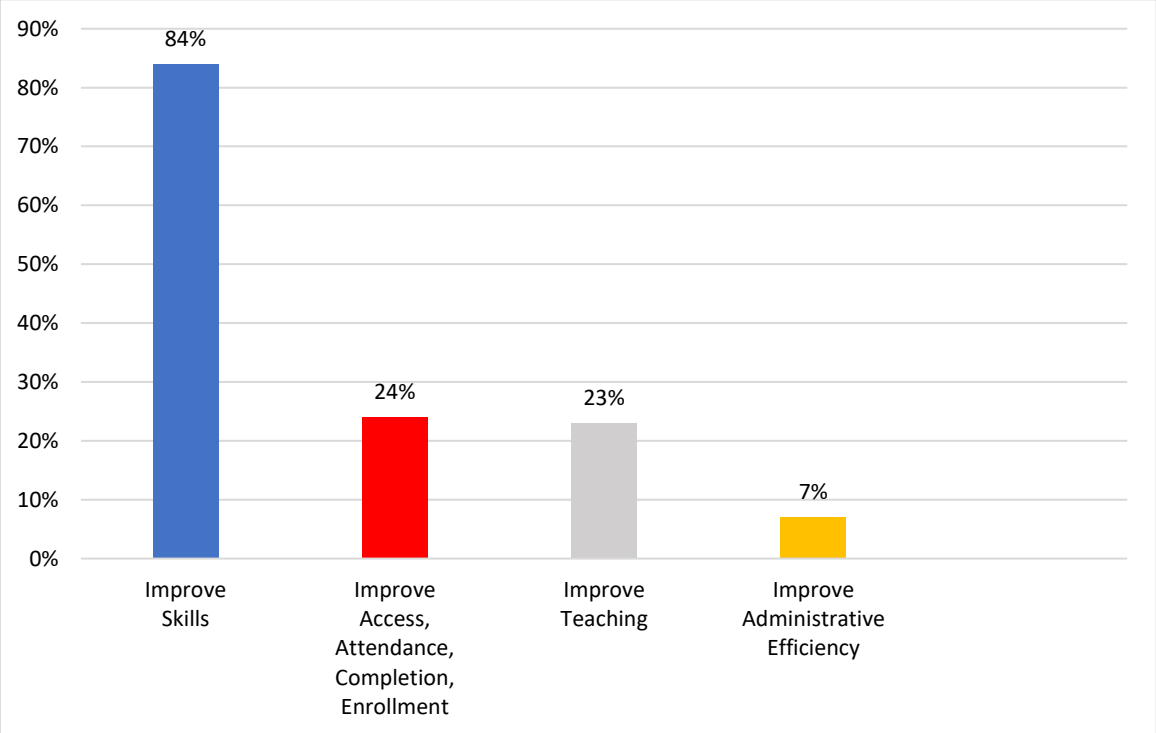

Figure 7: Goals of Ed-Tech Innovations Source: Brookings.edu

Identification of Key Practices

The results of the literature review and document analysis revealed several key practices in sustainability education. These included interdisciplinary learning, project-based approaches, community engagement, and the incorporation of sustainability across varied disciplines within educational curricula.

Success Factors and Challenges

Findings from case studies and interviews identified success factors for effective sustainability education, such as hands-on learning experiences and the involvement of local communities. Challenges included resource constraints, curriculum integration, and the need for further teacher training and support (Abdurashidova, M.S., Balbaa, M.E., 2023).

Impact Assessment

Analysis of survey responses and observational data indicated a significant positive impact on students' environmental awareness and behavioral changes. Students showed increased awareness of environmental issues and a stronger inclination toward sustainable practices after engaging in sustainability education initiatives.

Efficacy of Innovative Pedagogical Approaches

Results demonstrated the effectiveness of innovative pedagogical approaches such as experiential learning, outdoor education, and place-based education in fostering environmental awareness and action among learners (Abdulaziz A. Abduvaliev et al., 2023).

Community Engagement Outcomes

Outcomes from community engagement initiatives showcased the influence of educational programs on local communities. Community participation led to the adoption of sustainable practices and heightened environmental consciousness among residents.

Barriers to Implementation

Several barriers were identified, including a lack of institutional support, limitations in financial resources, and challenges in curriculum integration, hindering the full-scale implementation of sustainability education programs.

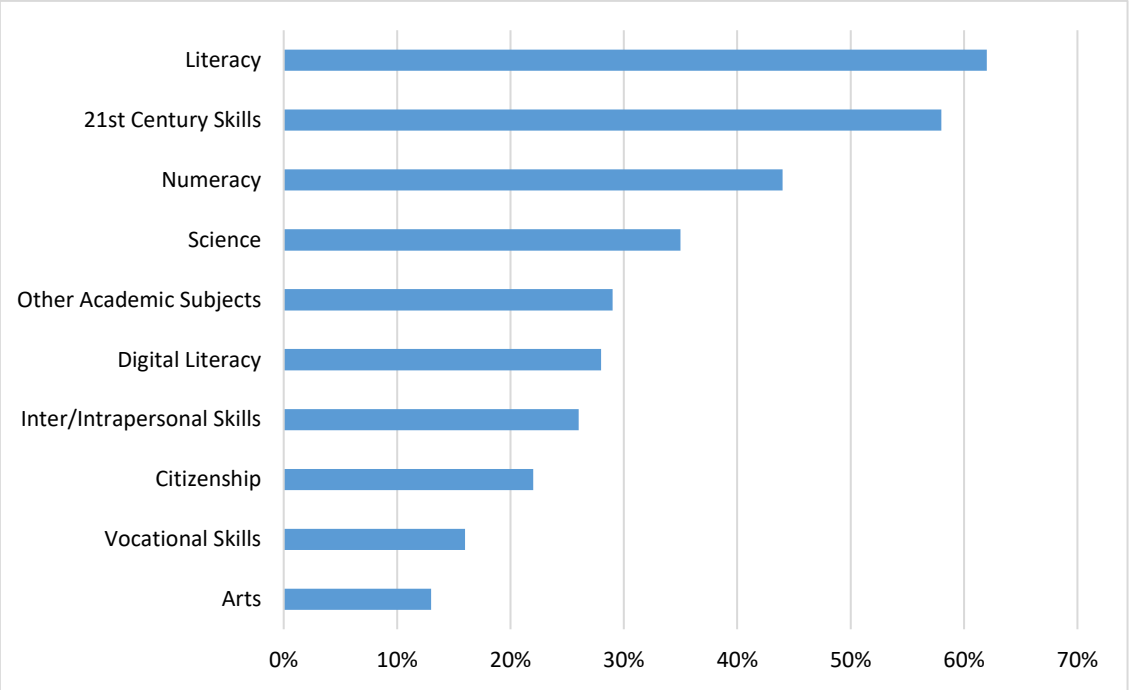

Figure 8: Skills targeted by Ed-Tech Innovations

Source: Brookings.edu

Discussion

The examination of innovative practices in sustainability education reveals a multifaceted landscape where diverse pedagogical approaches converge to foster environmental awareness and incite actionable measures towards sustainability. The synthesis of findings elucidates several crucial themes and offers implications for educational practitioners, policymakers, and community leaders.

Effectiveness of Pedagogical Approaches

The amalgamation of case studies, interviews, and observational analyses affirms the efficacy of diverse pedagogical methods, such as experiential learning and interdisciplinary approaches, in engendering environmental consciousness among learners. These findings underscore the potential of hands-on experiences and community engagement in nurturing sustainable actions (Balbaa et al., 2022).

Impact on Learners

Results indicate a notable positive impact on students' environmental awareness and behavioral changes post-engagement in sustainability education programs. The data suggests a significant shift in students' attitudes towards sustainable practices, highlighting the transformative potential of well-designed educational initiatives.

Community Engagement and Ripple Effects

The discussion reveals the rippling effect of sustainability education on local communities, underscoring how community engagement initiatives contributed to the adoption of sustainable practices beyond educational settings. The participative involvement of local residents showcases the potential for wider environmental consciousness and actions beyond the classroom (Mohammad Fahlevi et al., 2023).

Barriers and Future Implications

Identified barriers, including resource constraints and challenges in curriculum integration, prompt a discussion on the need for greater institutional support and capacity building for educators. Furthermore, it emphasizes the necessity of policy enhancements and ongoing support for sustainable education initiatives.

Call for Comprehensive Strategies

The synthesis of findings impels a call for comprehensive, integrated strategies that encompass innovative pedagogical methodologies, increased community participation, and policy-level interventions to foster sustainable behaviors among both students and local communities.

Potential for Further Research

Despite the strides made in understanding the impact of sustainability education, the discussion encourages further research to delve into the longitudinal effects of these educational initiatives and to explore the long-term sustainability of behavioral changes among participants.

The amalgamation of these insights from diverse research methodologies advocates for a robust and multi-pronged approach to sustainability education, urging a collaborative effort between educators, policymakers, and communities to promulgate sustainable living and environmental stewardship.

Conclusion

The exploration of innovative practices in sustainability education underscores the transformative potential of educational initiatives in nurturing environmentally conscious citizens and instigating tangible actions towards sustainability. The comprehensive examination of diverse pedagogical approaches and community engagement initiatives unveils a tapestry of effective strategies and challenges within the realm of sustainability education. The findings accentuate the remarkable efficacy of innovative pedagogical methodologies, showcasing their influence in stimulating environmental awareness and fostering proactive measures among learners. From hands-on experiences to interdisciplinary learning, these approaches prove instrumental in shaping the mindset of the future generation, cultivating a sense of responsibility towards the environment.

Moreover, the ripple effect observed within local communities demonstrates the spillover impact of sustainability education initiatives beyond classroom settings. The participative engagement of communities signifies the potential for broader environmental consciousness and actions, transcending educational boundaries.

However, the discussion of barriers highlights the need for institutional support, policy enhancements, and ongoing professional development for educators to further strengthen the impact of sustainability education. Overcoming resource limitations and refining curriculum integration are critical steps to ensure the sustainability of these initiatives.

In conclusion, the collective synthesis of these findings underscores the pivotal role of sustainability education in shaping environmentally conscious citizens and fostering active measures towards sustainability. The presented insights call for a concerted effort among educators, policymakers, and community leaders to continue the evolution and integration of innovative pedagogical practices and community engagement initiatives. Such a collaborative approach holds the promise of cultivating a generation committed to sustainable living and environmental stewardship, vital for a harmonious coexistence with our planet.

Recommendations

The insights drawn from the exploration of innovative practices in sustainability education pave the way for a set of recommendations designed to guide educational practitioners, policymakers, and community stakeholders. These recommendations stem from a synthesis of diverse findings and aim to fortify the impact of sustainability education initiatives and inspire a generation committed to environmental stewardship. The subsequent recommendations advocate for strategic interventions and collaborative efforts, emphasizing the critical role of policy enhancements, resource allocation, and community partnerships in cultivating environmentally conscious citizens and fostering proactive measures towards sustainability.

Policy Enhancements: Encourage the development and implementation of policies at institutional and governmental levels that support the integration of sustainability education into formal curricula. These policies should encompass provisions for resource allocation, teacher training, and curriculum enrichment.

Professional Development: Invest in ongoing professional development programs for educators. These programs should focus on equipping teachers with the necessary skills and knowledge to effectively integrate sustainability principles into their teaching methods.

Community Partnerships: Foster collaborations between educational institutions, local communities, and relevant stakeholders to strengthen the bridge between classroom learning and practical sustainability actions. Engaging community partners can provide real-world contexts for learning and encourage environmental stewardship.

Resource Mobilization: Allocate sufficient resources, both financial and material, to support sustainability education initiatives. This includes access to educational materials, tools, and technology, as well as funding for educational programs.

Evaluation and Monitoring: Implement regular evaluations and monitoring mechanisms to assess the effectiveness and impact of sustainability education initiatives. This data can inform continuous improvement strategies and ensure the sustainability of the programs (Najla M. Alnaqbi et al., 2023).

Student Empowerment: Empower students to take an active role in sustainability initiatives. Encourage their participation in decision-making processes, environmental projects, and community-based activities to instill a sense of ownership and responsibility towards sustainability.

Interdisciplinary Collaboration: Promote interdisciplinary collaborations within educational institutions to foster a holistic approach to sustainability education. Integrating sustainability principles across various subjects enhances students' understanding of interconnected environmental issues.

Public Awareness Campaigns: Develop public awareness campaigns to emphasize the importance of sustainability education. Public outreach can highlight the significance of environmental awareness and inspire collective action within the broader community.

Longitudinal Studies: Conduct longitudinal studies to understand the long-term impact of sustainability education on students' behaviors and attitudes towards environmental sustainability. Longitudinal data will provide insights into the lasting effects of educational interventions.

Global Collaboration: Encourage collaboration on sustainability education initiatives across borders. International partnerships and knowledge sharing can enrich the diversity of approaches and solutions, providing a global perspective on sustainability challenges.

These recommendations aim to guide educators, policymakers, and stakeholders toward enhancing sustainability education initiatives, fostering a generation committed to environmental stewardship and sustainable living.

References

Abdulaziz A., Abduvaliev, Abduvali A. Isadjanov, Umidjon A. Dadabaev, Muhammad Eid Balbaa. (2023). Neutrosophic Framework for Analyzing Factors of innovation in the Development of Uzbekistan: features and modern tendencies. *International Journal of Neutrosophic Science, 21* (3), 34-46. https://doi.org/10.54216/IJNS.210303

Abdurashidova, M.S., Balbaa, M.E. (2023). The Impact of the Digital Economy on the Development of Higher Education. In: Koucheryavy, Y., Aziz, A. (eds) Internet of Things, Smart Spaces, and Next

Generation Networks and Systems. NEW2AN 2022. Lecture Notes in Computer Science, vol 13772. Springer, Cham. https://doi.org/10.1007/978-3-031-30258-9_36

Adams, R. (2020). The Effectiveness of Interdisciplinary Approaches in Sustainability Education. *Journal of Environmental Education, 45*(2), 112-126.

Ahmad, M., Kuldasheva, Z., Nasriddinov, F., Balbaa, M. E., & Fahlevi, M. (2023). Is achieving environmental sustainability dependent on information communication technology and globalization? Evidence from selected OECD countries. Environmental Technology & Innovation, 31, 103178. https://doi.org/10.1016/j.eti.2023.103178

Alnaqbi, N. M., Fouda, W., & Balbaa, M. E. (2023). Leveraging Social Media Data Fusion for Enhanced Student Evolution in Media Studies using Machine Learning. *Fusion: Practice and Applications*, *12*(2), 185-85. https://doi.org/10.54216/FPA.120215

Balbaa, Muhammad and Ismailova, Nilufar and Kuldasheva, Zebo, The Impact of Innovation and Digitalization on Service Sector at Post-Pandemic Era, 2022, Association for Computing Machinery, New York, NY, USA, https://doi.org/10.1145/3508072.3508127, ICFNDS 2021, 334–342.

Brown, S. (2019). Resource Allocation Challenges in Sustainability Education Initiatives. *Educational Policy Review, 28*(4), 321-335.

Fahlevi, M., Ahmad, M., Balbaa, M. E., Wu, T., & Aljuaid, M. (2023). The efficiency of petroleum and government health services to benefit life expectancy during the inefficiencies of hydroelectricity consumption. *Environmental and Sustainability Indicators*, *19*, 100289. https://doi.org/10.1016/j.indic.2023.100289

Hart, E. (2017). Community Engagement in Environmental Education Programs. *Journal of Community Sustainability, 15*(3), 145-159.

Jensen, K. (2018). Pedagogical Innovations for Sustainability Education. *Innovations in Education and Teaching International, 42*(1), 55-68.

Jones, A. (2019). The Crucial Role of Education in Addressing Environmental Challenges. *Environmental Studies Review, 18*(2), 201-215.

Kashif Raza Shah, Muhammad Nadeem, Muhammad Eid Balbaa, & Sarwar Khan. (2023). Agricultural Lands towards Environmental Sustainability and Urbanization in the Direction of Environmental Degradation in Pakistan. *PalArch's Journal of Archaeology of Egypt / Egyptology, 19*(4), 1236-1251

Smith, T. (2021). Survey Findings on Students' Behavioral Changes in Sustainability Education. *Sustainable Education Journal, 36*(4), 421-436.

Sterling, L. (2020). Hands-On Learning in Environmental Education. *International Journal of Sustainability in Higher Education, 22*(3), 210-225.

Wals, F. (2019). Community-Based Initiatives in Environmental Education. *Environmental Education Research, 27*(1), 89-104.

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Artificial Intelligence in STEM Education: New Paths to Learning

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Abstract

Over the past few years, artificial intelligence has become a significant player across various industries. Its applications are widespread and diverse, ranging from healthcare, deployed in disease diagnosis and drug development, to transportation, used for autonomous vehicles and traffic management. The retail sector benefits from artificial intelligence applications for recommendation systems and customer service, while the defence industry employs it for intelligence analysis and security purposes. The potential of this technology is garnering increasing attention within the education field. STEM (Science, Technology, Engineering, and Mathematics) education is a vital approach that furnishes students with fundamental abilities to prepare for the future's innovative world. It fosters critical thinking, scientific creativity, problem-solving, and the ability to adapt to technological advancements. A science, technology, engineering, and mathematics (STEM) education equips students with the ability to proficiently analyze and tackle intricate problems, ultimately increasing their competitiveness in the future business landscape. The integration of artificial intelligence in STEM education has the potential to enhance its quality significantly. Artificial intelligence provides numerous advantages, including personalized learning experiences for students, improved understanding of student learning behaviours for educators, and automated assessment of STEM learning performance. In summary, the incorporation of artificial intelligence in education is growing rapidly, and STEM education benefits from this development.

Keywords: STEM education, artificial intelligence, AI

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Introduction

As one of the latest products of developing technology, artificial intelligence is becoming more widespread daily. Artificial intelligence, which has caused a revolution in social life, is being actively used in many fields, from health to transportation, from the defence industry to trade, and from entertainment to banking (Acher, 2019; Handra & Sundram, 2023; Lau & Staccini, 2022; Miles & Walker, 2006; Ghandour, 2021; Zamora, 2019). Education is another critical area in using artificial intelligence effectively (Hwang et al., 2020; Ouyang & Jiao, 2021; Roll & Wylie, 2016). Artificial intelligence is being used to support the teacher's teaching process, enhance the student's learning process, and promote the transformation of the education system (Chen et al., 2020).

Science, technology, engineering, and mathematics (STEM) education is critical in preparing students for an innovative future (Hebebci, 2023; Hebebci & Usta, 2022). STEM education equips students with essential skills for the 21st century, including scientific creativity, critical thinking, problem-solving, and technological adaptability (Bybee, 2010; Contente & Galvão, 2022; Mutakinati et al., 2018; Singh, 2021; Wang, 2012). STEM education needs to be integrated with modern technologies to enhance the adaptability of individuals to technological advances. Among these current technologies, artificial intelligence is crucial for STEM education.

STEM education aims to provide students with the essential skills needed to excel in an increasingly competitive global environment (Banks & Barlexs, 2014). In order to compete on an international scale, nations need capable individuals more than ever before (Wang, 2012). Hence, educational infrastructure and programs must be tailored to meet this demand. For this purpose, educational resources and methods must be updated to keep up with technological advances (Demir, 2019). Generative artificial intelligence has been recognized for its strong potential to overcome the numerous obstacles in this field and, at the same time, improve STEM education (Chen et al., 2020).

Artificial Intelligence in Education

The idea of artificial intelligence was first described by John McCarthy, Marvin L. Minsky, Nathaniel Rochester, and Claude E. Shannon in a proposal letter submitted to the Dortmund Conference in 1956 (Arslan, 2020). Nevertheless, John McCarthy is recognized as the pioneer of the concept (Alpaydın, 2013). Initially coined as the science and engineering behind the creation of intelligent machines (McCarthy, 2007), artificial intelligence has since been identified as a means to enhance education by processing real-time data in a personalized, adaptive, all-encompassing and stimulating manner (UNESCO, 2017). Figure 1 is an illustration of the evolution of artificial intelligence over time.

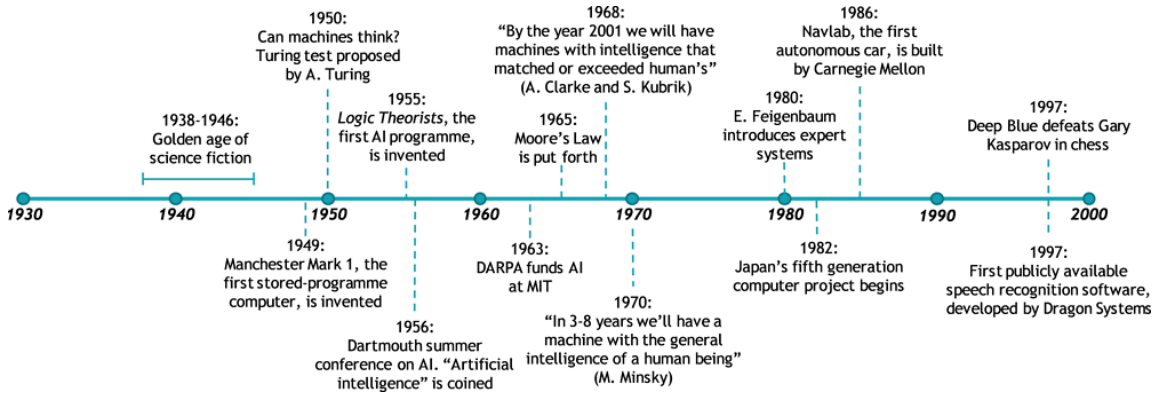

Figure 1. Timeline of Artificial Intelligence Development (OECD, 2019)

Artificial intelligence in education focuses on supporting instructors' teaching process, enhancing students' learning experience and promoting the education system's development with this technology (Holmes et al., 2019; Hwang et al., 2020). The rapid advancement of artificial intelligence technology has an impact on all aspects of society, including the education system and the business world. The evolution of artificial intelligence is rapidly changing the requirements and duties of the workforce. Countries must evaluate their education and development plans in light of this change (Demir, 2019). The evolution of artificial intelligence is rapidly changing the requirements and duties of the workforce. The evolution of artificial intelligence is rapidly changing the requirements and duties of the workforce. Supporting lifelong learning and retraining opportunities will help the workforce adapt and meet future demands.

The application of artificial intelligence in education has received considerable attention in recent years (Hwang et al., 2020; Ouyang et al., 2022), but there are still discussions and concerns. Despite these debates, Spector and Ma (2019) highlight a trend toward intelligent educational learning environments. Several AI-supported applications, such as ChatGPT, have been extensively used by teachers and students for educational purposes (Taşçı & Çelebi, 2020). However, the widespread application of AI-assisted educational technologies has also been the source of issues such as ethical concerns, data security, and student privacy. As a result, using artificial intelligence in the educational sector requires conscientious management and supervision. In this regard, maintaining a balance between the potential of AI technology and ethical obligations will be crucial. These debates are essential for the more efficient and sustainable use of AI technology in education.

Artificial Intelligence in STEM Education

Artificial intelligence and its remarkable effects are increasingly used in teaching, including STEM (Ouyang et al., 2022; Linn et al., 2023). However, few studies have explored AI's impact, integration challenges, and implementation approaches in STEM education (Triplett, 2023; Zhai et al., 2023). According to Chng et al. (20-23), this scenario points to critical research gaps. "*While the potential for emerging technologies to transform STEM education has been established, the feasibility of implementing these technologies in schools*

remains unclear." With the potential of artificial intelligence in mind, this limitation is expected to be overcome soon.

Implementing artificial intelligence in STEM education provides substantial advantages to students and instructors. However, the complex nature of STEM education and the lack of understanding of its nature by specific population segments poses significant obstacles to this potential. Integrating artificial intelligence in an educational environment where the true nature of STEM has not yet been understood seems unlikely. Thus, the effective use of artificial intelligence in STEM education requires the consideration of complex social, pedagogical, and environmental factors rather than implementing artificial intelligence technologies (Krasovskiy, 2020; Xu & Ouyang, 2022). The main hurdle is in selecting and implementing artificial intelligence technologies in STEM education (Castañeda & Selwyn, 2018).

Artificial intelligence, a technology that emulates human cognitive behaviour, holds enormous potential to address some of the most vexing issues in STEM education (Zhai, 2021). The main goal of using artificial intelligence in STEM education is to improve the quality of teaching and learning in the STEM fields (Hwang et al., 2020). Implementing artificial intelligence technology in STEM education provides benefits such as personalized and adaptable learning opportunities, facilitating teachers' understanding of students' learning behaviours, and automatically assessing STEM learning outcomes (Alabdulhadi & Faisal, 2021; Walker et al., 2014).

One of the significant benefits artificial intelligence provides is the development of a proficient STEM education system. In this regard, educators can utilize artificial intelligence assistance (Zhai et al., 2023) to understand students better, provide tailored learning experiences, and effectively track student progress. Artificial intelligence applications, especially in big data analytics and the analysis of student behaviour, serve as an essential tool for identifying the needs of students and tailoring educational programs accordingly. Consequently, artificial intelligence enables more efficient, student-centred STEM education, resulting in better student outcomes.

Conclusion

Research on the use of artificial intelligence in STEM education is still limited. However, it is expected to gain momentum and importance in the literature rapidly. In summary, artificial intelligence presents a significant potential for advancing STEM education through factors such as personalized learning, speed, progress monitoring, and consistent support from the teacher, which will ultimately result in a more efficient and effective educational experience. In this way, students will receive an enhanced STEM education, while teachers will gain a better understanding and direction of their students. Artificial intelligence is expected to play a critical role as one of the cornerstones of future STEM education.

References

Achar, S. (2019). Early consequences regarding the impact of artificial intelligence on international trade. *American Journal of Trade and Policy*, *6*(3), 119-126.

Alabdulhadi, A., & Faisal, M. (2021). Systematic literature review of STEM self-study related ITSs. *Education and Information Technologies*, *26*(2), 1549-1588. https://doi.org/10.1007/s10639-020-10315-z

Alpaydın, E. (2013). Yapay öğrenme [Artificial learning]. Boğaziçi University Publishing

Arslan, K. (2020). Eğitimde yapay zekâ ve uygulamaları [Artificial Intelligence and Applications in Education]. *Batı Anadolu Eğitim Bilimleri Dergisi*, *11*(1), 71-88.

Banks, F., & Barlex, D. (2014). *Teaching STEM in the secondary school: How teachers and schools can meet the challenge*. Routledge.

Bybee, R. W. (2010). What is STEM education?. *Science, 329*(5995), 996. https://doi.org/10.1126/science.1194998.

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access, 8*, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988510

Chng, E., Tan, A. L., & Tan, S. C. (2023). Examining the use of emerging technologies in schools: A review of artificial intelligence and immersive technologies in STEM education. *Journal for STEM Education Research*. https://doi.org/10.1007/s41979-023-00092-y

Contente, J., & Galvão, C. (2022). STEM education and problem-solving in space science: A case study with CanSat. *Education Sciences*, *12*(4), 251. https://doi.org/10.3390/educsci12040251

Demir, O. (2019). Sürdürülebilir kalkınma için yapay zeka [Artificial intelligence for sustainable development]. G. Telli (Ed.), In *Yapay zeka ve gelecek [Artificial intelligence and the future]* (ss. 44-63). Doğu Bookstore.

Handra, T., & Sundram, V. P. K. (2023). The effect of human resource information systems (HRIS) and artificial intelligence on defense industry performance. *IAIC Transactions on Sustainable Digital Innovation (ITSDI)*, *4*(2), 155-163. https://doi.org/10.34306/itsdi.v4i2.584

Hebebci, M. T., & Usta, E. (2022). The effects of integrated STEM education practices on problem solving skills, scientific creativity, and critical thinking dispositions. *Participatory Educational Research*, *9*(6), 358-379. https://doi.org/10.17275/per.22.143.9.6

Hebebci, M. T. (2023). A Systematic Review of Experimental Studies on STEM Education. *Journal of Education in Science Environment and Health*, *9*(1), 56-73.

Holmes, W., Bialik, M., & Fadel, C. (2023). *Artificial intelligence in education*. Globethics Publications.

Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, *1*, 100001. https://doi.org/10.1016/j.caeai.2020.100001

Karsenti, T. (2019). Artificial intelligence in education: The Urgent need to prepare teachers for tomorrow's schools. *Formation et Profession, 27*(1), 112-116. https://doi.org/10.18162/fp. 2019.a166

Lau, A. Y., & Staccini, P. (2019). Artificial intelligence in health: new opportunities, challenges, and practical implications. *Yearbook of Medical Informatics*, *28*(1), 174-178. https://doi.org/ 10.1055/s-0039-1677935

Linn, M. C., Donnelly-Hermosillo, D., & Gerard, L. (2023). Synergies between learning technologies and learning sciences: promoting equitable secondary school teaching. (Editors: N. G. Lederman, D. L. Zeidler, & J. S. Lederman) In *Handbook of Research on Science Education* (pp. 447-498). Routledge.

McCarthy, J. (2007). What is artificial intelligence? http://jmc.stanford.edu/articles/whatisai/whatisai.pdf

Miles, J. C., & Walker, A. J. (2006, September). The potential application of artificial intelligence in transport. In *IEE Proceedings-Intelligent Transport Systems* (pp. 183-198). IET Digital Library. https://doi.org/10.1049/ip-its:20060014

Mutakinati, L., Anwari, I., & Kumano, Y. (2018). Analysis of students' critical thinking skill of middle school through stem education project-based learning. *Jurnal Pendidikan IPA Indonesia*, *7*(1), 54-65.

OECD (2019). *Artificial Intelligence in Society*. https://doi.org/10.1787/eedfee77-en

Ouyang, F., & Jiao, P. (2021). Artificial intelligence in education: The three paradigms. *Computers and Education: Artificial Intelligence*, *2*, 100020. https://doi.org/10.1016/j.caeai.2021.100020

Ouyang, F., Zheng, L., & Jiao, P. (2022). Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020. *Education and Information Technologies*, *27*(6), 7893-7925. https://doi.org/10.1007/s10639-022-10925-9

Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education*, *26*, 582-599. https://doi.org/10.1007/s40593-016-0110-3

Ghandour, A. (2021). Opportunities and challenges of artificial intelligence in banking: Systematic literature review. *TEM Journal*, *10*(4), 1581-1587.

Singh, M. (2021). Acquisition of 21st century skills through STEAM education. *Academia Letters*, 712. https://doi.org/10.20935/AL712

Spector, J. M., & Ma, S. (2019). Inquiry and critical thinking skills for the next generation: from artificial intelligence back to human intelligence. *Smart Learning Environments*, *6*(1), 1-11. https://doi.org/10.1186/s40561-019-0088-z

Taşçı, G., & Çelebi, M. (2020). Eğitimde yeni bir paradigma: Yükseköğretimde yapay zekâ [A New Paradigm in Education: Artificial Intelli-gence in Higher Education]. *OPUS International Journal of Society Researches*, *16*(29), 2346-2370. https://doi.org/10.26466/opus.747634

Triplett, W. J. (2023). Artificial Intelligence in STEM Education. *Cybersecurity and Innovation Technology Journal*, *1*(1), 23-29

Walker, E., Rummel, N., & Koedinger, K. R. (2014). Adaptive intelligent support to improve peer tutoring in algebra. *International Journal of Artificial Intelligence in Education*, *24*, 33-61. https://doi.org/10.1007/s40593-013-0001-9

Wang, H. (2012). A New era of science education: science teachers‘ perceptions and classroom practices of science, technology, engineering, and mathematics (STEM) integration. (Unpublished Doctoral Dissertation). University of Minnesota, USA

Zamora, J. (2019, September). Are We Having Fun Yet? Designing for Fun in Artificial Intelligence That Is Multicultural and Multiplatform. In *Proceedings of the 7th International Conference on Human-Agent Interaction* (pp. 208-210).

Zhai, X. (2021). Practices and theories: How can machine learning assist in innovative assessment practices in science education. *Journal of Science Education and Technology*, *30*(2), 139-149. https://doi.org/10.1007/s10956-021-09901-8

Zhai, X., Neumann, K., & Krajcik, J. (2023, March). AI for tackling STEM education challenges. In *Frontiers in Education,* 8, 1183030. https://doi.org/10.3389/feduc.2023.1183030

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English Conversational Learning in First Middle School Based Boarding School: A Pedagogic Ethnographic Research

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Abstract

Support from environmental situations that support the process of learning English is one of the important factors that influence the success of learning English, especially speaking skills. In many ways this condition cannot be realized in learning English in class-based formal schools. The purpose of this study was to gain an in-depth understanding of the English conversation learning process in boarding school-based junior high schools. This research is qualitative research using the ethnographic method of the Spradley model with a purposive technique sampling. This research was conducted in September 2021 up to September 2022. Data collection was carried out through direct participation in research settings by conducting interviews, direct observation, documentation studies and field notes. The results of this study indicate that (1) The general objective of learning English at SMP Budi Luhur Boarding School is for students to be able to communicate in English. The specific goal is for students to master language skills, especially conversation in English. (2) The strategies used by students in learning English are cognitive strategies, metacognitive strategies, social strategies and resource management strategies. The methods used at Budi Luhur Boarding School Middle School are the direct method, the grammar-translation method, the reading method, the listening method and the communicative method. (3) The English language learning curriculum at Budi Luhur Boarding School Middle School is the government curriculum, and the Budi Luhur Middle School curriculum own boarding school. The curriculum and syllabus for learning English used at SMP Budi Luhur Boarding School use a separate curriculum (separated curriculum).

Keywords: Sustainability, education, environment, innovation, digitalization

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Introduction

The environment is one of the factors supporting the success of an educational process. This has also changed the development of the education system in the world and in Indonesia in particular. The education system is a strategy or method used in the teaching and learning process to achieve goals so that students can actively develop the potential within themselves (Andran, 2014). This change can be seen from the changes in the education system which consists of learning, teaching, curriculum, learner development, learning methods, learning tools, facilities and infrastructure and graduate competencies from time to time.

Learning English as a foreign language, especially in speaking skills, is not only done in formal classroom-based learning, but to maximize the success of English learning can be done by doing habits carried out in the school environment more specifically in boarding schools.

The word learning is a process carried out by humans to gain a variety of abilities (competencies), skills (skills), and attitudes (attitudes), which are acquired gradually and continuously from infancy to old age through a series of lifelong learning processes.... As used today, learning must be viewed from two perspectives. One perspective considers learning as a process or activity. Then, the other point of view emphasizes learning as an outcome or product. Meanwhile, teaching is an activity designed to produce changes in learners (students) to provide encouragement, assistance, and direction for certain changes. Littlewood (1984) states that language learning is a natural response to communication needs (both productive and receptive).

In general, speaking means communicating ideas, feelings, emotions, imagination, or facts in the context of a particular situation, involving knowledge. Knowledge is required as material for speaking. Apart from the experience of hearing or seeing, most knowledge is gained from reading. In junior high school students, learning English conversation which is a foreign language requires a variety of methods so that students can receive the material provided by the teacher, especially class-based conversation learning cannot be optimal.

In boarding-based schools, the curriculum and methods of learning conversation use a collaboration between the national curriculum and a special curriculum, hoping that this collaboration can achieve optimal results, but boarding-based schools cannot practice speaking English because it is a foreign language and not a first language (L1).

Although there have been various innovations or efforts made in education, teachers still use the old way of learning such as the lecture method and only use books as learning resources and learning activities rarely involve them actively and they only rely on explanations or reading books themselves, so students have difficulty understanding the lessons given, especially English lessons and it has an impact on the results.

Boarding schools also accommodate students from various backgrounds with a high level of heterogeneity, students come from various regions with very diverse social backgrounds, cultures, inclinations and academic abilities. This condition is very conducive to building national insight and students are accustomed to interacting with their different friends so that it is very good for training children's wisdom and appreciating plurality. Especially in English learning, it will be more effective by doing habituation in speaking both in the classroom and outside the classroom.

Boarding life is designed to encourage the growth of a spirit of togetherness, independence and mastery of concrete life-skills. Through boarding life, students are trained to build discipline, have a sense of responsibility and the ability to manage time, organize themselves, and develop leadership traits and a spirit of caring for others and the environment. Older students are trained to take part in mentoring younger students, organizing schedules together and arranging weekend activities.

Parents who intend to send their children to Boarding School with a variety of considerations / reasons, namely a conditioned environment so that there are no worries for parents with their children's socialization, children's socialization is monitored with the assistance and guidance of Pamong teachers in the dormitory, Dormitory Companion teachers who are always standby conditioning students in the dormitory. One behavior that is not found in public schools is the association between men and women. At the Boarding School, boys and girls are separated. In addition, it is not allowed to shake hands between the two if it is not mughrim.

In addition to getting general knowledge like in public schools, students who go to Boarding School are also given the same religious knowledge as boarding school children. So by going to Boarding School, you will get two sciences at once, namely the science of the world and the akherat. The education curriculum in boarding schools is designed effectively so that students in the dormitory can absorb lessons properly and correctly, especially in learning English at Boarding-based Junior High Schools. This study took a sample at a Boarding-based Junior High School located in East Lampung Regency, namely Budi Luhur Boarding School Pasir Sakti Junior High School, East Lampung Indonesia.

Method

The principal approach to language pedagogy, it is clear from the previous sketch that a competent teacher is characterized by the ability to think about the number of methodological options adapted to a particular class and context. Language teaching methodology is a rational theory that underlies whatever is done in the classroom. The actual approach describes some of what is presented in books, issues, findings, conclusions,

and principles of language learning and teaching. The principles are that motivation from within is the main impetus for learning, eligibility is at a high level, retrieval behavior, language and culture are intertwined, students successfully invest strategies in learning and self-confidence is an important start for success. Understanding these principles is the basis for making curriculum plans, learning designs, and learning techniques and activities.

Pedagogical approaches form a fixed set of principles that are immutable, a dynamic composition of energy that also changes or should change with the experience gained in teaching and learning itself. What ways of understanding language learning-what makes learning succeed and fail, may be stable across months and years, but satisfying. The interplay between approach and classroom practice is the key to dynamic teaching note this cyclical example. The relationship between language and culture as described above is an important factor in foreign language learning, potentially, there is a basis to one's approach to language teaching, how that basis interacts with the following illustrates how techniques are generated in the form of divisions according to this principle.

Along with the functional approach used in the language learning curriculum, this approach views language as a social phenomenon by showing language use based on social context. Certain social contexts require linguistic forms or choices that can account for the real-world experiences in which the language is used. Different social contexts require different forms of language. The functional approach based on systemic functional linguistics suggests that language is explained and explains context. There is no language formation without context. In contrast to other approaches that emphasize the formality of form without any connection to context.

An important consideration in English language learning is the role of approaches to language use based on meaningfulness. Meaningfulness is the goal of learning based on the functional approach. In line with this functional approach, knowledge of the linguistic concepts underlying the birth of any language learning approach is very important. An approach will experience the fate of 'suspended animation' and is powerless to teach learners to have language skills if the approach applied is not supported by theoretical concepts. There will be paradoxical academic activities in such a learning model. For example, teachers conduct learning activities with curriculum A, but the underlying linguistic concepts are still linguistic concepts B or C which are less relevant in contextual teaching. The learning model will not be maximally powerful, because the linguistic concept underlying the curriculum does not influence the teacher's behavior in developing teaching materials.

This type of research is qualitative, which is conducted in the field (field research). Qualitative research is a systematic and subjective approach used to explain life experiences and give meaning to them. This research was conducted using an ethnographic research design. Ethnography is the work of describing a culture. Its main purpose is to understand a way of life from the point of view of the natives. Spradley (1979, p.5) says that the core of ethnography is an attempt to pay attention to the meanings of the actions of the events that happen to the people we want to understand. Iskandar (2008, p.208) says that in order to understand and

describe culture from this perspective, a researcher must think about events or phenomena in the way he or she thinks. An ethnographic researcher must explain human behavior by describing what he knows, which makes him able to behave in accordance with the general behavior of the community under study.

Results

Based on observations, interviews, and analysis of various written documents in this chapter the researcher will explain the research findings and data found in learning English conversation at boarding schools using a pedagogical ethnographic approach. To facilitate the description of the research findings, previously the data will be described in the form of an overview of the research setting relating to the profile of English language learning, vision, and mission goals, learning facilities and infrastructure, social interaction and extracurricular activities. In the research findings, the results of the research related to the findings of domain analysis, the results of taxonomic analysis, the results of componential findings and the findings of cultural analysis will be described.

This research was conducted at Budi Luhur Boarding School, located at Jalan Lintas Timur Sumatera, Mulyosari Village, Pasir Sakti District, East Lampung Regency, Lampung Province, Indonesia. In the initial study, literature study and setting selection were conducted. The literature study was conducted to trace the theoretical constructs related to the value of school culture as a provision for designing research that will be developed further.

Because the approach and method used in this research is a qualitative approach with ethnographic methods, the discussion of the results of this research is based on qualitative analysis with ethnographic methods, namely the discussion of research results that follow the elements that are closely related to English learning and acquisition found in Budi Luhur Boarding School Junior High School Lampung Timur which include: 1) English learning objectives; 2) English learning materials; 3) English learning strategies and methods; 4) English learning curriculum and syllabus; 5) English learning and acquisition activities; 6) the role of teachers and students in English learning; and 7) English learning assessment system at Budi Luhur Boarding School East Lampung.

The above objectives for English language learning at SMP Budi Luhur Boarding School Lampung Timur show that these objectives are born and sourced from the elaboration of the criteria for learning objectives, namely:

1. English learning objectives must be in accordance with the concept of Islamic knowledge.
2. The objectives must be in accordance with the social environment where the learning process is carried out.
3. Objectives should be in accordance with the latest pedagogical rules in language learning.

Discussion

In addition to the general objectives, the School also formulates specific objectives. These specific objectives are outlined in relation to the four language skills namely maharat al-istima', maharat al- qira'ah, maharat al-kalam and maharat al-kitabah. Specific objectives of Listening skills (maharatul istima') include the ability of students to understand and respond to oral information obtained either conversations, announcements, lectures, muhadatsah and others. In speaking skills (maharatul kalam) includes the ability of students to understand and express information, ideas and their intentions and the meaning of words in oral communication in accordance with proper grammar and pronunciation.

Fatimah Abdul Aziz Usman said that language learning is for the purpose of direct practice. Learning a language is not just to understand but to be proficient and able to communicate. Learning language is to enable the language itself, learning language is to learn the consensual between rules and content and learning language is to integrate between language skills. According to him, if the above methods are practiced by language teachers, the problems in language learning will be minimized.

Based on interviews with ustadz/ah and students of SMP Budi Luhur Boarding School regarding the students' English learning strategies, the researchers found that the learning strategies of the students of SMP Budi Luhur Boarding School Lampung Timur are divided into four categories:

1. cognitive strategies, which are strategies related to the students' thinking power in processing materials or learning materials. For example, students correct their own language mistakes, use sign language, practice the pronunciation of English words with the correct accent and intonation, write in a notebook, read from the blackboard, stare at learning media, compare new things with what is already known before both from the mother tongue and English, organize information.
2. Metacognitive strategies, namely all santri behaviors related to their tactics or ways of dealing with and managing learning materials or materials, for example focusing their attention, planning and structuring learning activities, monitoring self-development, evaluating the teaching and learning process, all of this must come from and be done by santri.
3. Social strategies, namely the cooperation of santri with their friends in achieving learning goals, for example speaking English with their classmates or roommates, helping friends in accordance with teaching and learning activities, group work, speaking with native speakers, giving praise to friends, correcting friends' work.

Conclusion

Based on the description and analysis as well as theoretical studies as contained in this study, in this section the researcher will present some conclusions regarding the learning of English Conversation at SMP Budi Luhur Boarding School Pasir Sakti East Lampung based on its components, namely learning objectives,

learning materials, strategies and methods, curriculum and syllabus, learning and acquisition activities, the role of teachers and students and the assessment system.

The main purpose of learning English Conversation at SMP Budi Luhur Boarding School Pasir Sakti East Lampung is that santri must be able to communicate in English both in daily relationships and to explore religious knowledge and respond to scientific developments. This is reflected in their daily activities when they are in the boarding school environment and outside the boarding school where they are required to use English in their daily communication if the boarding school system requires English that week. This communicative goal is in line with the communicative theory which says that the purpose of learning a language is to develop the learner's competence in the language.

Recommendations

English language learning at SMP Budi Luhur Boarding School Pasir Sakti Lampung Timur is conducive, not only because it is an educational institution that provides 24-hour learning, but also because it is strategically located on Jalan Lintas Timur Sumatera Lampung Indonesia. Therefore, the researcher recommends several things:

1. The government of Lampung Province, especially Lampung Timur Regency, should pay more attention to the needs of pesantren in developing their English language learning by providing assistance in the form of complete facilities and infrastructure for the language laboratory of SMP Budi Luhur Boarding School Pasir Sakti Lampung Timur because this pesantren has also contributed a lot to the Lampung Provincial government, especially in providing human resources who will be sent to participate in competitions such as O2sn (Olah raga dan Seni Pelajar) and others on behalf of delegates from Lampung Province.
2. To the English teachers, they should be an example for the students in everything, especially to always communicate in English to their students whenever and wherever they are. And teachers should continue to develop their syllabus and English learning tools for communicative learning purposes.
3. To the students of SMP Budi Luhur Boarding School Pasir Sakti Lampung Timur Lampung Indonesia, they should always practice their English in communicating both in the context of learning, acquisition and in unofficial contexts so that the objectives of English language learning can be realized.
4. To the parents or guardians of the students of SMP Budi Luhur Boarding School Pasir Sakti Lampung Timur Lampung Indonesia, they should also play a role in realizing the success of their children's education in the pesantren by visiting and providing taushiyah for their children, not releasing and leaving their children's education entirely to the boarding school while they relinquish their responsibilities as parents.
5. all boarding school junior high school English syllabus and curriculum in this research can be applied to boarding schools around the world, especially in Muslim-based countries.

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References

Andran, C. (2014). Sistem Pendidikan. Retrieved February 4, 2019, from https://www.kompasiana.com/andreancan/54f76a90a33311b0368b47ea/sistempendi dikan

Graham, C. R. *Blended Learnin System: Definition, Current Trends and Future Direction dalam Bonk, Curtis, J. and Graham, Charles, R., "The Handbook of Blended Learning: Global Perspective, Local Design".* San Fransisco, CA, USA: John Wiley and Sons, Inc., 2006.

Iskandar. (2008). Metodologi Penelitian Pendidikan dan Sosial. Jakarta: GP Press

Littlewood, W. (1984) *Foreign and Second Language Learning: Language Acquisition Research and Its Implications for the Classroom*. Cambridge University Press, Cambridge.

Spradley, J. P. (1997). Metode Etnografi. Yogyakarta: Tiara Wacana.

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The Path Less Taken: The Reflective and the Intuitive in Design

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Abstract

The main argument within this paper is that we might think about design approaches that enable ways of addressing indetermination as means of creation. Further to a theoretical framing we try to contextualize and to conceive very simple experimental pieces that might enable us to reflect on outcomes that are driven by intensive rather than extensive design strategies. We put forward a concept of atmosphere that structures a framework that might enable valid and fruitful pragmatic explorations and reflections in design. On the overall we try to make contributions to the research of possible relations between the extensive and the intensive qualities and approaches to design. By doing so, we also endeavor to establish possible connections between body and the designed object.

Keywords: Educator preparation, ESOL, language awareness, language variation

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Introduction

First of all we would like to clarify that this paper intends to be mainly a reflection and in that sense it does not propose to present in itself any methodological approach or recommendation in the design process. But we do think that the questions raised in the context of this study are relevant in the sense that they might allow to question some constraints that we identify in contemporary design practice.

So, we then question forms of thinking that might escape static and purely formalistic project methodologies. We try to contribute on alternative ways of thinking design that are contrasting to pure Cartesian, extensive and quantitative approaches. And we try to balance a theoretical course of investigation with an operative and pragmatic side constituted by two very simple case studies. We focus on two experimental pieces that result from an intuitive and intensive approach to design. So, and on the overall, we put forward the question:

Is it possible to think about indetermination, of form, of an extensive character, as a methodology of creation in itself?

In our contemporary approximations to thinking about design we frequently strive in project methodologies that are charged with intentions. Intentions relevant to a certain project and perhaps, in that sense, even all the intentions that compose us as designers. These might be materialized by the ideas and facts that we bring into each project in factual, extensive terms. But they might also represent hidden instincts that we carry with us on subjective and unconscious levels, as intensive qualities.

Contemporary design displays a certain obsession with precision in the processes of thinking that we argue, are oriented towards extensive and quantitative qualities. Also, we live in a world where extensive capacities dominate our main overall thinking. We argue that these properties have led in some cases into a sterile project world, where our body and its capacities for referencing intensive, intuitive and direct capacities have been underestimated or almost completely replaced by methodologies that stem from the almost absolute infinite possibilities of precision – but at a very steep price. The cost of an almost total disconnection from the body – from our own body, where sensation and thought coalesce as one.

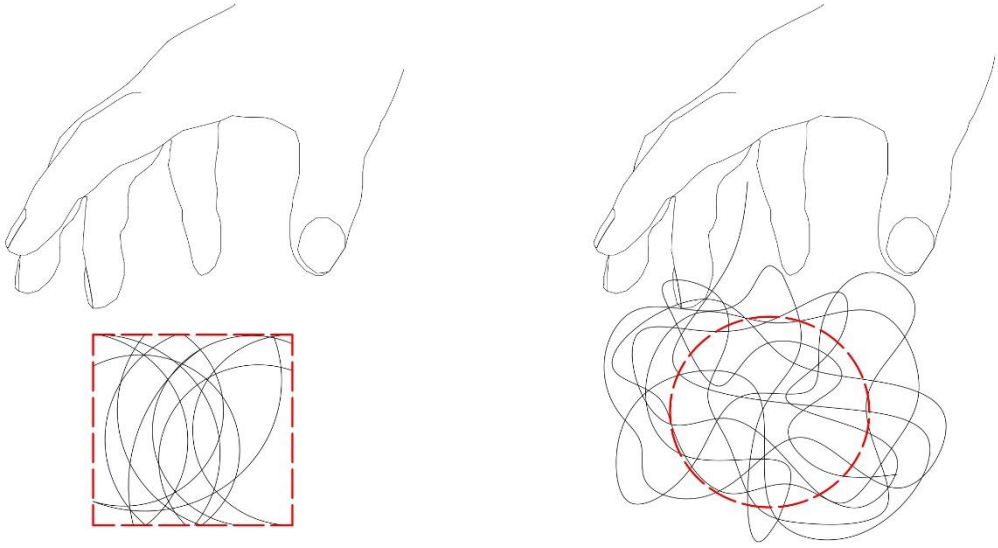

Figure 1, 2. Concept drawing of object A and B

A clear example would be the way that almost everything we do is mediated digitally. We think that this almost total disconnection from the body produces an overall disconnection from sensation and generates an approach to project thinking that is deeply related to quantitative, practical and extensive properties. Further to design

capabilities in extension, one might think of an active effort of relieving – at least as an exercise -, of a total control inherent to an extensive approach to design. To let go of a deterministic approximation to the design project, and thus to enable a certain space for indetermination. In that sense, of allowing the intuitive, despite the ever present rational. This approximation to design might acknowledge on the one side, a sense of absence of extensive values, and on the other, the allowance for spaces, objects and relations that are fluid, and that escape absolute organization – the ever-present search for the *"striated"*, for a *"Cartesian"* grid.

By doing so this process might surprise the actual designer. The connection between designer and the exploratory design process – further to the rational and extensive – brings to mind the notion of *"primitive present",* we argue. This concept from philosopher Hermann Schmitz associates the experience of the self with the scope of the here and now – which he names *"primitive present"*. Schmitz addresses the dogma of hegemonic systems of thought as the "*interior world dogma*". It posits the possibility to advance it with a *"system of thought that is anchored more deeply in the human experience of life than the existing one."* (Kazig, 2016) This connection to the here and now and to experience, brings us closer, we also argue, to a connection to the body and to sensation itself, as a way to surpass a primacy of rationality. We might be looking here also for an acknowledgment of what Gilles Deleuze and Felix Guattari designated as the *"smooth"* and the *"striated"*. (Deleuze & Guattari, 1987) We find the *"striated"* as a way of thinking human tendency for the orthogonal, for the grid that sustains our primordial need for order and reason, as we face the world. This is a search that reached its pinnacle with modernism, we argue. On the other hand, *"smooth"* space refers to nature prior to human intervention.

We might correlate and find a connection here between the rational and the intuitive. And also as a possibility of fulfillment between thinking design as connected concurrently to the *"smooth"* and to the *"striated"*. In general, and in the very humble scope of this study, we try mainly to address two objectives in the form of two possibilities and intentions:

- A "*minimum*" of design, in the sense of a minimum of parametrization of the project in extensive values.
- A "*maximum*" of letting actions happen within a certain context of chance. These might provide a connection to the "smooth" rather than the "*striated*". To the intuitive and intensive, beyond the extensive and, in that sense, to a process that is less controlled by its author.

Case Studies

As we observe on Figure 1 and 2, we attempt to question the issues raised theoretically in this paper by means of two concepts for two *formalizations*. These are formalizations of what we might define as potentials of *"indetermination"* - or of choice as possibility of design. The two objects were experimentally materialized in concrete. One of them was thought tentatively from exterior to interior, and the other as the inverse. As we can observe on both Figures 1, 2, 3 and 4, our initial vague parameters only attempt to express guidelines and initial ideas, and not to formalise the objects in an extensive overall sense.


Figure 3, 4. Object A and object B

On piece A, we try to think an object in which the interior is indeterminate, framed within a determined envelope – the shape of a cube. On piece B the object is built from the outside to the inside. Each of them represents an effort to engage with in determination rather than with extensive parameters – as a possible process for project development. Figure 1 and 2 conceptual sketches show that, obviously, in the beginning of a project there must always be some level of intentions – otherwise we would face total emptiness. But these are in a sense an instinct – a drive. We think of these as primary bases for thought; for the condition and character that precedes an extensive definition proper. We consider each piece as a possibility of addressing absence in the definition of a material piece. And in doing so, both objects become more a function of an intention and less the result of an overall determined and extensive blueprint.

Discussion

We think it is fundamental to link our study to the concept of somaesthetic. As Hook (2018) points out, "*Shusterman wants to ground our understanding of aesthetics even more firmly in the rich soil our bodies offer.*" Also, according to Hook (2018), "*Instead of engaging with beauty, he (Shusterman) turned back to the original meaning of aesthetic: sensory perception.*" In this sense, we argue that these piece – and the overall thinking we address -, arise from an idea linked less to a search for what is not necessarily "*pretty or special, but ordinary or even disturbing and unpleasant.*" (Hook, 2018) More linked to a concept of aesthetic as sensory perception – as a spontaneous condition.

Our main focus on these pieces lies in finding ways of expressing in some way what lies "*in between*" - that which is in between the extensive and its absence. Which is less a result of reflective thought and comes rather from the emergence of an intuitive or intensive framework. More connected to chance and to possible unconscious intentions than to the formal, pragmatic or the programmatic. In both pieces, the rational line – of modernism, as we argue ahead -, exists only as a frame, but ultimately does not condition the final form.

The main point in both pieces is the way they become a certain function of a certain ambiguity. This process is mediated by the designer in the way both interact during the actual construction. So, we argue that in these pieces we endeavour to formalise in some way, a certain absence of design. The main "*project*" is, we might say, to create an envelope to allow hidden intentions to metamorphose into the visible. To create an embodiment for unconscious intentions to be formalised. This done by the agency of the designer – through his hands and by his sensory perception, as he builds them physically.

The Hand and the Body

One of the factors that we consider relevant in the scope of this study is the possibility it addresses of a reconnection between body and project. Our argument is that the existence of the body – our body -, enables the capacity of establishing connections that are not necessarily denoted in extensive terms. The body enables sensation and sensory perception as the mediation and connection between the body and projectual thinking. On the other hand, it enables the construction of the object itself.

Figure 5, 6, 7. Object A

We consider this as a relevant condition for the existence of a reconnection to a certain intuition in design. Such connection enables the formalization of what is indeterminate in character and might be considered analog, or intensive, into what is extensive, and so capable of being formalized as mensurable and eventually expressed and treated by digital means. There might then be a bridge between the lack of direct sense-making to something materialized. The incoherent and ambiguous becomes substantiated to the extent that is embodied. So, we believe we do need a body as it enables the intuitive into something with a character in extension. We argue that it allows to literally induce the invisible to become apparent.

Inside to Outside

In the case of object,A, we think it represents the possibility of a project being constructed from the inside to the outside. There is a container which acknowledges a rational attitude. This is the minimum structure, the

envelope that then enables a shape to be generated on its inside. The developed interior shape underlines the very nature of a lack of an extensive design and an emphasis on what is generated. This is a process where shapes flow and grow by means of a temporary interior morphological structure that is placed by the hand of the author and as soon as the concrete stabilises is removed. The hands of the designer, by means of chance of trial and error, are the main driver to reveal the final shape.

Outside to Inside

In this case of object B, the development of the piece comes from the outside to the inside, and the interference of the designer is minimal as well. There is once again a rational side to the piece – the plane that cuts through its middle –, and allows its actual physical construction. But what is brought forward by the lack of mediation from the designer is an object that despite being constricted to an overall shape, assumes a boundary that is non linear. So, this second object once again represents an interaction that is only possible and enabled by the existence of a hand that touches and provides shape, driven by a body and mind working and being effective as a whole. The sphere here constitutes also a complement of sorts to the also previous primordial cube.

Figure 8, 9. Object B

Approximations and Consequences

Both pieces propose in determination as a possible approximation to form. At least in part, as total non-interference would be impossible in this sort of outset and material conditions. So, we have a structure where the designer obviously interferes, but tries to keep that intrusion to a minimum. The design of one of the boundaries that defines the piece – interior or exterior – is the main focus. These are two very simple and unassuming exercises that serve mainly as possibilities to illustrate our argumentation. So, we think we were able to accomplish two main points, within the overall exercise:

1. A disassociating from form as sole design purpose,
2. An effort to search for a connection to the body and eventually to sensation proper.

Conclusions

Harry Frances Mallgrave refers that the dichotomy between body and mind has always been a staple of western thinking. But there were nonconformists such as in Eastern philosophies built on monistic beliefs, and even in early Western thought with Pythagoras and Hippocrates, which theorized a more unified view of our coupling with the world. (Mallgrave, 2013) Further to Mallgrave's articulation we think that the approach we propose in this paper endorses and tries – in its humble capacity surely – to propose a less dualistic view of mind and body. The approximation that we find in somaesthetics also conducts us to a world where a possible reconnection between the rational and the intuitive, is of relevance in our field of design.

Mind, Body, Intensive and Extensive

We think that in this paper we address the importance of a possible reconnection to the body in the practice of design. It is this operative proximity that we argue might help surpass methodologies that are reliant on a focus on all things digital and disconnected from the body. Deep down we also believe that this approach might further enable a counterpart to the hegemony of the rectilinear and orthogonal of *"striation"* – and from *"modernity's straight line"* as Tim Ingold (2016) defines it. We might also add that the modern movement – particularly in architecture – has taken this thinking into a hegemonic stature.

Furthermore, we argue that the prevalence of the extensive and the digital in contemporary culture, has given the final blow on a more intuitive, holistic and intensive design thinking – and one where we might find that body and mind can be expressed at the same level. So, in a sense, also going back to Heidegger's thinking, we argue that a certain idea of *"Dasein",* of *"being-in-the-world",* is important, as it refers to a sense of body, mind and the world that surround us, taken and becoming just one. (Mallgrave, 2013) This takes us back to a holistic approach and to the field of soma design (Höök, 2018). This sort of construction promotes and establishes connections to an understanding based on a sensation driven subjective approach. This connection between body and thinking would, in our argumentation, allow a liberation from a worldview so dichotomic betwee mind and body – between intensive and extensive, or between rationality and intuition.

And it might takes us closer to a world more focused on Spinoza than Descartes, as António Damásio refers. (2003) Neurologists such as him and Ian McGilchrist (Damasio 2003, McGilchrist 2019) argue that the actual capacity for thinking is deeply connected – or even only possible -, due of its total dependency on our specific and individual body. Mind and body – cognition and intuition – are, and can only exist, as one entity.

The Possibility of an Operative Medium

On the other hand, how might this world-vision be translated into the design world is a relevant question we try to postulate. We argue that this might be possible by taking into account forms of thinking that surpass the linear and the rational. One way of addressing this might be through the concept of the creation of atmospheres,

such as thinkers like Griffero (2016) and Böhme (2017) conjecture, and as we try to define them. We think of atmospheres as profoundly connected to the dichotomy that Gilles Deleuze (1981) established with his attempt of escape from figuration by what he defines as the *"Figure"*. Atmospheres might allow us to think about design on a different perspective from a linear, rational, and extensive decision led thinking. And in that sense, less connected to figuration proper, and more to an idea of *"Figure"*. Authors such as Peter Zumthor incorporate the notion of atmosphere into their project practice. Such procedures enable the prevalence of a sense of whole, made possible by an intensive mindset in which the practical design demeanor becomes an *"accomplice"* to the whole. The project itself becomes an entity *"greater"* and more relevant than the actual sum of the distinct, *"discrete"* project elements. In that sense, we might also reconsider Deleuze's exact definition of the notion of *"Figure"*. The French philosopher refers how Paul Cezanne supposedly gave a simple name to such search for the *"Figure"* – he designated it simply as sensation. (Deleuze, 1981) And that is precisely where we might take our stand globally on this paper – arguing for the possibility and capability of design reaching deeper connections on the operative dialogue between sensation and thinking. In this sense, and globally, a possibility of integration of intuition with a critical and rational approach.

Reflections on the Possibilities of Atmospheres as Operative Design Tools

In this paper in particular, the empirical and tentative path we took led us to conceive two objects where the elements of chance, the behavior of their particular material constituents, the force of gravity, the given constrictions and a minimum interference from the author, played the major roles. Obviously, we don't intend to provide clues for any particular methodology - we rather just hope that in their innocence and simplicity, these pieces might attempt to show us possible reflections from the results achieved. And in that sense, reflections that might enable process and method assessments. So, we argue that a connection of sensation with the rational design side might facilitate creation through an atmospheric approach.

By atmosphere we thus designate the possibility of accomplishing an approach to thinking design where the body is imperative and central, as it enables this deep connection between reason and sensation. In this manner, atmospheres become more than purely aesthetic approaches – they become forms of cognition within the design project.

We argue that this approach might enable the development and affirmation of a design practice that might be bigger than the sum of its parts. And by doing so, by integrating the reflective with the intuitive, we just might be able to travel the less taken path in the creative field that constitutes design.

References

Böhme, G. (2018). *The Aesthetics of Atmospheres*. Routledge.

Böhme, G. (2017). *Atmospheric Architectures: The Aesthetics of Felt Spaces*. T. Engels-Schwarzpaul, Ed. Bloomsbury Academic.

Damásio, A. (2003). *Looking for Spinoza: Joy, Sorrow, and the Feeling Brain* (First edition). Harvest.

Deleuze, G. (1981). *Francis Bacon: The Logic of Sensation*. A&C Black, p.3

Deleuze, G., & Guattari, F. (1987). *A Thousand Plateaus: Capitalism and Schizophrenia* (B. Massumi, Trans.; First edition). University of Minnesota Press.

Griffero, T. (2016). *Atmospheres: Aesthetics of Emotional Spaces*. Routledge.

Hook, K. (2018). *Designing with the Body: Somaesthetic Interaction Design* (Illustrated edition). The MIT Press, p. 32

Ingold, T. (2016) *Lines: A Brief History*. 1st edition. New York: Routledge.

Kazig, R. (2016). Presentation of Hermann Schmitz' paper, "Atmospheric Spaces". *Ambiances Environnement Sensible, Architecture et Espace Urbain.*

Mallgrave, H. F. (2013). Architecture and Embodiment: The Implications of the New Sciences and Humanities for Design. Routledge, p.9

Mcgilchrist, I. (2019). The Master and His Emissary: The Divided Brain and the Making of the Western World. Yale University Press.

Pallasmaa, J. (2011). The Embodied Image: Imagination and Imagery in Architecture. Wiley.

Shusterman, R. (2008). Body consciousness: A philosophy of mindfulness and somaesthetics. Cambridge University Press.

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OPEN ACCESS

Supporting Pre-Service ESOL Teachers' Critical Language Awareness Through Dialectical Variation

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Abstract

This article reviews the logistics of a course unit on dialectical variation within a culture and education ESOL course intended to foster elementary-education teacher candidates' expertise regarding language variation writ large and dialectical variation in the United States more specifically while also increasing their understanding of issues surrounding cultural attitudes and stereotypes associated with speakers of these linguistic varieties. The article begins with an overview of the activities and resources that comprised the course unit and an exploration of the reasoning behind their selection and implementation. The article then provides contextual information with respect to an exploratory study designed to investigate students' perceptions of the strengths and weaknesses of various aspects of the course unit. Data for the study were collected via a mixed-methods post-course questionnaire which were subsequently analyzed via descriptive statistics and content analysis. Preliminary findings suggest that the course unit contributed to participants' emerging understanding of the nature of dialectical variation and supported them in adopting a more positive outlook with regards to the linguistic/dialectical varieties of their future students.

Keywords: Design Approaches, intensive, extensive, indetermination

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Introduction

Curzan & Adams (2012) perceive language as "…a conventional system of signs that allows for the creative communication of meaning" (p. 8). Although people commonly employ language in their everyday lives to

perform a variety of communicative and social functions, they are often not aware of the ways in which they utilize language, nor are they frequently conscious of the reasons behind their language use. To that end, one of the aims of language awareness is to articulate and advance our understanding concerning these phenomena. According to Fairclough (1992), language awareness is "…conscious attention to properties of language and language use as an element of language education" (p. 1). One could conceivably contend that educators primarily should develop their conscious understanding of how language works in a general sense for their own edification and to promote this knowledge amongst their students. Teachers should additionally concern themselves with the inherent conceptual and political nature of language use, one of the essential goals of critical language awareness, which Fairclough (1992) conceptualizes as "how language conventions and language practices are invested with power relations and ideological processes which people are often unaware of" (p. 7). Thus, critical language awareness can be seen as an essential part of teacher training in order to ready future educators for the linguistic diversity they will encounter in their classrooms while simultaneously assisting them in appreciating and valuing the linguistic funds of knowledge (González et al., 2005) of their students.

Theoretical Framework

Janks et al. (2017), outlines several principles with regards to the nature of language that helped shape the course unit that formed the basis of the current study. First, in contrast to a common perception that language is an objective and unbiased phenomenon, language is not a neutral tool for communication but is everywhere implicated in the ways we read and write the world, the ways in which knowledge is produced and legitimated, and the ways in which a human subject is constructed as a complex set of identities… (p. 186).

This quote highlights a number of important aspects concerning the concept of language. First, language is subject to the attitudes, ideologies, and prejudices of others and consequently is a subjective and inherent biased construct. Second, language is inextricably intertwined with how we utilize language to not only communicate with others but also to "be" in the world; language is thus tightly connected with our individuality and who we are along with our conduct and demeanor in social interactions.

Second, certain varieties of a given language are typically conceptualized as superior/inferior to others; in most cases, the standard variety is seen as the proverbial gold standard to which all other varieties are compared, and these non-standard varieties are commonly believed to be "incorrect", "ungrammatical", etc. Thus, the standard variety is frequently seen as possessing positive attributes, while other varieties are generally visualized in a negative light. While these associations with different varieties of a language may seem natural and normal, Janks et al. (2017) contend that "what sets these varieties apart is their social status, not any inherent linguistic superiority or inferiority" (p. 187). In other words, any vernacular of a particular language is not fundamentally "better" than another, but that such judgments are based on society's beliefs and perceptions of these language varieties. Additionally, Janks et al. (2017) argue that "what is appropriate [in language] is decided by social norms, which are…inevitably the naturalized cultural practices of social élites"

(p. 187), meaning that the varieties of a specific language utilized by people from higher socioeconomic classes along with those people with substantial power and authority are often taken as the standard. Ultimately, Janks et al. (2017) assert that "language is both a site and a stake for a more humane and just world" (p. 190), meaning that language is one of the essential locations where issues of diversity, equity and inclusion converge and is also an ideal tool for remedying many of the education, political, and social ills currently plaguing our society.

Lippi-Green (2012) highlights five "facts of life" or tenets that explain the nature and inherent characteristics of language which can apply equally well to language varieties. First, language is a living, breathing organism that must adapt to the ever-changing realities of the world; just as with standard versions of a given language, all language varieties change and evolve over time depending on various historical and situational factors. Second, all languages have the ability to express an infinite number of ideas, as do all language varieties, although each variety does so in its own unique way. Third, the linguistic accuracy of a given person's utterance does not necessarily correlate with the effectiveness with which they convey meaning through language, meaning that, just as with standard versions of a given language, the grammatical and linguistic choices made by speakers of a specific language variety when verbally interacting with others does not typically detract from the communicative effectiveness of the message they wish to convey. Fourth, the ways in which people verbally socialize with others through spoken language often vary extensively from the manner in which they impart meaning through writing, which also holds for language varieties in that the spoken version of a particular language variety can diverge significantly from its written version. Finally, change is a natural and organic feature of language, and just as languages change due to political and social circumstances, so too do language varieties.

Hinkel (2018) highlights two overarching views of language variation that also concern language varieties. People who subscribe to a prescriptive view ordinarily make value judgments concerning a given person's use of language in a particular context. Prescriptivists essentially regard the standard variety of a language as the "correct" form of that language and recognize other varieties of the language as "incorrect", "ungrammatical", "wrong", etc. In contrast, individuals subscribing to a descriptive view contend that no variety of a language is inherently superior or inferior to any other variety. Linguists adopting this perspective are typically attempting to document and understand the ways in which a given speech community utilizes language to accomplish various social and communicative purposes without regard to the perceived grammatical (in)accuracy of their language production. Thus, in regards to language variation, someone who accepts the prescriptivist stance believes in the inherent superiority of the standard variety of a language and the inferiority of other varieties of the language, while a person endorsing the descriptive position embraces linguistic diversity by appreciating and valuing all varieties of the language. Therefore, the goal of this exploratory study was to advance pre-service teachers' understanding of the nature of dialects and challenge traditional notions commonly held about language variation.

Wolfram and Schilling (2016) explain that a dialect is "a variety of a language associated with a particular regional or social group" (p. 357). Although dialects commonly vary geographically (e.g., a person from the southeastern United States does not speak the same way as someone from the northeastern part of the country),

dialectical variation can be due to a number of sociocultural variables, including (but not limited to) race, ethnicity, class, gender, sexual orientation, age, etc. along with the intersections of these variables (i.e., a Black gay young man may from a lower socioeconomic status may speak differently from a cisgender White man from a higher socioeconomic status). With regards to dialectical variation, Wolfram and Schilling (2016) concur with the arguments presented above and demonstrate how these notions specifically apply to dialects. For example, "…dialects are *not* deviant forms of language, but simply different systems, with distinct subsets of language patterns" (Wolfram & Schilling, 2016, p. 4; emphasis in original). In other words, not only do dialects exhibit systematicity in regards to the language rules that govern them, but these perceptions regarding the (un)grammaticality of such varieties are not due to any inherent linguistic superiority or inferiority of one dialect over another but are instead due to commonly-held misconceptions regarding language variation along with negative attitudes and opinions concerning the community of speakers of that dialect. For example, the variety of American English spoken by many Blacks (known as African American Vernacular English (AAVE), African American English (AAE), African American Language (AAL), Black English, etc.) is typically viewed unfavorably, but this is not due to the intrinsic mediocrity of the dialect but is instead a result of the conventional views and beliefs concerning the Black community itself: "language is closely tied to its sociopolitical context and can be a powerful political force for inclusion or exclusion of particular groups" (Lucas, 2010, p. 7). This remark also applies to the notion of dialects in which one's language use is inextricably connected with their linguistic and social identity: "a person's language is deeply entwined with his or her sense of identity and affiliations with social and cultural groups" (Lucas & Villegas, 2013, p. 102). Moreover, the perceived viability of a specific variety of a language is not due to any inherent linguistic deficiency of the variety itself but is instead completely intertwined with issues of authority and control: "the dominant position of a language or language variety within a particular social context derives solely from the power of the speakers of that language" (Lucas & Villegas, 2010a, p. 59).

Consequently, dialects should not be understood as being deficient in any way but instead are the natural result of language change over time due to a variety of economic, geographic, historical, social, and topographical factors; thus, dialects are "…a natural manifestation of cultural and linguistic diversity" (Wolfram & Schilling, 2016, p. 328). Additionally, despite the fact that many language users believe that they speak the standard variety of a given language while others speak a dialect of the language, Wolfram & Schilling (2016) nevertheless declare that "everyone who speaks a language speaks some dialect of the language; it is not possible to speak a language without speaking a dialect of the language" (p. 8). These principles guided the design and implementation of the course unit that formed the basis for the research project outlined in this chapter.

Moreover, numerous scholars have highlighted the importance of developing pre-service teacher critical language awareness in order to guide them in better understanding the social and political motivations underlying language use and ultimately to prepare them for the linguistically- and culturally-diverse nature of current and future public-school classrooms. For instance, Shleppegrell (2004) asserts that "schooling is primarily a linguistic process" (p. 2), meaning that language is an essential characteristic of education and that, consequently, a given student's lack of success in school might potentially be due to the learner's inability to

meet the language demands required of them. This observation not only applied to second language learners but also to students from minoritized populations since the language varieties they know are commonly not accepted, understood, or valued by the educational system. Lucas (2010) subscribes to this view by maintaining that, since virtually all school tasks involve the comprehension and/or production of language, "language cannot be separated from what is taught and learned in school" (p. 5). Additionally, Lucas & Villegas (2010b) claim that, because of this interdependent nature of language and education, "the process of learning [standard] English profoundly influences and is influenced by all…other school learning" (p. 301). Thus, educator preparation programs must train pre-service teachers to become linguistically responsive teachers in order to meet the educational needs of this student population.

Gay (2002) understands culturally responsive teaching as "using the cultural characteristics, experiences, and perspectives of ethnically diverse students as conduits for teaching them more effectively" (p. 106). In essence, this approach strives to integrate students' out-of-school abilities, expertise, skills, etc. in order to establish connections between their cultural funds of knowledge (González et al., 2005) and also demonstrate the relevancy of the curriculum to their families and their community. Lucas & Villegas (2010a) argue that, although culturally responsive teaching does indeed work to re-center education on the assets and strengths of these students, an aspect of education which has often been neglected in the educational system, such efforts may focus too generally on culture and not necessarily address the specific linguistic needs of these students: "embedding the preparation of teachers to teach ELLs [and students from minoritized groups] within broad efforts to prepare teachers for culturally diverse populations does not ensure that teacher can draw on students' linguistic resources and help them develop academic facility in [standard] English" (p. 56) and that, in order to remedy this situation, "teachers need specific language-related preparation" (p. 56), or linguistically responsive teaching, which involves, among other aspects, "the connections between language and schooling and the particular implications of those connections for ELLs [and students from minoritized communities]" (Lucas & Villegas, 2010b, p. 300).

The goal of this approach is "to spotlight the language-related issues that are too often lost in the larger conversation about culturally responsive teacher preparation" (Lucas & Villegas, 2013, p. 100) in order to prepare all students generally, and students from marginalized populations in particular, to embrace their linguistic identities by seeing themselves as strong multilingual/multidialectical speakers who are able to adjust their language to meet their communicative and social aims in a variety of contexts. Additionally, Lucas (2010) contends that "efforts to prepare classroom teachers to teach ELLs [English language learners] tend to be especially fragmented and 'spotty'" (p. 11) in that not all educator preparation programs adequately equip pre-service teachers with the strategies and techniques they need to effectively instruct these students; the same observation could conceivably also be made in regards to pupils speaking nonstandard varieties of English. Consequently, the ultimate goal of the course unit that formed the basis of the study was to address this curricular gap by striving to educate teacher candidates regarding the nature of language variation in order to guide them in challenging and questioning their views concerning students who communicate via languages/dialects other than (standard) English: "when preservice teachers interrogate [their] beliefs about

linguistic diversity, they can begin to develop new visions for becoming linguistically responsive teachers" (p. 102).

Research Context

The unit on dialectical variation was embedded within two sections of an ESOL culture and education course offered as part of an educator preparation program housed in a four-year postsecondary institution located in the southeastern United States. The current research study took place during the summer semester of 2023 and involved teacher candidates preparing to teach in elementary-school classrooms for students ages five to eleven. The course is required for all elementary-education pre-service teachers pursuing the ESOL endorsement at the institution, which consists of three required courses (Applied Linguistics for Teachers of ESOL, Methods of Teaching ESOL, Culture and Education) that they complete as part of their education program. This ESOL course focuses on acquainting students with various aspects of the notion of culture, the role culture plays in facilitating/inhibiting language learning, and the funds of knowledge approach; the unit on language variation was integrated into the class as an additional unit in the course. The goal of the unit was to familiarize teacher candidates with important aspects of dialects and language variation in order to help them better understand the challenges faced by students speaking nonstandard varieties of American English and equipping them with strategies and techniques to aid them in valuing and appreciating these students' linguistic funds of knowledge while also preparing them for the linguistically diverse nature of elementary-school classrooms they will likely encounter in their career. Table 1 below indicates the core area explored in each module within the course unit.

Table 1. Course Unit on Dialectical Variation

Module	Description of the Module
1	Prescriptive versus Descriptive Views of Language
2	An Overview of Dialects of American English
3	Practical Analysis of Dialectical Variation
4	A Balanced Approach to Teaching Dialectical Variation

In the first module of the course unit, students read Hinkel (2018) which outlines the two overarching views on language variation outlined above. The goal of this module was to provide students with some theoretical perspective regarding language variation would serve as a foundation for their further learning during the unit. In class, students were separated into groups and completed the T-chart below to guide them in identifying the salient points concerning each view of language. After having read the article before class, students then participated in a class discussion then ensued concerning the essential characteristics of each view, how each view perceives dialectical variation, and where students themselves stood in regards to both views. In the second module, students watched several documentaries (*American Tongues, Do You Speak American?*) on dialectical variation in American English and discussed their emerging understanding of various linguistic features of these dialects along with cultural stereotypes that are commonly held by speakers of these dialects. These documentaries were included in the course unit in order to extend the knowledge students gained in the

first module while also introducing them to specific linguistic characteristics possessed and demonstrated by various dialects of American English. In the third module, students built on the information explored in the previous module by listening to video clips of speakers of the major dialects of American English and identifying prominent phonological, morphological, syntactic, semantic, and pragmatic features exhibited by these dialects. Table 2 below provides a list of the video clips that were used for each of the major dialects of American English.

Table 2. Video Clips for the Major Dialects of American English

- 1. New England (Maine Video Canal, 2021)
- 2. The Mid Atlantic (People Like Us – The CNAM Channel, 2017)
- 3. The South (Jones, C., 2012)
- 4. The Midland (Lavender Sky, 2014)
- 5. The North (Berens, C., 2019)
- 6. The West (Saturday Night Live, 2019)

In the fourth and final module, students read a series of articles (Christian, 1997; Delpit, 2006; Hazen, 2001; Wolfram, 2013) designed to inform them of a variety of activities they could conceivably utilize in their classrooms to familiarize their future learners with multiple facets of language variation writ large as well as their homes/communities. Following completion of the modules, students completed a critical essay in which they recorded the knowledge and skills gained during the unit modules and ways in which they could apply this learning in their careers.

At the conclusion of the unit activities, participants completed a post-course questionnaire (see Appendix A) which asked them to reflect on and indicate the contributions of the course unit to their understanding of and appreciation for dialectical variation along with their comments concerning the strengths and weaknesses of the course unit.

The current study was conducted during the summer semester of 2023 and involved thirty-three students enrolled in two sections of a culture and education ESOL course designed for elementary education teacher candidates attending a four-year college in the southeastern United States who were pursuing the ESOL endorsement; thirty-three students ultimately agreed to participate in the study. Tables 3-5 below disclose the demographic information of the participants of the study.

Table 3. Participants' Ages

Section #1 (N = 16)		Section #2 (N = 17)	
20	1	20	4
21	2	21	4
22	6	22	2
23	2	23	1
24	2	24	2
25	1		
		27	1
29	1		
		30	1
31	1		
		32	2

Table 4. Participants' Self-Identified Gender

Section #1 (N = 16)		Section #2 (N = 17)	
Female	15	Female	15
Male	1	Male	2

Table 5. Participants' Self-Identified Ethnicity

Section #1 (N = 16)		Section #2 (N = 17)	
Hispanic/Latinx	9	Hispanic/Latinx	10
White/Caucasian	6	White/Caucasian	7
Other	1		

Method

Participants' responses to the Likert-scale statements were analyzed using descriptive statistics. According to Dörnyei (2007), the goal of descriptive statistics is to provide a summary of findings and describe general tendencies occurring in the data in order to provide a global picture of the behavior of the participants. Four types of descriptive statistics were calculated for each Likert-scale statement: the mean (the average of students' rating for the statement), the median (the middle rating between the highest and lowest ratings for the statement), the mode (the rating occurring most often for the statement), and the range (the difference between the largest rating and the smallest rating for the statement). The results of the analysis of the quantitative data obtained during the study can be found in Appendix B. Additionally, participants' comments regarding the open-ended questions were reviewed via qualitative content analysis. Although both quantitative and qualitative were collected and analyzed during the course of the research study, this article will focus on the results obtained from the quantitative data.

Results and Discussion

Section #1

Analysis of the quantitative data collected during the study revealed several interesting patterns. For example, in Section #1, the statement that received the highest mean was a tie between statement #2 (4.88) ("I understand the importance of understanding and valuing students' home dialects/languages.") and statement #6 (4.88) ("The dialect activity helped me understand how to teach students about dialectical/linguistic variation."). Regarding participants' overall response to statement #2, the course unit apparently accomplished the intended effect of challenging teacher candidates' perspectives regarding the languages/dialects spoken by students from minoritized populations and facilitated their understanding of and appreciation for these students' linguistic funds of knowledge. With respect to statement #6, this result was likely obtained because the activity helped familiarize the pre-service teachers with specific features of various dialects of American English, which may have helped demystify the linguistic nature of these dialects by providing them with detailed information about the systematicity of these dialects and hence developing their metalinguistic awareness in this regard. The statement that was rated lowest by participants in Section #1 was statement #1 ("I understand what dialectical variation is."). In this case, teacher candidates may not have understood the term "dialectical variation" and may not have understood what specifically this phrase was referring to, despite the fact that it was utilized repeatedly through the course of the unit. It is also conceivable that the unit may have been too short in duration and may have included too many resources for them to truly understand the nature and logistics of this phenomenon.

Section #2

Similar to the students in Section #1, statement #2 was not only the highest-ranked statement (4.88) by participants in Section #2, but the same mean was also obtained for the statement as with Section #1. As with the teacher candidates in Section #1, these students also believed that the course unit facilitated the evolution of their stances regarding language variation and helped them learn to positively evaluate and value their current/future students' linguistic differences. Interestingly, in contrast to students in Section #1, statement #6 not only received a moderately low rating (4.53), but this statement was the lowest-ranked statement among participants in Section #2. In this case, the students may have felt that the activity was too difficult and complex since they needed to first understand the definitions of various linguistic terms (i.e., phonology, morphology, syntax, semantics, pragmatics) in order to complete the activity, which may have confused them and distracted them from focusing on identifying particular features of the various dialects. Additionally, participants in Section #2 rated statement #1 as substantially higher than participants in Section #1, which appears to indicate that, despite the fact the same resources and activities were utilized virtually identically with both sections, students in Section #2 were more comfortable with and better understood the term "dialectical variation" and perhaps may have felt more comfortable with the linguistic terminology employed through the unit than participants in Section #1 in Section #1.

Comparisons Across Sections

Analysis of the quantitative data across both sections also revealed several interesting patterns. For instance, the average mean score across all ten statements was 4.67 for Section #1 and 4.74 for Section #2. Although this difference is not likely significant statistically, it nevertheless suggests a pattern that holds across the majority of the statements in that, with respect to eight of the ten statements, participants in Section #1 routinely rated the statements less highly than the participants in Section #2. This finding may be the result of a various of intersecting factors including, but certainly not limited to, the status of these students in the course and whether they had (not) previously completed the applied linguistics course (ESOL 4240). In other words, students who had taken ESOL 4240 in previous semesters would have already encountered some linguistic terminology and would conceivably have possessed more familiarity with specific linguistic terms in comparison with other students who had not taken the applied linguistics course. In some cases, the mean scores for certain statements between both sections varied little.

For example, participants in both sections were largely in agreement concerning statement #7 ("The articles helped me understand how to appreciate the variety of students' home dialects/languages.") and rated the statement relatively highly but also at about the same mean (4.63 for Section #1 and 4.65 for Section #2). This result seems to suggest that teacher candidates in both sections believed that the articles included in the first and fourth modules of the course unit contributed positively to their emergent understanding of the nature of language variation but also perhaps changed their stances regarding minoritized students' home languages/dialects. In other cases, teacher candidates' views regarding certain statements varied widely between both sections. For instance, with respect to statement #10 ("The critical essay helped me understand how to appreciate the variety of students' home dialects/languages."), participants in Section #2 rated this statement considerably more favorably (4.82) in comparison with participants in Section #1 (4.56). This result implies that the pre-service teachers in the second section considered the critical essay as a more educationally valuable activity than those enrolled in the first section.

This may align with their responses on the other statements in that, if they believed that the articles, documentaries, and corresponding activities did not necessarily contribute positively to their understanding of dialectical variation, then it is plausible to assume that the critical essay, which asked them to reflect on their learning gains during the course of the unit, was not an effective means for them to consolidate their learning. Another example of divergence regarding students' responses can be found in regards to statement #5 ("The dialect activity helped me understand how to appreciate the variety of students' home dialects/languages."). In this case, the trend is interestingly reversed, with participants in Section #1 (4.81) rating the statement considerably higher than participants in Section #2 (4.59). This finding may have potentially occurred because, from their perspective, the teacher candidates in section #2 might have been distracted by the complex linguistic terminology associated with the dialect activity in module three and thus might have not seen the relevancy between the activity and students home languages/dialects as clearly as the teacher candidates in Section #1.

Conclusion

The objective of the research study described herein was to document and study the thoughts and impressions of elementary-education ESOL pre-service teachers concerning the strengths and weaknesses of a course unit on dialectical variation. A variety of resources and activities were included as part of the unit to familiarize them with various perspectives concerning language variation, provide them with both general and specific information regarding the nature of various dialects of American English, furnish them with an opportunity to explore the systematic nature of these dialects, equip them with multiple strategies and techniques to develop their current/future students' awareness and understanding of linguistic/dialectical variation, and supply them with time and space to consider and reflect on the learning they gained during the course of the unit and possible applications of this knowledge to their own instructional contexts. Data for the study were collected via a post-course questionnaire consisting of both Likert-scale statements and open-ended questions, with the quantitative data being analyzed using descriptive statistics and the qualitative data being analyzed via content analysis. Results obtained from the quantitative data suggest that, while the course unit encouraged participants to view minoritized students' linguistic funds of knowledge in a positive light and acquainted them with various linguistic and cultural aspects of the major dialects of American English, the unit also posed logistical and technical challenges for participants which in some respect impeded them from fulling realizing the goals and aims of the unit. The author plans to incorporate this feedback into subsequent iterations of the course unit and replicate the current study in the future in order to confirm the initial findings obtained from the study and also include additional triangulated data sources to more clearly understand participants' views concerning the unit.

Moving forward, the author plans to implement several changes to the course unit based on the analysis of the data collected during the study. First, the course unit will likely be longer in duration and will include more activities designed to help pre-service teachers better understand various facets of each major dialect. Second, an additional module will potentially be added to the unit which would incorporate resources concerning essential facets of African American English since this is a predominant variety of American English not only in our region but in the United States. Third, in a similar vein, an additional module concerning World Englishes may also be integrated into the course unit to acquaint teacher candidates with numerous varieties of English existing across the world while also preparing them for the possibility of working with international students who communicate using these varieties. Fourth, the course unit will ostensibly include additional resources to more clearly emphasize "critical" nature critical language awareness to help students better grasp and contest the political and social forces shaping the ways in which dialects are typically viewed. Finally, the author intends to replicate this study to substantiate the findings obtained in this study which would also include more data points to gather more information concerning participants' observations concerning the course unit and triangulate them across these data points.

Recommendations

The present article may ideally inspire other teacher educators to consider incorporating similar course units in their educator preparation programs in an effort to prepare teacher candidates for the multicultural and

multilingual nature of public-school classrooms while additionally guiding them in questioning their assumptions regarding the nature of language variation. This article contributes valuably to the current literature on developing pre-service teachers' critical language awareness and may conceivably provide researchers with possible future directions for their current/future investigations. Additionally, it is hoped that the article may encourage scholars to consider utilizing this participant population in their research in order to better understand the effects of various pedagogical interventions on their knowledge and expertise as future educators.

References

Berens, Charlie [Username]. (2019, October 22). *Midwest Voice Translator* [Video]. YouTube. https://www.youtube.com/watch?v=7OR7yPK4wEw.

Christian, D. (1997). Vernacular dialects in US schools. ERIC Document Reproduction Services No. ED406846. Retrieved from https://files.eric.ed.gov/fulltext/ED406846.pdf.

Curzan, A., & Adams, M. (2012). *How English works: A linguistic introduction* (3rd ed.). Longman.

Delpit, L. (2006) What should teachers do? Ebonics and culturally responsive instruction. In S. J. Nero (Ed.), *Dialects, Englishes, creoles, and education* (pp. 93-101). New York, NY: Routledge.

Dörnyei, Z. (2007). *Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies*. Oxford University Press.

Fairclough, N. (1992). Introduction. In N. Fairclough (ed.), *Critical language awareness* (pp. 1-30). Routledge.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*(2), 106-116.

González, N., Moll. L. C., & Amanti, C. (2005). *Funds of knowledge: Theorizing practices in households, communities, and classrooms*. Routledge.

Hazen, K. (2001). Teaching about dialects. ERIC Document Reproduction Services No. ED456674. Retrieved from https://files.eric.ed.gov/fulltext/ED456674.pdf.

Hinkel, E. (2018). Descriptive versus prescriptive grammar. In Nassaji, H. (Ed.), *TESOL encyclopedia of English language teaching* (pp. 1-6). Wiley.

Janks, H., Rogers, R., & O'Daniels, K. (2017). Language and power in the classroom. In T. L. McCarty & S. May (Eds.), *Language policy and political issues in education* (pp. 185-197). Springer International Publishing.

Jones, Chris [Username]. (2012, April 18). *Southern accent, North Carolina* [Video]. YouTube. https://www.youtube.com/watch?v=gAqm5ls8Ep8.

Lavender Sky [Username]. (2014, September 23). *Accent challenge – Midwest – Iowa Minnesota Wisconsin USA – Mother & Daughter* [Video]. YouTube. https://www.youtube.com/watch?v=XUrpH0JedO0.

Lippi-Green, R. (2012). The linguistic facts of life. In *English with an accent: Language, ideology, and discrimination in the United States* (pp. 5-26). Routledge.

Lucas, T. (2010). Language, schooling, and the preparation of teachers for linguistic diversity. In T. Lucas (Ed.), *Teacher preparation for linguistically diverse classrooms: A resource for teacher educators* (pp. 3-17). Routledge.

Lucas, T., & Villegas, A. M. (2010a). A framework for preparing linguistically responsive teachers. In T. Lucas (Ed.), *Teacher preparation for linguistically diverse classrooms: A resource for teacher educators* (pp. 55-72). Routledge.

Lucas, T., & Villegas, A. M. (2010b). The missing piece in teacher education: The preparation of linguistically responsive teachers. *Yearbook of the National Society for the Study of Education, 109*(2), 297-318.

Lucas, T., & Villegas, A. M. (2013). Preparing linguistically responsive teachers: Laying the foundation in preservice teachers. *Theory into Practice, 52*(2), 98-109.

Maine Video Canal [Username]. (2021, November 9). *How to talk like a Maine-ah, 9 great words to mispronounce* [Video]. YouTube. https://www.youtube.com/watch?v=p3L5czFvyCc.

People Like Us – The CNAM Channel [Username]. (2017, March 8). *#Real thick accent: Boston North End Italian* [Video]. YouTube. https://www.youtube.com/watch?v=omVFxtbZoyw.

Saturday Night Live [Username]. (2019, October 18). *Every Californians ever (part 1 of 2)* [Video]. YouTube. https://www.youtube.com/watch?v=dCer2e0t8r8.

Shleppegrell, M. J. (2004). *The language of schooling: A functional linguistics perspective*. Lawrence Erlbaum.

Wolfram, W. (2013). Sounds effects: Challenging language prejudice in the classroom. *The Education Digest, 79*(1), 27-30.

Wolfram, W., & Schilling, N. (2016). *American English: Dialects and variation* (3rd ed.). Blackwell.

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Appendix A: Post-Course Questionnaire

Part A. Please indicate the level of your agreement with the following statements by writing the number to the left of each statement that matches your level of agreement with the statement.

"1" = "Strongly Disagree" "2" = "Moderately Disagree" "3" = "Neither Disagree Nor Agree" "4" = "Moderately Agree" "5" = Strongly Agree"	
Rating	**Statement**
	1. I understand what dialectical variation is.
	2. I understand the importance of understanding and valuing students' home dialects/ languages.
	3. The documentaries helped me understand how to appreciate the variety of students' home dialects/languages.
	4. The documentaries helped me understand how to teach students about dialectical/linguistic variation.
	5. The dialect activity helped me understand how to appreciate the variety of students' home dialects/languages.
	6. The dialect activity helped me understand how to teach students about dialectical/linguistic variation.
	7. The articles helped me understand how to appreciate the variety of students' home dialects/languages.
	8. The articles helped me understand how to teach students about dialectical/linguistic variation.
	9. The critical essay helped me understand how to appreciate the variety of students' home dialects/languages.
	10. The critical essay helped me understand how to appreciate the variety of students' home dialects/languages.

Part B. Please answer each question below by writing your response in the box under each question.

- 1. Which aspects of the course unit on dialectical variation (i.e., documentaries, dialect activity, articles, critical essay) did you enjoy the most? Why?
- 2. Which aspects of the course unit on dialectical variation (i.e., documentaries, dialect activity, articles, critical essay) did you enjoy the least? Why?
- 3. Which aspects of the course unit on dialectical variation (i.e., documentaries, dialect activity, articles, critical essay did you find most helpful? Why?
- 4. Which aspects of the course unit on dialectical variation (i.e., documentaries, dialect activity, articles, critical essay) did you find least helpful? Why?
- 5. What suggestions do you have for improving the course unit on dialectical variation?

Appendix B: Descriptive Statistics for Likert-Scale Questionnaire Items

Statement #	Category	Section 1*	Section 2**
1	Mean	4.44	4.77
	Median	4	4.5
	Mode	5	5
	Range	2	1
Statement #	**Category**	**Section 1***	**Section 2****
2	Mean	4.88	4.88
	Median	4.5	4.5
	Mode	5	5
	Range	1	1
Statement #	**Category**	**Section 1***	**Section 2****
3	Mean	4.63	4.82
	Median	4	4.5
	Mode	5	5
	Range	2	1
Statement #	**Category**	**Section 1***	**Section 2****
4	Mean	4.63	4.77
	Median	4	4.5
	Mode	5	5
	Range	2	1
Statement #	**Category**	**Section 1***	**Section 2****
5	Mean	4.81	4.59
	Median	4	4
	Mode	5	5
	Range	2	2
Statement #	**Category**	**Section 1***	**Section 2****
6	Mean	4.88	4.53
	Median	4.5	4.5
	Mode	5	5
	Range	1	1
Statement #	**Category**	**Section 1***	**Section 2****
7	Mean	4.75	4.82
	Median	4	4.5
	Mode	5	5
	Range	2	1
Statement #	**Category**	**Section 1***	**Section 2****
8	Mean	4.63	4.65
	Median	4	4.5
	Mode	5	5
	Range	2	1
Statement #	**Category**	**Section 1***	**Section 2****
9	Mean	4.56	4.71
	Median	4	4
	Mode	5	5
	Range	2	2
Statement #	**Category**	**Section 1***	**Section 2****
10	Mean	4.56	4.82
	Median	4	4.5
	Mode	5	5
	Range	2	1

* n = 16

** n = 17

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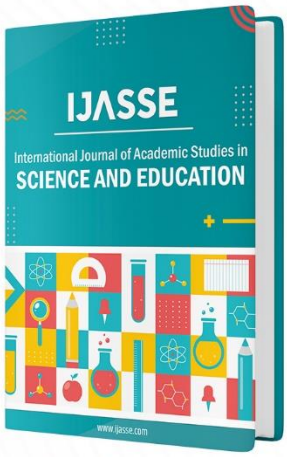

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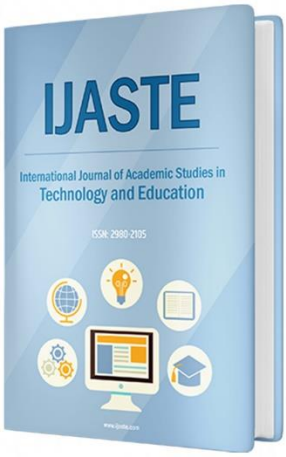

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