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Selected Research and Development Papers - Volume 1
Selected Papers on the Practice of Educational Communications and Technology - Volume 2

Presented Online during The Annual Convention of the Association for Educational Communications and Technology

Editors
Michael Simonson, Ph.D.
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Extended Learning
Academic Affairs
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2020 Annual Proceedings – Volumes 1 & 2

Volume 1: Selected Research and Development Papers
And
Volume 2: Selected Papers
On the Practice of Educational Communications and Technology

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Preface

For the forty third time, the Association for Educational Communications and Technology (AECT) is sponsoring the publication of these Proceedings. Papers published in this volume were presented line during the annual AECT Convention. A limited quantity of these Proceedings were printed and sold in both hardcopy and electronic versions. Volumes 1 and 2 are available through the Educational Resources Clearinghouse (ERIC) System. Proceedings volumes are available to members at AECT.org.

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The Proceedings of AECT's Convention are published in two volumes. Volume #1 contains papers dealing primarily with research and development topics. Papers dealing with the practice of instructional technology including instruction and training issues are contained in Volume #2. This year, both volumes are included in one document.

REFEREEING PROCESS: Papers selected for presentation at the AECT Convention and included in these Proceedings were subjected to a reviewing process. All references to authorship were removed from proposals before they were submitted to referees for review. Approximately sixty percent of the manuscripts submitted for consideration were selected for presentation at the convention and for publication in these Proceedings. The papers contained in this document represent some of the most current thinking in educational communications and technology.

Michael R. Simonson
Deborah J. Seepersaud
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Volume 2

Selected Papers On the Practice of Educational Communications and Technology

An Analytical Framework for Inclusive Online/Blended Learning Experiences in Higher Education

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Introduction

Trends such as globalization, automation, and a shift towards skilled-services necessitate college degrees for good wages (Carnevale et al., 2018). The U.S. will not be able to meet the workforce demands of today's knowledge economy without equitable access to higher education (U.S. Department of Education, 2016). Yet, despite steady growth in diversity in the U.S., college participation and degree completion rates of most ethnic minorities and other underrepresented groups are lower as compared to Whites (McFarland et al. 2018; U.S. Department of Education, 2016). The degree attainment gap for low-income (Association of American Colleges and Universities (AACU, 2015) and first generation students (AACU, 2015; Cataldi et al., 2018) puts increasing pressure on institutes of higher education to address retention issues faced by a diverse student body to provide students with 21st century skills that employers demand (Adams Becker et al., 2017).

Technical skills and cultural awareness are just two of the 21st century competencies identified by van Laar et al.'s (2017) systematic literature review as necessary skills for working in today's global economy driven by an ethnically diverse workforce. With the number of students participating in distance education continually growing (Seaman et al., 2018), technical and cultural competencies of students and faculty become a greater concern. Attrition issues still plague online learning (Chiyaka et al., 2016), making it even more imperative for universities to rethink the ways digital platforms can support diverse learners through collaborative student-centered learning in innovative ways (Alexander et al., 2019).

How then do universities ensure that their faculty possess a critical awareness of increasing student diversity, and are able to design and deliver inclusive 21st century education that will ultimately meet the needs of the modern workplace? We propose a framework that brings emerging trends and best practice research together through Functional-Modular (Layer Design) View (FMV) (Gibbons & Rogers, 2009). FMV allows the articulation and incorporation of multiple layers to build a holistic analytical framework needed for the design and delivery of equitable 21st Century learning experiences. Our framework utilizes Universal Design for Learning (UDL) (CAST, 2018b), culturally relevant pedagogy (CRP) (Ladson-Billings, 1995), and intersectionality (Collins, 2015) in a three layer framework that encompasses context, design and pedagogy.

Literature Review

With a focus on creating inclusive learning environments, Universal Design for Learning (UDL) provides a framework to support the needs of diverse learners from different backgrounds and ability levels. Originating from architectural principles developed to ensure access to all built

structures (North Carolina State University, The Center for Universal Design, 1997), the Center for Applied Special Technology (CAST) applied theories and practices in education, developmental psychology, cognitive science, and cognitive neuroscience to create the UDL Framework (CAST, 2018a). The framework is based upon the fundamental notion that all learners respond in different ways to instruction and takes a benefits-based standpoint when considering learner differences. Adopted by the Individuals with disabilities Act (IDEA 2004), UDL gained popularity in special education classrooms, but has since realized relatively steady and widespread adoption (Al-Azawei et al., 2016). By embracing student differences, UDL presents several strengths in supporting online learners who may be nontraditional students drawn to the flexibility of distance learning (Rogers-Shaw et al., 2018).

Guidelines for applying UDL are organized by three principles: 1) multiple means of engagement, 2) multiple means of representation, and 3) multiple means of action and expression (CAST, 2018b). Each principle consists of three guidelines to support the design of instruction across three major categories of learning actions to 1) increase access to the learning goal, 2) develop effort and persistence, language and symbols, and expression and communication, and 3) empower learners through self-regulation, comprehension and executive function. Each guideline contains several checkpoints that provide more specific suggestions for applying the framework.

The first principle, multiple means of engagement addresses the "why" of learning by providing options for recruiting interest (7), sustaining effort and persistence (8), and self-regulation (9). There are 10 checkpoints within this category that broadly define the need to build engagement and provide learner choice for the purpose of providing an effective learning environment. This includes creating effective challenges for learner motivation, providing flexible support, and incorporating opportunities for peer grouping and role change while supporting learners to set personal goals and manage emotional responses during the learning process.

The second principle, multiple means of representation addresses the "what" of learning by providing options for perception (1), language and symbols (2), and self-regulation (3). There are 12 checkpoints within this category that broadly define the need for the provision of learning environments that activate existing learner knowledge and link out to pre-requisite content information. This includes the use of embedded model scaffolds, feedback, and memory supports to explicitly highlight relationships between content elements in order to make text more comprehensible and facilitate perceptual clarity with visual supplemental support to decipher semantic elements.

Finally, multiple means of action and expression addresses the "how" of learning and provides options for physical action (4), expression and communication (5), and executive functions (6). There are 9 checkpoints within this category that broadly define the need to allow for learner adaptability and independence by reducing learner barriers through the provision of alternative media choices for artifact representation and participation accompanied with instructor demonstration of embedded supports and organizational aids for strategic planning.

Research supports the overall effectiveness of UDL in positively affecting learner perceptions and/or academic performance (Al-Azawei et al., 2016) including students with disabilities (Cook & Rao, 2018), English language learners (Rao & Torres, 2017) and international students (Bracken & Novak, 2019). Research on its effectiveness in online settings, however, is still emerging (Al-Azawei et al., 2016). Recent studies conducted in online higher education settings included the areas of teacher education (He, 2014; Lohmann et al., 2018), an

undergraduate computer science course (Al-Azawei et al., 2017), graduate student orientation (Lock et al., 2019), and faculty professional development (Craig et al., 2019; Singleton, 2019). Findings suggest that UDL engagement strategies have the potential to make students feel more connected, valued and supported (Lohmann et al., 2018) and improve learners' satisfaction and acceptance of e-learning (Al-Azawei et al., 2017) as well as their confidence and self-efficacy (He, 2014). Additionally, learning about UDL practices influenced participants' likeliness to adopt UDL in their own teaching (Craig et al., 2019; He, 2014; Singleton, 2019).

Like UDL, culturally relevant pedagogy (CRP) has been shown to promote inclusiveness and academic success (Garvin-Hudson & Jackson, 2018; Sanguins, 2015) by scaffolding learning and incorporating multiple forms of assessment (Ladson-Billings, 1995). Embracing social justice, CRP additionally "helps students to accept and affirm their cultural identity while developing critical perspectives that challenge inequities that schools (and other institutions) perpetuate" (Ladson-Billings, 1995, p. 469). By expecting academic success and promoting cultural competence, CRP fosters positive cultural identity, thereby increasing engagement (Chinn, 2015) and positive self-efficacy (Jocson, 2016; Sanguins, 2015). Creating interactive environments for culturally diverse students to recognize their learning needs and collaborate with peers enables students to bridge knowledge gaps (Heitner & Jennings, 2016; Lim et al., 2019) and cultural differences between faculty and students, which has demonstrated the potential of improving retention rates in higher education (Heitner & Jennings, 2016).

Although UDL encourages the use of a variety of activities and sources of information in order to be culturally relevant and responsive (CAST, 2018a), it fails to critique education norms and address the ways power and privilege oppress students in the margins (Waitoller & King Thorius, 2016). Expanding UDL to incorporate culturally relevant pedagogy can help educators consider the impacts dominant race, culture and language have on learning that are necessary for truly equitable learning experiences (Keiran & Anderson, 2019). Waitoller and King Thorius (2016), proposed to enhance UDL with a cross-pollination of ideas from culturally sustaining pedagogies like CRP in order to dismantle racism and ableism by enlisting students in interrogating dominant culture and empowering students to redefine the notion of expert learner.

Similarly, intersectionality theory interrogates the social construction of power and the creation of multiple, complex inequalities (Collins, 2015). The theory serves as a tool to highlight the multiplicative effects of marginalization experienced by individuals with more than one stigmatized socially constructed identity dimension as well as the systemic inequalities that perpetuate those unequal intersections of power (Crenshaw, 1990; Collins, 1990/2009). Intersectionality provides additional considerations for understanding the diverse needs of learners for inclusiveness and equity in online/blended learning (Harris & Patton, 2019). Examining online learning environments through the lens of intersectionality brings attention to the new digital divide (issues of access, use and outcomes) (Warschauer, 2010) as well as reducing stigmas associated with multiple overlapping identity factors (Alvarado & Hurtado, 2015).

To address culturally responsive teaching practices and intersectionality, we propose the use of Critical Practices for Anti-Bias Education (Scharf, 2016). Developed by Teaching Tolerance, a non-profit group dedicated to reducing prejudice and promoting equitable school experiences, the guide contains twenty critical practices informed by Teaching Tolerance Social Justice Standards. The four sections: Instruction, Classroom Culture, Family and Community Engagement and Teacher Leadership, help to organize recommended practices and specific strategies that support diverse learners through culturally responsive teaching practices that

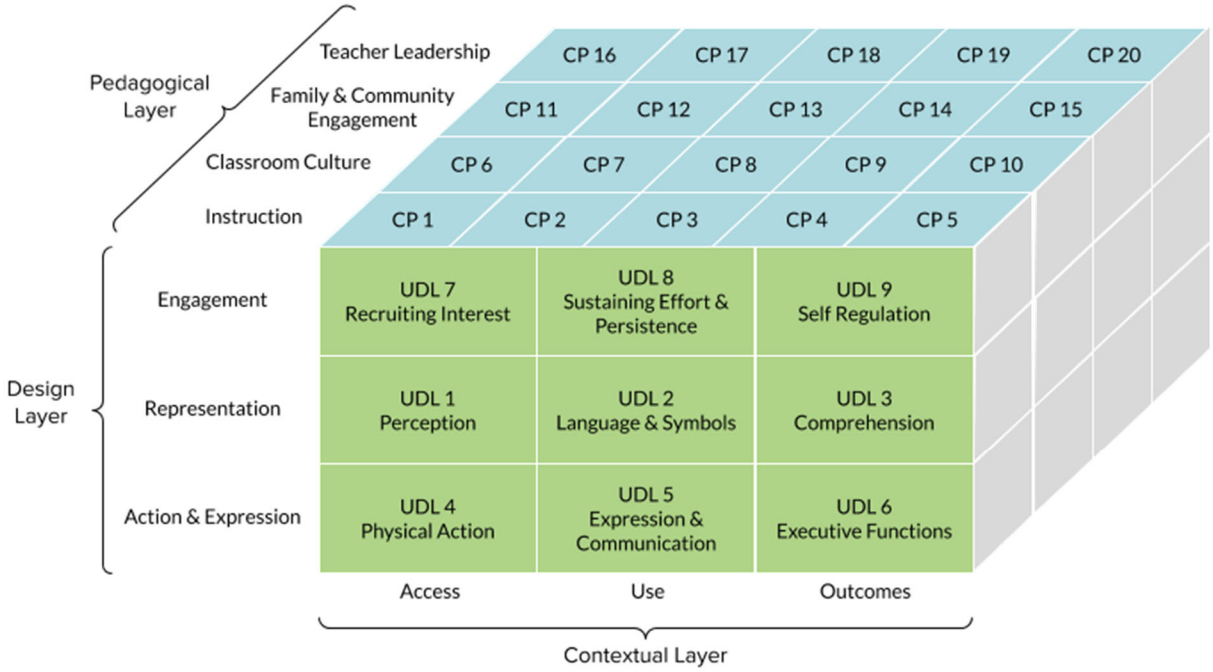
engage families and communities and encourage students to take action against bias and injustice. Critical Practices for Anti-Bias Education has been recommended as a tool for reducing prejudices against disability and leveraging differentiation to develop an equity pedagogy (Bialka, 2017).

Analytical Framework for Inclusive Online/Blended Learning Experiences

Recognizing the need for a flexible tool to guide instructional design and coaching for culturally responsive equitable learning environments that support the needs of diverse learners, we developed an Analytical Framework for Inclusive Online/Blended Learning Experiences (AFIOBLE). The AFIOBLE combines UDL Guidelines with Critical Practices for Anti-Bias Education into three interconnected layers: contextual, design and pedagogical (see Figure 1). The contextual layer additionally supports a critical awareness of the varying intersections of identity essential in understanding the needs of diverse learners in online/blended learning through a lens of intersectionality. The AFIOBLE synthesizes UDL checkpoints and Teaching Tolerance critical practices (see Table 1) and utilizes guiding questions (see Table 2) to assist the user in operationalizing UDL and culturally responsive practices.

Figure 1

AFIOBLE Contextual, Design & Pedagogical Layers



Note. UDL = Universal Design for Learning; CP = Critical Practice for Anti-Bias Education

Table 1
Synthesis of UDL and Critical Practices for Anti-Bias Education

UDL Checkpoints	Critical Practices for Anti-Bias Education
Contextual Layer	
1.1 Offer ways of customizing the display of information 4.2 Optimize access to tools & assistive technologies 5.2 Use multiple tools for construction & composition 6.4 Enhance capacity for monitoring progress 7.3 Minimize threats and distractions	7. Thoughtful classroom setup & structure 9. Social & emotional safety 13. Increased connections among families 14. Use of local resources 17. Speaking up & responding to prejudice, bias & stereotypes 18. Building alliances 19. Leading beyond the classroom
Design & Pedagogical Layers	
Recruiting Interest 7.1 Optimize individual choice & autonomy 7.2 Optimize relevance, value & authenticity 7.3 Minimize threats & distractions	 2. Differentiated instruction 3. Real world connections 14. Use of local resources 15. Engage with community issues & problems 17. Speak up & respond to prejudice, bias & stereotypes
Perception 1.1 Offer ways of customizing the display of information 1.2 Offer alternatives for auditory information 1.3 Offer alternatives for visual information	 7. Thoughtful classroom setup & structure
Physical Action 4.1 Vary the methods for response & navigation 4.2 Optimize access to tools & assistive tech	 2. Differentiated instruction 7. Thoughtful classroom setup & structure
Sustaining Effort & Persistence 8.1 Heighten salience of goals & objectives 8.2 Vary demands & resources to optimize challenge 8.3 Foster collaboration & community 8.4 Increase mastery-oriented feedback	 1. Critical engagement with material 3. Cooperative & collaborative learning 5. Values based assessment, evaluation & grading 6. Honoring student experience 7. Thoughtful classroom setup & structure 8. Shared inquiry & dialogue 10. Values based behavior management
Language & Symbols 2.1 Clarify vocabulary & symbols 2.2 Clarify syntax & structure 2.3 Support decoding of text, mathematical notation, & symbols 2.4 Promote understanding across languages 2.5 Illustrate through multiple media	 11. Culturally sensitive communication 12. Inclusion of family & community wisdom

Table 1 (continued)
Synthesis of UDL and Critical Practices for Anti-Bias Education

UDL Checkpoints	Critical Practices for Anti-Bias Education
Design & Pedagogical Layers	
Expression & Communication	
5.1 Use of multiple media for communication	8. Shared inquiry & dialogue
5.2 Use multiple tools for construction & composition	11. Culturally sensitive communication
5.3 Building fluencies with graduated levels of support for practice & performance	
Self Regulation	
9.1 Promote expectations & beliefs that optimize motivation	5. Values based assessment, evaluation & grading
	10. Values based behavior management
9.2 Facilitate personal coping skills & strategies	13. Increased connection among families
9.3 Develop self-assessment & reflection	20. Ongoing reflection & learning
Comprehension	
3.1 Activate or supply background knowledge	1. Critical engagement with material
3.2 Highlight patterns, critical features, big ideas & relationships	2. Differentiated instruction
	4. Real world connections
3.3 Guide information processing & visualization	
3.4 Maximize transfer & generalization	
Executive Functions	
6.1 Guide appropriate goal setting	2. Differentiated instruction
6.2 Support planning & strategy	4. Real world connections
6.3 Facilitate managing information & resources	17. Speaking up & responding to prejudice, bias & stereotypes
6.4 Enhance capacity for monitoring progress	
	20. Ongoing reflecting and learning

The AFIOBLE tool is a real-time Google Doc that contains the framework and guiding questions. It is intended to support critical reflection on course design and practice on an individual, peer to peer, or instructional coaching setting. Google Docs is a cloud-based word processing application that allows for simultaneous sharing and editing with multiple users. The tool also includes commenting and chat features, document version history, and document permissions and sharing. Employing existing free/low cost resources furthers replication, customization, collaboration and broader use. As such, the tool is available at http://bit.ly/afioble, and is licensed by Creative Commons 4.0 Share-Alike (CC BY-SA 4.0). Additionally, the choice of Google Docs for tool creation facilitates embedded technology skills acquisition through the use of the web-based tool during the usage process (Singleton et al., 2019).

We also recommend that the AFIOBLE tool be used alongside the ADDIE instructional design (ID) framework. Branch and Merrill (2012) define the core elements that inform many ID models as ADDIE, an acronym for Analyze, Design, Develop, Implement, and Evaluate. Analyze describes the needs assessment stage, where measurable objectives are created and learning types and activities are specified. Thus, we recommend using the context layer during this stage. Findings from the analysis stage inform the design and development stages where instructional strategies are planned and instructional materials are subsequently created. The design layer complements these phases. The implementation stage involves the delivery of the

intervention in the context for which it was designed and aligns with the pedagogical layer. Finally, the evaluation component includes both formative and summative assessments and subsequent revisions. ADDIE embraces an iterative process to be adaptive (Branch & Merrill, 2012). The AFIOBLE incorporates this tradition and other important characteristics of ID such as its student-centered, goal-oriented, empirical, self-correcting, and collaborative nature that is focused on meaningful performance and measurable outcomes (Branch & Merrill, 2012).

Table 2
Sample AFIOBLE Guiding Questions

Layer	Guiding Questions
Contextual	Consider internet connectivity and speeds in relation to accessing course content and activities. Are there low tech options to engage in the course?
Design	How does the design of your course allow for use across the continuum of technological ability and access?
Pedagogical	How does your teaching style facilitate varied student interaction with the course site and materials based on individual student need?

Conclusion

This analytical framework was developed in response to the complexity and interrelatedness of the skills needed to teach in the 21st Century classroom. We believe it can contribute to research that supports understanding of how instructional design and teaching interacts within a system and culture. This understanding is critical to bridge the divide between different cultures and foster better appreciation and acceptance of cultural diversity (Walter, 2018) as well as avoid clashes with the system (Warr et al., 2019). This framework also serves to support growing research on cultural perspectives in learning environments, and teaching strategies that address diversity in education using student-centric approaches (Alalshaikh, 2015). Ladson-Billings (2014) stated, “remixing is vital to innovation in art, science, and pedagogy, and it is crucial that we are willing to remix what we created and/or inherited” (p. 76). This remixed framework provides an ecological and holistic way to view the knowledge, skills and pedagogies necessary for inclusive 21st Century teaching and learning.

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Designing effective learning experiences for diverse and scattered ethnic minority groups across Yunnan Province, China

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Abstract

Five key interrelated areas are being mapped, analyzed, and synthesized to better understand the challenges and issues for quality multicultural educational materials and learning experiences for ethnic minority groups within a large province in southwest China. Rapid urbanization and intensive social exchanges have changed the cultural outlook of ethnic minority groups and society. The related educational issue is how to preserve the cultures and languages of ethnic minorities and their sociocultural identity in the process of government-encouraged social and cultural integration with Han culture, Mandarin, and modernity.

Sociocultural Ethnic Minority Groups in Yunnan Province, PRC

Yunnan Province in the People's Republic of China (PRC) is slightly smaller in size than the U.S. state of California. Its diverse geography and widespread rurality are home to approximately 48.3 million people (2018 estimate). While the majority are of Han ethnicity, 34% (16.4 million) of the population are members of ethnic minority groups. The 25 largest ethnic groups within the province have populations of 5,000 or more, including the Yi, Hani, Bai, Dai, Zhuang, Miao, Hui, and Lahu. A number of these ethnic groups also move freely back and forth between the borders of the PRC and neighboring countries leading to fluctuations in minority populations and quite active cross-border relations. Yunnan is widely known as an area within China where ethnic minorities are concentrated; it ranks first in the country in variety and number of ethnic minorities.

Gao and Wang (2015) believe that the 26 distinct ethnic groups found in Yunnan are the epitome of China's multi-ethnic groups and are uniquely different in religion, food, clothing, architecture, festival etiquette, literature and art, etc. They serve as representatives of the different characteristics found among the entire 56 recognized ethnic groups throughout the nation. Wu (2020) conducted field investigations on the development of compulsory education in nine ethnically-concentrated provinces, including Yunnan. According to his team's investigation, the development of compulsory education in ethnic areas still faces difficulties and problems, such as the diversification of education supply functions, special school administration units, high school operating costs, and a poor supply of teachers. Wu (2020) noted that within education in border ethnic areas such as Yunnan, it is considered vitally necessary to continuously enhance ethnic students' recognition of the outstanding culture of the Chinese (overwhelmingly Han-dominant) nation. The purpose of this educational effort is to prevent ethnic separatists located

on China's border areas from propagating false statements and undermining national unity. This concern has led to the implementation of additional social functions to compulsory education. These additional social functions provided by the compulsory education program in ethnic areas brings a substantial increase in tasks for frontline teachers. The required diversified educational services pose significant challenges to teachers' knowledge levels, language abilities, and working styles. Teachers' teaching energy is diffused by all these requirements and teaching quality inevitably decreases as such policies are implemented (Wu, 2020). Because ethnic areas are scattered in mountainous areas, pastoral areas, and forested areas which are sparsely populated, the forms of compulsory education are also unique, with boarding schools and small-scale schools (teaching sites) most common. These small-scale schools in the Chinese context refers to schools with less than 100 students (Lei & Zhang , 2011; Yang & Zhang, 2014).

We are mapping a variety of information sources across the following five areas to increase our own understandings of the complex interactive issues in play regarding education of ethnic minorities in Yunnan Province:

1) Chinese national government policies and the formal curriculum of schools
2) Instructional designs that promote learning by ethnic minorities in China
3) Rurality and the tradeoffs facing rural development in Yunnan
4) Urbanization and globalization as both threats and opportunities for China's ethnic minorities
5) Analogous situations and approaches that have been or could be fruitful when confronting these types of challenges

National Government Policies and the Formal Curriculum of Schools

In 1951, the "Report of the Ministry of Education on the First National Education Conference on Ethnic Minorities" mentioned that for ethnic groups, school subjects in primary and middle schools must be taught in their own languages. The meeting unanimously agreed that schools of all ethnic groups at all levels may provide Chinese (i.e., Mandarin) lessons according to the needs and voluntary wishes of the minorities. Between 1957 and 1965 the government largely ignored ethnic differences and the role of ethnic languages declined. The Cultural Revolution and its aftermath, 1996-1976, further damaged bilingual education. The teaching of ethnic languages was abolished, and ethnic primary and secondary schools in ethnic autonomous areas were mostly closed or converted to ordinary schools (Huang et al., 2015).

Between 1992-2001 the PRC issued a series of policies to promote the (re)development of minority education. The National Civil Affairs Commission and the State Education Commission of China in 1992 stipulated that "in areas where ethnic languages are used for teaching, bilingual teaching shall be carried out in accordance with local conditions." The policy encouraged the compilation and publication of ethnic textbooks while also promoting "universal Mandarin" as the required lingua franca. By 2010, bilingual education became compulsory for pre-school age minority children, and bilingual teaching objectives were further expanded.

Xu and Cai (2018) analyzed the current development status and problems of curriculum resources in minority areas in China from the perspective of multicultural education. First of all,

the development of multicultural curriculum resources in many ethnic areas is only a spontaneous act initiated by the supervisor, without systematic and standardized guidance from the Ministry of Education or regional educational officials. Secondly, in many ethnic regions, the multicultural curriculum takes Han culture as its core value and standpoint and then merely introduces the cultural content of ethnic minorities as a supplemental attachment. This kind of multicultural curriculum has not taken significant hold in the multicultural environment of ethnic minority areas not least because it does not adequately account for students' daily experiences. In addition, the implementation of multicultural courses in many regions follows common utilitarian purposes. Multicultural courses in most ethnic regions are integrated with disciplines such as music, sports, and fine arts. These subjects are not included as examination subjects. Due to the influence of exam-oriented education, these courses are often squeezed by exam subjects and receive little distributed time in the curriculum. Some education authorities require schools to offer multicultural courses; others leave it to local discretion. Some schools offer courses only to satisfy upcoming inspections and investigations by superiors.

Finally, the development of ethnic minority curriculum resources and the implementation of multicultural courses requires evaluation as a driving force. The teaching evaluation system needs to be developed in a diversified way that accounts for the existence of ethnic minority curriculum content. But in the actual operational process, strongly affected by test-oriented education, the scores achieved are still the dominant factor used to measure the quality of a school's teaching. This has largely precluded the establishment and implementation of a diversified teaching evaluation system that is sensitive to multicultural issues. Both teachers and students are constrained by the scores. Teacher initiative and student interest in the implementation of minority curriculum issues is diminished and incommensurate with the needs to preserve ethnic minority awareness and cultural and linguistic understanding.

Instructional Designs that Promote Learning by Ethnic Minorities

Li and Ma (2010) proposed that only by implementing a multicultural education concept into the curriculum content can education be culturally inclusive and adaptable to diverse needs across the nation. Students from ethnic minorities come from different ethnic groups and possess deep and diverse cultural backgrounds. Therefore, appropriate curriculum content should have its own characteristics consonant with these backgrounds. However, the current curriculum content still rarely covers minority cultures. The content of courses continues to use mainstream culture as the standard which not only leads to a superficial understanding of minority cultures, but also causes minority students a lot of discomfort in the classroom as many topics discussed are ill-matched to local cultural mores, customs, and practices.

There are many practical difficulties in multicultural curriculum design. For example, should a multicultural curriculum include all cultures? It seems reasonable on the surface, but in reality it doesn't work because the capacity of the curriculum is limited and the learning burden of both students and teachers is limited. Moreover, some cultural customs or mores may only be suitable for students within that ethnic group; there is no need to enculturate students from different cultural groups to these unique features. Yet Feinberg (1995) correctly points out that students who have not received their own cultural education may feel alienated and rootless. At the same time, students who lack mainstream cultural education will lose many economic, political, and

social advantages and opportunities. Therefore, not only is it difficult for curriculum designers to make cultural choices, but it is also a challenge for affected ethnic minorities. Monistic culturalism is still the dominant guiding ideology within the current Chinese national curriculum, so how will the curriculum within Chinese schools in areas of high minority concentrations solve this dilemma?

In the context of maintaining the diversity of world cultures, the inheritance and development of ethnic minority traditional cultures has become more and more prominent. In August 2015, the State Council of China issued the "Decision on Accelerating the Development of Ethnic Education," which clearly states that it is necessary to ensure the continuance and promote the excellent traditional culture of ethnic minorities. Among topics mentioned is the construction of ethnic culture school-based courses as an important measure to promote the inheritance of ethnic culture and advance the progress of ethnic education. During this period, the guarantee of relevant national policies and regulations also provided motivation for the study of curriculum reform in ethnic areas.

Zhu and Li (2020) used "Citespace" software to conduct a content quantitative analysis of relevant documents in the field of school-based construction of Chinese ethnic culture from 2003 to 2018. Their research shows that the rapid development of ethnic culture school-based curriculum research took place between 2012 and 2018. Zhu and Li demonstrate that there are some common problems in the development of an ethnic culture school-based curriculum: First, the goals of curriculum development were too general to play a true guiding and regulatory role. Second, there is a lack of external support. Meng and Wu (2016) concurred, pointing out that there is a lack of financial support and policy guarantee in the development of an ethnic culture school-based curriculum. Finally, the regulatory system is imperfect. Most ethnic schools have not established a special school-based curriculum development committee, nor have they introduced a supporting inspection (i.e., evaluation) system (Zhu & Li, 2020).

Jin (2020) proposed that minority cultures shape individuals with different personalities and abilities than those typically found in the dominant Chinese culture. In terms of the target culture of the curriculum, the pre-school curriculum in ethnic regions should cultivate multicultural awareness and promote the comprehensive and harmonious development of children; in the content of the curriculum content and culture, it should be multi-valued and culturally appropriate. In terms of curriculum evaluation culture, educators should pay attention to diversity and differentiation to meet the inherent needs of children in ethnic regions.

Zhu and Cao (2012) investigated the bilingual teaching situation in ethnic minority areas in Yunnan Province and pointed out a series of problems in the composition and support of teaching staff. For example, the distribution of bilingual teachers is uneven, the overall structure is unreasonable, and the teaching staff is unstable. In addition, bilingual teachers have heavy teaching tasks, the overall quality is not high, and the enthusiasm for bilingual teaching among supervisors is low. Although the training of bilingual teachers is institutionalized and routine, there are too few trainings on practical teaching strategies. The bilingual teaching teacher training policy for ethnic groups with a small population is very weak as compared to bilingual teaching teacher training in, for example, Mandarin and English.

Teachers in ethnic areas tend to focus on their own culture and teach from the perspective of that culture – which is most cases is Han (Wang, 2020). They lack understanding of and sensitivity towards the cultural background of ethnic minority students. Wang believes that the reason is that China's teacher education and teacher training usually form teacher professional skills and those teacher training models reflect the mainstream Han culture. Such a model ignores the acquisition of local and ethnic cultural knowledge, as well as promoting a lack of understanding of the differences in students' cultural backgrounds across the nation and within particular regions. Therefore, in the current teacher training and especially training in ethnic areas, it is necessary to enhance teachers' own cross-cultural sensitivity and strengthen the training of teachers' cross-cultural knowledge and skills.

Rurality and the Tradeoffs Facing Rural Development in Yunnan

Yang (2012) used ethnographic field work to investigate the case of a Lahu village school and summarized the difficulties in the development of local education. Among them, the early marriage and childbearing of the Lahu people has a negative impact on formal school education. In addition, the economic drive brought about by the rise of the tea trade in the villages has led to high, yet largely hidden school dropout rates. Existing textbooks were also deemed unsuitable for the realities of mountain villages with their alien and difficult content.

Lin and Zhang (2002) conducted a field survey of 25 ethnic minority villages in Yunnan and found that the economic development of Yunnan's ethnic minority villages was uneven, at best. In 2009, the National Ethnic Affairs Commission of China launched the “Pilot Work for the Protection and Development of Ethnic Minority Characteristic Villages.” The main objective of the commission was the creation of a pilot program in progressive activities work. On the basis of summarizing the protection and development experience of the pilot project, the guiding principles and measures were further developed and improved. In 2012, the “Outline for the Development of Ethnic Minority Villages 2011-2015” was officially promulgated and implemented throughout China, which became the basis for the ongoing development of ethnic villages in China.

Urbanization and Globalization as both Threats and Opportunities for China's Ethnic Minorities

Historically, Yunnan was an important launch pad and hub for the opening of Southwest China to the outside world. However, due to its relatively backward economic development, limited access, and low use of resources in ethnic regions compared with the more accessible domestic coastal cities, Yunnan's level of openness to the outside world is lower and foreign investment is less than in all but three other (large ethnic minority) Chinese provinces (Li et al., 2016). After implementation of the national government’s “Belt and Road” strategy, Yunnan and its many ethnic minorities will have closer communication and greater openness with both the PRC as a whole, as well as with its many Southeast Asian neighbors. Li et al. (2016) are worried that there will be problems as cross-border ethnic groups attempt to manage both the centripetal and dispersive forces in terms of "cultural identity" and "national identity." It could cause civil unrest as minorities become restive regarding internal development versus what they see among their cultural counterparts in adjacent countries. This may resurrect prior government programs that

resulted in diminished multicultural educational efforts in Yunnan. Some areas in northern China with large minority populations already seem to be experiencing such a response.

Globalization has intensified the heterogeneous exchanges between cultures. In this cultural development, Yunnan's cross-border ethnic groups are faced with significant new challenges. The traditionality and relative independence of the original cultural system of cross-border ethnic regions has been broken (Zhou and Chen, 2020). They now exist synchronically with foreign values and local values. For cross-border students, it is particularly important to promote multicultural understanding and value consensus.

Analogous Situations and Approaches that have been or could be Fruitful when Confronting these Types of Challenges

Some scholars have proposed that we can innovate multicultural education through informatization and networking while providing a more precise and humane educational support structure (Xiong and Yang, 2019; Wang, 2020). They believe that the combination of artificial intelligence and education can provide promising new ideas for multicultural education and education equity. Using artificial intelligence technology allows for the real-time collection of classroom teaching data, allows educators to monitor students' learning process at any time, analyzes the interaction between teachers and students in real-time, improves teaching efficiency, and promotes the evaluation and personalization of teaching performance and goals (Xiong and Yang, 2019). In addition, technologies such as knowledge graphs, big data platforms, and pattern recognition can also be used to analyze and accommodate the social and cultural background of students outside the curriculum (Wang, 2020). Yang and Yang (2014) believe that the research on the informatization of minority education focuses mainly on the construction of information network infrastructure, information technology education, education informatization management and evaluation, and development status and countermeasures.

Although there has been some progress in the construction of ethnic education informatization, there are also some problems. For example, the construction of education informatization in ethnic areas is relatively lagging, especially in the construction of information infrastructure and the loss and shortage of informatization talents and not surprisingly, areas of high rurality and low labor opportunities are unattractive to knowledge workers (Zhao and Liu, 2020).

Designing Effective Learning Experiences for Diverse and Scattered Ethnic Minority Groups

The design of curriculum structure, the compilation of teaching materials, the development of cognitive tools, the creativity of related education networks, and the development of various learning and teaching resources should all be devoted to promoting the organic connection among school, family, and society. The design concept is to actively create an open, immersive, and active interactive learning process to help students overcome knowledge inertia, enhance knowledge flexibility, and promote knowledge transfer.

Bilingual education is an effective way to realize multi-ethnic language protection and cultural diversity inheritance (Wei & Tian, 2019). The challenge is how to better provide the educated with a language environment and choice of bilingual learning so that they can master the tools,

knowledge, and skills necessary for a globalized society, instead of isolating and inflexibly inheriting a certain language that is not one's native tongue. This requires us to focus not only on the school and the family, but to go beyond the school and the family to achieve lasting and measurable change.

As the main place for the acquisition and use of ethnic languages, the protection of ethnic minority villages is essential to help strengthen language vitality. This is also the clearest path to maintaining and improving the ecological environment of minority languages. Qian (2005) called the Wa villages in Yunnan the "cultural fingerprints" and "spiritual homes" that maintain the Wa language context (pp. 159 - 171). Protecting the Wa villages will help strengthen the vitality of the Wa language and activate the ethnic language ecology (Zhao, 2013; Fan, 2005).

In order to realize and promote the healthy development of ethnic culture school-based courses in ethnic areas, the most urgent task is to further coordinate the relationship between school education functions and the development and setting of ethnic culture school-based courses. It is necessary not only to reform and innovate ethnic education regulations and systems at the national (macro) level, but also to actively develop multicultural courses through the ethnic schools themselves. Yao (2019) combed and analyzed the literature regarding the protection and development of ethnic minority villages in the past ten years. He found that there were not too many protected villages. Whether a village can be developed is affected by the characteristics of the village and the support of the local government.

At present, in specific practice, we can see that the construction of ethnic culture school-based courses is mainly based on the education management department, supplemented by the school, resulting in the decision-making and planning related to the curriculum being determined by the management department (Zhu & Li, 2020; Wang, 2020). To a certain extent, this situation has weakened the school's leading role in the construction of such courses and the main status of students. There are some contradictions between the focus of school education and the development of ethnic culture school-based curriculum which need to be addressed if there is to be any significant progress.

Wang (2020) believes that the key to the development of teacher education in ethnic areas is the preparation of teachers' cross-cultural knowledge. Facing students from different nationalities and different cultural backgrounds, teachers need to have a certain amount of cross-cultural knowledge in order to correctly guide students of various ethnic minorities with their diverse cultures.

Conclusion

The preservation of ethnic minority cultures and their distinctive languages can only be achieved by far-ranging partnerships both within and outside of the People's Republic of China. Success over time will undoubtedly involve learning from and learning with partners working on similar issues throughout the world, but especially among nations whose situations are similar in certain respects to those of China in regards to distribution of minority groups, geographic barriers, rurality and mountain cultures, and economic development within minority-intensive areas. While there are a reasonable number of ethnic Han scholars actively investigating these issues

within China there remains a need for the development of additional scholarly interest and research and development investments addressing the many issues raised by language-minority cultures within larger, more pervasive language-majority contexts. It is never a question of lose-win but rather a question of balancing many factors in sufficient manner to produce future generations that appreciate the worth of fully bilingual speakers of multiple ancient languages of China with each of those languages successfully evolving its own grammar and vocabularies in a manner that increases the likelihood of language sustenance and continuance far into the future.

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Six Key Principles in Designing Artificial Intelligence (AI) Curriculum for Middle Schools

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Abstract

Recently, AI education in K-12 schools has begun in full swing; however, educators and experts found designing AI-related curricula challenging. We seriously lack of the relevant studies to inform practitioners to design and implement AI-related curricula. Curriculum design approaches could inform researchers and curriculum designers how to planning a quality and sustainable curriculum. Teacher perspectives are very essential to make sense of the emerging AI technology for curriculum designing. According. This paper used four curriculum design approaches – content, produce, process and praxis as the framework and thematic analysis to analyze data collected from 12 K-12 schools including individual interviews, teaching documents, meeting minutes, school-based curriculum documents of 24 teachers. Hence, we posited 6 key principles - definition, relationale, impact (content), flexibility, learning, communication (process) - in designing AI curriculum.

Keywords: Artificial Intelligence Education, Curriculum Design, K-12 schools, design principles

Introduction

The explosive growth of Artificial Intelligence (AI) is fundamentally transforming the way we live, learn and work. The emerging ubiquity of innovative AI applications has significant implications to our society and our future generations. AI has grown way beyond a branch of professional and academic research. It is necessary to move AI education from professionals to the mainstream (Chiu and Chai, 2020). Topics in AI, which have conventionally been covered in post-secondary education, are making their way into K-12 classrooms as a global strategic initiative (Pedró et al., 2019). This initiative aims to educate the future generation. AI education in K-12 not only helps children understand what the emerging technologies are and how they work, but also inspires future AI users, ethical designers, software developers and researchers (Pedró et al., 2019). However, curriculum design for K-12 schools is more complex compared to post-secondary education. It involves considerations of how the new initiative translates into practice and considerable variation in delivery can be expected from school to school. Hence, designing AI or AI-related curricula is challenging (Chiu & Chai, 2020; Touretzky et al., 2019).

To address the global initiative, we lack of relevant studies that informing how to design a quality AI curriculum for K-12. Curriculum designing theory could inform researchers how to design the curriculum (Chiu & Chai, 2020). As such, this study used four basic curriculum theory approaches - curriculum as content, product, process and praxis – as a framework to suggest six principles in designing AI curriculum for K-12 schools.

Literature Review

Four curriculum design approaches

Curriculum refers to the totality of student experiences in the educational process that are planned and guided by the teachers, and learned by the students in any environments (e.g. group, individual, classrooms, after schools, online) (Kelly, 2009; Marsh and Willis, 2003). Current literature points out four major design approaches to understand curriculum. They are curriculum as content, product, process and praxis (Kelly, 2009; Grundy, 1987; Glatthorn et al., 2018), and theorize curricula design. They are useful for researchers to study curriculum innovation and for practitioners to create or revise curriculum.

The curriculum as content approach sees education as transmission of knowledge. This approach is thus a body of subject content, i.e. a syllabus, and the identification of effective teaching methods (Blenkin et al., 1992; Glatthorn et al., 2018; Kelly, 2009). Teachers will follow suggestions stated in the curriculum - an order of contents, a knowledge structure, and teaching methods to teach. They tend to limit their lesson planning to a consideration of the body of knowledge that they want to deliver. The justification for the curriculum lies in its content, but not its effects. This view of curriculum is very popular amongst primary school teachers (Kelly, 2009).

The curriculum as product see teaching as instrumental to enhancing student competencies. It takes the performance and competence of students as the core components (Bonnett et al., 1999; Swanson & Pashby, 2016) and the assessment of student learning outcomes as main goal (Glatthorn et al., 2018; Kelly, 2009). The curriculum development is viewed as a technical exercise. This curriculum approach aims to prepare students adequately for specific tasks; therefore, its development requires detailed attention to what the students need to learn and know. This approach is often found in many technical, skill-based, training programmes where specific tasks or jobs have been identified. It often prepares lists of competencies, inform students what they must learn and how they will do it; therefore, the students have little or no voice to their learning. By having pre-defined outcomes, this approach tends to direct attention to teaching. These two approaches create set of documents for implementation. However, contemporary education advocates student-centered approaches - curriculum as process and praxis by shifting the focus of curriculum from teaching to learning (Kelly, 2009).

The curriculum as process sees teaching as development and emphasizes how teachers, students and content interact and evolve, rather than pre-defined content and outcomes. The learning goals have will change as the triadic relationships evolve (Kelly, 2009). The curriculum is not a standard package of materials for all the teachers to cover and deliver in their classrooms, but a guideline about teaching practice (Glatthorn et al., 2018). It could tell us what teachers and students do to prepare and evaluate the lessons, i.e. what actually happens in the classroom (Chiu & Chai, 2020). For example, choices of content depend on what fit student needs and interests; learning outcomes are developed from the collaboration of teachers and students, but not applied

to all the students. In this curriculum, students are not treated as objects but as subjects who have voices (Chiu & Hew, 2017; Chiu & Lim; 2020).

The process approach emphasizes meeting student needs, and does not make clear statements about the interests it serves. Bringing this issue to the center of the process, the curriculum as praxis sees teaching as committed action, and focuses on making sense of the knowledge in the learning process by connecting it to real world applications (Glatthorn et al., 2018; Grundy, 1987). Guided by teachers, students will learn with peers to solve real-world problems by working out an action plan for acquiring the content knowledge and achieving the outcomes. The learning process and outcomes are continually evaluated.

Adopting a particular curriculum design approach has a major influence on teaching and learning strategies (Priestley & Biesta, 2013). For example, the content approach encourages teacher-centered approaches to teaching; the heavy emphasis on product encourages drilling and practice; the process approach leads to the design of student-centered learning activities; the practice approach tends to adopt problem-based learning. However, these four approaches to curriculum designing are not mutually exclusive (Glatthorn et al., 2018; Kelly, 2009). For example, followers of the process approach would not argue that content and assessment are unnecessary and negligible, but the selection of content is a secondary consideration. The first two approaches adopt behavioral stance and structured teaching, and set objectives and attainment targets that must be taught to students. The last two approaches are "the curriculum is not simply a set of plans to be implemented, but rather is constituted through an active process in which planning, acting and evaluating are all reciprocally related and integrated into the process" Grundy (1987). They draw on student-centered learning theory, and educational and developmental psychology. They identify and nurture the strengths of students, with every student taking an active role in her or his learning, and with both students and teachers developing the curriculum.

AI education for K-12 research

Most studies on AI education for K-12 focused on what techniques and skills should be included and what AI tools should be adopted in teacher teaching (Burgsteiner et al., 2016; Papert and Solomon, 1971; Sensetime, 2018; Williams et al., 2019). For example, the first formal study of teaching children AI was to explore AI concept through LOGO programming and Turtle robot (Papert and Solomon, 1971), which was a pilot teaching, rather than a curriculum. SenseTime (2018) worked with East China Normal University, to write the first textbook series for high schools - Fundamentals of Artificial Intelligence. The content in these series is aligned with AI courses in higher education, hence they focused on techniques and skills. The series are appropriate for student with higher academic abilities or stronger engineering knowledge. This curriculum adopted content and product approaches. Moreover, Williams and colleagues (2019) from Massachusetts Institute of Technology examined different AI learning activities with robots on children learning. Their ideas focused on more process and praxis approaches. In sum, these studies did not useful guidance us to design AI formal curricula for K-12, but provided crucial but fragmented findings in the research of AI K-12 curriculum design. Therefore, there is neither existing established curriculum nor well-defined content knowledge for secondary schools. To address the global initiative, it is essential to conduct research on the curriculum design so that this educational innovation can be sustained. Curriculum design approaches could inform researchers and curriculum designers how to planning a quality and sustainable curriculum (Chiu & Chai, 2020; Kelly, 2009; Marsh & Willis, 2003).

This Study

Research Question and Participants

Teacher perspectives are very essential to make sense of the emerging AI technology for curriculum designing (Chiu, 2017; Chiu & Churchill, 2016; Cope et al., 2020;). Accordingly, this paper used the four major curriculum design approaches – content, product, process and praxis – as a framework to investigate the views of AI teachers' curriculum and teaching experience on key principles for designing AI curriculum for K-12 education. The research question is "How do the four approaches relate to the curriculum design?".

The participants were 24 teachers from 12 Hong Kong middle schools (2 from each school), and designed and taught their own school-based teaching units of AI. The average age of the teachers is 30.5 years old; 20 teachers are male, and 4 are female. The schools were located in different districts and varied in socioeconomic backgrounds and academic standards.

Method

A qualitative method was adopted to achieve this study goal. Sixty-minute individual semi-structured interviews with the teachers were conducted to understand what, why and how they taught the units. Documented data including their teaching materials (plans, slides and worksheets), meetings minutes, emails, teacher reflections and student work, were collected. To analyze the data, this paper used thematic analysis to identify the essential components of AI curriculum because the analysis usefully summarizes key features of a large body of data, and highlights similarities and differences across the data set; therefore, offers a useful method for working within participatory research paradigm and informing curriculum development (Braun and Victoria, 2006).

Results and Discussions

The final thematic map devised in the results consisted of two themes: (i) content and product and (ii) process and praxis, hence this paper posited 6 key principles - definition, relationale, impact (content and product), flexibility, learning, communication (process and praxis) - in designing AI curriculum, See Figure 1. The followings explains the 6 subthemes (key principles).

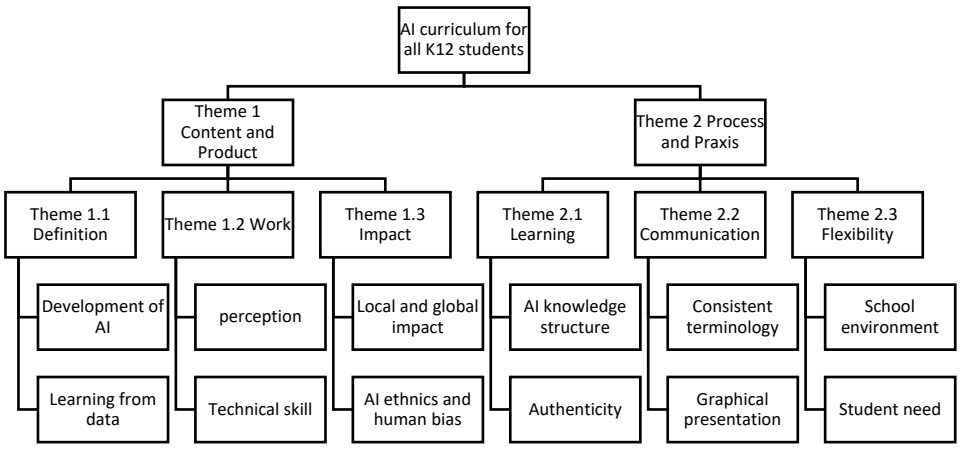

Figure 1 The final thematic map

Theme 1: Curriculum as Content and Product

All the AI teachers highlighted that there was no existing and appropriate content for their teaching. Majority of them shared that the content and learning outcomes should be Knowledge in AI (what AI is), Process in AI (e.g. how AI works) and Impact of AI (social good and ethical use). See the following expert.

> *"I did not have any appropriate content for my students to learn. The existing textbooks we bought were not too technical and professional."* (Teacher 1)
> *"Students should know who the background and history of the AI technologies."* (Teacher 4; Knowledge in AI)
> *"Students should learn about how the computer develops the ability, which includes modeling, statistics and learning algorithm. ... They also should learn how AI technologies process data in different aspects."* (Teacher 5, Process in AI)
> *"I believe my students should learn about societal and personal impact of AI locally and globally."* (Teacher 8, Impact of AI)
> *"My students should consider ethical issues from different perspectives of stakeholders including developers, policy makers and users. They should not only explore ethical issues from different perspectives, but also develop principles for the ethical design and deployment of AI-based technologies."* (Teacher 10, Impact of AI)

Theme 1.1: Definition - What is AI?

This paper analyzed all the data such as teaching slides, school-based teaching materials and teacher interviews, and showed that the definition of AI should comprising (1) Development of AI: The impact of AI in our everyday life is more sophisticated, from the business and entertainment to your mobile phone and social media; from providing online help to recognizing our voice and face. More integration of AI technologies in our everyday lives will be seen relatively soon. Students should understand the history and development of AI: fourth industrial evolution and its changes of workforce, evolutions of technologies including big data and deep learning, as well as the future development. (2) Learning from data: AI refers to the ability of a computer to perform tasks that are similar to that of human learning and decision making (Shubhendu and Vijay, 2013). Students should learn about how the computer develop the ability, which includes modeling, statistical inference and learning algorithm. To train better model and/or algorithm, this requires cloud computing to process tremendous amounts of data.

Theme 1.2: Work - How do different AI technologies work?

The analysis further indicated that perception and technical skills should be included when teaching how AI technologies work. (1) Perception: "Human learning and decision marking" is one of the core knowledge in AI, i.e. it requires computers to perceive our world by collecting data. Perception is ability to organize, identify, interpret the sensory data to represent and understand the presented information. Students should understand how AI technologies process data in different aspects including see, hear, speak, think, create and reasoning through experiencing, interacting and coding. (2) Technical skill: AI is about so much more than coding. Students should be able to perform some mathematical operations and train classifiers / models by drawing upon main machine learning libraries, and be acquainted to the notion of Neural Networks. For example, adding AI elements to existing computer applications and/or students' own work.

Theme 1.3: Impact - How do AI technologies affect our society and life?

Finally, the analysis further showed that impact and ethics of AI are very important in K-12 education. Therefore, the two suggested areas in the analysis are (1) Global and local impact: AI technologies solve real world problems for us on a daily basis and it has the capability to turn every interaction into an endless learning process. They have been making negative and positive impact in our world, society, and personal lives. All teacher teaching adopted an approach of "explainable AI – from local explanations to global understanding" (Lundberg et al, 2016), which make connections between the subject and the students' life. Students could have better understanding of the societal and personal impact of AI by combining many high-quality local explanations that allow to represent global understanding. (2) AI ethnics and human bias: AI ethnics and human bias is another core knowledge in the all teacher teaching. Their goal is to train students to be an ethical designer. AI technologies that computer engineers view as ethical may be seen as unethical by the users. For example, "Google fixed its racist algorithm by removing gorillas from its image-labeling tech". Students should consider ethical issues from different perspectives of stakeholders including developers, policy makers and users. They should not only explore ethical issues from different perspectives, but also develop principles for the ethical design and deployment of AI-based technologies.

Theme 2: Curriculum as Process and Praxis

In this theme, the analysis suggested three subthemes - learning, communications, and flexibility.

Theme 2.1: Learning - How do students learn AI knowledge and concept?

All the teaching suggested two important areas that can facilitate student AI learning. They are (1) Knowledge structure: The structure informs how to learn AI knowledge and concept in an effective way because it promotes self-regulated learning. The 5-stage structure is (i) raising students' awareness by building associations between real-world applications of AI and their daily experiences, (ii) providing foundational understanding that connects student current learning to cutting edge applications, (iii) facilitating student understanding of how different AI technologies work through experiencing, interacting and coding accessible AI applications, (iv) engaging students with appropriate design challenges, and (v) preparing students to be ethical and responsible local and global citizens. This knowledge structure can scaffold and bridge the new learning by allowing going back into previous and drawing it forth. (2) Authenticity: How authentic of the learning design is crucial for AI education due to its abstract nature. Students should learn AI with reference to real-world applications which they are likely to encounter in their daily experiences (Chiu & Chai, 2020). Learning by design that is an emerging paradigm in education and it is advocated as the key instructional approach to cultivate students as ethical designers, developers and users of AI technologies (Tsai et al, 2013). Students should design solutions with authentic problems and examine their designed solutions with reference to AI ethical principles. Being grounded in authentic learning, students should develop better historical and contextual understanding of AI.

Theme 2.2: Communication - How do teachers/teaching materials communicate with students?

All the AI teachers reported that AI terminologies are unfamiliar to the teachers/students and may be too technical for general education. They suggested (1) using consistent terminology

to facilitate the communications between teachers and students. In AI teaching, there are many different technical and abstract terminologies such as Big data, cloud computing and machine learning. The terminologies are too new, rigid and rigorous for school general education; sometimes, different terminologies are used to describe the same concepts. Therefore, it is very different for most students to comprehend the relevant concepts and knowledge well when using inconsistent terminologies. Curriculum should not be presented as finished abstractions, but should include the student preconceptions and should incorporate how the students view their own world and language (Chiu & Churchill, 2015; Chiu & Mok, 2017; Chiu & Chai, 2020). The inconsistent and abstract terminologies become one of main obstacles in teaching them all technical knowledge. Accordingly, using consistent and familiar languages facilities the communications between teachers and students. For example, using "Input, process and output" to demonstrate the learning mechanism throughout the curriculum, i.e. how AI learn and process data. (2) using graphical representations. A picture is worth a thousand words. Using graphical representation to present and explain abstract terminologies, knowledge and concept could facilitate teacher teaching and student learning in the curriculum (Chiu & Churchill, 2015; Chiu & Mok, 2017; Chiu et al., 2020). For example, a diagram with a timeline we designed represents and explains the definition and develop of AI. This diagram also gives the students an overview of whole curriculum. These two subthemes are evidenced by the following excerpt.

> *"I used diagrams to explain what machine learning is." (Teacher 2)*
> *"I found many terms so abstract in AI, and needed to suggest new ways to explain them to my students." (Teacher 10)*

Theme 2.3: Flexibility - How does the curriculum address the needs of schools and students?

All the teacher teaching reported that it was necessary to revise their teaching materials and improve pedagogy in cycle; therefore, flexibility is very important. The majority suggested that using module and level up approach would offer high level of flexibility to revise the curriculum. In the approach, all the teaching units should have no prerequisite knowledge and show the learning path, see the following excerpt.

> *"There is no way that I will not revise the teaching materials. I have a lot to improve."* (Teacher 3)
> *"The teaching units must be explicitly designed for a specific goal (module). ... The units should provide students with a clear learning path learn by themselves. (level up)"* (Teacher 5)
> *"Module-based curriculum should be adopted. Easier to choose the unit for teaching and revising."* (Teacher 7)

The analysis suggested that the flexibility – module and level up design approach - is very important in designing a new technology subject that requires extra tools and resources for teaching and learning. It is because (1) School environment: Flexibility is very important for school education. This design approach should offer maximum flexibility for school teachers to teach the curriculum, based on their school environments and students' interests and competencies. The schools and teachers are able to balance "breadth" (i.e. broad coverage of awareness, knowledge and ethical issues across the modules) with "depth" (i.e. choosing to deep-

dive into a module to cover the technical aspects, interactions through hands-on activities and empowerment through innovative system implementations) in a flexible way. The curriculum is associated with AI teaching and learning tools for developing technical skills. Different schools have different resources, the curriculum should be flexible that allows teachers to make decisions in the best interest of individual schools and students. The teachers can select the tools that are suitable for the school classroom environments and are easily assessed by their students. This will maximize the student learning. (2) Students' need: This approach allows high level of flexibility for teachers to design the best programmes for their students to fit their school culture and learning ability. For example, teachers who wants their students learning more about social issues, they can pick more modules in social impact and future work. The level-up content shows a pathway of learning in term of knowledge structure, which can direct and guide student learning. In other words, the teachers can decide what to teach, when to teach them, and how long to spend teaching them.

Conclusion and Limitations

Designing an appropriate AI curriculum seems remarkably challenging — particularly at K12 general education school level. This paper had considered difficulties in catering to the needs and interests of diverse students and schools, and posited the two themes and six key pricniples for designing the curriculum.

Currently, some emerging AI teaching practices in schools are about coding non-AI applications, for example, remote control appliances - adding microchips to a device. Such practice did not cover the main concepts of AI and may not be beneficial in equipping students with basic understanding and to get them ready for an AI infused world. The author hopes to contribute to the creation of appropriate K-12 AI curriculum with the six principles. However, the main limitation is that the six principles are not tested in the field; it is suggested future studies should examine the applications of the six principles.

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Deep Learning: Helping Teachers Assist Students to Take a Deep Approach to Their Learning by Utilizing All Four Major Parts of Their Brain.

Darin Griffith

Introduction

Teachers cherish those special moments when a student tell them how much their lives have changed because of those things they learned and felt in class. But all too often, teachers hear the sound of students who are just trying to get through the class by saying, "Will this be on the test?" Is it possible for teachers to make changes in their teaching to assist students to take a deep approach to their learning rather than a surface approach? The answer needs to be "YES" or what we as teachers do really does not make any difference. And teachers do make a difference! The purpose of this paper is to: firstly, give a brief review of the differences between deep and surface approaches to learning; secondly, show how different parts of the brain can be used to help a student learn deeply; lastly, offer suggestions for how teachers can assist students in using all four major parts of the brain to assist with the deep learning process.

Deep Approach Versus Surface Approach to Learning

The concept of deep learning is called by many names and defined in different ways which has led to some inconsistencies and ambiguity in research (Dinsmore & Alexander, 2012). Tagg (2003) defines deep learning as "learning that takes root in our apparatus of understanding, in the embedded meanings that define us and that we use to define the world" (p. 70). Deep learning emphasizes integration, reflection, and synthesis by the learner and is retained by the learner (Nelson Laird et al., 2008; Roberts, 2011). Surface learning is when students do the minimal amount of work to remember enough information to pass a test or receive an acceptable grade and students reproduce facts to pass tests and please teachers (Dolmans et al., 2016; Ramsden, 2003). Surface learning engages the lowest stages of Bloom's Taxonomy (Bloom, 1956).

It is important to note the difference between deep learning and approaches to learning. Approaches to learning describe the types of behaviors students use in learning and not the result of learning (Nelson Laird et al., 2008). A deep approach to learning is when a student has intentions to understand what is being taught (Asikainen & Gijbels, 2017). When a student takes a deep approach to learning, they experience higher levels of learning. They move from the knowledge stage of Bloom's Taxonomy up to and including the analyze, synthesis, and evaluation stages and begin to experience deep learning (Razzouk & Razzouk, 2008). In contrast, a surface approach to learning "has nothing to do with wisdom and everything to do with aimless accumulation" (Ramsden, 2003, p. 59). Surface approaches to learning focus on memorization and rote learning and students' academic goals focus on passing tests and avoid failing classes (Nelson Laird et al., 2008).

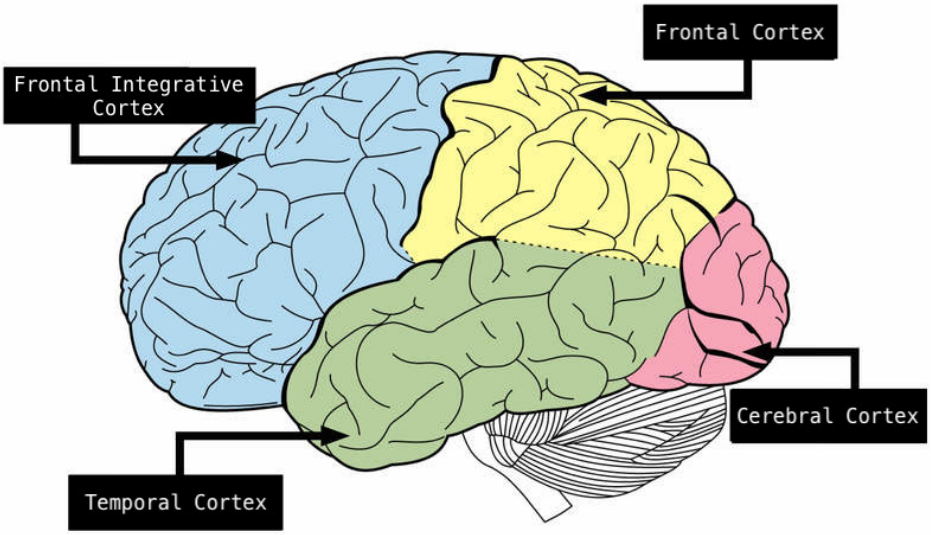
Students approach learning in a number of ways. For example, some students walk into a class with great excitement and anticipation, while others may enter the same class with hopes of producing minimal effort to pass the class. Martin and Säljö (1976) introduced the terms surface level and deep level processing in their ground-breaking study and later amended the terms to surface and deep approaches to learning (Entwistle, 1991). Their study took a group of university

students and assigned them to read an article and asked how they approached learning the information in the article. Students who focused on remembering facts did poorly on retention tests, while students who looked for ideas and principles and made connections with the readings did well. Thus, the approach students took played an important part in what they learned and whether or not they retained that knowledge. The process of learning appears to be directly correlated to the outcome of learning (Marton & Säljö, 1976). One's approach to learning may impact what is learned and how much. "A deep approach to learning emphasizes learning for the purpose of grasping a meaningful understanding and mastery of concepts" (Campbell & Cabrera, 2014, p. 497).

There are many factors to why students choose which approach they will take to learning. Biggs (1978) claims personality is a major factor and Zhang (2003) found that out of the five major personality types, conscientiousness and openness traits contributed to deep learning approaches, while neuroticism predicted surface level approaches while extraversion did not show a relationship to any of the learning approaches. Thus, students approach learning in varying degrees and which approach they take directly affects their level of learning.

Neuroscience and Deep Learning

Figure 1



Insights about how the brain functions can enhance learning and teaching and understanding how the brain learns can help teachers effectively teach and help students more effectively learn (Shearer, 2018). One insight is how neuroscience reveals how people learn and psychologists theorize that deep learning comes through a cycle "of experience, reflection, abstraction, and testing—which then creates a new experience to continue the cycle of learning" (Roberts, 2011, p. 2). Those four cycles use different parts of the brain and thus deep learning does not take place unless all four parts of the brain are used (Zull, 2002). The human brain first processes new information in the back of the brain called the cerebral cortex. Stories, images, actions, and lectures are first processed in this part of the brain. Information is processed with existing knowledge in the temporal cortex, which is the bottom of the brain. Consequently, if students hear a lecture and then take a test, they are using only half their brain. The third area is

the frontal integrative cortex which, as it sounds, is in the front of the brain. This part of the brain is where formal operational thinking, judgement, ownership of ideas, and new creation of ideas, takes place. The final area in this cycle is located in the frontal cortex near the top of the brain. This area is where learners test ideas for accuracy and relevance. The process results in new experiences and the cycle begins again (Roberts, 2011; Zull, 2002). "Deep approaches to learning require students to use a diverse array of cognitive complexity in their learning process" (Campbell & Cabrera, 2014, p. 497). Thus, effective teaching and deep learning would use all four parts of the brain.

Because we know how the brain functions in the learning process, teachers can use that knowledge to structure learning activities to enhance student learning. The more we engage the brain during the learning process, the higher the level of learning in Bloom's Taxonomy. Zull (2002) argues that if the entire brain is not engaged, then long term learning will not take place. If no two people are alike, then similarly, no two brains would be alike. Different methods and strategies would be needed for different brains to comprehend learning. Pask (1976) labled two approaches holistic and serialistic styles of learning and Kolb (1971) characterized four learning styles as divergers, accommodators, convergers and assimilators.

The brain is key to memory, and memory plays an important role in learning. There are different types of memory. Episodic memory is the type of memory that helps us remember facts as they are linked to episodes of our lives while semantic memory is an engaging and transforming memory that is long lasting. Episodic memory is linked to surface learning while semantic memory is linked to deep learning (Roberts & Roberts, 2008). Students who use episodic memory are engaged in the lowest level of Bloom's Taxonomy while students who are using semantic memory are using higher levels of learning.

Teachers' Role in Deep Learning

What can teachers do to foster deep learning and help students take a deep approach to their learning? Is it possible to make learning more impactful and change the lives of students, even if the classroom is only a part of their lives? Because context plays an important role in learning, teachers play an important role in shaping which approach students take in their learning for a class (Biggs, 1987; Nelson Laird et al., 2008). Umback and Wawrzynsk (2005) find that faculty have a significant influence on students both in and outside of the classroom. Students work at the level required by their teachers. In other words, generally speaking, students do what their teachers ask them to do (Nelson Laird et al., 2008). Teachers must encourage students to search for meaning with the ideas presented in class by giving classwork and assignments that plant seeds that will result in students engaging in deep learning (Roberts & Roberts, 2008; Tagg, 2003). If teachers are involved with their students' learning, by fostering students active participation, students are more inclined to use deep approaches (Baeten et al., 2010; Biggs, 2003b).

Teacher Strategies

There are numerous methods for teachers to incorporate deep learning strategies in their classroom. As teachers shift from lectures to learner-centered activities, they encourage their students to think and analyze from different perspectives which results in the use of deep learning strategies (Mayhew et al., 2012). Teachers can incorporate role-taking activities and

inquiry-based approaches in their classrooms, such as asking and answering questions (Offir et al., 2008; Roberts, 2002). Teachers can structure their lessons with the use of effective questions and discussion. "Effective learning obligates asking questions, and therefore obligates the lecturer to integrate stimuli that evoke the asking of questions" (Offir et al., 2008, p. 1181). In college, students report higher satisfaction with frequent interaction with faculty than with any other type of involvement, thus teachers should be involved with their students in questioning, discussions, and interaction beyond the lecture (Astin, 1999).

Deep learning techniques engage students in the learning process. This does not mean lectures and reading articles and textbooks cannot be used effectively as the use of research articles can still be used as a tool in teaching and achieve deep learning (Bordt, 2005). Teachers can give quizzes to encourage students to read the textbook to promote learning. However, if the purpose is to have the students read the text book, deep learning may not occur as introductory textbooks have been criticized as lacking in intellectual rigor and depth (Howard, 2004). Most comprehensive textbooks represent the kind of reading associated with surface level learning and quizzes on assigned readings often only encourage students to memorize key words and promotes surface level learning and multiple choice and true/false tests encourage superficial memorization and out-of-context facts (Howard, 2004; Roberts & Roberts, 2008; Tagg, 2003). If reading assignmetns, quizzes and testing are not about memorizing facts but helping enhance understanding concepts, these activities can enhance and encourage learning (Jacoby et al., 2010; Jensen et al., 2014).

Roberts and Roberts (2008) gives six factors that contribute to deep reading. First is the reading must have an intrinsic interest to motivate readers. And the second, related to the first, is the reader must be curious about how the readings will be related to their work and study. Third, the reader must see how the readings are connected to their life. Fourth, deep reading must go beyond the scope of episodic memory and use one's semantic memory, making it easier to recall information for tests or other tasks. Fifth, the readers must take a deep learning perspective. And finally, readers must know that higher order thinking skills will be required of them. In other words, the test will be more than a mere collection of facts, but synthesis and evaluation will be required. Roberts and Roberts (2008) conclude that "students are motivated to read more carefully when they are provided with a variety of ways to respond to the text—ways that are consistent with their own learning style" (p. 135). When students are encouraged to read and process the readings in different ways, to make meaning out of the readings, then share new ideas, multiple parts of the brain are being used and deep learning is taking place.

Teachers can encourage deep learning approaches to studying even in reading required texts. Howard (2004) has put into practice the idea of Just-in-Time quizzes. He gives a two-question quiz to his students that are thought provoking and can only be answered effectively by completing the required readings prior to class. The quizzes are due two hours prior to class and classroom instruction includes submissions from his students' submissions. This altering of the lesson meets the needs of the students. If they did poorly on the quizzes, then they obviously struggled with the concepts in the reading, so he reteaches the principles to help them understand. If they answered the questions with a deep understanding of the topic, then he can instigate a higher-level discussion in class from the readings. His findings include students complete the readings and elicit strong emotional responses because of his Just-in-Time quizzes (Howard, 2004). In this situation, students are actively participating in their learning by preparing for class. This is in harmony with Yamane's (2006) class preparation assignments (CPA's). He asks each student to read and think about the assigned readings and submit a writing

assignment prior to each class. Each assignment includes four elements: an introductory statement, the objective, background information on the topic, and then the writing assignment. The CPA's have led students into a higher level of engagement and involvement into the class discussion. These Just-in-Time quizzes and CPA's are just two ideas to help students get involved with their own learning on a deeper level prior to class.

Deep learning is more than just student involvement. For example, a student could play a learning game but only understand enough to play the game and not internalize the information. One study shows that students learn more by creating a game than just by playing a game (Vos et al., 2011). Deep learning involves the entire learning process. Teachers must create and organize classes to follow deep learning design principles to effectively help students achieve deep learning. Boyle and Ravenscroft (2012) express: "Deep learning design encourages the creative study of a learning problem or opportunity. It applies substantive insights from the learning disciplines to exploit the affordances of the technology in order to develop contexts that empower learners to achieve educational goals" (p. 1225).

Technology may be used to enhance learning, but technology alone does not promote deep learning and peer discussions and student contracts have been shown to lead to an increase in deep approaches to learning (Entwistle, 1991). Another factor in helping students to learn deeply is to give them time to do so. One study reveals that when students are given time for reflection and contemplating issues, they exhibited higher developmental gains (Mayhew & King, 2008).

Teachers who desire students to learn using higher-order learning processes are encouraged by Biggs (2003a) to do four things. First, define the desired learning outcomes. Second, choose learning and teaching activities that are likely to lead to the learning outcomes. Third, access the students' actual learning outcomes and see if they match the intended outcomes. And finally, assign grades based on how well students met the learning outcomes. Teachers can encourage students to take a deep approach to their learning by how the class is organized and what is emphasized. The learning environment which students perceive influences how students learn (Entwistle, 1991). Teachers can help control the perception of the learning environment with how they create learning objectives and structure the class. As Roberts (2011) explained, "if we take deep learning seriously, we must also be serious about [the] course design—the entire course must be of the same fabric" (p.11). When creating a course, the objectives, teaching, and assessments can be aligned to enhance the students learning to reach beyond the remembering level of Bloom's Taxonomy (Alexandra & Moldovan, 2010). Roberts (2011) postulates that the curriculum needs to be scaffolded to expect deep learning to take place in the classroom. Teachers need to plan learning activities that will reach students in the way they want them to understand (Biggs, 1999). Research indicates transferring control of the learning process from the teachers to students is probably the best way to construct, high-quality learning activities (Vermunt, 1998). Learning must have meaning for the students and teachers must make the lessons mean something to engage students (Shearer, 2018).

Conclusion

If there were a quiz on this reading, what should be included? If readers knew there were questions about names, facts, and details, they would read to look for these things and possibly miss the main point. However, if the reader knew the expectations of the quiz were to explain the main point and suggest application of that point, the reader would have a different experience

while reading, a deep learning experience. If a student asks: "will this reading be on the test?" then a teacher focusing on deep learning might reply: "what concept in the reading do you feel should be incorporated in the test? That will be the question on the test."

Teachers really do make a difference. They can use teaching techniques that utilize all four major areas of the brain to help stimulate deep learning in the minds and lives if their students. As teachers stimulate the minds of their students, these students will experience more moments in class that will change who they are, how they think, and how they feel. They will experience deep learning.

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Interactive E-Learning Courseware for the United States Coast Guard Aviation Pilots

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Abstract

The United States Coast Guard is a unique blend of cultures comprising military, law enforcement, humanitarian efforts, regulatory, and diplomatic capabilities. E-learning content that is culturally-situated to this population must be effective and timely because large amounts of learning content and training is condensed into a short amount of time. Interactive Courseware (ICW) is used to support training and development of the USCG. This proposal consists of four strategies that can be implemented when creating training modules in Articulate Storyline that can be adapted to suit the military culture of the USCG Aviation Training Center in Mobile, AL.

Interactive E-Learning Courseware for the United States Coast Guard Aviation Pilots

The United States Coast Guard (USCG) is one of five military services that exist to defend and protect our nation. This military, multi-mission, maritime force offers a unique blend of cultures that include military, law enforcement, humanitarian efforts, regulatory, and diplomatic capabilities (Auxiliary Leadership Development Program, n.d.). The purpose of this proposal is to showcase the research in revising e-learning courses to meet the unique learning needs of Coast Guard aviators. It is appropriate for a roundtable discussion as immersive and interactive e-learning modules adapted for military culture will be included as part of a small group discussion regarding the pedagogical strategies utilized in revising learning content for USCG pilots.

To support training and development, Interactive Courseware (ICWs) modules will be created using Articulate Storyline. The training technology courseware for computer-based training and instruction incorporates expert knowledge with multimedia instruction delivered in CD form or are installed as software on desktops in the training facilities. The ICWs convey instructional content and relies on the learner's interactions to determine the pace, sequencing, and content of instructional delivery (Tsai, 2018). At the USCG Aviation Training Center (ATC) in Mobile, AL, the ICWs are used in combination with classroom instruction, performance based instruction, and practical application in simulators and aircrafts. The USCG ATC has taken on an intern to make recommendations for incorporating instructional strategies adaptive to military culture into the ICWs, as well as assist in designing and developing those ICWs. This will increase the hybridization of multiple instructional approaches for better learning retention and stronger recall when needing to make decisions in split-second, life-saving situations.

The unique military aviation culture must be noted when deciding on the instructional approaches to incorporate within the ICW. The USCG aviators are highly competitive and the trainees are motivated, high-performing individuals. Due to the criticality of USCG aviation missions, recall of important information accurately and quickly results in better flight safety in dangerous events. The training period for the aviators of CG pilots ranges from 30-45 days of intense performance based training. Ten of those 30-45 days will involve the ICWs and face-to-face lectures. Therefore, consideration of time and cognitive overload is imperative when employing instructional strategies for this culture. Evidence-based strategies I would be utilizing for the USCG ATC would include microlearning, gamification, and knowledge checks.

Microlearning

Microlearning is one of the most beneficial strategies to use for ICWs. The content-heavy ICWs will be divided into micro lessons with more interactive learning content, and only include the necessary information that would supplement lectures. Breaking content into smaller units makes transfer of learning 17% more efficient than traditional longer-duration courses (Armstrong & Sadler-Smith, 2008). Microlearning is a more successful alternative to traditional e-learning courses because it allows learners to digest content quickly, multi-task between other activities, and the learn through an adaptive experience that can be customized to their needs in a more digestible format (Gutierrez, 2018). While operations manuals contain important learning material, their format can contribute to learner disengagement. With engaging, media-rich modules that can be delivered in three to seven minutes, learners would be more successful in recall as this matches the working memory capacity of humans and avoids cognitive overload (Torgerson & Iannone, 2019). When a trainee's everyday job is made up of highly dangerous situations, several lives depend on accurate and timely recall and reinforcement.

Gamification

Gamification strategies would be another effective technique to engage learners with immersive learning experiences since ICWs contain content that supplement lectures and are employed before utilizing aircraft simulations as part of training program. Gamification applies game-design thinking for non-game applications to improve engagement and effectiveness in already high-performing learners (Pandey, 2018). This strategy plays into the competitive and motivated personalities that are highly characteristic within the aviation culture of the USCG. Gamification provides instant feedback for learners, which facilitates better knowledge retention. In addition, gamification techniques can prompt behavioral changes in learners by leveraging their natural desire for learning, mastery, achievement, and closure. Increasing engagement and positive learning experiences through rewards such as points, achievement badges/levels, and progress bars, will capture and retain learners' attention (Pandey, 2018). These techniques will not only challenge learners, but it will also teach them as well.

Some gamification techniques useful for the USCG culture include:

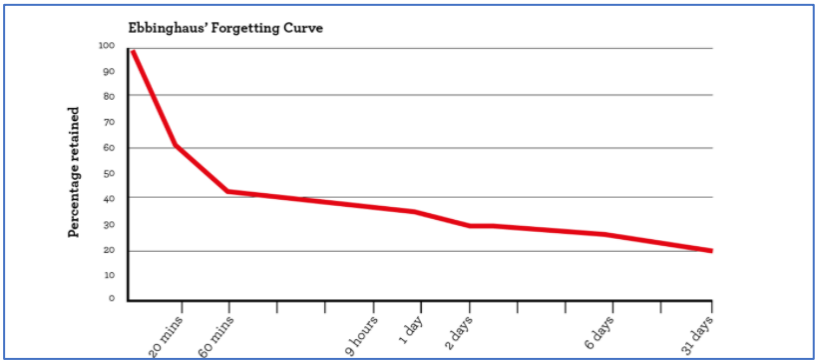
1. induction programs that serve as on-boarding training to reduce stress and anxiety
2. professional skills enhancements such as mapping real life challenges they would face in the field to measure proficiency

3. rewards and recognition using point systems, levels, or leaderboards to create a sense of progression and accomplishment

Gamification will provide aviators the opportunity to employ their knowledge in valuable experiences with immersive learning activities to aid them in solving real-world challenges in a low-risk environment.

Spaced repetition

Studies have shown that people forget 50% of new information within the first hour, and 70% of new information within 24 hours of exposure (Stahl et al., 2010). Considering the training intensity of the USCG and today's digital world, aviators are exposed to constant slew of new information from phones, computers, and other classwork multiple times throughout the day. As time passes, people are likely to forget information that is not frequently used (Murre & Dros, 2015). Spaced repetition can be used as an effective technique to bypass Ebbinghaus' Forgetting Curve (shown right) because it reviews content in gradually increasing intervals to aid in learning and recall. By teaching and testing the same information frequently over time, the retained information eventually becomes part of long term memory. This technique efficiently organizes information, which results in near perfect recall. Spaced repetition, in combination with microlearning, will help aviators conquer the Forgetting Curve in their fast-paced training period and high stress, intense environment to learn the latest skills and knowledge with strong recall where every passing moment counts.



Knowledge Checks

Research comparing online and traditional course delivery methods has revealed that online course delivery is superior to traditional delivery in terms of applied learning and process of knowledge transfer by developing skills from classroom knowledge to real-world circumstances (Hansen, 2008). Utilizing knowledge checks would give learners the opportunity to gauge how well they are learning the content. For example, knowledge checks could take the form of infographics, interactive quizzing, or mini-scenario based multiple choice questions. The benefit of knowledge checks is the instant feedback learners receive, allowing them to explore correct and incorrect choices, while gaining valuable feedback about each choice through formative assessment. For the ICWs, it is important to build interactive knowledge checks that bring static content to life to help the learners gain confidence and familiarity with the content before proceeding through the course lectures and simulations (Hansen, 2008).

Conclusion

Documentation of approaches to e-learning and the tools needed for a learner-centered paradigm are much more prevalent in primary, secondary, and higher education as opposed to military training settings. Due to the disparities in goals, outcomes, and performances of what was learned, the mission and purpose of education compared to military training have fundamental differences that require distinctive approaches. What may successfully work in education, may not yield the same results when used in a military environment where time is of the essence. Shifting the content of ICWs to effective learning experiences, rich with engagement and interaction, places greater responsibility on the trainee to learn facts, procedures, and complex skills in high-risk, critically hazardous events. Text dominant ICWs can be effectively adapted to military culture by utilizing instructional techniques, such as microlearning strategies, gamification principles, spaced repetition, and knowledge checks to create efficient learning experiences that keep USCG pilots engaged and immersed with the content.

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GOOGLE MY MAPS AS A CONDUIT TO CULTURALLY RICH LEARNING EXPERIENCES

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Introduction

The research[1] aims to understand the potential of mobile communication, and how technologic events are part of our culture. Practices of in-service teachers with mobile devices and apps are analyzed to create an integrative project that intersects technology, communication, culture and the art in education. The research-training in cyberculture (Santos, 2019) is a methodology designed in the crossings between educational processes and scientific investigation. The context is always the teaching, not isolating teaching from research and extension, which means, when there is an educational ambience proposed by the teacher, they are researching the educational movements that happen.

The context of the study is the course "Teaching Education for Communication, Culture and Art", offered by the Federal Institute of Rio de Janeiro in Belford Roxo campus, Brazil. Research participants are teachers from the Metropolitan region of Rio de Janeiro, specially from Baixada Fluminense in Brazil. The Baixada Fluminense region's population is about three million located in the periphery of Rio de Janeiro. The region has a reputation of poverty, crime and social injustice. In this study there here were 52 participants in total, between 23 and 58 years old.

It's up to the teacher to take experiences and repertoire to enrich the artistic and cultural knowledges of their students. In order to deconstruct the discourse that in the Baixada Fluminense there are no points of culture, one of the results of this study was to expose experiences in diverse educational contexts with schools, artistic expositions, memory institutions, cultural centers, patrimony, recognized cultural manifests as immaterial patrimonies, social movements and diverse public and private segments of the cities.

This study changed the teachers' perceptions towards culture and to the value of the multiplicity of cultural expressions in Baixada Fluminense using Google My Maps (https://www.google.com/maps/about/mymaps/). From those experiences, one action have been designed: the collaborative map, with curation of educational webs in the cities of Baixada Fluminense in Google My Maps. Technology contributes to the sharing of narratives and guarantees the continuity of the learning experience itself and gaining new meanings.

This study addresses the teachers' perceived lack of access to the cultural assets in Baixada Fluminense in particular in the peripherical regions of the city. The opportunities of

[1] This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brazil (CAPES - Finance Code 001) and in part by Federal Institute of Rio de Janeiro.

contact with the culture and art can occurred in many school visits and encouraged the teachers' development of pedagogical practices that emphasize the diversity of cultures and multicultural communities.

Research-training in cyberculture

Research-training is a methodology created by Josso (2004) for the development of a "theory of education" (Josso, 2004, p. 213) in which people are educated in the use of the autobiographic approach. It aims at understanding the knowledge produced by the experiences of the subjects at implying, transforming, and getting to know themselves in the autobiographical work.

The research-training in cyberculture is a method that researches the/in cyberculture, as it triggers ambiances and devices which are correspondent to online education, trying to understand the phenomena in cyberculture. Inquietudes generate study questions, which are transformed into educational processes and research devices in order to meet the data that allows a better understanding of the object that one intends to research.

According to Josso (2004), the research-training is funded in the life stories as project of knowledge and education, whose methodological path is the narrative of life experiences and education for the understanding of the educational experimental processes which are affective and reflexive. Narratives of such nature are fundamental for the present research.

"The position of the research-training differs or not, and in what terms from the position of the occasional learner-researcher?" (Josso, 2004, p. 214) The researcher is not placed as a specialist or superior, looking down from above at the object of study; and the performer is not in a crystalized situation as a student, they learn and teach. Their narratives are valued in the same horizontality of the bibliographic analysis, providing plural understandings to the phenomena studies.

Thus, research-training in cyberculture (Santos, 2019) is created as a method of research that considers an intercritical intervention for education, allowing to be perfectly applied to the education of teachers. A research implied with the demands of education, with the eye that considers the practical knowledge of the social group in the institution routine more relevant than the "specialists that come from outside of the ambiance of the group, the community or the institution" (Macedo, 2010, p. 160).

The teacher-researcher is the one constantly thinking about their practice, as stated by Freire (1996):

> There is no teaching without research, nor research without teaching. These doings find embodiment in each other. While I teach, I keep on searching, re-searching. I teach because I search, because I asked and wondered. I research in order to verify, and verifying, I intervein. As I intervein, I educate and educate myself. I research to know what I don´t know yet, and to communicate or to announce the new. (Freire, 1996, p. 29).

One of the authors of this article is a faculty member at the Distance Education and Educational Technologies of the Federal Institute of Rio de Janeiro, Brazil and the instructor for "Teaching Education for Communication, Culture and Art". Google My Maps was the technology used that made possible to create, edit and share personalized and collaborative maps online. As a repository for storage in the cloud, it allows the organization of different maps created or altered, with the addition of points, drawings, texts, photos and videos. It also allows teachers to save maps available on the internet, search for places, add favorite points and import maps based on spreadsheets.

Collaborative map in the Baixada Fluminense cities: curation of educational webs and urban micronarratives

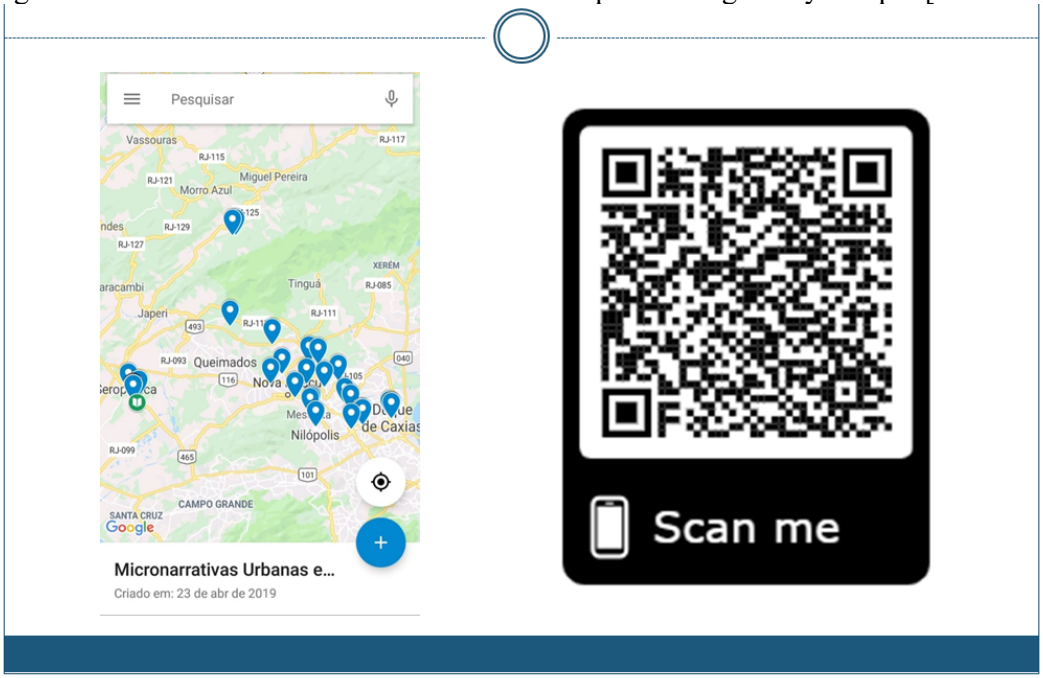
Lefebvre (2010) ponders on the urban problem, contextualizing the industrialization processes close to the world urban centers. He reflects on how the working class was expropriated from the city context, removed to suburbs and peripheries or new cities, to give way to a sovereign elite. “As urban democracy threatened the privileges of the new ruling class, it prevented this democracy from being born. How? Expelling the proletariat from the urban center and the city itself, destroying ‘urbanity’.” (Lefebvre, 2010, p. 23). In this way, in addition to basic rights, urban awareness and creative capacity decrease significantly.

However, for Lefebvre (2010), the city is not determined, static, it is the object of constant changes. Since it is impossible to reconstruct the old city, it is necessary to promote the construction of a new one, to move towards a “new humanism” (Lefebvre, 2010, p. 108), with new human beings and praxis. Transformation is urgently needed, undoing dominant strategies with a revolutionary urban revolution contrary to what is set by the working class. "Only the social force capable of investing itself in the urban, in the course of a long political experience, can be in charge of carrying out the program related to urban society" (Lefebvre, 2010, p. 115). To think about this transformation, the present study is carried out and educating cities are presented as a possibility.

Canclini (2015) highlights the importance of the study of cultural patrimony as a space of fight and memory “even if the patrimony serves as a tool to gather each nation, the inequalities in its formation and the appropriateness demand to study it as a space for material and symbolic struggle among classes, races and groups” (Canclini, 2015, p. 195). Despite of the highlight to the necessity of such study for a wide comprehension of formation, such speech is not constantly seen in Brazilian schools.

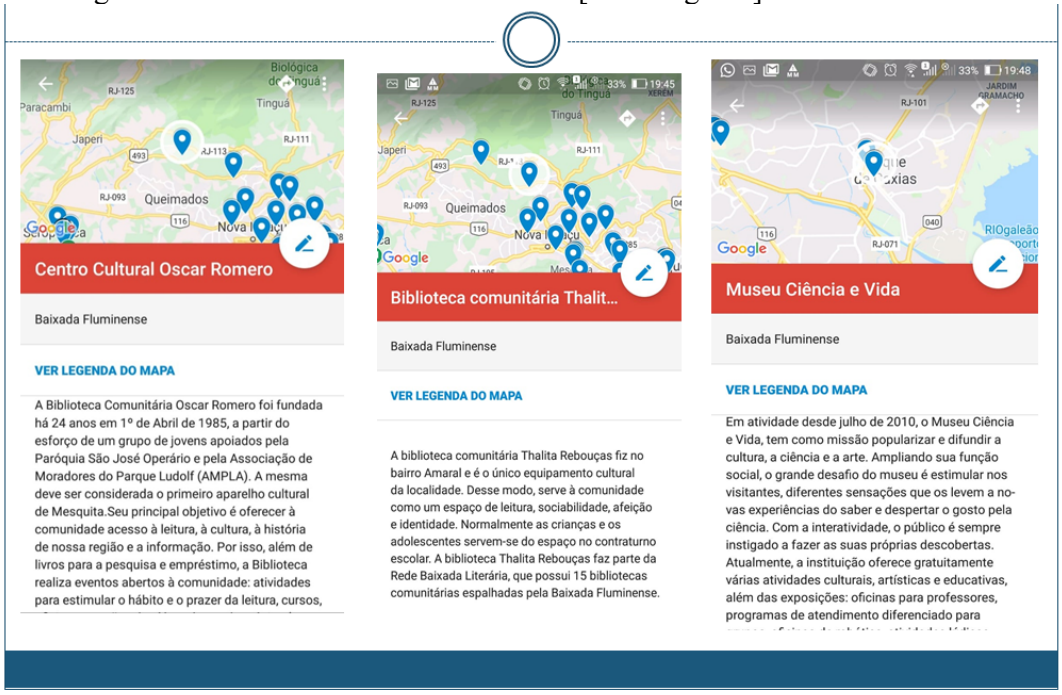
In this project teachers mapped the educational possibilities of the periphery and pedagogical itineraries that could be traced and experienced by citizens. The term “mapping” refers to a human capacity, while a map is a graphic object. And collaborative means that the curation was accomplished by everyone working together. Teachers included points they visited, with photos, descriptions and educational proposals. Twenty-five points were included, such as community libraries, theaters, museums, cultural centers, schools, community entrance exams, coworking spaces and universities. See examples on Figure 1, 2 and 3.

Figure 1 – Screenshot of a collaborative map at Google My Maps [in Portuguese]



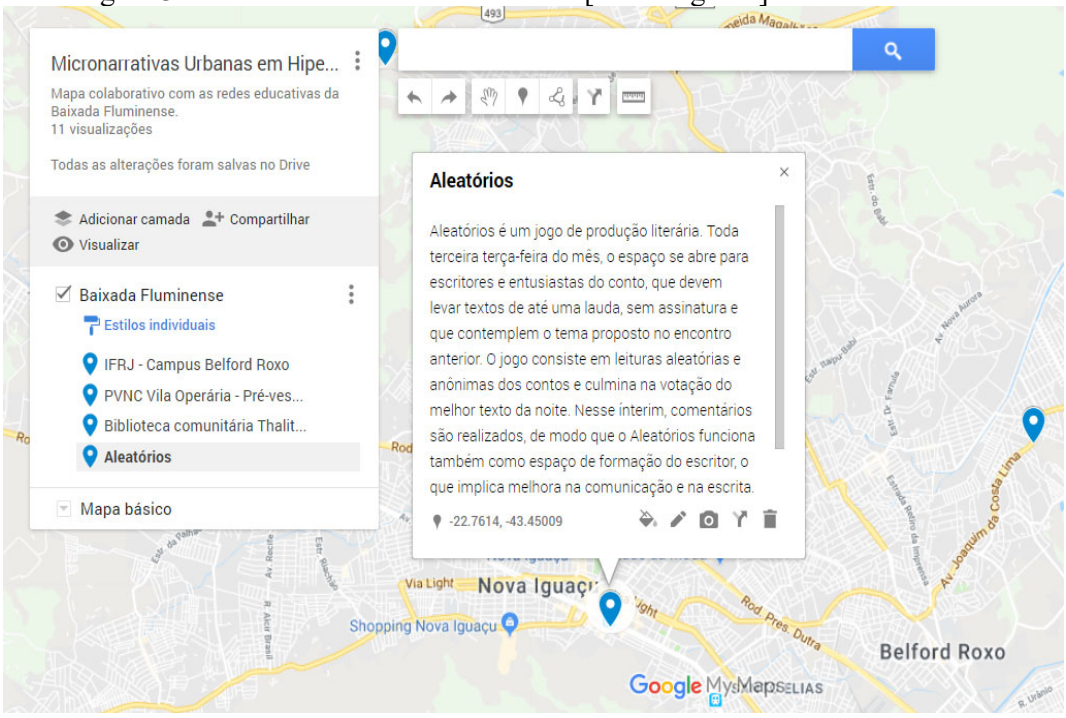
Source: produced by research participants.

Figure 2 – Screenshot of a micronarrative [in Portuguese]



Source: produced by research participants.

Figure 3 – Screenshot of a micronarrative [in Portuguese]



Source: produced by research participants.

The relevance of the essay is found in the disclosure of educational webs (Alves, 2007) in Baixada Fluminense, an area that is out of the great axes of communication, culture, art and education in Rio de Janeiro, being justified by the need to share experiences and understanding how education happens in the cities in times of cyberculture.

The notion of urban micronarratives in hypermobility emerged from a gathering of readings, everyday experiences, and narratives of research practitioners. The term "micronarratives" (Jacques, 2012) does not refer to narratives that are small or diminished in value, but the narratives of ordinary practitioners in cities (Certeau, 1984), those who experience daily practices, tactics, uses and craftiness, with which they resist authoritarian mechanisms and dominant strategies.

> These errant narratives are minor narratives, they are micronarratives in the face of the great modern narratives; they emphasize the issues of experience, body and otherness in the city and, thus, reaffirm the enormous power of collective life, a complexity and multiplicity of meanings that confronts any "single thought" or consensus, such as that promoted today by luminous media images and spectacular cities (Jacques, 2012, p. 20-21).

Jacques (2012) understands that in addition to experiencing the city, practitioners must transmit these experiences through their micronarratives, advancing from lived experiences, to shared, transmitted and collective experiences. To this author, the micronarratives can be realized in different formats: "artistic urban narratives – literary, ethnographic, photography, cinematography, musical, cartographic, etc. – realized by the wanderers from their experiences of wandering around town" (p. 30). Being with all the senses in alert, practitioners can share scents, sounds, looks, contacts, touches and different tastes, in individual and experimental meanings.

The notion of hypermobility was created by Santaella (2013), that says: "hypermobility is the physical mobility plus the mobile devices that give us access to cyberspace" (p. 15). It provides the creation of fluid and intersected spaces from the connection, in the displacements, in all daily spaces, in transit, at home, at school, in the cultural equipment in the cities (Martins; Santos, 2019).

In this way, we understand the space in agreement with Santos (1996, p. 63), who proposes the geographical space being "formed by an inseparable, solidary and also contradictory set of systems of objects and systems of actions, not considered in isolation but as the unique framework in which the story takes place". Approaching walks in the city from the various possible interlaces, we explore contents not only directed to communication, culture and art, but to the knowledge of the different spaces, the different people, the different paths we travel, contributing to the citizen formation. The difference and the coexistence of multiplicity in cities is a power that cannot be forgotten to think about education, in this respect Rios (2012, p. 167) asks: "why build learning strategies with their backs to this universe that sticks together?"

The city has an educational nature, at every moment new educational scenarios are instituted in the complex urban plot and we need to explore this to promote other perspectives in education. Teachers can be artisans in the construction of the city as an educational space, proposing pedagogical practices in their educational daily lives, which include the school-city-cyberspace interface in their curricula. And also, from the perspective of their training and their willingness to learn and teach, as research practitioners did. According to Rios (2012), we cannot ignore the city experiences. In displacement, we observe, but also intervene, making proposals for pedagogical practices throughout the city, contributing to the resignification of education and the city itself, according to the micronarratives below.

Figure 4 – Example of teachers' reflections

Julio: Google maps is a very intuitive tool for those who are already familiar with the virtual structure. I was surprised by this curation function, the user can make travel itineraries. The mechanisms of virtual georeferencing are extremely important, to work on the issue of urban, rural, local, global, gentrification, conurbation, territories, limits, networks and among other geography themes. I will contribute to the formation of new individuals who are not afraid of the new and different, in this way, subjects about art, culture and communication will be more palpable for different realities in which these devices can work. I visualize the use of this resource at the time of the execution of didactic activities, because in this way it will be developing new meanings for the elements that would be discussed in a classroom. Taking the city as an object, in which there is a cultural shock from different realities circulating in the same place, and from that we can learn more about the daily life and the development of solutions to different problems. In this way, contact with different cultures ends up expanding the individuals' world perspectives.

Thais: I believe that the use of the virtual space of the Google My Maps application was one of my greatest discoveries. I did not know this tool yet and I believe that, like the other colleagues, it effectively contributed to our training. The use of this type of technology that allows the insertion of "points" on the map, shows us how much we can be protagonists of our own cultural experiences. Places that, although public, are not popular and even unknown. From this, we can modify some teaching practices, both in the places where the classes we would teach would be held, and in the presentation of new spaces for students. I reaffirm the importance of this education outside of space, when I read Paulo Freire (1992) affirming that "the city is culture, it is creation, not only, for what we do in it and for it, for what we create in it and with it." We have a fundamental role in the environment of cities.

Source: produced by research participants.

From the teachers' narratives, several themes were identified: intuitive interface, curation, diverse cultures in the cities, local, global, gentrification, conurbation, territories, limits, networks, and protagonists of our own experiences, creations in and with the city. In addition, the use of Google My Maps contributed to collaborative experiences that did not end with the project presented in this article. The general public is also an author and who is including points, micronarratives and experiences around the city.

Teachers in this study were be inspired by practices gathered in Google My Maps and learned where to look for points of communication, culture and art in Baixada Fluminense to take their students without having to travel to the capital because of the teachers' perceptions that there is no cultural richness in their cities and local neighborhoods. And equally as learning designers have responsibilities as agents of change (Yusop & Correia, 2014). The realization and opportunities to recognize and celebrate local culture and art encourages practices that emphasize the diversity of cultures and value of multicultural communities.

Some notions themes emerged from the teaching narratives: the recognition that time-space is eminently educational, continuous learning, and a pedagogy that allows an increasing approximation between what is taught and what is learnt.

Rios (2012, p. 172-173) points out that "once this pedagogical journey is crossed, perhaps we can also undertake our own journey, trace multiple itineraries and find in the most unexpected corners of the city that we inhabit, a scene that allows us to develop our poetical and pedagogical imagination". When proposing pedagogical practices in the cities, the practitioners devised a course that goes beyond the limits of inside and outside school, proposing a practice that talks to the student in its complexity and completeness, whether to think emotions, or to think about the environment. They have proposed an effective action, in the territories where life happens, after all, the city is made up of those who inhabit it and those who inhabit it are also crossed by it, and to think in this way is to recognize the legitimacy of the knowledge produced in the different areas and spaces of life.

Paulo Freire (2013, p. 19) warns that "there is, therefore, no possibility of dichotomizing the man of the world, since there is no one without the other". When proposing that the construction of knowledge occurs through confrontation with the world, Freire (2013) inspires us to encourage a curious attitude of the subject towards the outside, in a constant search for creating and transforming what is set. We learned from the transforming relationships between men and the world, in a bidirectional action, human beings are transformed in the relationship with the city, which is transformed from the new actions of these human beings, that is, both are transformed in this reciprocal and dialogical. Therefore, believing in education in cities is a necessity.

Opportunities for producing culture and art can occur during school days, in the classrooms, with didactic, paradidactic books and other sources of consultation made official by formal education institutions. However, nothing beats the feeling of belonging and experiencing the city, the experience of feeling, touching and being touched. This kind of experiences can help us to think of cultural heritage as a space for struggle and memory, with power to reinforce the importance of integrative learning.

Final remarks

We understand that education occurs from different time spaces, not just the school. From a multiplicity of productions, we learn and teach, expanding the possibilities and knowledge, occupying other spaces in the city. From this proposal, we recognize the existence of other educational spaces, promoting a meeting between different territories and education, originating urban micronarratives in hypermobility, in different formats: imagetical, text, mapping, among others.

In this study we comprehended the experience in the city through Google My Maps as an opportunity for learning and teaching, where culture pulsates, citizenship is expressed and technologies are created. Multiple reflections are raised from the teachers' micronarratives, especially the importance of the school-city-cyberspace relationship. Teachers' micronarratives express their sense of belonging to the Baixada Fluminense city, commitment to the collective and the need to learn or relearn how to reinvent the city that shapes and transforms its citizens.

The sharing of narratives guarantees the continuity and new meaning of their own experiences, stories to be told, so that the perception that "nothing ever happens here" that is often voiced about the Baixada Fluminense city might gain new meaning. The use of Google My Maps was critical to overcome this cultural misconception and contribute to culturally rich learning experiences that recognizes local neighborhoods as cultural epicenters.

The proposal outlined in this article seeks to present some actions and teaching perspectives regarding education in the city. In a perspective of a training that comprises educational paths beyond the walls of the school, the city and its territories act as a reference for pedagogical proposals by interested teachers with the integral training of their students, connecting experiences from different areas of knowledge to everyday life.

We hope that the continuing education of teachers reported in this article will inspire other practices. Without intending to indicate recipes, we leave clues to captivate the reader for this subject that we consider to be of great importance. May more and better experiences happen, and other stories be told, so that speeches like "nothing happens here", which we hear about the education and culture of the Baixada Fluminense are reframed.

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A New Typology of Communication Configurations: Building Blocks for Lesson Design

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Abstract

Following a review of the literature on classifying teaching-learning arrangements, conducting a conceptual analysis of the basic elements of instruction, and carrying out a conceptual synthesis, the authors propose that the basic elements of instruction—learner, facilitator, resources, setting, and communication pattern—can be combined into eight different configurations, comprising a typology that encompasses all of commonly used arrangements for teaching and learning in face-to-face instruction, in online instruction, and in every other type of organized instruction. The eight communication configurations are: Presentation, Demonstration, Whole-Class Discussion, Small-Group Discussion, Tutorial, Repetition, Study, and Expression.

Review of Literature on Classifying Teaching-Learning Arrangements

In one of his early books, Robert Gagné proposed a typology of what he called *modes* of instruction (Gagné, 1965). Gagné (1965) outlined six different *modes* of instruction: tutoring, lecture, recitation, discussion, laboratory, and homework. Gagne himself did not pursue this idea in his subsequent work.

Later researchers, such as Ivor Davies (1981), David Berliner (1983), and Susan Stodolsky (1988), also proposed classification schemes for what they termed, respectively, as "methods," "activity structures," and "instructional formats." None of these was based on a systematic definition of its elements nor did they specify the basis used for classifying activities into different categories. Further, all of them were developed before the era of distance education, and so were focused on the sorts of activities that take place in face-to-face (F2F) classrooms.

One of the authors began working on this problem early in his career and continued to return to it as a topic in classes he taught in instructional design; see, for example, Molenda (1972). It was not until distance education came into prominence that the flaws of earlier classification systems became apparent. The earliest form of distance education, correspondence study, consisted of little more than printed brochures sent through the mail, for the student to read and respond to study questions or quizzes, which were graded and returned in the mail. The next major format of distance education was "telecourses," broadcast or closed-circuit television programs, coupled with print materials and tests. By the mid-1990s, online computer-based delivery became the norm—but the content tended to be audio or video lectures supplemented with textbooks or other print materials. What was new was that learners could now communicate easily and quickly with each other through discussion forums and with the instructor through forums, chatrooms, and email. In the U.S., government regulations specified that distance education required "regular and substantive interaction between the students and the instructor." These developments placed a new spotlight on factors that had previously been lurking in the shadows—the importance of individual study and individual expression, in the form of answers to quizzes, oral or written exchanges with classmates, projects, and research papers. Plus the

requirement of "regular and substantive interaction"—focusing attention on the flow of communication between and among students and instructors. These features may also appear in F2F instruction, but they tended to be overlooked because they normally took place *outside* the classroom.

The categories to be included in a comprehensive classification scheme of teaching-learning activities were now much clearer, but on what basis should the categories be defined?

Conceptual Analysis: Defining the Basic Elements

The authors realized that a sound classification system required a sound vocabulary of basic terminology. Consistency in the use of basic terms has never been a strong point of the literature of pedagogy. Even the term *instruction* itself has lacked a clear consensual definition. We propose the following definition, based on Gagné's focus on "conditions of learning." *Instruction* is a deliberate effort to provide learners with conditions suitable for achieving specified learning objectives; success criteria include being humane, effective, and efficient. Further, an *instructional event* is defined as any occasion during which one or more learners engage in purposive and controlled learning in some setting.

A review of recent findings of neuroscience—reported in detail in Chapter 3 of *The Elements of Instruction* (Molenda & Subramony, 2021)—led to the realization that even the concept of *learning* was open to new, more sophisticated interpretation. Researchers beginning with Kandel (2006) found that different types of learning follow distinctly different neural pathways, being received, processed, stored, and retrieved differently. For educators, the most fundamental distinction is between the unconscious, effortless process of *implicit* learning (acquired through everyday life experiences) and the conscious, effortful process of *explicit*

learning (acquired through interventions proffered by instructors). The former could be termed *experiential* learning, the latter could be termed *instructed* learning. The analyses reported in this paper are focused on *instructed* learning, as most of the pedagogical literature and most of the conventional educational research endeavors have focused these processes.

Starting from this base, the Elements of Instruction Group, after a review and conceptual analysis of pedagogical literature, decided to base its terminology on the concrete entities that are visible during any instructional event: 1) a learner, 2) a facilitator, 3) resources, and 4) a setting, as described in detail in Molenda and Subramony (2021). Very simply, a *learner* is anyone who voluntarily enters into an instructional setting and participates in teaching-learning activities; a *facilitator* is a person or device that manages instructional events, selecting instructional objectives and methods, monitoring and guiding learner progress, and assessing achievement; a *resource* is any material or device that learners interact with during instructional events; they may be instructional resources or real-world resources. A *setting* consists of the physical surroundings in which the learner, facilitator, and resources interact.

The term *element* is used in chemistry to designate substances that cannot be separated into simpler substances; here *element* is used similarly—to indicate the simplest component of a complex whole, that "complex whole" being an instructional event. The fifth basic element of an instructional event is not a physical object, but it is observable—the communication pattern among facilitator, learner, and resources during the event. We refer to this pattern as a *communication configuration*—which we define as the pattern of the flow of information and control among learner, facilitator, and resources during an instructional event.

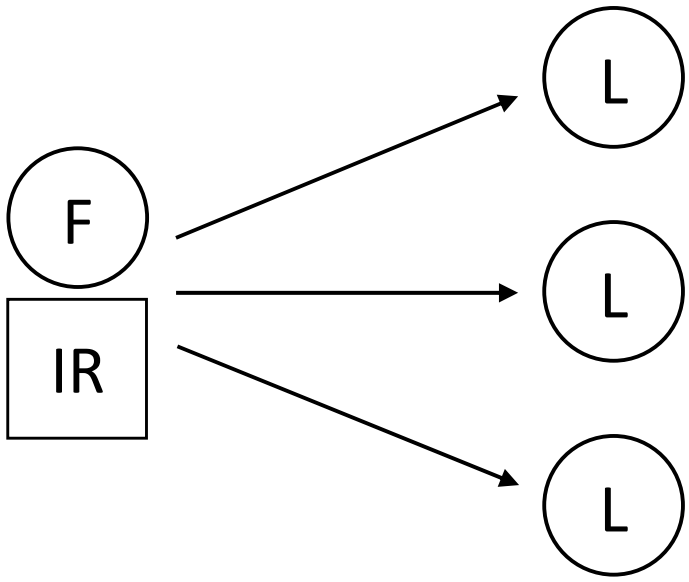
Conceptual Synthesis: Creating A New Typology

The Elements of Instruction Group proposes that the basic elements described above can be combined into eight different configurations, comprising a typology that encompasses all of commonly used arrangements for teaching and learning in face-to-face instruction, in online instruction, and in every other type of organized instruction. These eight configurations are: Presentation, Demonstration, Whole-Class Discussion, Small-Group Discussion, Tutorial, Repetition, Study, and Expression (Molenda & Subramony, 2021). Each has a distinctive pattern of information flow and control among learner, facilitator, and resources.

Presentation Configuration

In the Presentation configuration, a Facilitator (F), or some Instructional Resource (IR) playing the role of Facilitator, conveys information one-way to a number of Learners (L); the Facilitator or Instructional Resource controls the flow of communication.

Figure 1: The Presentation configuration



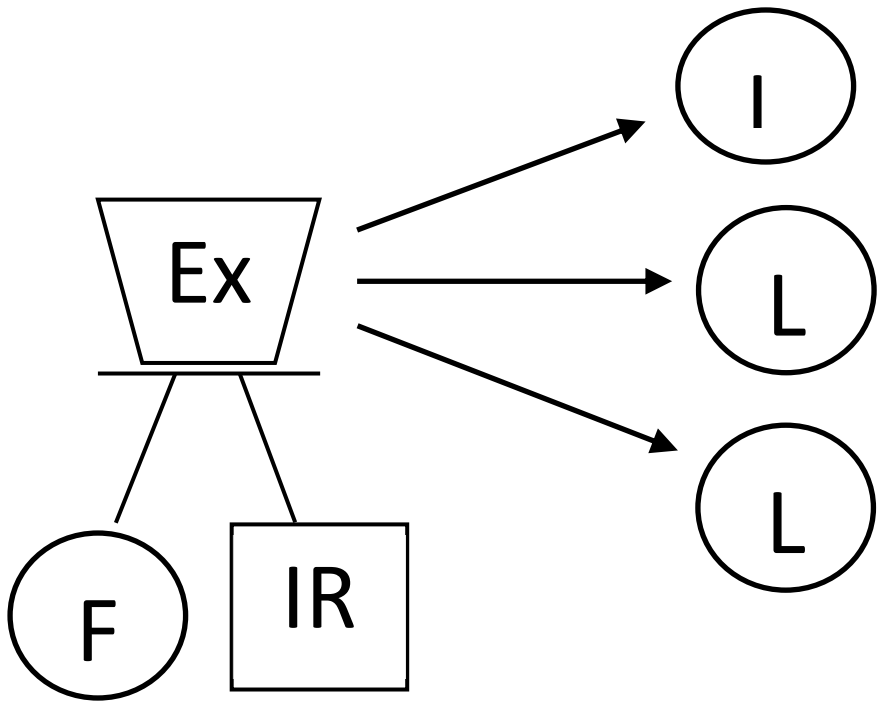
Examples of activities conducted in the Presentation configuration:

- A teacher giving a lecture in a normal classroom
- Audio or video clips inserted into a live presentation in a classroom
- A PowerPoint presentation given by a speaker in front of a live audience
- A lecture recital in a music hall—a pianist plays and talks about the music
- Instructional film or video shown to a classroom audience
- Panel discussions or debates conducted in front of an audience
- Didactic stage plays, e.g., the "morality plays" of the Middle Ages.

Demonstration Configuration

In the Demonstration configuration, a Facilitator (F) or some Instructional Resource (IR) playing the role of Facilitator displays and explains an Example (Ex) of some process, procedure, or other complex task to a number of Learners (L); the Facilitator controls the flow of communication.

Figure 2: Demonstration configuration



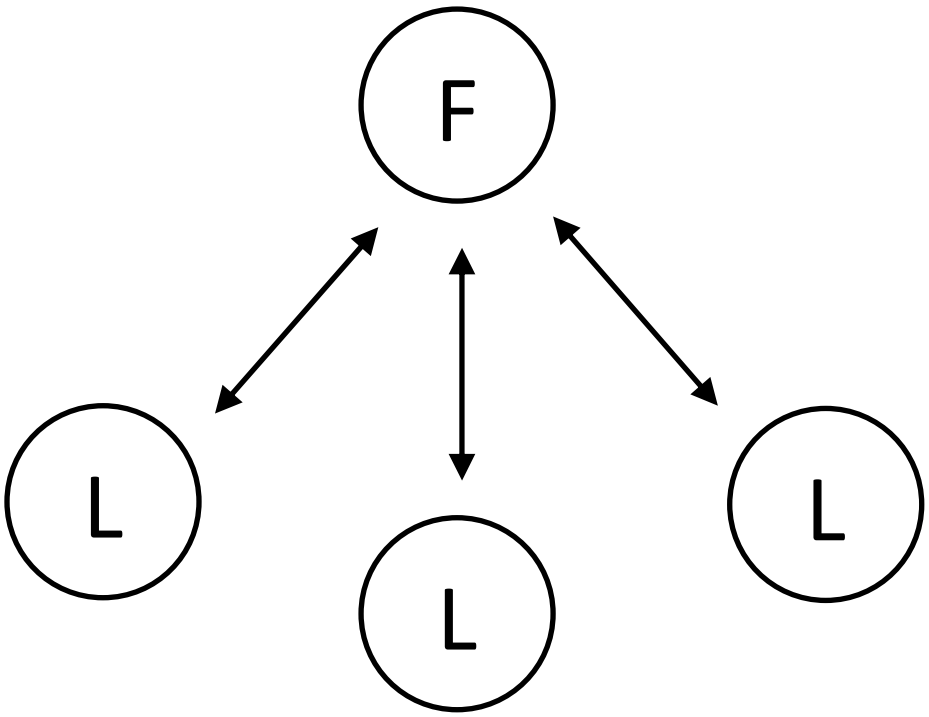
Examples of activities in the Demonstration configuration:

- Physics experiment in front of a class
- An oversize model of a clock to show hours & minutes
- A dynamic model of the solar system (orrery) showing planetary movements
- Role play of salesperson and customer conducted in front of sales trainees
- Historical re-enactments, e.g. Civil War battles
- Slow-motion video of proper free-throw technique
- Working math problems on whiteboard
- YouTube "how-to" video (some may call it a "tutorial," but it is demonstration).

Whole-Class Discussion Configuration

In the Whole-Class Discussion configuration, a Facilitator (F) engages the whole class in a conversation in which Learners (L) take turns sharing information and opinions, with the Facilitator remaining at the center, setting the agenda and controlling the flow of communication.

Figure 3: Whole-Class Discussion configuration



We distinguish Whole-Class Discussion from Small-Group Discussion because they have significantly different patterns of information flow and control. The most important difference is that in the Whole-Class Discussion the teacher or moderator remains in control. In effect, all audience members' comments are directed to the chair, who decides how to respond and what to do next.

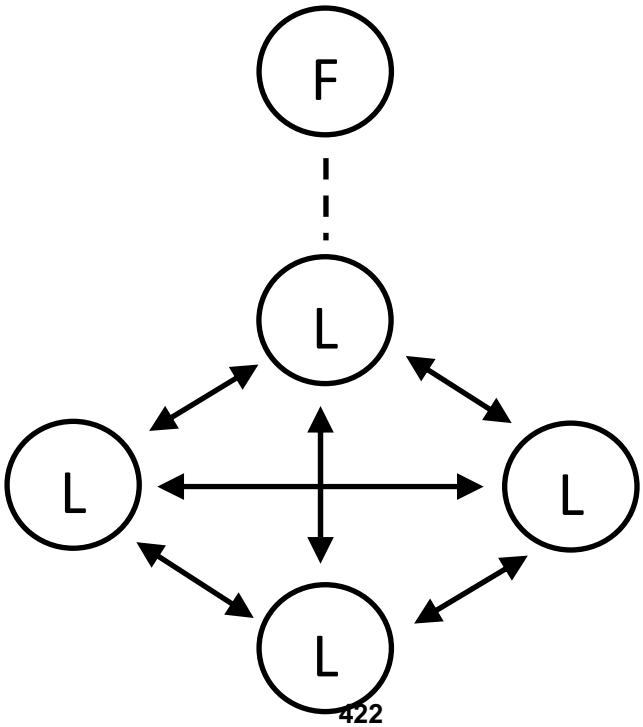
Examples of activities in the Whole-Class Discussion configuration:

- Seminar having open discussion with students guiding the discussion
- Class interaction during a pause in a lecture, e.g. brainstorming session during a lecture
- Debriefing discussion following play of a game or simulation.

Small-Group Discussion Configuration

In the Small-Group Discussion configuration, two or more Learners (L) exchange information and opinions without the intermediation of a Facilitator; a Facilitator may set the agenda and control logistics, but Learners control the flow of communication within the group.

Figure 4: Small-Group Discussion configuration



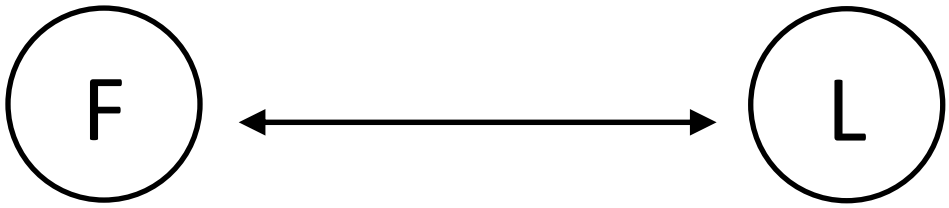
Examples of activities in the Discussion configuration:

- Buzz group or breakout session during a lecture
- Study groups, meeting live or over a Web application
- Web chatroom or discussion forum
- Dyads are also considered "small groups," e.g. "interteaching" method, "writing buddies," or conversation partners for language learning.

Tutorial Configuration

In the Tutorial configuration, a person or a device playing the role of Facilitator (F) interacts, intensively and substantively, one-to-one with a Learner (L) (or small group of Learners acting as one or taking turns); the Facilitator (tutor) and Learner (tutee) share control of two-way communication.

Figure 5: Tutorial configuration



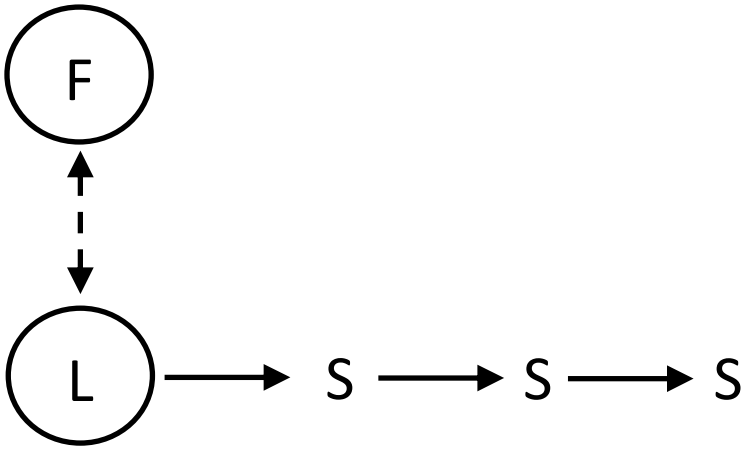
Examples of activities in the Tutorial configuration:

- Peer or cross-age tutoring
- Apprenticeship training or mentoring in the workplace
- Learner-teacher email exchanges of substantive content
- Athletic coaching, e.g., a personal trainer
- Intelligent computer tutoring systems with sophisticated response judgment and feedback capability.

Repetition Configuration

This category might also be labeled as "Practice," but that term has a more generic meaning, in that most skills—cognitive, affective, interpersonal, or psychomotor—require some sort of mental rehearsal or physical practice, but not necessarily repetitious rounds of practice, as is implied here. In the Repetition configuration, a Learner (L) performs repeatedly all or part of a specified Skill (S) in order to improve retention and proficiency. Learners may monitor their own performance, but it is often desirable to have a Facilitator (a coach) to provide corrective feedback.

Figure 6: Repetition configuration



Examples of activities in the Repetition configuration:

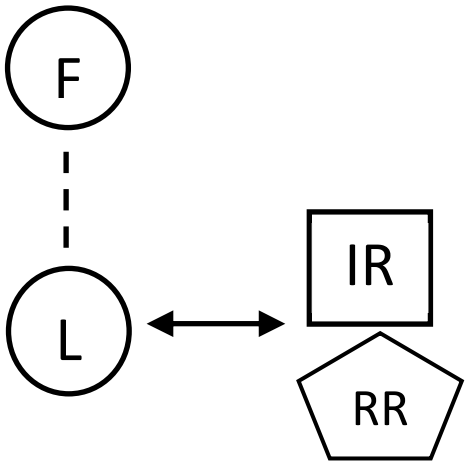
- Memorization drills, e.g. reciting multiplication tables
- Athletic practice, such as a volleyball practice session
- Written exercises, such as worksheets for math or language study
- Working as an intern or volunteer
- Conversation practice for language learning
- Games, e.g. "Math Blaster" that require repeated practice of a curricular objective
- Simulator practice, e.g., CPR with a manikin

- Most tests would also be examples of Repetition; the learner is applying the new knowledge or skill for evaluation purposes, but enhanced learning is another outcome.

Study Configuration

In the Study configuration, a Learner (L) interacts with Instructional Resources (IR), or with Real-World Resources (RR), or with their own inner resources, without the direct supervision of a Facilitator (F), but often inspired or guided by someone playing the role of Facilitator. The Learner is in control of events, deciding exactly what to do and when to do it.

Figure 7: Study configuration



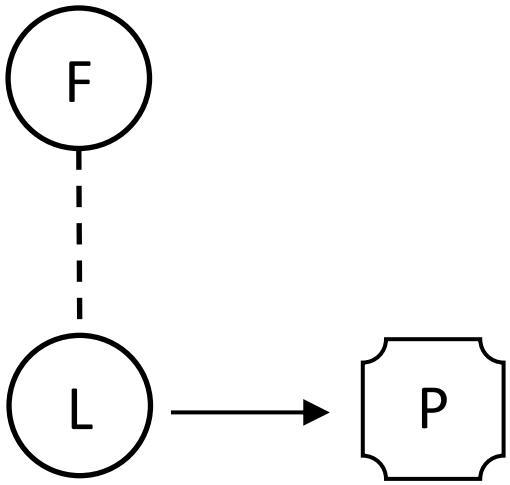
Examples of activities in the Study configuration:

- Reading a textbook (IR)
- Private listening to a podcast or video or slide set (IR)
- Reading a blog that is informative (IR) or that is an example to be critiqued (RR)
- Examining biological specimens under a microscope (RR)
- Analyzing architectural style of buildings while walking in a historic district (RR)
- Identifying artifacts at archeological dig (RR).

Expression Configuration

In the Expression configuration, a Learner (L) creates some type of tangible Product (P) in order to process some new knowledge or attitude; the experience may be structured and/or monitored by a Facilitator (F), but the Learner controls what is created and how it is created.

Figure 8: Expression configuration



Examples of activities in the Expression configuration:

- Writing a term paper
- Preparing a written or podcast book report
- Short reflection paper at end of class
- Writing a blog or memoir about one's experiences
- Creating a schematic diagram of a process
- Painting a picture using a new brush technique
- Sculpting a figure
- Designing a set for a theatrical play.

Communication Configurations as Building Blocks

Different Configurations for Different Stages of Instructed Learning

Any given lesson might combine different configurations to accomplish different stages of the learning process. Each instance would be like a photograph which, combined with others photographs, can constitute a movie of the lesson. Different configurations are suited to different steps in the process—gaining attention, stimulating motivation to learn, providing practice opportunities, and evaluating achievement of the objectives. For example, an elementary school teacher:

- holds up a jar containing a tadpole (Demonstration) and ask children to guess what it is;
- individuals call out answers (Repetition in the form of recitation);
- the teacher then states that the tadpole represents one stage in the life cycle of a frog (Presentation);
- using flash cards, the students then read new vocabulary terms in unison (Repetition);
- teacher projects images showing all the stages in the life cycle of a tadpole (Demonstration);
- as she points to each stage, students identify them in unison (Repetition);
- students work individually on worksheets, labeling the stages in the life cycle (Repetition);
- the culminating activity is a construction project: consulting a chapter in the textbook (Study) and using art supplies to create a frog life-cycle drawing (Expression).

Each Configuration Can Consist of Different Formats

As illustrated in the earlier discussion of communication configurations, any given configuration might be instantiated by a number of different media formats. For example,

someone planning a F2F class may decide that a Presentation is needed to provide new information early in a lesson. They may choose among a live oral presentation, an audio recording of a lecture, an instructional video, a "chalk talk" with a whiteboard, or a panel discussion. In a distance-education course, the same Presentation need may be met by showing an existing video or a newly made audio or video recording.

Our contention is that different media formats are essentially fungible. As long as the format offers the affordances needed to convey that new information—say, diagrams accompanied by oral narration—it doesn't matter instructionally which format is chosen. One of the options may be readily available, while other options would be expensive or time-consuming to acquire or create. Different media formats offer time and expense trade-offs, but they are instructionally fungible. Thus, lesson design becomes simplified as what matters is selecting appropriate configurations for each step of the instructional process—a choice of one of eight configurations—versus sorting through scores of various media formats and teaching-learning activities.

Next Steps

The Elements of Instruction Group intends to continue to explore the applications of the Molenda-Subramony communication configurations to instructional design. Which configurations are best suited to what sorts of objectives? To what stages in the instructed learning process? What are the "best practices" for implementing each configuration, for obtaining the most "bang for the buck" when creating learning experiences within each configuration? Finally, we intend to return to the different types of learning and to explore the relationship of our communication configurations for the "conditions of learning" needed for *experiential* learning, an area that has burgeoned over recent concern for social and emotional

learning (SEL), as discussed, for example, by Lopes and Salovey (2004). Much work remains to be done.

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Hierarchical Healthcare System: Measuring Pre-qualified Student Interprofessional Competency Through High-fidelity Simulations in Higher Education

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Introduction

Interprofessional education (IPE) in healthcare promotes interprofessional competency, which in turn increases team performance and positive patient outcomes. Further research is needed when combining IPE in healthcare with high-fidelity simulations (HFS) (O'Leary, Nash, & Lewis, 2015). Multiple studies have shown positive benefits such as increased teamwork and communication skills through the use of interprofessional learning within the high-fidelity patient simulation setting (Guraya & Barr, 2008; Smithburger, Kane-Gill, Kloet, Lohr, & Seybert, 2013). However, other studies have shown neutral to negative outcomes (Johnson, 2019; Reeves, Pelone, Harrison, Goldman, & Zwarenstein, 2017). Furthermore, IPE has received negative feedback from students in accelerated programs who were exposed to repeated high-fidelity simulations (Kaddoura, Vandyke, Smallwood, & Gonzalez, 2015). Due to divergences in outcomes and the hierarchical structure of healthcare, further research into the use of IPE in healthcare education through the instructional strategy of HFS is needed.

This paper explores the intersection of student interprofessional competency, views on IPE learning, satisfaction with interprofessional interaction, and thoughts about interprofessional collaboration HFSs. The exploration of these topics will include the theoretical underpinnings and their application over time and the relevance they still hold today. Topics will include the healthcare hierarchy, interprofessional teams in healthcare, interprofessional education in healthcare higher education, measuring interprofessional competency, simulation, learning, satisfaction, and collaboration.

Hierarchies of Healthcare

Healthcare of hierarchies are mainly built through licensures, certifications, governing bodies, and legislation to define standards in which a healthcare provider is designated into. Within the clinical setting there are established policies, procedures, and scopes of practice with the purpose of ensuring the best patient outcomes while mitigating legal liabilities (Weller, Boyd, & Cumin, 2014). Despite evidence-based research suggesting alterations are needed to longstanding policies, procedures, and scopes of practice, there remains a rigid system that

providers are classified into; this leads to natural social affects to how healthcare providers are treated by adjacent professions (Shaw, Rees, Anderson, Black, & Monrouxe, 2018).

Research suggest social hierarchies can be viewed as simple to complex creatures, from instinctual animals such as birds (Price & Sloman, 1987) to the reasoning capabilities of primates (Weisfeld & Beresford, 1982). For humans, hierarchies can exist in various forms and arrangements of perceived value. This can include the concept of vertical and horizontal ranks and levels within a group of people or, in the case of this research, can exist within a team of student healthcare providers. During an interprofessional simulation the program of study places the student within the role of their future profession where a hierarchy of orders, decisions, and responses follow.

However, there are complexities to interprofessional clinical simulations that must be first addressed. An example of this are differing points in time of clinical exposure to clinical simulations by healthcare fields such as nursing, medicine, and respiratory therapy. Nursing and respiratory therapy majors are often well adapted to the interactive details of the clinical simulation environment long before medical students are introduced. Another example stems from how these professions are trained. For example, medical students tend to focus on solving a specific medical problem and not the more holistic approach from nursing students (Nyström, Dahlberg, Hult, & Dahlgren, 2016). When put together in a simulated environment, students often learn how differently other professions address patient care. This can lead to role insecurity and produce negative feelings towards IPE. With increased exposure and in-depth understanding of the clinical environment, medical students often grow into their leadership role. This assumed leadership role for medical students makes the simulation more realistic as it will mirror the real-world setting in certain respects. Senior nurses and newly minted medical students approach patient care differently due to differences in training and faculty guidance. IPE provides a mirror to the clinical environments that can help faculty and other educators to incorporate interprofessional competency skills required for high performing healthcare teams (Anderson, Jensen, Lippert, & Ostergaard, 2010; Baker, Day, & Salas, 2006; Leonard, Graham, & Bonacum, 2004).

Conflict within Hierarchies of Healthcare

Hierarchies in healthcare exist and so does the natural conflict that exist within these hierarchies that can unfortunately lead to poor patient outcomes. Incivility among healthcare professionals has been linked with a lowered clinical performance, safety risk for patients, and negative patient outcomes (Belyansky, et al., 2011; Katz et al., 2019). Multiple studies show detrimental outcomes to patients when conflict exist within the healthcare team (Gittell, Weinberg, Pfefferle, & Bishop, 2008; Lee & Doran, 2017). Disruptive intraoperative communication and conflict can be detrimental to patient outcomes (Belyansky, et al. 2011). It is this conflict within the hierarchies of healthcare that provides another key reason for research in this area. IPE HFSs attempt to mirror the environments these healthcare students will be entering into and allows students to develop and practice interprofessional competency and collaboration (Josi, Bianchi, & Brandt, 2020). It can be reasonably stated that IPE during pre-qualifying education could decrease future workplace conflicts created by miscommunication and general mistrust between the professions. If the healthcare team is not producing beneficial patient outcomes, then there is a dissonance with its very existence. To bring harmony to this dissonance it is crucial that early and continued opportunities are provided to healthcare students that adjust them to interactions with the multitude of healthcare workers in the clinical setting. IPE provides

this opportunity for applied collaborative practice, a type of practice that can produce positive patient outcomes (Kim, Radloff, Stokes, & Lysaght, 2019).

The Need for Interprofessional Healthcare Teams

There is growing need for efficient, effective, and appealing interprofessional healthcare provider team-based models in the United States largely due to an economical supply and demand issue. On multiple levels, there are not enough healthcare professionals to address the current and increasing number of patients. One of the largest predictors of this shift is the aging population which is set to grow to about 69 million people by 2025 (Altman, Butler, & Shern, 2016). Older populations require more care due to natural aging processes, onset of chronic illness, and comorbidities which all demand increased amounts of healthcare expenditure to address in a holistic manner (Altman, Butler, & Shern, 2016). Current providers face additional stress from administrative pressures for positive Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey scores. This survey is provided to Medicaid and Medicare patients post-hospital stay. The federal government uses a Value Based Purchasing (VBP) program based on these scores in order to determine the reimbursement rate coming from the Centers for Medicare and Medicaid Services (CMS). Scores are also used to provide the public with a comparison between healthcare organizations through the Agency for Health Research and Quality (AHRQ). Depending on the scores, hospitals may be reimbursement in full, at a lower rate, or a higher rate (Shulman, Crowe, Hutzler, Karia, & Bosco, 2018). This ties together real or perceived positive patient outcomes with monetary reimbursement.

In order to attempt to meet these pressures and needs there has been a slow restructuring over the decades from (a) a healthcare system model where a physician makes the majority of the decisions one-on-one with the patient to (b) an interprofessional team-based care model where there is a larger team of a lower level providers that are managed by physicians. These mid- to lower-level providers can include nurse practitioners (NPs), Physician Assistants (PAs), Occupational Therapist (OTs), Physical Therapist (PTs), Speech Pathologist, Respiratory Therapist (RTs), Registered Nurses (RNs), Dieticians, and Community Paramedics who often have an increasing scope of practice and autonomy (Corso, Dorrance, & LaRochelle, 2018; Flaherty & Bartels, 2019). On a clinical level, allowing RNs and RTs practice to the top of their scope of practice decreases physician burden while allowing them to attend to the needs of higher acuity patients.

Further evidence of the growing need for a more rapid healthcare system change to the more interprofessional team-based model can be seen in the decline of medical school graduates who elect to go into primary care and emergency medicine. There are a multitude of reasons for these medical students to not elect to go into these professions. Of specific note is the increasingly higher student loan debt upon graduation, lower salary, and lower insurance/CMS reimbursement rates compared to other more specialized areas such as anesthesiology, gastroenterology, or orthopedics (Corso, Dorrance, & LaRochelle, 2018). Additionally, and sometimes of equal importance, the ever-increasing number of patient interactions to address, lack of work/life balance, lower patient satisfaction scores, and increased negative patient outcomes due to lack of resources. All of these contribute to physician burnout and lower retention rates (Corso, Dorrance, & LaRochelle, 2018; Flaherty & Bartels, 2019). This effect can be seen in the retirement-replacement ratio where there is currently a downward trend in the number of primary care physicians with around 8,500 retiring and being replaced by only 8,000

(Petterson, Winston, Tran, & Bazemore, 2015). Another projection for 2025 show a physician shortage in general in the U.S. of 61,700-94,700 (Altschuler, Margolius, Bodenheime, & Grumbach. 2012).

Due to lack of primary care physicians, mid- to lower-level providers in this hierarchal system have been trying to fill this gap and seizing this opportunity to increase their scope of practice and gain more autonomy. Reports from organizations like the American Association of Nurse Practitioners (2018) reported in 2017, 87% of NP students were in a primary care program while only 14.5% of newly graduated medical students entered a residency program focused on primary care. This skew towards primary care puts NPs in a position for continued employment growth where they could see more mid- to lower-level acuity patients while still under the direction of a physician or have "full practice authority" as they do in 20 states (Van Fleet & Paradise, 2015). Full practice authority simply means NPs do not have to practice under a physician. It has also been shown that NPs can handle 80 to 90 percent of cases conducted by primary care physicians (Mundinger, 1994). Therefore, in the 30 states where there is some level of physician oversight it is these two professions that must work well together. In all states, the vast majority of physicians and NPs will be working in interprofessional teams. Physicians are dominate in this hierarchy which sometimes cause conflict and lead to poor patient and professional outcomes.

Registered Nurses (RNs) are the largest licensed health professionals in the lower hierarchical levels addressing the increasing healthcare provider shortage in the U.S. As of 2011, there are around 3.7 million RNs and that number has grown to 3.8 million in 2017 with employment growth projections of 15% from 2016 to 2026 (Institute of Medicine, 2011; Smiley, et al., 2018; Tropey, 2018). RNs practice inside the hospital setting but also outside of it in areas such as home health, ambulatory care, public health, schools, long-term care, skilled nursing facilities, wound care, and hospice. Some have proposed that this group of healthcare professionals, in combination with other professionals, be used responsibly within the creation and establishment of the following: new protocols of practice, complex care management teams, coordination of services between primary and specialty, and a co-visit model with low to medium acuity patients with minor infections and illnesses that do not require a visit to a physician's office, urgent care, or an emergency room (Flaherty & Bartels, 2019; Institute of Medicine, 2011). This plan allows for physician supplementation need that can conceivably offset the increasing demand for patient care. However, implementation of this plan requires embracing of larger interprofessional teams and a culture of teamwork.

Additionally, there is an established positive correlation among interprofessional healthcare teams to increased job satisfaction, overall performance, and positive patient outcomes (Kash, Cheon, Halzack, & Miller, 2018; Janss, Rispens, Segers, & Jehn, 2012). The effectiveness in positive patient outcomes through interprofessional teamwork is further seen in the inclusion of pharmacist during hospital rounds. Hospital rounds are a dedicated period of time in which a healthcare team address complete care for each patient. It's been shown that the inclusion of pharmacists can reduce adverse patient drug reactions, resulting in positive patient outcomes (Kucukarslan, Peters, Mlynarek, & Nafziger, 2003).

The question then becomes what goes into the creation of positive healthcare interprofessional team interaction? The recent work of Josi, Bianchi, and Brandt (2020) suggests multiple factors that go into positive healthcare interprofessional team interaction and performance. These factors include conflict management, patient-centered care, communication, and role clarification. However, it is important to emphasize that out of all of the factors listed

above from their study, role clarification was found to be the most important because when a person does not know their role and is placed in a teamwork environment, negative effects on interprofessional team performance has been observed at a significant level. Physicians who lack interprofessional competency may not speak up around nurses with more seniority (Markay, 2006; Sutcliffe, Lewton, & Rosenthal, 2004). Therefore, to create and maintain positive interprofessional interactions and team performance there must be careful consideration and purposeful regard to who is placed on that team. A healthcare team member who does not know enough about their role on the team will consequently be detrimental to that team. The question becomes is the lack of role clarification due to poor team onboarding, incompetence, or performance anxiety? Therefore, there is a need for continued research into interprofessional best-practices and delivery of instruction through HSF environments.

Interprofessional Competency in Healthcare

The section focuses on interprofessional competency and how it intertwines with IPE in the healthcare educational environment to make future effective, efficient, and appealing healthcare teams. High performing teams that improve patient outcomes, produce higher HCAHPS scores, and increase reimbursement rates commonly boost morale of healthcare teams and administration. However, to look at interprofessional competency it is important to step back and first look at interprofessional collaboration.

The need for interprofessional collaboration originates when two or more professions need to interact to achieve a common goal or objective. Most large organizations require multiple professions such as management, human resources, finance, accounting, and logistics working together to meet common goals or objectives. Meeting goals and objectives is important however, it becomes critical in professions that focus on healthcare and interpose immediate decisions that are often lifesaving in nature (Llewellyn & Skevington, 2015).

Interestingly, the origins of the term ‘interprofessional practice’ came from patient-centered healthcare and overtime has been applied in numerous other settings outside of healthcare due to its positive effects in training and performance outcomes (Giess & Serianni, 2018). One of these settings includes higher education. The encouragement of collaboration among students is not a new thing and has been talked about for some time. In regard to higher education, Chickering and Gamson (1987) provide seven principles of good practice in higher education that encourages cooperation between students and mutual respect. Successful cooperation suggests interprofessional competency.

To measure interprofessional competency it must first be defined, and then appropriate measurement instrument(s) must be found. Defining interprofessional competency can be difficult because the framework of knowledge and skills on display by any one healthcare discipline can be drastically different from one another. A working example of defining competency comes from researchers who studied the Japanese Association of Interprofessional Education (JAIPE) and then developed a framework (Haruta, 2018). This framework consisted of two core domains: “patient-/client-/family-/community centered” and “interprofessional communication” and four peripheral domains: “role contribution”, “facilitation of relationships”, “reflection”, and “understanding of others” (Haruta, 2018). Another example comes from a well-known interprofessional organization, the Interprofessional Education Collaborative (IPEC). IPEC’s Expert Panel (2011) states the following four interprofessional competencies:

"values/ethics for interprofessional practice", "roles/responsibilities", interprofessional communication", and "teams and teamwork".

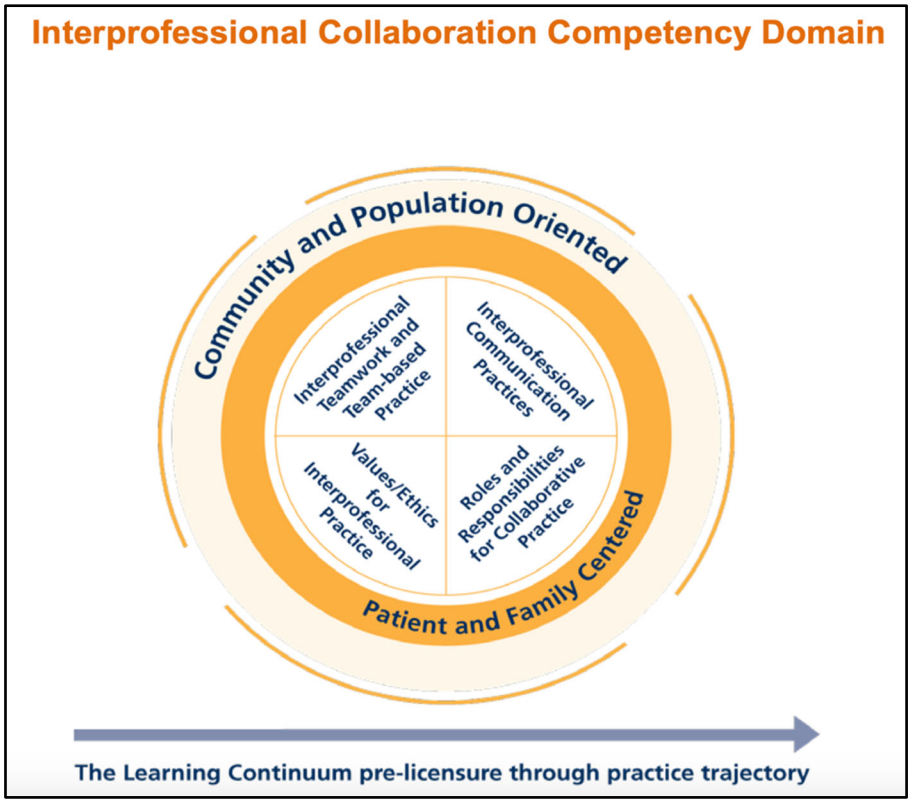

Figure 1. Interprofessional Collaboration Competency Domain (adapted from IPEC. (2016), "Core competencies for interprofessional collaborative practice: 2016 update").

Five years later, IPEC (2016) updated these interprofessional competencies for three reasons: (a) to reaffirm all four competencies, (b) to organize the four competencies under a single domain of "interprofessional collaboration", and (c) to achieve the Triple Aim of "improve the patient experience of care", "improve the health of populations", and "reduce the per capita cost of health care". Figure 1 from the IPEC (2016) update illustrates this singular domain and how the four competencies are to relate to one another which includes a trajectory for the pre-licensure learner.

All of the competencies mentioned above share very similar wordings and it is through that similarity that a search for an appropriate instrument to measure interprofessional competency was conducted. It was also important to keep in mind that the search for an instrument includes the need for it to be valid, reliable, and appropriate for statistical use and the population size.

Complex Adaptive Systems Theory in Healthcare

The application of a particular pedagogical theory has been an issue when it comes to interprofessional learning. A primary issue is the multitude of learning and performance contexts that needs to be taken into consideration throughout a simulated event. In healthcare environment there is often a level of culture shock and difference from the training environment to the

workplace environment. It is a complex system that has increasingly been viewed through a variety of systems thinking lenses and social networks (Benham-Hutchins & Clancy, 2010; Nugus et al., 2019). Shepard and Burton's (2019) reviewed and evaluated the need for simulations in healthcare which resulted in the validation of a framework that follows a traditional ADDIE (analyze, design, develop, implement, evaluate) cycle.

There is an established link between a Strategic Operational Research model with a Strategy Development Process model though the use of Complex Adaptative Systems Theory in order to get a more holistic view of that system (Hammer, Edwards, & Tapinos, 2012). It may be possible to use Complex Adaptative Systems Theory to gain a more holistic approach to the development and improvement of interprofessional healthcare simulations HFSs. Below is a figure to be used as a visual guide to explain the application of Complex Adaptive Systems Theory.

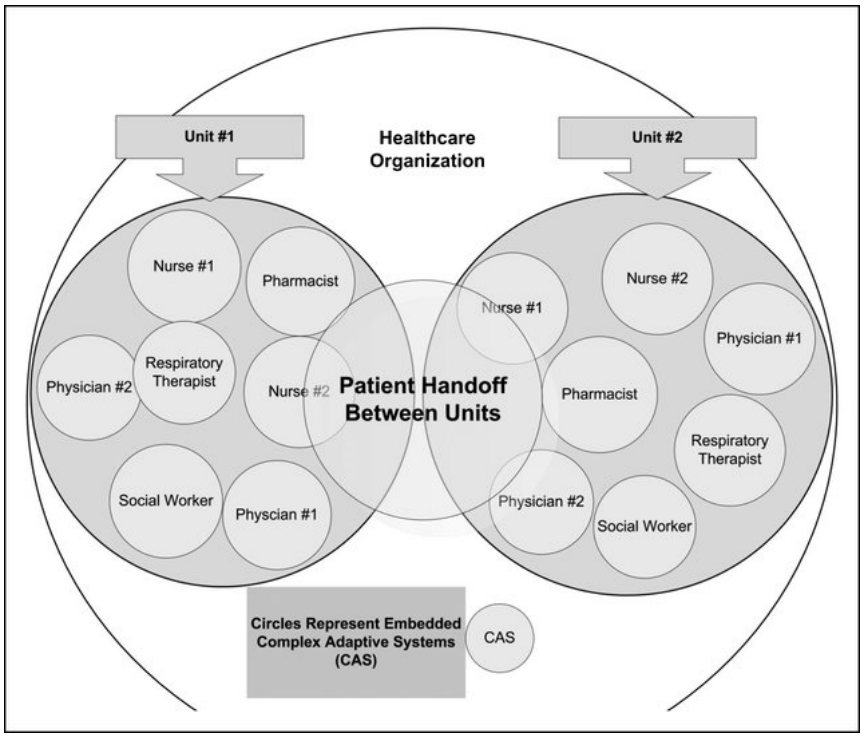

Figure 2. Healthcare organizations: Embedded complex adaptive systems (Benham-Hutchins & Clancy, 2010).

Figure 2 portrays the different parts of a patient hand-off between two units. An example of the above could easily be a shift change or a patient moving from the Intensive Care Unit (ICU) to a Critical Care Unit (CCU). There is a clear complex adaptive system and a patterned output which can be seen by the fundamentals of positive patient outcomes and the multiple interactions between all the facets in the system (Dodder & Dare, 2000). It is because of this that Complex Adaptive Systems Theory can be applied in the process of study and research of healthcare settings. Key characteristics of this theory include a large number of dynamic interaction where elements are constantly affecting each other, non-linear interactions, openness, constant energy, history, and most importantly parts of the system that aren't aware of each other. This can be summed up in the following properties: emergence, co-evolution,

connectivity, nested systems, simple rules, iteration, sub-optimal, requisite variety, self-organizing, and edge of chaos (The Health Foundation, 2010). It is through the lens of Complex Adaptive Systems Theory that IPE HFSs can capture the highest fidelity and practical utility.

Interprofessional Healthcare Education

IPE in healthcare and the research behind it has over the last decade become better defined and validated. The standard accepted definition of IPE in healthcare was set by the World Health Organization (WHO) in 2010. It is as follows, "two or more professions learning about, from and with each other to enable effective collaboration and improve health outcomes." (World Health Organization, 2010). The primary purpose of IPE in healthcare has been to expose healthcare teams and students to the interprofessional teams they will be working with upon graduation. It is also worth noting the impact well researched and designed training can have in the healthcare setting (Rumball & Tober, 2013).

According to a systematic meta-analysis by Guraya and Barr (2008) IPE in healthcare promotes a positive outlook on other professions. Therefore, there has been a growing popularity to incorporate IPE into the healthcare education curriculum. However, it is important to note that that there are others that state there is no valid evidence to support the claim that IPE increases collaborative performance or improves health outcomes of patients (Reeves et al., 2017). This includes not creating a positive professional identity in the student before the introduction of IPE education can be detrimental and cause negative attitudes towards their own profession and others (Johnson, 2019; Stull & Blue, 2016). The manifestation of the lack of professional identity is seen in the interprofessional environment in which these students will enter upon graduation through the lack of role clarification which becomes detrimental (Joshi et al., 2020).

Simulation in Healthcare Education

Simulation as an instructional strategy has been in use in various forms of practice especially in the medical field for decades (Gaba, 2004; Issenberg, McGaghie, Petrusa, Gordon, & Scalese, 2005). Simulations today can allow for a variety of situations including medical interventions being brought forth from interprofessional small groups (Bays et al., 2014). Multiple sources of healthcare literature and studies over the years has given the healthcare community a better framework and understanding of which to craft better and higher quality simulations (Jeffries, 2006). The primary purpose of healthcare IPE within simulations has not always been clinical competency but teamwork competency focused. The ability for the team to function took precedence over the quality of the clinical judgement. Over the past two decades there has been a remarkable increase in quality integration in terms of appropriate clinical judgements into the simulations. The definition of teamwork, what it means, and how it is enacted has changed and become a lot more complex through looking at it from a perspective of interprofessionalism (Pollard, Miers, & Gilchrist, 2004; Pollard, Miers, & Gilchrist, 2005).

High-Fidelity Simulations and the Suspension of Disbelief

There are some very important questions to ask when it comes to realism so good that a literal suspension of a student's disbelief occurs. In terms of HFSs, where is the balance to be as real as it can without doing harm to the participants? Suspension of disbelief and fidelity can be a very difficult thing to measure and there are various definitions that encompass a spectrum from

low to high. A variety of sensory measures must be kept in mind and include auditory, visual, tactile, and olfactory (Cook, et al., 2012).

HFSs of patients present the healthcare student with a very realistic simulated environment to apply the knowledge and skill they've developed in a safe, no-fault environment. HFSs of patients have long been used by the medical community to help train students before they practice within the clinical setting on live human beings. To be successful in education through simulation there needs to be an understanding of the basics and how the simulation will match the learning and performance context as closely as possible.

The suspension of disbelief can be quite hard for humans when it comes to working on plastic/rubber manikins. It is possible to recreated faces and arms down to details such as pores on the skin, wrinkles, individual hairs, and various skin complexions. However, the cost to do this can be astronomical and increase the fears of cost that already exist when a program invest in HFSs. To overcome this, four themes that healthcare students identified that allowed them to suspend belief and they were: seeing beyond the plastic, knowing what to do, connection and care, and diversity (Power et al., 2016).

There is overwhelming support from students in regard to HFSs. For example, entry-level healthcare students have shown significant increases in skills and knowledge after going through HFSs and applying that practiced knowledge within the clinical setting (Jefferies, 2006). Additionally, there are significant increases in a healthcare students' self-efficacy and self-confidence in their ability to transfer that skill and knowledge from simulation to a clinical setting (Jefferies, 2005). Jeffries & Rogers (2007) state that fidelity and self-reflection are some of the cornerstones of healthcare simulation. This means there must be enough detail in the fidelity of that simulation that it stimulates the student to put together what they have already learned (Jeffries, 2005; Jeffries 2007). The positive effects of high-fidelity versus low-fidelity or paper/pencil can be seen in research that shows increased student performance and satisfaction with HSFs (Jeffries & Rizzolo, 2006). O'Leary, Nash, & Lewis, (2016) showed increases in student knowledge retention rates and self-efficacy while using HFS versus didactic presentations using PowerPoint.

Recommendations

There are drastic changes within the population of the U.S. and a global pandemic of COVID-19. Consequently, changes are being forced on our healthcare system that is causing a complex adaption to a more interprofessional team-based model in order to try to efficiently, effectively, and adequately care for patients. More research needs to look into interprofessional competency, complex adaptive systems theory, learning and performance context, high-fidelity simulations and suspension of disbelief. The following instrument of measure is recommended. The University of the West of England – Interprofessional Questionnaire (UWE-IPQ) (Pollard, Miers, & Gilchrist, 2004; Pollard, Miers, & Gilchrist, 2005) is a validated 35-item questionnaire made up over four scales. It measures communication and teamwork, interprofessional learning, interprofessional interaction, and the interprofessional relationships. The UWE-IPQ was validated and found to have a Cronbach's alpha in the 2004 study for the first three sub-scales scales of (0.76-0.84). for reliability multiple test were done and reported these three sub-scales at (0.77-0.86) with a p-value of ($p < 0.001$). The 2005 study included a Cronbach's alpha estimate for the fourth scale, interprofessional relationships at (alpha = 0.71) with a re-test reliability of (alpha = 0.83).

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Educational digital data analytics: Five research areas and Four Philosophical Divides

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Abstract

The growth of access to digital data in education has led to a massive increase in research utilizing digital data in education over the last several decades. Despite this growth, however, researchers remain unsure of the impact that learning analytics and other research areas are having on the educational landscape, or even how to measure this impact. This theoretical piece situates learning analytics within the larger research area of educational digital data analytics, summarizes different research within this larger research area, and offers a conceptual framework to situate different research within the educational digital data analytics research area that includes four philosophical divides. Suggestions are made for how this understanding of a larger research area within which learning analytics is a subset can be used to evaluate the quality and impact of research.

Introduction

Over the past two decades, the availability of big data has fundamentally transformed human consumption and analysis of information. This change has directly affected fields such as statistics and machine learning, (Gantz et al., 2012) as well as education. To accommodate the influx of digital data, new research areas and fields have been created within the educational research landscape. This is evidenced both by the rise of terms such as *educational data mining* and *learning analytics* (Sin & Muthu 2015), and by the creation of new research societies and journals such as the Society for Learning Analytics Research (SoLAR), and International Educational Data Mining Society (IEDMS). As this growth has taken place, criticism has also grown that this research remains unapplied in nature (Knight et al., 2019). This criticism suggests that there are two bodies of growing and related research: the more technical, mathematically focused research, and the more theoretical, educationally focused research (Xie et al., 2020**)**. It has been suggested that this split in the research has led to a lack of practical, applied, and evaluable learning analytics models (Baker, 2019).

While there is merit to these criticisms, much of this confusion may simply be due to a lack of agreement as to what the boundaries are for these new research areas. For example, one of the most quoted definitions of learning analytics is given by SoLAR. They define learning analytics research as "... the measurement, collection, analysis and reporting of data about learners and their contexts, for the purposes of understanding and optimizing learning and the environments in which it occurs" (SoLAR, 2019a para. 1) While this definition is simple in theory, in practice it does not accurately capture what is commonly considered learning analytics research. One issue is that this definition is too broad. It could be argued that much research in fields such as problem-based-learning, curriculum and instruction, and educational policy (Site

Justin) could fall under this definition. The Handbook of learning analytics further clarifies the boundaries of learning analytics by suggesting common methods and practices within the field (Hoppe, 2017), but no new definition is suggested.

The ambiguity of the definitions of learning analytics and related research creates confusion among researchers that inhibits the free flow of information throughout academic research. This theoretical piece suggests a new area of research: educational digital data analytics research. After briefly defining this research area, five prominent research areas that fall within the bounds of EDDA research are summarized. Next, four philosophical divides between these research areas are identified. Finally, this information is synthesized into a conceptual framework of the current landscape of EDDA research, and current gaps in EDDA research are described. The view of learning analytics as a sub-field of EDDA research may help to understand the true impact it is having on educational research, and the conceptual framework suggested allows for a common set of vocabulary that can be used to evaluate and understand all EDDA research.

Educational Digital Data Analytics Research

EDDA research is here defined as any educational research that utilizes digitally-collected data to understand and improve student learning. This data can be directly generated by students, such as when trace data is collected from a learning management system, or may be collected and aggregated by teachers and administrators. EDDA research has grown exponentially since computers with network-connectivity capabilities began to be integrated into education in the early 2000's (Hew & Brush, 2007**)** This growth in research has taken place in an organic, unorganized fashion (Calvet Linan & Juan Perez, 2015**)**. While this organic growth has allowed for unique ideas and multiple outlets for researchers, it has also led to a lack of cohesion and communication between researchers who may benefit from collaboration and greater awareness of each other's work. The idea of a single community of educational analytics researchers in education research is not common in the literature. Instead, literature reviews and meta-analyses focus on smaller groups of literature such as learning analytics (Avella et al., 2016), educational data mining **(**Dutt et al., 2017), and intelligent tutoring, (Crow et al., 2018) treating each as a unique and discrete research field. Each of these terms, along with its accompanying research society(s) and journal(s), represents a unique area within the EDDA landscape, all with their own philosophical and practical orientations.

Five research areas

Any simplification of the EDDA landscape will fail to capture all the opinions present in the literature. Not only are there thousands of publications each year that focus explicitly on EDDA, because the use of digital technologies such as learning management systems and computerized tests is common place in both K-12 and higher education, (Lochner et al., 2015) there are many more publications that implicitly involve EDDA in some way. However, there are large and/or distinct groups of research that are easily identifiable in the research, and it is those areas that this section focuses on.

Learning analytics

Learning analytics research is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs **(**SoLAR, 2019**)**. The

Society for Learning Analytics Research (SoLAR) is the foci for this area of research. They are the publishers of the Journal of Learning Analytics Research, and host the yearly International Conference on Learning Analytics & Knowledge (SoLAR, 2019**)**. The learning analytics research area of EDDA research was born out of collaboration between computer and learning scientists, and so takes a relatively technical approach to EDDA research (Dawson et al., 2014). Hoppe (2017) identifies three main methodological approaches that are central to learning analytics: Content-oriented analysis of learner artefacts using information and text mining techniques, Process-oriented analysis of action logs to detect temporal patterns in learners data, and network analysis to show the relationship between actors within the learning process. The 2017 publication of *The handbook of learning analytics* codified many of the methods, concerns, and philosophies of this strongly united research area.

Educational data mining

Educational Data Mining is an area of EDDA research that focuses on creating methods that take advantage of the large amounts of data created by students in order to better understand these students and their environments **(**IEDMS 2019 [1]). The foci of this research area is the International Educational Data Mining Society (IEDMS), which also publishes the Journal of Educational Data Mining and hosts an annual conference **(**IEDMS 2019 [2]**)**. Educational data mining is often grouped with learning analytics, **(**Du et al. 2019**)** and the two fields do collaborate closely (Siemens & Baker 2012). Educational Data Mining concerns itself more with data in large-scale settings than learning analytics (IEDMS, 2019 [1]).

Intelligent tutoring

Intelligent tutoring systems (ITS) is centered around the development of individualized computer software design to give students immediate and operable feedback on their work (Clancey, 1981). The foci of Intelligent tutoring research is the Intelligent Tutoring System Conference hosted by the Institute of Intelligent Systems **(**ITS, 2019**)**. ITS research differs in many important ways from the aforementioned research in that it is focused on a specific educational context— the use of computerized tutors**.** Some scholars (Pardo et al., 2018) differentiate ITS from related research in Artificial Intelligence in Education (AIED). The main goal of AI in education, as stated by the International Journal on Artificial Intelligence in Education is to aid in the design of computer-based learning systems (IJAIED, 2019). Because of the similarity of the two areas, they will be considered together in this paper.

Teacher analytics

While not a large or well-known research area, teacher analytics is theoretically distinct from all the other research areas so far mentioned. While the methods employed may be similar to those of other research areas, especially learning analytics, teacher analytics has a distinctly different goal (Mor et al., 2015). Data collected may use student achievement as a benchmark but focuses on capturing teacher actions. The goal of teacher analytics is to allow teachers to improve instruction *before instruction is delivered,* (Sergis & Sampson, 2017) often through the study of past iterations of the instruction. Synthesized data is seldom designed for student consumption and feedback. Instead, teacher analytics utilizes a framework of continuous teacher self-evaluation to improve their teaching methods, referred to in the literature as the process of teacher inquiry (Check & Schutt, 2012). The research area of teacher analytics is small and relatively new. There is no journal or society expressly focused on teacher analytics, but it does offer a unique perspective in the EDDA landscape.

Integrated analytics

When reviewing the literature on EDDA, creating the four research areas mentioned above left a large group of literature unaccounted for. This literature included many areas that utilized digital technology, but only occasionally or incidentally used analytics as part of their research. Instead, the use of analytic methods was ancillary to the main research questions or goals of the study. One prominent example of this research area is Massive Open Online Courses (MOOCs). While research on MOOCs often utilizes analytics, and some research conducted by researchers in other research areas is often conducted utilizing MOOCs (Wise et al., 2017), the field in and of itself is concerned with improving the design and use of MOOCs, with analytics mainly considered an ancillary concern or available analysis tool. Research areas with similar paradigms are plentiful, including Computer-Supported Collaborative Learning, Interactive Digital Storytelling, and eLearning (Row et al., 2019; Atwell, 2007)**.** While analytics is not the focus of these research areas, they contain scholarly knowledge that may be critical in the development of mature EDDA research. To be inclusive of this research, we broadly defined a research area within EDDA called *integrated analytics*. This encompasses all research that, in an ancillary or embedded fashion, utilizes and interacts with EDDA. It is possible that it is within integrated analytics that the impact of other areas, such as learning analytics and educational data mining can be seen.

Four philosophical divides

Because of the continued growth of EDDA research, new trends and areas are regularly emerging. In order to offer a framework with more longevity than a simple definition of current research areas, below a philosophical framework that attempts to explain what it is that philosophically divides different research areas is set forth. After review of the EDDA literature in conjunction with key papers exploring the different philosophies of education research, it was determined that four main philosophical factors could be used to delineate EDDA research.

This framework is designed to be more generally applicable to EDDA research, even beyond the five research areas defined above. This framework may be useful for researchers who are attempting to place their research within the EDDA landscape, critically evaluate the research of other scholars, or make comparisons between different EDDA research that uses different vocabulary and writing norms.

Measures of Long-Term Success

The first philosophical divide between EDDA research areas is different measure of long-term success In their review, Morel et al. (2019) found that in educational research in general, different researchers and stake-holders frequently use “scale” as a measure of success, but neglect to define the term. Morel et al. continued by defining four different definitions of scale:

1. Adoption, a measure of how many people are using a certain educational tool.
2. Replication, or how reliably an educational tool produces a desired outcome.
3. Adaptation, or how easily a tool can be modified to meet local needs.
4. Reinvention, or the use of a tool as a catalyst for further innovation. This measure of scale is most commonly used when considering near-ubiquitous tools.

This implicit use of different definitions of scale seems to be occurring in EDDA research. In the context of EDDA research, adoption (definition 1) is considered a worthwhile goal (Baker, 2016; Shum et al., 2019). There is no evidence of discussion of

the use of EDDA tools as catalyst for reinvention (definition 4). This is consistent with Morel et al.'s observation that reinvention tends to be used only with more mature education tools.

When measuring success, researchers most commonly differ on their consideration of replication and adaptation. For example, Wise and Vytasek's (2018) paper on the implementation of learning analytics systems identifies three main principles for implementation: coordination between stakeholders, comparison against local benchmarks, and customization. This paradigms aligns with the idea of adaptation as a measure of success. Wise and Vytasek's paper is indicative of the stance of learning analytics researchers, whose tools are often designed for specific contexts, not for large-scale deployment (Elbadrawy et al., 2016; Macfadyden & Dawson, 2010). Teacher Analytics favors a similar philosophy of scale, desiring tools that allow teachers to decide what data is most important for their specific teaching context (Sergis & Simpson 2017).

The focus of learning and teacher analytics on adaptation is in direct contrast to a focus on replication by both the intelligent tutoring and educational data mining research area. This allows for a distinction between educational data mining and learning analytics, which are often grouped together **(**Papamitsiou & Economides, 2014; Ihantola et al., 2015; Sin & Muthu, 2015 **)**. Where adaptation focuses on customizing tools for local contexts, using replication as a measure of long-term success focuses on tools giving students consistent results across contexts. This is most pronounced in intelligent tutoring systems, which attempt to create a single tool that can be applied across a broad array of contexts **(**Kulik & Fletcher, 2016**)**. If a tool is successful, it should require little to no modification by researchers and developers. Educational data mining is not expressly focused on replication, but by nature of its focus on large scale data, inherently finds itself using methods that focus more on replication than customization. For example, Acharya and Sinha (2014) focused on using an algorithmic approach to large-scale student data to select variables of interest for predicting student grades. These algorithmic approaches are, inherently, blind, and besides the selection of the algorithm, researchers do not influence the selection of model features and equations.

It is important to note that these two measures of success are not always in direct competition. For example, intelligent tutoring systems, while focusing on replicability across contexts, often achieve this replication by creating tools that customize themselves to individual student needs **(**Kulik & Fletcher, 2016**)**. However, there are many cases where these two goals are directly competing with one another. Predictive tools like those often created in the learning analytics research area are tightly tuned to the specific context they are being applied in, and thus may not be statistically valid outside of that context (Gong et al., 2010; Dietterich, 1995**).**

EDDA researchers should remember that there is one measure of long-term success that almost all stake-holders agree on: greater adoption. In order to reach this goal, researchers must balance concerns of both replication and adoption. There are many examples of this within the research area of integrated analytics. This balance is achieved both through a diversity of opinions as well as an internal balance within individual studies. MOOCs offer a prime example of this balance. Research into student performance in MOOCs often utilizes natural language processing techniques instead of manual coding, and thus creates statistical models that can be more easily adapted to other contexts (Kloft et al., 2014; Robinson et al., 2016**)**.

Augment vs. automate

Here, automation of learning is defined as any use of technology to perform a task that previously would have been performed by an instructor. The augmentation of learning is defined as any use of technology to increase the quality or quantity of learning taking place. Both goals attempt to solve different problems. Automation can increase the affordability of education (Scandura, 2010**).** Augmentation is not as expressly defined or explored in the literature but in the context of EDDA often aims at giving students better feedback and teachers greater insights (Gasevic et al., 2015; Check and Schutt, 2012).

One of the reasons that augmentation may not be as expressly defined is because it represents the bulk of research in learning analytics, educational data mining, and teacher analytics as these fields all aim to enhance the understanding of student learning (and in the case of teacher analytics, teacher processes) in order to increase the quality of existing education (Gasevic et al., 2015; Ihantola et al., 2015; Mor et al., 2015**)**. One reason more focus may be placed on augmentation is because the attempt to automate learning has often utilized a model often criticized by researchers. This model views learners as simple containers, and learning as chunks of information to be packaged and delivered to students (Velesianos & More, 2017). One of the leading critiques of the automation movement is that it has been led mainly by private companies with vested interests in selling software, (Veletsianos & Moe, 2017) with little involvement from researchers. Currently, the research area of intelligent tutoring is the only group performing research on automation (Niehaus et al., 2011; Aleven et al., 2010**)**. Some individual studies do exist in various research areas that suggest or apply automation techniques in a pedagogical justified fashion (Baker, 2016**)**. It has been suggested that researchers "explore how human and non-human teachers might work together," (Bayne 2015, p. 460) in such a way that the important aspects of the human instructor are not automated away.

The study of learning vs. teaching

Ertmer and Glazewski (2013) state that "[the question of studying learning vs teaching] determines where you place emphasis in your investigation and guides your research question, research design, data sources, analysis, procedures, and interpretations" (p. 61). This divide can be seen in EDDA research through the decision of what data source to use. The vast majority of EDDA research bends towards the study of learners. Learning analytics, educational data mining, and intelligent tutoring systems rely almost solely on student action and achievement data for analysis, and frequently focus on individual student success (Gasevic et al., 2015; Ihantola et al., 2015; Mor et al., 2015; Baker et al., 2004). Teacher analytics lies in most direct contrast to this overwhelming focus on student data. While even teacher analytics frequently relies on student outcomes for success, this data is often aggregated and used as a proxy for teacher success (e.g. Hansen and Wasson, 2016). Other data sources, such as the corpus of teacher created content, are also often central to teacher analytics (Timperley et al., 2010). Integrated research contains a variety of approaches, and often focuses more on teaching data than other research areas. For example, in determining how online classes impact undergraduate degree completion, Wavle and Ozogul (2019) used whether or not students had taken online courses during their freshman year (i.e. interfaced with a certain type of teaching) as the main factor of interest. Part of the lack of teaching focused research may be a function of the lack of teacher-level data sources.

As more large-scale data sources are opened for analysis, there may be greater opportunities for EDDA research to focus on teaching.

Design vs. discovery of knowledge

The idea of design vs. discovery stems from EDDA research's close ties to statistics. One side of the argument asserts that: "social science research at its best is a creative process of insight and *discovery* taking place within a well-established structure" (Keohane 1996, p. 12, emphasis added). The discovery-based argument states that scientists should follow existing methods in an effort to uncover objective truths about the learning process. However, it is also well established in modern statistics that such perfect objectivity is not possible. In contrast to the discovery argument, the design argument asserts that "there is an apparent conflict in statistics between the need to be objective, and the need to… make progress… through following up subjective insight" (Blyth 1978, p. 20). Some argue that it is impossible to have a blind, objective mathematical model, and that research requires the consideration of the design of the model in use **(**Begoli & Horey, 2012**)**.

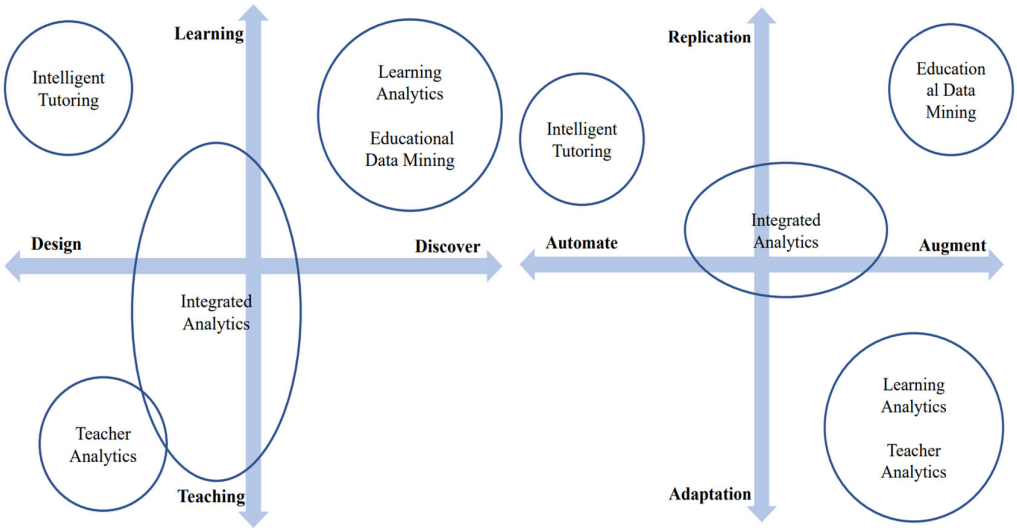
Researchers commonly discuss model selection as a design process (Liu 2017; D'mello et al., 2014; Dong, 2005), however, when explaining results, the goal of EDDA research is often to gain objective "insight into learning and vital educational practices" (Siemens 2012, p. 4). When dealing with simpler, more established modes of modeling (such as regression and basic natural language processing) there are best-practices for quantifying the error established with the claims being asserted, including familiar methods like p-values, and confidence intervals **(**Cobb, 1998). When dealing with complex machine learning models that are inherently non-probabilistic and often uninterpretable, validity of the research claim can often only be measured by how closely the model predicts the data (Japkowicx & Shah, 2015**)**.

When researchers use these methods, they must decide between making objective claims about the nature of a psychological phenomena or making a design-based claim where claims about changes in some behavior are made, but claims about psychological phenomena are omitted. The research areas of intelligent tutoring (Chabay et al., 2020**)**, integrated analytics— particularly those tied to instructional design (Park & Jo, 2019**)** and teacher analytics **(**Sergis & Sampson, 2017**)** tend to favor design-based claims. These researchers are more concerned with measuring outcomes than interpreting or discovering base psychological factors. This leaves the research areas of learning analytics and educational data mining to attempt to make discovery-based claims (Gasevic et al., 2015). Educational data mining particularly faces the difficult tasks of attempting to make sense of big-data while retaining objective interpretability in their models.

Conceptual Framework

In order to simplify these four philosophical divides into a more concise form, the figure below frames the four philosophical divides as a conceptual framework of the EDDA research space. This conceptual framework groups the four philosophical debates into two general categories. The first is research-centric concerns (teaching vs. learning, design vs. discovery) and the second is philosophical divides based on design (automate vs. augment, replications vs. adaptation).

Figure I: Divides in research paradigms (left) and design paradigms (right)



In each of these two visualizations, one of the four quadrants is empty, suggesting a gap in current research. Because teacher analytics adopts a reflective, more subjective approach to teacher improvement, (More et al. 2015**)** there is not a large body of EDDA research that utilizes digital data to uncover discovery-based, objective claims about teachers. Some integrated analytics research bleeds into this area, (e.g. Wavle & Ozogul, 2019) but there appears to be an opportunity for greater research in this area. Because the study of teaching and pedagogy tends to be discipline specific, (Abell 2013; Tu 2003; Eisner & Day, 2004) there may not yet be a method in place for the sharing of information on EDDA research that deals with objective claims about teachers and teaching.

Also noteworthy, though perhaps less explainable, is the gap in design paradigms. It may be that the goals of creating an automated system that is also adaptable to different contexts at scale is not feasible with current technology. It is also feasible that as intelligent tutoring research continues to expand, it will fill this gap. Roll and Wylie (2016) suggest that artificial intelligence may develop into a tool that can adapt to students everyday needs, becoming embedded in all processes of education, instead of being localized to certain learning contexts, like intelligent tutoring systems.

Discussion

Currently, learning analytics, educational data mining, and related fields, are often treated as separate and self-contained. However, when viewing each field as a member of a large EDDA community, we can begin to better understand the impact of research in these areas. For example, one of the earliest methods developed in learning analytics was the use of student grades and demographics at an administrative level to predict student collegiate success (Pistilli & Arnold, 2010). In this initial 2010 paper, Pistilli and Arnold report on how interventions based on predicting student success increase grades during the first several years of college. They included some basic percentages, but either lacked the sample size or statistical power to report findings of statistical significance. In a paper published a few years later (Arnold & Pistilli, 2012) the same intervention system is shown to significantly increase retention of students.

However, there are some issues with validity within the study— teachers at the universities chose whether or not to participate in the intervention, and it is reasonable to assume that those teachers who opted in to a time-intensive intervention may simply tend on average to be higher quality instructors. In short, it is difficult to evaluate the effectiveness of this learning analytics study when viewed in a vacuum. However, when viewed within the broader EDDA landscape, we see that this study has had significant impact on learning analytics and the use of administrative interventions. Google Scholar reports that Arnold and Pistilli (2012) has been cited more than 800 times as of June, 2020, by empirical studies in as varied publications as varied as *Computers & Education,* (Asif et al., 2017; Cerezo et al., 2016), *Journal of Universal Computer Science***,** (Park & Jo, 2015) and *The Journal of Interactive Media in Education* **(**Rienties et al., 2016).

In evaluating learning EDDA research, it is important to thoughtfully measure the impact that these studies have as they permeate into the large EDDA research landscape. The relatively recent release of the *Handbook of learning analytics* (2017) suggests a stable body of methods is being developed, and learning analytics is shifting towards a more practice-centered paradigm. This shift may lead to a more cohesive EDDA research area as the research- philosophical positioning (Figure 1) of learning analytics moves closer to integrated analytics research. Even if this shift does not happen, it is important to consider all EDDA research when evaluating the impact of learning analytics. Though vocabulary may continue to vary across related EDDA disciplines, the conceptual framework suggested above allows for critical comparisons and evaluations of EDDA research.

Conclusion

This paper introduced the idea of educational digital data analytics (EDDA) as a single research area with many different research areas, each with different philosophical viewpoints. It identified five major research areas emergent in the literature: learning analytics, teacher analytics, educational data mining, intelligent tutoring, and integrated analytics. A set of four different philosophical principles that divide these research areas was presented. Two of these divides were design oriented: measurements of long-term success, and automation vs. augmentation. Two of these divides were research oriented: the study of learning vs. teaching, and the design vs. discovery of knowledge. Using these philosophical divides to construct a conceptual framework of the EDDA research landscape. Two major gaps in the literature were identified, the first at the intersection of the study of teaching and the assertion of objective knowledge claims, and the second at the intersection of automating teaching and creating tools that can be adapted at scale.

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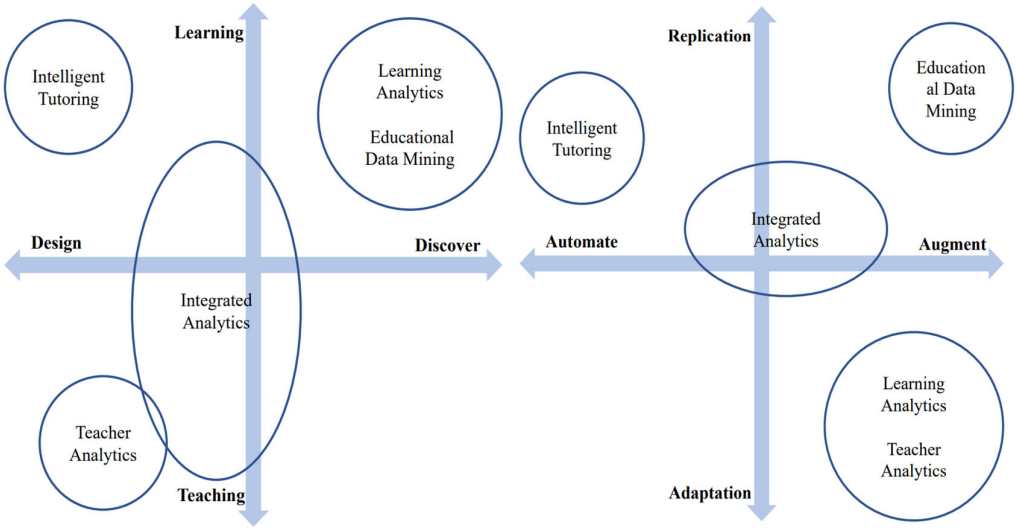
Figure I: Divides in research paradigms (left) and design paradigms (right)



Students Writing Their Own Textbook, A Successful Situational Learning Case Study

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Abstract

Culturally-situated learning is the creation of learning environments where theory is tied to contextual practice, such as students authoring a textbook on instructional message design during an online instructional design graduate course. From this perspective, learning is enhanced when it is imbedded in an authentic system of shared beliefs, values, goals, customs, and behaviors. This class project tied theory to practice, and the result is now available as a hardcopy from Amazon, as a Kindle e-book, and as a free PDF from the host institution's Digital Commons. This AECT presentation and proceedings paper illustrates a successful process where the affordances of Google Docs and Amazon Kindle Direct Publishing were used to coordinate, communicate, and create the book. Lessons learned and best practices are offered for attendees and readers, and thoughts, comments, and suggestions for the second volume are welcome.

Introduction

Culturally-situated learning applies theory to real-world contexts where learning is enhanced through practice, feedback, and collaboration (Brown et al., 1989). This project describes a creative instructional design that expands upon previous work, an innovative application of technology tools, and an effective culturally-situated instructional strategy. Culturally-situated learning is the creation of authentic learning environments where theory is tied to practice, such as students authoring their own textbook on instructional message design during an instructional design graduate course. From this perspective, learning is enhanced when it is imbedded in an authentic system of shared beliefs, values, goals, customs, and behaviors. As an added motivation, students did not have to buy a textbook for this class because they were writing the textbook during the class. This AECT presentation illustrated a successful process where the affordances of Google Docs, Creative Commons copyright options, and Amazon Kindle Direct Publishing were used to coordinate, communicate, and create a course textbook.

Literature reviews are a popular assignment in graduate courses and give students an opportunity to research, analyze, synthesize, and summarize a class-related topic. However, it has been this instructor's experience that these literature reviews have limited or no direct application after the course. That effort commonly goes into a binder to collect dust or takes up storage space on a hard drive somewhere never to be seen again. Along with a comprehensive textbook for the class, another goal of the course was to turn a classic academic literature review assignment into a published book chapter with best practice guidelines for the practical application of a self-selected topic (see Figure 1).

Figure 1. Each chapter was written by a graduate student and peer-reviewed by the instructor and all other students in class. The result was the course textbook *Instructional Message Design: Theory, Research, and Practice, Volume 1*.

The Culturally-Situated Learning Activity

The graduate course, "Instructional Message Design", details and describes a critical aspect of design models for instructional designers and human performance technologists. Instructional message design is the use of theory, tools, and techniques to convey information to learners to create knowledge and understanding (Fleming & Levie, 1993). There are several textbooks on the topic, though the foundational text has been out of print for over 25 years. The instructor also wanted to include contemporary applications such as simulations, augmented and virtual reality, cultural aspects, and empathic considerations. Other textbooks cover significant aspects of the course's learning objectives, though this collection would require students to spend a small fortune buying nearly half a dozen books (or the instructor navigating the legal copyright implications of scanning and posting online multiple chapters from each book). The instructor was uncomfortable with either prospect. However, the instructor was inspired by similar research, projects, and other ongoing work with student-generated books (Kidd et al., 2011; Mays et al., 2017). The instructor revised the structure of the course to focus on the student chapters being the main, culturally-situated deliverable.

The process started with the instructor creating a list of nearly 24 topics in Google Docs and sending the link to their students. Topics ranged from theories, models, and cultural aspects of message design, to contemporary tools and techniques. Students self-selected a topic based on their specific research agendas or their general interests. The topics not selected became the focus of the instructor's chapters, class presentations, and other learning objectives throughout the course. Several milestones were worked into the course to ensure students stayed on pace to finish their projects. These milestones were paced several weeks apart and included their selection of a topic, initial chapter outline, initial chapter draft, working draft, then their final draft. The instructor's introduction chapter served as a starting point for students and a basic template for their chapters. This chapter was written before class started, introduced students (and future readers) to the main topics (and future chapters), and was read by students as one of the class's early assignments. The chapter was posted to Google Docs, and students were asked to provide feedback via Google's “Suggesting” and add “Comments” features as they would when they reviewed their peers' chapters later in the course. The format of the chapter (and the example for student chapters) employed APA version 6 formatting with the use of single-spaced, 14-point font size and 1-1/2 inch margins to aid in readability when color printed and bound by Amazon.

Each student's working chapter draft was posted and shared online as a Google Document, and each student was required to read and provide their peers with feedback on each chapter. The instructor wrote one of the theory chapters and also provided each student with feedback. The student authors could see their received input via the Suggestions and Comments features in Google Docs. These features work very similarly to Track Changes and New Comment features in Microsoft Word where students can compare their original work with suggested edits, feedback, and comments. The students then used this feedback to edit and create their final draft. Learners were also required to analyze and synthesize each chapter in a reflection assignment to confirm that all students had read every chapter. The final activity of the class was the student authors voting and selecting the book's front and inner cover (a PowerPoint slide sized to about 11x17 was used to create the front and rear cover of the book).

While the final draft of their chapters completed the requirements of the course, the instructor served as the book editor after the class was complete. The instructor integrated the book chapters together into a single cohesive document, addressed image copyright issues, and initiated the upload process to Amazon using Amazon's Kindle authoring tools (the book was made available at the lowest cost Amazon would allow). The instructor also partnered with the host institution's library to upload each chapter to that university's Digital Commons (with a Creative Commons Attribution-NonCommercial-NoDerivs license). The book and each chapter are now publicly available as a free open source PDF, as a hardcopy from Amazon, and as a Kindle e-book (see Figure 2).

Figure 2. The finished book is now available as a hardcopy and a Kindle e-book from Amazon, and as an open source PDF.

Conclusion

Culturally-situated, real-world projects create authentic learning activities that connect theory to application. The purpose of this AECT presentation and paper was to describe how the lack of an available course textbook and the desire for applied literature reviews led to the creation of a culturally-situated, open-source, student-authored book. A lot of work goes into a thorough literature review, and it would be a shame if the efforts of talented students and future scholars did not extend beyond the graded deliverables of a class. Adult learners are also motivated when they can see the real-world relevance of their work, and creating a book that will benefit others and live on after class was definitely motivating. Each student now also has a published chapter that can be listed and referenced in their professional portfolios and in their growing curriculum vitae and resumes.

Writing a book takes a significant investment of time and effort (Ben-Ari, 2002; Kerr, 1978). However, the overall workload can be lessened when a group of interested authors work together. The online access and shared affordance of Google Docs allowed for a level of communication where co-authoring, reviewing, and editing book chapters was much easier than managing files sent to and from the authors. Meanwhile, the authoring tools in Amazon's Kindle Direct Publishing service opens other avenues for student-authored books besides an institution's Digital Commons and other open resource collections. The use of Google Docs, Amazon's authoring tools, and Word and PowerPoint meant that expensive or custom software was not required to author or assemble the book. Several other lessons learned includes to leave more time for students to revise their final drafts, review the use of open source figures and diagrams, and for the instructor to plan for a lengthy editing process when creating the book. For instance, after the class was complete, the instructor was still contacting students for edit feedback, was replacing figures that were not open sourced or were previously copyrighted, and organizing the book into its final form. This final process took several weeks after the end of the class. However, this project worked well, students provided feedback that they enjoyed the process and the final result, and the instructor looks forward to a second volume that should be created in the Summer of 2021. This model can successfully be applied to other disciplines in other classes, especially when the instructor is sensitive to the cost of textbooks and wants to motivate adult learners with an authentic and culturally-situated project.

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Four facets of needs assessment and analysis for the design of online learning systems.

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Abstract:

As instructional systems designers, we need to consider and take a holistic systems approach when designing our solutions. This review analyzes and synthesizes the literature from four specific online learning contexts: K-12, trade training and industrial education, higher education, and corporate training. The characteristics, social structures, environments, and expectations of each of these cultures are very different. This review will summarize the research related to each context, discuss best practices, and areas for future research.

Introduction

As instructional designers, systems designers, and technology leaders, we need to consider and take a systems approach when designing our solutions. However, a system that works well in one organization or context may not be effective in another. This review analyzes and synthesizes the literature from four specific online learning contexts: K-12 education, higher education, career and technical training, and corporate training. The client characteristics, social structures, environments, and expectations of each of these cultures are very different. While a thorough needs assessment and analysis is critical in any instructional systems design scenario, it is equally critical to understand that assessment models that work well in one of these contexts may not work well in another. This review will present and summarize the latest research and findings related to systematic needs assessment in each online context, discuss the current state of best practice, and suggest areas of future research and areas for future collaboration.

Culturally situated systems design can be operationally defined as instructional systems created specifically for the authentic contextual needs of the learners. Situated learning is the applied theory that learning is inextricably linked to the culture, context, and environment that utilizes that knowledge (Brown et al., 1989). A needs assessment is the first step towards designing an instructional system and a need is the gap or discrepancy between an existing result and a desired result (Altschuld & Watkins, 2014; Kaufman, 1972). A system is the organized effort of an organization or entity to achieve a common goal (von Bartalanffy, 1972). The systemic idea of a bounded organization or network that has interconnected layers and subsystems that work toward an achievable goal is an integral aspect of a successful needs assessment. When these concepts are combined in online learning, distance learning, or e-learning, this gap is the learning or training objectives of the course or program and the

instructional system is the means to achieve these objectives. Designing for culturally situated contexts will enhance the effectiveness of our instructional systems.

In addition to identifying the results based gaps, a needs assessment and analysis also determines the type of human performance intervention required to address that gap. In the case of instructional design interventions, the needs assessment and analysis defines the instructional problems, identifies goals, analyzes the learners, and leads to specific learning objectives (Dick, et al. 2001; Morrison et al. 2019). Needs assessment models that consider microsystems (individuals), macrosystems (organizations), and megasystems (society), are particularly suited to transformative change and positive impact (Leigh et al., 2000). In addition to the layers of impacted systems, it is important to also consider the layers of stakeholders within each system. For example, a thorough needs assessment should consider the needs of the level one clients, the level two service providers, and the level three service provider support infrastructures (Altschuld & Kumar, 2010). Other needs assessment models from the field of human performance technology and improvement also implement a structure that considers individual change and well as change of the overall system or organization of individuals (Gilbert, 1978; Rummler & Branche, 1995; Wedman 2014). While these models (and newer models that trace their evolution to these foundational models) can be used to study an organization, the facilitator risks a failed needs assessment if they do not consider the culturally situated context of that assessment. For instance, a needs assessment in an online K-12 context would have to consider the layer one students, the layer two teachers, as well as the layer three administrators. The uniqueness of these stakeholders and their needs will differ in significant ways from layer one adult students, layer two instructors, and layer three faculty, staff, and administrators in e-learning higher education environments. The layer one adult learners, layer two instructors and trainers, and layer three support systems in online career and technical training institutions will also require a different focus. In addition to K-12, higher education, and technical and career training scenarios are corporate training needs. The layer one working adult learners in this context do not need a degree or industry recognized certification but do need to advance their knowledge, skills, and abilities to maintain or immediately benefit their careers. These adult learners, as well as the layer two trainers and layer three support systems, will have different needs as compared to other instructional systems.

K-12 & Technology

With more than $726 Billion spent on public K-12 education in the United States (Snyder, de Brey, & Dillow, 2019), the need that each piece of technology fills should be seriously considered before the first dollar is spent. The difficulty lies in the lack of preparedness of administrators and district coordinators to conduct rigorous technology focused classroom needs assessments. Typical school administrators are former classroom teachers and have rigorous training in pedagogy; school administration preparation and licensure programs typically neglect instruction on needs assessment generally and technology needs assessment in particular. Technology is after all a tool and not a teaching style and should receive special attention as to how it is used.

Few students take online and blended courses because this method of instruction is preferred by the learner, but because online courses afford students an opportunity to take classes that are not otherwise offered at their school or to fulfill some other student need (Picciano, Seaman, Shea, & Swan, 2012). Credit recovery is one such opportunity that technology supports,

providing inexpensive second opportunities for students who have failed a class. A study of ninth grade students in 17 Chicago public high schools who had previously failed Algebra 1 found that students who participated in online credit recovery had significantly poorer outcomes than their peers who participated in face-to-face remediation classes (Heppen et al., 2017). Only 66% of the students in the online recovery course ultimately received credit for the class as opposed to a 78% pass rate for students in the face-to-face classes. If credit recovery is the more pressing goal and not cost reduction as discussed in Picciano (2012), a needs assessment should be done to consider if technology is a viable answer to solving this particular problem.

Results like this are not surprising in light of how little technology instruction is involved in teacher preparation programs (Admiraal et al., 2017). Teachers are often forced to find out what technology does and does not work in the field. Reactive implementation of technology can be costly, time consuming, and demoralizing for students, the teachers who are trying to help them, and the administrators who hold accountability for the interventions enacted in their schools.

Technology needs assessment may be one solution to closing student performance gaps and relieving teacher stress and anxiety around technology use in the classroom. Unfortunately, many technology integration plans initially focus on which tools will be used and not how the tool will be used, even when implementation is a primary concern of educators (Gülbahar, 2007). Needs assessment that involves all stake holders, from students to administrators and families could shed light on the disconnect between the desires of teachers to educate 21st century students and the ability of students to be educated with appropriate accessible 21st century tools.

Training Trade and Industrial Education

With many education programs moving online, it is important to assess how the transition from in-class learning to online environments will change for both students and teachers. In career and technical education (formerly referred to vocational education), programs are designed to provide learning opportunities with a focus on occupational endeavors (Carver & Kosloski, 2015). Trade and industrial education is one aspect of career and technical education that relies on the use of industry technology and equipment to prepare students for the workforce. The technology and equipment can be very expensive and is often difficult to keep current. Education systems are under increasing pressure to reduce costs while maintaining or improving outcomes for students, and in order to improve educational productivity many districts are turning to online learning (Bakia, et al., 2012). In programs within trade and industrial education, several factors need to be considered before moving to such an online platform. Culturally, these courses have been held in the traditional classroom environment. The issue with this perspective is that technology improves so rapidly that schools have a difficult time keeping up with the demands in industry. Due to the scarcity of resources as well as cost pressure, the increased need for this type of training cannot be feasibly taught in the classroom alone (Belaya, 2018). This is where needs assessment can play a critical role in the success of the in-class to online transition.

A needs assessment is designed to better separate the perceived need and the actual need. Groups tend to jump prematurely to solutions before identifying and prioritizing needs or delving into what really underlies them (Altschuld & Kumar, 2010). For this reason, following a needs assessment model can be critical to finding a long-term solution. The online environment needs to be able to give students the ability to understand skilled-based objectives, and students need to feel that they are getting what they need from the course. Teachers and students must understand

the working of the online learning environment and understand how to incorporate skills-based learning and create a learning community in the online environment. Safety must also be considered if there is a need to practice those skills outside the online environment. This section of our review will look at each of these from a needs assessment perspective to better understand how programs can transition to an online environment while providing the skills necessary for the job.

One needs assessment issue in online training for trade and industrial education is how to move skilled based training to the online environment. Many programs in trade and industrial education require practicing skills that may be difficult to learn online. There is limited literature on the impact the delivery method has on experiential or skilled-based learning (Arbaugh, et al., 2013). Since trade and industrial education is skilled based, a needs assessment may help discover ways to implement this type of delivery method without losing the practical application that these programs provide. Another consideration could be how moving to an online environment could benefit the workforce after completing a trade and industrial program. Research suggests employers of trade and industrial education graduates could benefit from students learning better computer skills. For example, employers in manufacturing say prospective employees do not have the skill set required to perform necessary functions such as math and computer abilities (Robertson & Aquino, 2016). A needs assessment could work to bridge this gap by providing online solutions that not only teach the workforce skills associated with a student's chosen field, but also provide valuable computer skills that can decrease the skills gap employers are seeing.

Another issue where needs assessment is critical to trade and industrial education is teacher preparedness to teach skilled based learning online and accessibility for students in the online environment. Creating a meaningful and successful learning experience for students in an online environment is key to a program's success (Lane, 2013; Frass et al., 2017). For teachers, it is important to build a community of learners from the very beginning of the course to enhance learning outcomes (Yuan & Kim, 2014). A needs assessment would be able to identify what resources and programs may be available to assist teachers new to online teaching in ways to create this sense of community for their students. For students, accessibility must be assessed to ensure students have access to online resources. Research suggests that in order to be successful in the online environment, both teachers and students have to make a joint effort to create an online community (Sun & Chen, 2016). Assessing and understanding the needs of both teachers and students is critical to establishing an online community that promotes the same value as in the classroom.

Safety would have to be a consideration when looking at how to implement online learning for these types of education programs. Since much of the curriculum is skilled based, would students be working on any tasks outside the classroom that may introduce safety issues? An example of this would be culinary arts where students are learning a cooking technique and then practice their skill in their own home. Secondary school resources such as pupil spending, class size, teachers and quality of content of curriculum are factors that could influence safety and health for students (Shendell et al., 2018). If a student becomes injured while attending an online class, how would it be handled? A needs assessment would be able to identify safety risks that come with moving this type of curriculum online so schools can be cognizant of these risks and make sure students and their families understand those risks if skills are to be practiced outside of the classroom.

There is not a lot of research on moving trade and industrial education to online environments, but a needs assessment could be beneficial in helping schools identify if there is any possibility or benefit to looking into online learning. Trade and industrial education can be very expensive for school districts due to the amount of equipment and resources needed, assessing alternatives that may be more cost effective could assist schools in ways to implement some form of online learning while still upholding the rigor of the coursework and provide a safe environment for students to practice their skills.

Higher Education Curriculum and Faculty Development

Needs assessment is a systematic process for analyzing a process and finding where the process is lacking. The areas that are lacking are known as "gaps" and they define where the organization or process currently stands and where it should be. These defined areas are identified as the need to be addressed. In higher education, needs assessment can be involved in many different ways. Higher education is such a vast world that assessing needs can be done in many different areas (Grant, 2002). When discerning these areas, higher education can be branched into areas of curriculum planning, individual problems, student progress, accountability for the university population, safety needs, and the online learning sector are only a few of these areas (Grant, 2002). It is not enough to do a needs assessment on "higher education," the specific field needs to be identified, research why it is lacking, and then conduct the assessment. Everything works in unison to create an effective higher education experience (Grant, 2002). It should be cautioned that, while needs assessment provides a detailed process, some of the rigidness can render out the creativity that is needed in the world of higher education. Education, in general, possesses both elements of art and science and limiting it down to nothing more than a tool would do be doing it a disservice (Grant, 2002). Among the many ways that needs assessment can fit into higher education, two crucial areas that it can have a profound impact on is curriculum development and faculty development.

Needs assessment has a key role in the world of higher education. Higher education is most effective when it is consistently evolving to hone professional development (Grant, 2002). The main purpose of needs assessment in this realm is to provide assistance in educational planning without falling into a trap of narrow vision (Grant, 2002). A crucial portion of educational planning comes through curriculum development (Grier, 2005). As a base need, it is important to understand that curriculum development creates an organized path, in a way, closing the "gap" that the students possess in their current knowledge of a topic and where they need to be by the end of the course (Williams, 2019). Since curriculum documents are not easily created the assessment helps in outlining how to evolve the lesson in the university setting. An example of this shows how assessing the need is embedded in its framework (Williams, 2019). Analyzing the curriculum could yield that students may benefit from breaking down larger learning goals into smaller, more precise, goals to better translate the overarching concept (Williams, 2019). This need could be translated as understanding various parts of the forest to understand how it works coming together as opposed to trying to understand the whole forest from beginning to end.

Addressing needs in curriculum will continue make sure that the content does not become stale. In a way, curriculum needs will never fully be addressed because the lesson will always have new requirements with current sources being updated and new sources emerging (Williams,

2019). Information gathering tools can be used to obtain data, this could involve surveying students, consulting with faculty, analyzing assignments, and student observations (Benesch, 1996). The logic for performing this analysis is that by identifying various elements of the situation, professors can continue to change and update their curriculum so that their students succeed (Benesch, 1996). Another benefit that accompanies consistent needs assessment in curriculum is the advancement of scholarly research in a particular field (Wang & Ashcroft, 2012). These studies promote interest and display other institutions and their methods for handling their needs assessments in expanding and revamping curriculum.

Needs assessment plays another significant role in higher education in the realm of faculty development. Developing curriculum is an important aspect to higher education but faculty need to continue to grow as well. The aim of faculty development is to promote advancement in their field of expertise and foster understanding of where the state of their field currently stands (Bahar-Horenstein et al., 2014). Environments evolve and new curriculum must be developed to stay current, however, that does not work without faculty piloting the program to impart those lessons to students. Encouraging faculty to respond to the various forms of needs assessment can be a challenging effort (Bahar-Horenstein et al., 2014). There can be an ego element involved in which professors fight against the need to admit that, as time passes, a gap can begin to develop between their possessed knowledge and the current state of their field (Bahar-Horenstein et al., 2014). Professors can be extremely protective of their responsibilities and authority over the subjects that they teach. If the needs assessment is not with proper considerations toward faculty, the process could be seen as gathering information to show that the professor is not living up to the standards of their universities (Bahar-Horenstein et al., 2014).

With proper care taken, many avenues exist for institutions to meet these needs for their faculty. These gap-closers can come in the form of seminars, continuing education, opportunities for faculty to conduct their own research, and in-house programs devoted to the betterment of faculty (Bahar-Horenstein et al., 2014). For instance, the University of Florida conducted a study in which they provided different types of opportunities ranging from various trainings, administration, and leadership skills. Results of the study were depicted in faculty outlook by which areas that faculty were proficient in, and which areas they believed to be low priority. The results imply that faculty may not consider an area of study important when they have knowledge of it, even when it should still be considered important (Bahar-Horenstein et al., 2014). Interviews were held to investigate thoughts that poor experiences in development from the past had skewed many views on the validity seeing faculty development as a need (Bahar-Horenstein et al., 2014). The end result for University of Florida was quite positive. The university shared the results of their needs assessment, along with the methods taken, with the rest of the school and this sparked further professional dialog in which faculty could continue to develop in more effective ways (Bahar-Horenstein et al., 2014).

Needs assessment is an important component of higher education. Even though curriculum development and faculty development were the two main components observed in this review, the fact is that needs assessment can help an educational institution provide the necessary training, planning, and implementation strategies necessary to resolve gaps in the organization (Nugraha et al., 2018). Needs assessment plans identify important objectives and sets goals for the institution to accomplish to continue to evolve in a way that is appropriate. It can be easy to think that it is okay to skip the needs assessment and go straight into implementation of what one thinks is necessary, but this is a fallacy many people buy into (Centor, 2019). In the long run, significant amounts of money and time will be wasted by paying

attention to areas that are not necessarily the problem. A key problem with supplying information being used to all individuals involved, leads to the institution developing faculty or keying in on curriculum not relevant to a specific gap (Centor, 2019). When time and money are interchangeable colleges, universities, trade schools, and other areas of the educational realm can increase their efficiency by applying the right tools to the right situations.

Corporate Online Training

Driven by cost efficiency, the globalization of business, and advancements in learning technologies, online learning has been widely adopted by corporations. Studies show that 98% of all U.S. companies have implemented some type of online distance training technology (Bose, 2017). Despite the wide adoption of online training in corporations, the determination of success for online programs has been largely focused on return on investment (Keen & Berge, 2014; Strother, 2002). For many corporate distance training programs, dropout rates remain high for voluntary courses and evaluation of training transfer is lacking (Derouin et al., 2005; Park & Choi, 2009). This would suggest that corporate online training programs are not always being designed in a way that serves the organization or its employees.

Needs assessment in online corporate training can facilitate better program planning, decision making and training design. The instructional design process, for example, which takes a systematic approach to training design, implementation, and evaluation, advocates needs assessment as the first step in the design process (Dick & Carey, 1977). Needs assessment can help justify and identify both organizational and individual needs (Watkins et al., 2013) to deliver efficient and effective online training programs.

In this section of Four Facets of Needs Assessment and Analysis for the Design of Online Learning Systems, we examine literature that looks at two aspects of needs assessment in online corporate training. The first reviews needs assessment research that demonstrates the value of aligning online training programs with an organization's strategic and environmental goals. The second looks at a less-explored body of literature that focuses on the use of needs assessment in identifying and addressing the learning needs of corporate learners with varying skills, backgrounds, and levels of motivation in a corporate distance learning environment.

Using Needs Assessment to Align Online Corporate Training with Organizational Goals

Needs assessment addresses three important areas: organizational, environmental, and the performer analysis (Rothwell, 1999). Organizational analysis looks to understand the vision, mission, values, and strategies of an organization. The environmental aspect of needs assessment looks at the workplace, the resources, procedures, and tools. Needs assessment applied to the performer or worker seeks to understand the knowledge, skill, and motivation of the employee (Watkins, et al., 2013). Needs assessment systematically focused on all elements can potentially align a corporate online training program with all aspects of an organization.

With the maturation of online corporate learning, much has been written about the need to align corporate strategy and online corporate training. Extensive work by Watkins and Kaufman demonstrate how needs assessment can be used in this process. Watkins, Kaufman, and Odunlami (2013) provide an important connection between all aspects of needs assessment, the

strategic planning process, and online corporate training. In context, the strategic planning process focuses on guiding an organization toward delivering results. Organizations should assess what they wish to accomplish and determine what initiatives will help them deliver on those goals. Online training may be just one of those initiatives. Before investing time and resources in an online training program, organizations should conduct a needs assessment to determine what gaps online training can close.

Unfortunately, for many organizations, the promise of scalability and cost efficiencies hurried investments in online training technologies before organizations were ready (Borotis & Poulymenakou, 2004). Little or no needs assessment was done before technology implementation, which has led to multiple problems that have hampered corporate online training effectiveness (Derouin et al., 2005).

For organizations that have already made the technology investment without the initial research, scaling needs assessment to address narrowly defined aspects of organizational, environmental, and performer needs can assist in advancing an online corporate training program. As an example, companies could use a framework like a model developed by Borotis and Poulymenakou (2004) to direct their needs assessment efforts. Borotis and Poulymenakou (2004) in their research identified seven key components that should be analyzed to ensure organizational effectiveness and readiness in corporate online training programs.

1. Business Readiness – the link between organizational business priorities and characteristics to online training efforts

2. Technology Readiness – technical infrastructure

3. Content Readiness – understanding how content will work in the technology stack

4. Training Process Readiness – the ability to create, design and evaluate content in the online framework

5. Culture Readiness – organizational culture preparedness to accept online training

6. Human Resource Readiness – the ability of employees (learners) to function and navigate available training technologies

7. Financial Readiness – organizational resources in implementing and maintaining a system

Because the Borotis and Poulymenakou framework crosses many aspects of needs assessment components, organization, environment, and performer, their work is one example of an approach that can be used to help an organization understand where specific gaps exist in an online corporate training program.

Addressing Learner Needs in Online Corporate Training

There exists a large body of research done specific to the use of needs assessment in addressing performance gaps in employee knowledge and skills. Work by Gilbert, Rummler and

Brache, Rossett, Kaufman and many other pioneers all provide guidance on the use of needs assessments to find and solve performance gaps for individuals and small groups (Leigh, Watkins, Platt & Kaufman, 2000). While not extensive, this initial literature review shows, however, that little has been written on needs assessment as it relates to addressing worker performance gaps in skills and knowledge for a heterogeneous employee population in online corporate training delivery.

Because of the quick adoption by corporations of online learning technologies, much of the focus in the development of online programs has been on the technology, ignoring the pedagogical issues needed for effective online learning (Ali, 2003; Park et al., 2009). Rather than understanding the needs of the learner, corporations have attempted to reverse engineer the technology, translating their existing instructor-led programs into online delivery (Wang, Vogel & Ran, 2011). Training to a one-size-fits all methodology has tainted the user experience which has led to high dropout rates, issues with training transfer, and overall dissatisfaction with online corporate training (Derouin et al., 2005).

The challenge for online corporate training programs is how to remain scalable, while still serving a heterogeneous population of learners. Normal learning interventions benefit from needs assessment at the individual performer or small group level (Rothwell, 1999), but can be difficult in designing self-directed online programs.

Granger and Bowman (2007) in their work on constructing knowledge in a distance learning environment, propose that addressing learner-centric needs can be done by focusing needs assessment and design on the online learning setting and allowing learners to create their own learning experience (Granger & Bowman, 2007). Granger and Bowman (2007) take a constructivist approach, advocating that the online ecosystem should be designed to allow learners to progressively build toward their own learning goals. To do this, it is important that companies understand the scope of their learning population and various learning preferences of that population. Needs assessment can assist in this process.

Wang, Vogel, and Ran (2010) take a similar view and believe that the success of an online workplace learning program requires a focus on aligning corporate interests with individual needs and work performance. Their work recognizes that employees are adult learners with distinct learning characteristics. They propose a Key Performance Indicator model that provides each employee with learning goals that align with corporate goals. Like Granger and Bowman, they believe that because adult learners are more apt to be self-directed, constructing an online training environment that offers a learner the ability to create their own learning experience is critical to program success.

In both research examples, application of a needs assessment at the organizational, environmental, and performer level can assist with the creation of a more learner-centric corporate online training offering that serves the interest of the firm and its employees.

Accelerating the Design of Corporate Online Training

Preliminary findings of this literature review demonstrate that there is a depth of research on broad application of needs assessment. Within the field of performance improvement, several models have been developed to assist the practitioner in aligning organizational, environmental and performance with training in general. We would advocate much more research is needed on two fronts specific to online corporate training. The first is recognizing and addressing learning needs of less-homogeneous corporate learners with varying skills, backgrounds, and levels of

motivation in online corporate training. The second centers around real-world application of needs assessment models to address a broad group of performers.

Summary

As systems designers and leaders, it is truly unfortunate when we see that the needs assessment and analysis phase of a systems design is often the phase glossed over the quickest, is stacked with assumptions, or rushed in an effort to reach a solution quickly. This review advocates change by focusing on the importance of that initial gap in results. Culturally situated needs assessment and analysis will be more effective than a generalized approach that does not specifically consider the context and distinctiveness of the learners. For example, when designing an online learning system it is essential to understand the motivation, available support, technology and Internet bandwidth availability, learning goals, and other needs of the learner. It is critical when conducting a needs assessment to consider the learning environment as a system of interrelated components and subsystems. For instance, considering different layers or levels within a larger system can help ensure that specific aspects of the system are not neglected by a needs assessment.

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Adopting ADDIE and SAMR Models for Developing Hybrid Onboarding Experiences for Library Student Employees

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Abstract

The article aims to introduce the process of designing a hybrid onboarding experience for student employees who are working at university library. Because of the dissatisfaction of the previous onboarding experience, there was a need to develop an effective training program for student workers to better serve library patrons. Guided by the ADDIE model, the design process included analysis, design, development, implementation, and evaluation (Morrison et al., 2010). Previous research findings showed the benefits of relying on mobile devices to promote "personalized, situated, and connected" learning experiences (Romrell et al., 2014, p. 2). The SAMR model, including "substitution, augmentation, modification, and redefinition," was used to guide the development of mobile training to supplement the limitations of the self-paced training experience (Romrell et al., 2014, p. 79). After working with subject matter experts (supervisors), the onboarding experience was designed to include both online and face-to-face sessions. The online training modules were built on the Top Hat, and Twitter was used to further enhance student workers' online training experiences.

Introduction

On-campus employment is usually viewed as an opportunity for many students to gain work experiences and skills before entering the labor market. Multiple types of on-campus jobs were able to provide students with opportunities to gain both hard and soft skills, such as culinary services, dormitories, libraries, and administrative offices. Amongst these employment opportunities, university library is often regarded as one of the popular spots which many students are interested in working at. For instance, there are 30-40 students working at the target library each year. Because of a high turnover rate among these student employees, the supervisors need to provide training to newcomers at the beginning of every semester. The training process can be extremely overwhelming when there are only two to three supervisors; and sometimes, they have other commitments to work on.

Because of the lack of staffing, the previous training was mainly delivered through a spreadsheet checklist and some face-to-face instruction. For instance, student workers were required to do a self-paced training during their shift and ask for face-to-face guidance if need. In the spreadsheet checklist, the training content was divided into seven weeks, and students need to go through each page and click the links to complete tasks (see Figure 1). According to the survey results, a majority of student workers expressed their dissatisfaction or negative attitudes with regard to their onboarding experiences (Ren, 2019). However, in terms of the important role that student workers play in providing services to library patrons, the need to develop an effective training program was urgent.

Time Frame	Tasks	Links or Training Materials	Notes or Questions	Task Status
Week 1: Most of these tasks can be learned at the desk but you can also find directions (where) or you can talk to any staff member at the desk, or talk to your Supervisor/Mentor.	**Student:** Learn how library printing works	https://www.library[redacted]/services/computing-printing/printing/		To do
	Student: Learn how to find out whether the library has a textbook for a particular class	http://www.library[redacted]question/textbook-for-my-class/		To do
	Student: Learn policies and procedures for library study room reservations	http://www.library[redacted]about/administration/policies-and-procedures/room_reservations/		To do
	Student:Meet with Nedra to review technology available in Alden. Printers: Jam recovery/toner location & replacement Peripherals Cabinet: Items that are checked out & usage of those items Study Room Tech: TV's & laptop connections			To do
	Student: Learn how to check out items at your desk.			To do
	Supervisor/Mentor: Give the student a quick tour of the library to show them other desks and important locations for them to know.			To do
	Student: Learn how to enter questions into the LibAnalytics form.	Access from link on the Staff Portal https://staff.library[redacted]portal		To do
	Supervisor/Mentor: By the end of the week, find your student at the desk and see if they have questions about completing any of this week's tasks. Talk about why we keep track of questions in LibAnalytics.			To do

Figure 1. A screenshot of the training spreadsheet

Onboarding Experience

Onboarding, or initial training, is served as a way for newly hired employees to be familiar with organization and prepared to successfully handle tasks in the work environment (Graybill et al., 2013; Keisling & Laning, 2016; Lisbon & Welsh, 2017). An effective onboarding experience could not only equip employees with needed skills but also increase their engagement and positivity in their future work. In the library context, student employees are viewed as valuable assets to achieve the library mission (Evanson, 2015). Therefore, onboarding training plays a crucial role in not only equipping them with needed knowledge and skills to better serve patrons but also increasing their positive attitudes while working at the university library.

Onboarding Experience Design

The ADDIE model was widely applied to develop courses and training programs in various contexts. In order to design an effective onboarding program for student workers, the design process was based on the ADDIE model, including analysis, design, development, implementation, and evaluation.

Analysis

To start the design of the model, analysis focused on contextual analysis and learner analysis (Morrison et al., 2010). Contextual analysis was used to analyze available resources in the work environment, such as existing training materials, facilities, and work procedures. Leaner analysis was used to understand the characteristics of learners, such as who are the learners, their knowledge and skills, and their learning preference. In terms of the contextual analysis, the designer conducted a document analysis to better understand the weaknesses of the old training materials and interviewed supervisors to identify available resources in the library and work procedures that student workers need to perform. In terms of the learner analysis, the designer sent a survey to student workers to understand their backgrounds, knowledge and skills, and learning preference.

As a result, 24 of student workers completed the survey, and the response rate was 80%. The survey responses indicated that all of student workers were undergraduates, and more than

90% of them did not have any library working experience before the training. In terms of their learning preference, 16% of students reported that they had positive learning experiences while using social media. A majority of students mentioned that Twitter was their favorite social media, and about 70% of the students reported that they checked their social media more than once per day.

The existing training materials are mainly stored on a spreadsheet checklist, and the training content were divided into seven weekly modules. The document analysis indicated the weakness of the training materials, including lack of training objectives, learning flexibility, and interactivity and engagement. Moreover, the interviews with supervisors were used to better understand the training process and work procedures. Supervisors further pointed out the problems with old training program, including inconsistency and communication issues.

Design and Development

Based on the findings from the contextual and learner analyses, the designer worked with supervisors to design and develop an engaging onboarding experience for student workers. The purpose of training is to provide needed information for the target learners to be proficient in performing specific tasks (Morrison et al., 2010). Thus, task analysis was used to determine what knowledge need to be included, including topics, procedures, and potential critical incidents. After working with supervisors, the newly designed onboarding program included six weekly modules, and topics covered library policies, library services, facilities, library website, and customer service.

Training objectives were used to design the training modules and evaluate trainees' learning outcomes (Morrison et al., 2010). They were developed based on three categories, including cognitive, psychomotor, and affective domains. For example, an example of cognitive objective was: to name right library services to solve patrons' problems. An example of psychomotor objective was: to perform right steps to check out/in items. An example of affective objective could be: to develop a friendly relationship with library patrons.

Because of different work shifts and class schedules that student workers had, the training was designed to deliver in a hybrid manner, including self-paced online training and face-to-face instruction components. The self-paced online training was built on the Top Hat, an active learning platform (see Figure 2). The online component included: Introduction and Overview, Consumer Service, Library Service 1, Library Service 2, Library Website 1, Library Website 2, and Summary and Evaluation.

The face-to-face component was mainly used to teach about step-by-step tasks and conduct role-playing simulation exercises. One of the supervisors would provide the training, and the topics included: Library Tour, Customer Service, Reference Interview, Technical Issues, and Checking In/Out Items.

In order to overcome the limitations of self-paced training, the SAMR model, including substitution, augmentation, modification, and redefinition, was used to develop the mobile learning component for student workers. According to the findings of the learner analysis, student workers were familiar with using social media to communicate and interact with others. A social media, Twitter, was used as a supplemental platform to increase student workers' engagement, interaction, and connection (see Figure 3). Meanwhile, social media could be used as an alternative platform to maintain communications between supervisors and student workers.

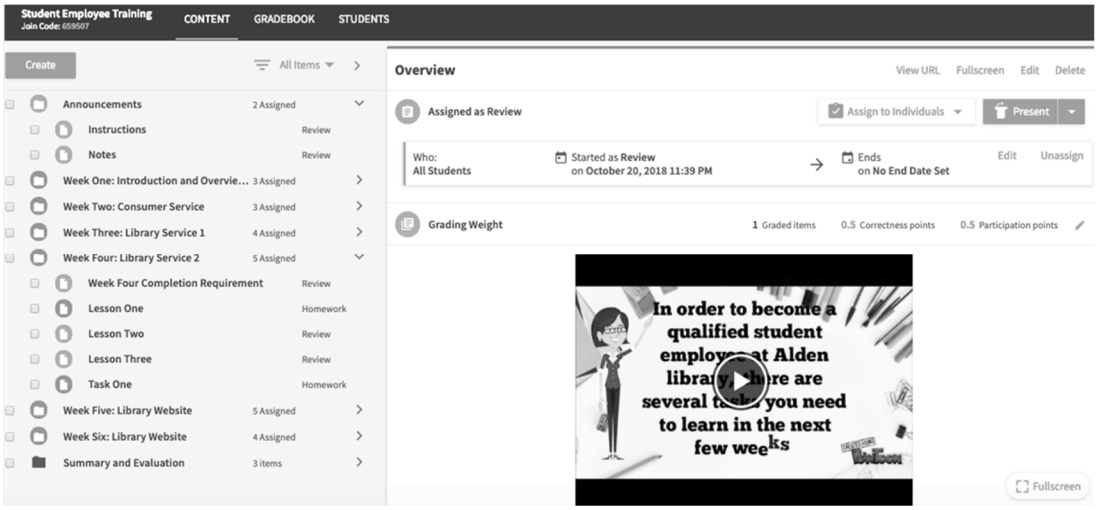

Figure 2. A screenshot of the online training on the Top Hat

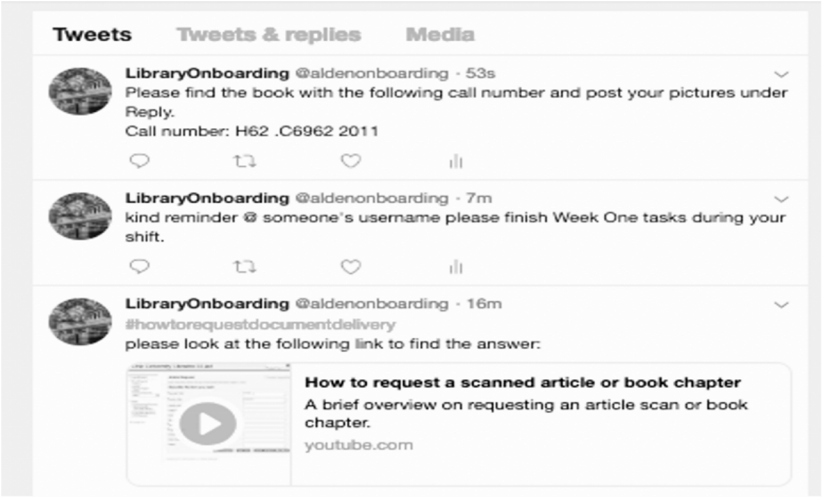

Figure 3. A screenshot of the Twitter page

Implementation

To ensure the success of the implementation of the training program, the CLER model, including configuration, linkages, environment, and resources, was used (Morrison et al., 2010). First, configuration and linkages were used to identify the relationships among entities to ensure effective communication. For example, supervisors would be responsible for explaining the onboarding program to student employees and monitoring their progress to ensure the completion of the program. Environment and resources were used to analyze needed recourses to support the onboarding training, such as staffing, facilities, and multimedia training materials. For example, the supervisors could send an email to student workers to invite them to complete the online training and provide a guideline or instruction on how to start the self-paced training.

Evaluation

Based on the predefined training objectives, the evaluation methods were used to analyze student workers' learning outcomes, work performance, and the effectiveness of the training program. At the end of the training, summative evaluation was used to assess the efficiency of the training program. Scenario-based questions and problem-solving questions were used to

evaluate objectives in the cognitive domain, such as to name library services. Observations with rubrics were used to evaluate objectives in the psychomotor domain, such as to perform reference interviews. Observations and surveys were used to evaluate objectives in the affective domain, such as attitudes while taking the training or interacting with library patrons.

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Toward a Unified Computer Learning Theory: Critical Techno Constructivism

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Schools are not known as places that move quickly in response to changing philosophies, burgeoning innovations, or marketplace attitudes outside of themselves (Educational Technology in the 21st Century, 1995; Micheuz, 2009). While innovations in the fields of art, medicine, and science evolve, the re-imagined classroom of the future that many have dreamt of and written about for nearly forty years has yet to take hold (Harel & Papert, 1990). Most people would leave a doctor's office upon seeing that the most current and available tools were from fifty years ago. Most people would have their doubts about the effectiveness of the doctor's approach if the office visit talk consisted of old strategies about which you had read many criticisms. In schools, however, students, teachers and families alike have grown to tolerate the anachronism (Feenberg, 2002).

Technology use in education can certainly speed up our use of paper and how we process and access information. In fact, that is the most understandable and basic goal of using a computer and the one that brings most novice users to convert their workflow to digital. However, replacing paper simply maintains things as they are. For decades, the machine has had the potential for more uses than yet discovered. Why invent a new gadget to teach the same material in the same way (Papert, 1972)? To disrupt the norm, the thoughts within this paper aim to urge the conversation about how to get students to learn together *with* computers and technology, not isolated individually in a corner *at* a computer terminal. Shifting the emphasis of computers in the classroom to a blended or mixed reality will empower the students and undermine the critics (Educational Technology in the 21st Century, 1995). Noting that the preposition change from "at" to "with" is more than a decorative device of language, the entirety of the approach with children and computers needs remodeling.

Again, and even at a glance, one can readily accept as true that the institution of school is known to move slowly in response to changes in society at large, but this pace does not match the students themselves who change rapidly and frequently in response to those same changes. Students daily bring to campus an abundance of microprocessors and have grown reliant on the widespread availability of high fidelity wireless Internet connectivity (Yoo, 2015)—school communities have witnessed a "new normal" with student familiarity of computing devices, computing literacy, and multi-user engagement in online virtual environments. This near-silent shift has occurred over the last ten years, during which time, some observed a widening gap between the kinds of jobs available and the relevance of subject matters studied in schools (Kellner & Kim, 2010). Additionally, schools and classrooms faced a greater number of restraints placed on curricula and student outcomes due to accountability and funding policies that largely dictate how administrators allow their teachers to use class time for what is sold as "in the interest of students." Students at earlier and earlier ages were far more flexible with more complicated tools than what their schools provide (Kafai & Burke, 2015). This indicates a gap

between student readiness and school preparedness that often went unrecognized and undiscussed. As schools set their "June outcomes" during the previous June, educators and administrators may then end up with predetermined outcomes that limit student growth and creativity, as well as their critical thinking and problem-solving skills. The growing mismatch and divide happens as a direct result of decision-making that disregards available data.

Global interconnectedness via Internet and pocket-sized devices to create, distribute, and access information has grown exponentially. The explosion of available information as well as an ongoing reliance on computing to access, collect, and share information, has resulted in an amplification of the already well-documented "digital divide" (Attewell, 2001) that politicians, philosophers, and philanthropists have worked on for at least two decades. A recent study (Araque et al, 2013) indicated an important reminder: increased availability of Internet access and computer hardware alone still did not improve the chances for low-income families to emerge from poverty. Training and support along with leveling the playing field had a greater chance for helping families to improve their station. This same equation for helping people to help themselves applied not only to families in their homes, and communities at large, but also students in a classroom. Teachers were often given a single computer for their classroom, or perhaps a school had a single computer lab for many classrooms, but even when a 1:1 computer program was implemented, training and support were still often lacking. As a result, the computer hardware and software were not utilized to transcend or transform lives, minds, curricula, or schooling. In other words, the yet unrealized vision of computers in schools as a radical liberation tool still awaits us: "High quality hardware and educational software alone cannot make this change and will not result in better educated students: educators need to change for this transformation to begin" (Troutner, 1991, p. 14). Fundamental shifts in daily classroom life for students can happen with guidance from research and theory, which has had great potential for decades to influence school leadership at the highest levels.

In a 1995 Congressional hearing on Education and Technology, Dr. Seymour Papert said, "I think there's an education establishment that has its head wedged in a culture that grew up over a century during which there was the most lethargic progress in education of all fields of human activity and they continue to suffer from being part of that culture" (Educational Technology in the 21st Century, 1995). This paper is founded on established writings that encompass the field, even reaching into some texts that were written before the advent of the computer; those authors discuss relevant fundamental principles and attitudes that directly relate to a reimagining of classroom computer use. Further, many articles have been written by educators, social critics, pundits, philosophers, parents, and industry moguls. New ideas are prevalent, perhaps in an overwhelming abundance, but how many of these ideas make their way to teacher and administrator credential programs? How many of them assist in guiding the work of training the very people charged with creating experiences for student growth and learning? And how many ideas penetrate the very heart of the system itself and position themselves in opposition to the status quo?

Computers today have incredible processing power far beyond most of the utilitarian purposes they serve in schools today. This is not entirely surprising given the history of teaching machines and learning machines, which were created as rote learning devices reliant on behaviorism as the main teaching strategy. Presenting students with stimuli to which they must respond represents the majority of both the historical and the current usage of computers in classrooms. Missing are the expectations that when students work with computers that they can

create original content and explore problems or develop critical thinking skills through the process of following their own inquiries.

In this age of test scores tied to budgets, typically only that which would increase test scores would survive a budget cut—dreaming up a new curriculum or pedagogy with computers does not have guaranteed funding nor very many promises of funding. An experimental program where students "learn by doing" in a shared experience with a three-dimensional creative space sounds intriguing, but it will typically lose the funding face-off with a program trusted to keep the core subject standardized test scores reliably strong and growing. Furthermore, many people might expect students to figure out how to use computers on their own outside of school, given the preponderance of devices and websites and apps readily available.

And while some schools and educators work with the guidance of International Society for Technology in Education (ISTE) and Partnership for 21st Century Learning (P21) in their lessons and outcomes, it is certainly not the order of the day nor the requirement at most school sites. To push at this some more, all of this occurs in a simultaneous space where educators, scientists, and parents often acknowledge the unmet needs of students to find their voice and style, and to find individualized pathways of learning. In other words, we have more tools and venues available than ever before for students to discover an individualized interest and focus, but are slow to let them have greater value, weight, time, and space in our classrooms. The rhetoric of meeting students where they are is at odds with the diagnostic tools used to determine that location.

Digital Learning Environments (DLEs) that are safe and sanctioned by schools can offer opportunities for students to develop essential 21st Century skills, such as cognitive flexibility, electronic civic engagement, computer science literacy, judgment of source material, collaboration, and complex problem solving. Further, DLEs can help provide spaces for students to remix concepts and objects in search of new innovations to help better serve humanity. As cultures and societies change, new needs for systems emerge, towards which students could be working with real data to produce ideas and prototypes. Too often the benefits of creative collaboration receive short shrift when pitted against one's individual academic progress.

Digital learning environments (DLEs) can also be powerful creative places for students to create, share, and explore a variety of cultural expressions in a diversified and meaningful manner. Underrepresented students are most often the marginalized voices in our classrooms. Educators seek pedagogies that emphasize inclusivity of all student ideas and experiences into the central narrative of the classroom. Using DLEs with a methodology steeped in critical theory and techno constructivism allows schools to create more places and pathways for students to express themselves, develop critical inquiries into their own assumptions and interests, challenge the assumptions of others, and deepen their connection to a lifetime of learning. It is incumbent upon schools to not only create and nurture these spaces for students, but to also train their faculty on how to use them and rethink their methods from previous years. The culture shift has already rapidly occurred outside of schools; now we must find a way to follow suit inside of schools.

This paper exists to lend its voice toward a unified learning theory for computers, computing, and digital learning environments for others to implement in their own practices and studies. There exists a two-headedness of behaviorism and constructivism in education, with particular focus on classroom computer usage and classroom computing. There is a high incidence rate of behaviorism alongside a high interest rate in constructivism. The relative absence of critical theory in techno constructivist thinking is a dilemma to explore and directly

address for the purpose of finding unification of these ideas, hence the title of this piece and the ideas herein—Toward a Unified Computer Learning Theory: Critical Techno Constructivism.

The larger significance and purpose here is also practical in looking for and asking for new approaches to school and the perpetually changing needs of students. In a digital learning environment, teachers and students have enormous potential for multimodal and multivalent approaches, as well as multiple entry points. Many classrooms today have access to incredibly powerful machines that can create an immersive and effective John Dewey-inspired learning environment that honors the students and the teachers, and even more, honors the process of creativity in pursuit of knowledge and production.

It is impressive to find that so many elements of the great constructivist thinkers instead of conflicting with one another can commingle and co-exist in our modern computing era. Once superimposed on each other, these elements begin to point toward a new approach, a new theory, a new classroom experience, and even a new graduation standard.

Looking back at the roots of computers in education, the main use and pedagogical design of the Pressey "teaching machines" was to encourage automaticity of skill and content in narrowly defined sets of data (Pressey, 1926). As the processing power of computers became powerful enough to allow for new designs in software and approaches with pedagogy, constructivism and constructionism were looked to for new possibilities and potential for how to use computers in schools. With all these changes in the potential and power of the "teaching machines," however, the approach many schools take has remained more closely aligned with behaviorism and cognitivism. The ideas derived for this piece were created from a document analysis (Bowen, 2009) of seminal works from John Dewey (1916), Paulo Freire (1970), and Seymour Papert (1980) for the purpose of adding to the existing theories of computer use in classrooms and further developing a unified learning theory for computers, computing, and digital learning environments.

In sum, the words "technology and education" all too often means "inventing new gadgets to teach the same old stuff in a thinly disguised version of the same old way" (Papert, 1980, p. 353). Most software used in classrooms for the past four decades has relied on closed loop situational data simulations and narrowly focuses students on predetermined sets of information—this is "edu-tainment", not education. Put another way, this is a transactional approach and not a transformational approach. Today's modern learners are ready for educators and leaders to figure out a new and comprehensive approach to effectively teach with the Internet in digital learning environments (DLEs)—and keep in mind that the power, the reach, the accessibility, and the information contained there within expands each month with no foreseeable limit. That students should be subjected to a model of education that strips them of their natural intellectual and creative value is itself a crisis. In its place, Critical Techno Constructivism can help create nurturing and meaningful learning environments for all students.

Critical Techno Constructivism abides by the following principles:

- Social justice is a goal, not a topic.
- Predetermined outcomes limit creativity, intellectual growth, critical thinking, and problem-solving skills.
- Student inquiry must drive curricular choices and learning outcomes.
- Downloaded, purchased, or otherwise imported curricular materials and solutions are inadequate substitutes for developing original and relevant course materials.
- Computer programming is a mediating language between ideas and people.
- Guidance, coaching, and formative assessment replaces testing.

- Computers and electronics are objects-to-think-with, and should not merely be used as replacements of analog tools.
- School is a laboratory, a studio, and an incubator for students to develop ideas into public-ready products and artifacts, or mimic what professionals create.

Critical Techno Constructivism holds as a central belief that we doom progress and innovation once we insist on reaching an externally defined outcome fed by imported curricular material and strategy; and that at the center of student-driven, problem posing education we must place the computer as an object-to-think-with.

Critical Techno Constructivism asks that educators and students work together instead of at odds in pursuit of real work that has real impact on problems posed and questions asked by the students.

Critical Techno Constructivism operates on the principle that all digital tools must be mixed up with humans and their reality, and that no student should be asked to work *at* a computer, but rather that people and technology work with each other.

Further, Critical Techno Constructivism was created to undo school as we know it; therefore putting these ideas into action is a conscious effort by the people involved to seek new relationships to knowledge, to seek new innovations that impact their community, to seek new social structures to provide financial freedom, and to counter traditional methods that have been used, consciously or not, for dehumanization.

The externally imposed outcomes for graduation and the rigid rules of college admissions translate into a ready-to-wear experience for most students. Whether or not students understand what they are asked to study is often of little concern. And another test is around the corner. The prescribed curriculum is so normal that it does not faze our sensibilities. Certainly students could learn something they do not previously know or understand, that is not in question, but just what is it that they are learning? Educators discuss multiplicity and diversity in the abstract, but our traditional teaching methods mostly do not help produce diverse and divergent thinkers. We continue to allow predetermined aims and outcomes to take precedence over the experiences and ideations of the child.

Many times the constructivist classroom is seen as a "free-for-all" for those untrained in what to look for when the classroom is de-centered. A teacher evaluator may come in and see that a teacher is not lecturing from the podium or forcing students to move "lockstep" through a downloaded and reproduced worksheet of problems, and for these "crimes" would be considered as going too slowly or not meeting performance standards: one might wonder where exactly this evaluator gets her ideas for what qualifies as quality work happening in school. Nevertheless, these are real glimpses of how schools operate—the fear that a teacher is non-performing has more to do with a misinformed perception of meeting the needs of all students. When the teacher is involved in the process of each student's pathway in the work, that teacher might be thought of as not teaching, and as strange as that sounds, it is true simply because teacher and administrative training courses do little to provide opportunities to practice anything but traditional methods.

Starving teachers of the opportunity to co-construct experiments with their students robs everyone. To stifle teacher creativity and autonomy can nearly ensure student misery: when the teacher is a lifeless robot, do not expect the students to accidentally find joy in their learning experience. We are suffering from a lack of imagination with how to run our schools, and most "solutions" are attempts to redirect or reinvent a traditional informational instructional model of teaching and learning—we stop short of reinventing school itself.

At the heart of the analyzed works of Dewey, Freire and Papert, is a belief that we always retain a portion of our wonder as children explorers of the world. Through conscious engagement with that wonder and the natural inquiry that ensues, schools have a chance to think with students about knowledge and learning in ways that can reactivate everyone's excitement for study and production of products or artifacts. The computer is only but a part of this approach and is not where learning ends; the computer is the strongest augmentation tool we currently have available to shift what we do when engaging in learning.

Seymour Papert saw that the default nature of how schools and educators and families think of computers was what doomed its categorical use. Students will, students will, students will—the outcomes and standards are full of sentences about what the students will do but nowhere does it state what the administrators and the faculty will do. Why is this? What promises ought to be made to students about what will be done by the school in their favor? I would like to start right there.

A powerful new classroom space starts to emerge when we rethink the resources and activities with students' freedom at the center. A class where if you are not wrong you cannot go forward in your work, that is a wholly different model. The trauma of failing in front of your peers would simply not exist because the errors in computer programming are necessary to find useful solutions to build the desired product. Thinking with the computer is considered a radical act, though there will likely come a time in human history that looking back at 2020 will provide a good chuckle at our stubbornness in insisting on a traditional model when we have the tools and philosophies to do otherwise. Included in this paper is an educator toolkit (see Table 1) that will hopefully contribute to accelerating our progress towards new learning theories and schools and experiences for students.

Classroom experiments of this nature could occur globally; the only barrier to entry is the will of one person. The computer is the kingpin in this untethered universe of learning potential for it alone can be used in a manner dreamt up by its user, and the biggest dreamers are children, if we leave them enough space to be just that. It is incumbent upon us to unmask the corporate and political takeover of Education. It is incumbent upon us to empower students and teachers to engage in authentic discovery and study. It is incumbent upon us to transform school in opposition to predetermined outcomes, planned curriculum, and standardized testing.

The fractured curriculum serves the specialist teacher and the accounting system more than it does the student. Freire contends that the fractured curriculum also further isolates people's minds and prevents them from engaging in the natural play of human imagination and conceptual strength. With authentic dialogue at the center of the work in school, it would be impossible to predetermine the curriculum and the outcomes. Viewing a learning environment in this manner liberates us from the stranglehold of testing and textbook companies. The re-education of the public might need to start right at this point, for it has many far-reaching implications that impact a community. But again, posing school as a problem for a community to solve will allow for the local needs to be heard and addressed. Leadership is essential in the creation of this approach and guidance through it, though that leadership must be of a transformative, not transactional, nature.

My vision for the future is less about using particular applications, clients, programs, and data sets, and more about my desire for the freedom that students and teachers together could have to choose and chart a path. Schools are hanging on for dear life to a traditional model of what Paulo Freire termed "banking education" (an idea that John Dewey wrote about many decades prior) and this is due mostly to how we, in the USA, are still tethered financially to the

Educational Testing Service (ETS). What happens with technology in education or educational technology today is often still recognizable as that which happened since the 1980s –- once a week "pull out" computer lab time, individual "one and done" projects, or digitizing work that was previously completed with pencil and paper or typewriters. As of yet, we have not toppled the political money machine that shackles well-intentioned creative people in schools. If we did, and allowed for a shift in graduation outcomes and the manner in which we ask students to engage in work and be assessed, then we would help unleash innovation in ways that we could not predict but would positively change how we think and live.

For future research, I recommend that educators study the students who do not fit the traditional mold and track their progress through colleges and careers. Additionally, I recommend that more research be done on how to create and maintain schools as nurturing places for student engagement, since that is the central component of many pedagogies and theories vying for prominence in traditional schools. And finally, I recommend that we spend time researching how experimental use of computers can augment human thinking. Studies have been performed to demonstrate that an alternative approach via computer programming can produce higher student test scores on traditional assessments than students who covered the material in a traditional manner (Harel & Papert, 1990). But what we have not yet done is to fully explore and study a constructivist, inquiry-based, student-driven computer and computing focus in an academic course.

What happens when we consciously counter the traditional narrative of school and schooling? What happens when students bring their own real-world situations to pose as problems for study? What happens when we make room for student control of the artifacts they produce? What happens when we use computers as objects-to-think-with? What happens when we learn computer programming languages to create software solutions of our own? What happens when we naturally and organically collaborate? What happens when we remove from school the artificial barriers of age grouping, grade levels, time spent, content areas, content sequencing, and testing measurements?

Schools can change. Administrators can change. Teachers can change. Classrooms can change. The students are waiting.

Table 1

Tenets of Critical Techno Constructivism with Suggestions for Operationalizing the Theory.

Tenet	Question	Action
Personal Inquiry	Did the student develop the learning task?	Engage in open dialogue with students with the explicit purpose of developing together new assignments or topics of study. Work with students to define audience, purpose, resources, tools, and goals of the learning task. Think big with students about possible uses and aims of their work beyond the classroom and the confines of school. Encourage students to follow through and develop to its end what they pose as a problem to solve.
Compelling Problem or Question	Did the student arrive at an answer that led to more questions or problems?	Coach students as they work to keep a log of their progress, handwritten, typed, audio or video recorded, for the purpose of tracking ideas as they occur. Encourage students to spot potential new paths or questions to chase as they work. Develop with students some methodologies for addressing conflict and dissonance in their work and studies and possible applications.
Technology as Tool to Think With	Did the student use technology in the thinking process?	Choose technology wisely with students. Remember that analog tools may provide instant freedom in expression. Demonstrate how to think with the computer. Use machine learning, graphical statistics, programming language, and concordances or natural language processing. Make certain the computer remains an object-to-think-with, not a replacement of paper or a push-button terminal.
Formative Demonstration of Learning	Did the student demonstrate learning throughout the process?	Develop guidelines, rubrics, and expectations of outcomes with students. Adjust these as necessary throughout the process of their work, sometimes abandoning them when students find them restrictive. Consult with students about progress and engage in conversations less as an evaluator and more as an interested peer. Sparingly make suggestions so that students retain ownership.
Reflection as Learning	Did the student demonstrate a reflective approach in the formation of knowledge?	Explicitly teach the skills of mindfulness in short lessons. Engage wholeheartedly in the process of looking for student interest and joy in their work. Emphasize to students the importance of caring about their own interest levels. Engage in reflective questions that are genuine. Avoid leading statements about what you would do as this not-so-subtly shows teacher judgment.
Social and Cultural Critique	Did the student demonstrate a critical awareness of the larger established modes and forms of thought that shape thought?	If an understanding of larger social constructs does not yet show in their work, make a weighed decision to point them out. Building consciousness more authentically through self-realization is the most powerful, however, students will need coaching and guiding. Avoid moralizing or hijacking student work with your own politics, values, or experiences. Make mention of historical events, people, or concepts that students might consider for study on their own.
Sharing and Collaborating	Did the student actively seek out collaborators in the process of acquiring knowledge, testing theories, and creating a shareable artifact?	Demonstrate methods, procedures, and styles of communicating with people. Seek out experts and amateurs as guest speakers or consultants. Show the crossover of work done in school and out of school. Practice presentation skills. Create space and time in class to talk together about student progress. Explicitly teach and coach how to communicate respectfully with operationalized critique. Engage with students to develop multiple venues and audiences for sharing.

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A framework for understanding the role of sociocultural issues in instructed learning

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Abstract

This paper zeroes in on the role of sociocultural issues in instructed learning, as part of a larger, exhaustive discussion—presented as the 'Molenda–Subramony Framework'—of the myriad proximal, distal, and environmental factors impacting the latter. Given that human society comprises a multitude of individual and institutional actors operating within multiple, overlapping environmental settings and contexts, our Framework features key actors—the learner, the facilitator, the learner's home/family members and peers, and the media—operating within the setting of classroom and school environments, important *frame factors*, and the larger sociocultural environment. This paper is devoted to examining in detail the sociocultural issues, aspects, and dimensions pertinent to each of the aforementioned key actors and settings.

Introduction

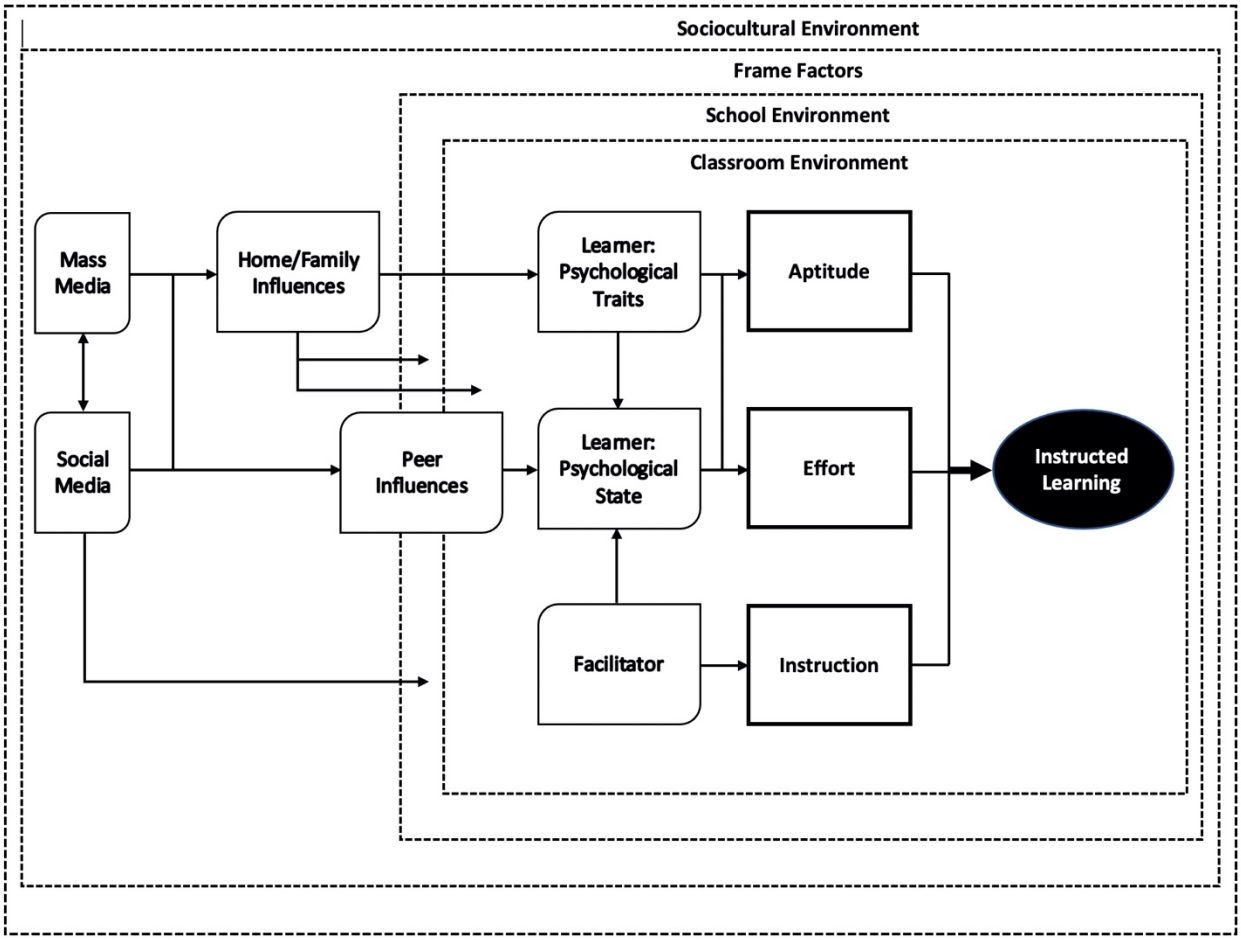
The role of sociocultural issues in learning have, until very recently in the field's history, attracted very little interest and attention amongst educational technologists; the extraordinary magnitude and all-pervasive nature of this neglect has been documented in vivid, painstaking detail in Subramony (2004), Subramony (2017), and Subramony (2018). As Jamison (1992) described, the roots of this collective blindness goes all the way back to our field's—particularly its branch that deals with instructional systems design (ISD)'s—origins within the deeply patriarchic milieux of the military, industrial, and medical spheres. These origins prompted it to traditionally look at the stakeholders targeted by our scholarship and praxis as uniform beings suited to uniform solutions; after all, our earliest target learners wore actual uniforms, whether on military bases or on factory floors. ISD thus started off as mere manipulation of content, following linear, restrictive, lock-step models that failed to comprehend the true nature of human learning as complex, multilayered, and messy. To its credit, ISD did eventually evolve somewhat from there; Schiffman's (1986) classic essay carefully traced ISD's development from a primitive media-selection approach to a more *systemic* one that better befitted its *instructional systems design* moniker.

Molenda-Subramony Framework

Our recently published book (Molenda & Subramony, 2021) presents a pathbreaking new Framework outlining the myriad factors—from proximal, to multiple levels of distal, to environmental—that directly or indirectly impact what we call *instructed* learning, a term borrowed from neuroscience that distinguishes human learning which occurs as a consequence of deliberate, planned, premeditated instruction from that which spontaneously occurs in response

to various life events/experiences. Fig. 1 below visually represents this Framework, which we call the 'Molenda–Subramony Framework of the Forces Affecting Instructed Learning.'

Fig. 1: Molenda–Subramony Framework of the Forces Affecting Instructed Learning



The above Framework constitutes a crucial part of our overarching argument that an *ecological* approach to educational technology scholarship and praxis is a logical next step in the evolution of our field into one that is 21st-century-ready. This entails extending the systems metaphor in a manner that allows us to see personal and social relationships as part of meaning making in an increasingly diverse, interconnected, globalized world; recognizing learning as spanning multiple human contexts, such that ours and our stakeholders' history, culture, race,

politics, etc. *all* matter and need to be taken into account within our scholarship and praxis; and thus acknowledging that—at the risk of sounding cliched—appropriate instruction truly requires a metaphoric 30,000-foot view, a capability to see the BIG big picture. The Molenda–Subramony Framework incorporates many elements that have traditionally not been taken into consideration by instructional designers, presenting a comprehensive, holistic view of the myriad factors that affect instructed learning—and therefore ought to be taken into account while designing, developing, and implementing instruction.

Key Actors and Settings

Human society comprises a multitude of individual and institutional actors operating within myriad, overlapping environmental settings and contexts. The Molenda–Subramony Framework features the following key actors: the learner, the facilitator, the learner's home/family members and peers, and the media. These actors operate within the setting of classroom and school environments, important *frame factors*, and the larger sociocultural environment. The rest of this paper is devoted to examining in detail the sociocultural issues, aspects and dimensions pertinent to each of the aforementioned key actors and settings.

Learner

Let us start by focusing on the sociocultural issues pertinent to the learner, who is the focus of instruction within the Molenda–Subramony Framework. As Fig. 1 shows, two of the three proximal factors that most *directly* impact instructed learning relate to the learner—namely, their Aptitude, and the quantum of Effort they put in towards learning. Directly feeding into these two proximal factors are two 'first-level distal' factors also pertaining to the learner—viz., their Psychological Traits and their Psychological State. Taken together, these four factors encompass a wide range of learner attributes, including the learner's prior achievement, prior

subject knowledge, self-efficacy, locus-of-control, maturational level, personal interests, expectancies, valuations, situational interest, and motivation to learn. In terms of their sociocultural aspects/dimensions, it is important to recognize certain crucially important issues/phenomena when considering the four aforementioned factors.

One of these phenomena that significantly impact the learner is their *cultural capital*. The eminent Bourdieu (1990) describes how learners with higher socioeconomic status (SES) origins inherit significantly different cultural capital—cultural background, knowledge, disposition, and skills—than those with lower SES origins. Learners growing up in environments where culturally valued activities like reading, travel, museum visits, and concert- and theatergoing are frequently practiced get socialized into the dominant culture that the educational system requires for academic achievement. Schools—where most instructed learning takes place—value and reward the cultural capital of the dominant classes, facilitating their easy translation into superior academic credentials. We will revisit this when discussing the classroom/school environments.

Besides, learners also acquire a distinct *habitus*—"a subjective but not individual system of internalized structures, schemes of perception, conception, and action common to all members of the same group or class"—along with their cultural capital (Bourdieu, 1990, p. 86). Functioning constantly as a matrix of perceptions, appreciations, and actions—as a system of lasting, deeply internalized, and transposable attitudes, beliefs, values, and dispositions integrating past experiences—a learner's habitus impacts their perceptions regarding self-efficacy and locus-of-control, as well as their interests, expectancies, valuations, and motivation. The learner's habitus engenders their aspirations—internalizations of objective probabilities that reflect the learner's view of their chances of success. Lower-SES learners raised in environments

where success is rare are less likely to develop strong ambitions than upper-SES learners inhabiting environments where the connection between effort and reward is infinitely clearer.

Meanwhile, learners' cultural capital and habitus are closely linked to their privilege and intersectionality—both important sociological concepts that must be comprehended in order for us to better understand where our learners are coming from and how they relate to instructed learning. In her seminal 1988 paper, McIntosh outlined her influential concept of a "knapsack" of *privilege*, which she formulated as a direct repudiation of the myth of meritocracy that constitutes a basis of modern capitalist society. She characterized privilege—conferred through one's belonging to a 'dominant' group based on any given criterion such as race, gender, sexual orientation, culture, citizenship, etc.—as "an invisible weightless knapsack of special provisions, assurances, tools, maps, guides, codebooks, passports, visas, clothes, compass, emergency gear, and blank checks" (p. 1-2) about which its possessor is meant to remain oblivious, and ignorant of his obliviousness. Furthermore, the existence of a matrix of privileges enjoyed by the dominant groups invariably engenders a corresponding matrix of oppressions experienced by the subjugated groups; some take "active forms which we can see" and others take "embedded forms which as a member of the dominant group one is taught not to see" (p. 17).

Logically extending McIntosh's arguments related to privilege and oppression, Crenshaw (1991, p. 1245) coined the term *intersectionality* to describe how different forms of discrimination can interact and overlap, and to emphasize the need to account for multiple grounds of identity when considering how the social world is constructed. While originally employed to explain how race and gender intersect and compound each other as forms of oppression in the lived experiences of women of color, the concept of intersectionality has since broadened to encompass the entire gamut of pertinent social variables including sexual

orientation, nationality, socioeconomic class, disability, etc. (Emba, 2015). Intersectionality reminds us that our identities based on race, gender, class, and sexuality accompany us in every social interaction (Collins, 1993)—including instructional activities. It helps us understand that human beings are complex beings who experience oppression in ways that are deeply intersected, in ways that cannot be disassembled and their parts analyzed separately; their myriad aforementioned sociocultural identities are thus profoundly interconnected with all other parts of their experiences and identities (Richards & Barker, 2015)—once again including educational experiences. An intersectional perspective allows us to see that we cannot begin to understand the contexts, experiences, issues, and needs of learners if we ignore and fail to take into account some very important parts of their identity and experience as human beings, parts that are inextricably interlinked with every other part thereof.

Furthermore, since the dawn of the current Information Age, a persistent and deeply impactful symptom of socioeconomic inequalities among learners has been the so-called *Digital Divide*—the widening and increasingly calamitous gulf between those who are appropriately positioned to effectively harness the puissant emancipatory potential of the myriad media technologies that are key to socioeconomic success and upward mobility within Information Age societies and those who are not. Borrowing McIntosh's theoretical lens, Subramony (2014, p. 7) proposed that the individuals belonging to those social/economic/cultural groups that are located on the "right" side of the Digital Divide could be seen as the largely oblivious beneficiaries of a vast matrix of privileges, unconscious possessors of a significant knapsack of gifts, when it comes to their relationship with media technologies. Evoking Crenshaw's concept of intersectionality, Subramony described these individuals as occupying "happy intersections" of demographic, economic, political, social and cultural factors that make it possible for them to

harness the full emancipatory potential of these technologies to get even further ahead within today's Information Age socioeconomic framework. In contrast, those on the opposite side of the tracks vis-à-vis the Digital Divide do not possess said knapsack, but instead remain trapped under multiple layers of oppressions.

Meanwhile, the learner's Psychological Traits and States are substantially influenced by their *self-identity* vis-à-vis the dominant class/cultural/economic systems that they construct based on their lived experiences within those systems. Willis (1977) saw learners as social agents who view, inhabit, and construct their own world. Some construct self-identities that aspire to upward socioeconomic mobility and comply with dominant rules and norms. Others construct oppositional self-identities—based on their profound insights into the economic condition of their social class—that reject the dominant achievement ideology; they become subversive nonconformists, believing that their chances for upward mobility are so remote under the current socioeconomic power structure as to render any attempts at good behavior and conformity pointless. Giroux presented his theory of student *resistance* (1983), explaining how students' opposition and nonconformity towards the educational system were responses rooted in their moral and political indignation and critique of school-constructed ideologies and relations of domination rather than any sort of psychological dysfunction.

Finally, the impact of the learner's sociocultural environment extends to their prior achievement and subject knowledge (factors of their Aptitude), since prior achievement and mastery of prerequisite skills—including literacy and numeracy—depend on their access to learning resources and ability to extract the benefits of said resources, which again are a function of their cultural capital and habitus, self-identity, privilege, and intersectionality.

Facilitator

Let us now move our focus to the sociocultural issues pertinent to the facilitator, who implements instruction within the Molenda–Subramony Framework. When facilitators possessing socioeconomically more valued cultural capital and more effective habitus are put in contact with learners from socioeconomically marginalized backgrounds, this throws up potential opportunities and pitfalls. Consequently, the facilitator must navigate adroitly and skillfully, figuring out how to nudge learners along pathways to emancipation and empowerment without making them feel devalued or disrespected. This requires the facilitator to check some of their tacit/explicit assumptions with regard to teaching and learning. Two common assumptions among professional educators are that the current ideological, structural, and media/technological frameworks within which most instructed learning takes place are (a) morally/ethically well-intentioned, and (b) culturally neutral.

Critical scholars argue, however, that neither of these assumptions is warranted, and that they both reflect the obliviousness that characterizes privilege. For those unfamiliar with the term critical scholars interpret the acts and the symbols of society to understand how various social groups are oppressed, believing that understanding the ways human being are oppressed enables one to take action to change oppressive forces. These scholars align themselves with the interests of those opposed to dominant order of society, and explore how competing interests clash and how conflicts are resolved in favor of particular groups (Seiler, 2006) .

A specific group of critical scholars—whom one may call “social reproductionists”—argue that modern schools are set up and operate in a way that perpetuates the intergenerational reproduction of socioeconomic inequalities, rather than promoting the empowerment and upward mobility of learners from socioeconomically marginalized backgrounds by providing them with appropriate pathways to meaningfully harness the emancipatory potential of instructed learning.

Meanwhile, and this is ever more germane given the increasing time, effort, and material resources accorded to the integration of media technologies into teaching and learning, many professional educators persist in believing that instructional methods and technologies are ideologically objective and culturally *neutral*. However, Bowers—see Bowers, Vasquez, & Roaf (2000)—reminds us of the "multibillion dollar reasons" (p. 184) that the vendors of media technologies have for maintaining the myth that these technologies are culturally neutral. Said technologies in fact encode Western ideals of individualism and a rootless form of existence (Howe, 1988) . As Bowers, et al. (2000) explain, the myth of the cultural neutrality of technology was important in hiding the forms of cultural transformation that needed to take place in order to enable the spread of the Industrial Revolution; and technology-mediated learning is currently reinforcing the same modern, Western pattern of individual-centered relations and forms of consciousness—equating greater individual autonomy, consumerism, and technological development with progress—during what is essentially the Industrial Revolution's digital phase.

That neither of the two sets of issues introduced in the preceding two paragraphs have historically attracted much attention or interest among the dominant, mainstream voices within professional educator communities—especially educational technologists (see Subramony, 2004; 2017)—speak to the privilege enjoyed by the latter. As a gender, sex and sexuality activist within the U.S. computer gaming industry—famously put it, privilege "is when you think that something's not a problem because it's not a problem for you personally" (Gaider, 2013) . The intergenerational reproduction of socioeconomic class inequalities—and the role of schools in perpetuating it—will naturally not be pressing, foregrounded issues for a given individual if they and their family currently enjoy a high SES and actually look forward to its intergenerational reproduction. Similarly, the cultural non-neutrality of technology will not be negatively

consequential for a given individual if the cultural values embedded in the former are compatible with their own cultural values.

Learner's Home/Family & Peers

Two other sets of actors—Home/Family members and Peers—are represented in the Molenda–Subramony Framework as second-level distal influences, in that we do not see them as affecting instructed learning directly, but rather as underlying the first-level distal factors.

Home and Family values are largely determined by the ways in which learners and their parents/relatives are shaped by their SES and cultural identity. Everything we discussed with respect to the sociocultural issues pertinent to the learner earlier in this paper logically applies to their home/family members as well. Learners acquire a significant portion of their cultural capital from their families, with high-SES children inheriting substantially different, and more valued, cultural capital than low-SES children, whose families are often immigrants, ethnic minorities and/or language minorities (Bourdieu, 1990) . Learners also acquire much of their habitus (Bourdieu, 1990) from their families. Family background hugely informs an individual learner's socioeconomic and cultural privilege (McIntosh, 1988)—or lack thereof—and is a crucial element of their intersectionality (Crenshaw, 1991).

Meanwhile, learners' relationships with peers also greatly hinge on the self-identity constructed by the individual learner vis-à-vis the educational system that represents the dominant class/cultural/economic system (Willis, 1977; Giroux, 1983) , as well as the respective self-identities constructed by their peers both within and outside the learner's own socioeconomic class and cultural group. These relationships are also determined by the learner's—and their peers'—relative privilege (McIntosh, 1988) and intersectionality (Crenshaw,

1991). Learners also acquire varying degrees of cultural capital and habitus (Bourdieu, 1990) from their peers.

Media

The Molenda–Subramony Framework sees mass media and social media as third-level influences; that is, they do not influence instructed learning directly but rather underlie the second-level distal factors, which impact the first-level distal factors, which in turn directly influence the proximal factors of Effort by the learner and Instruction by the facilitator.

Mainstream mass media—print, radio, and television, along with the advertising industry—are invariably owned by society's dominant group(s)—those with economic and political power over the rest of society—and openly embody the latter's sociocultural values. The phrase "All the News That's Fit to Print" that appears on the masthead of the New York Times represents a cultural determination and also an expression of power; these most famous seven words in American journalism indicate that a certain group of people have the power to decide—based on their own sociocultural values—what is fit to print and what is not. Mass media by definition engage in the powerful cultural processes of news *framing*, *agenda setting*, and *priming* (Scheufele & Tewksbury, 2007). They routinely *stereotype* human groups that are socio-culturally distant from themselves (Subramony, 2000), and decide whom to represent or marginalize. When advertisements for socio-culturally desirable products/services across Latin America, Africa and Asia feature light-skinned, light-haired, light-eyed actors who bear no physical resemblance to the target audience of said advertisements, unmistakable sociocultural messages are being transmitted, a logically extreme outcome of which is the burgeoning market for skin-, hair-, and eye-lightening products and procedures across the Global South.

Social media, on the other hand, are more complex in their intentions and efforts. Firstly, Western social media platforms unabashedly serve as agents of *digital colonialism*—extracting data from citizens of the Global South without the latter's explicit consent (Marker, Vestergaard, & Hendricks, 2019), and subsequently processing and using said data to create manufactured services to sell back to the latter (Kwet, 2019). In terms of peer influences on learners, social media are a well-known source of peer pressure and platform for cyber-bullying (see Subramony, 2018). On the other hand, social media can also be seen as a mode of resistance, a la Giroux (1983); that which is not considered fit to print by the mainstream mass media can be disseminated via social media, thus subverting and undermining the mainstream media's role in preserving the political, social, economic, and cultural hegemony of society's dominant group(s).

Classroom/School Environments

The classroom and school environments are depicted in Fig. 1 as the two smaller dotted boxes surrounding the proximal and first-level distal factors towards the right-hand side.

The school environment is, at its most basic level, a consequence of (a) how schools are fundamentally conceptualized and structured, and (b) the kind of cultural capital they are set up to reward—both of which are functions of the complex socioeconomic and cultural forces that created the educational system. Bowles & Gintis (1976, 2002) have long upheld a social reproductionist view of schooling; they have maintained that modern public school systems are set up to reflect the interests of capitalist business owners rather than any democratic or pedagogical ideal. In their view, schools (a) primarily serve to socialize future employees to work uncomplainingly within hierarchical corporate structures—by structuring social interactions and individual rewards in ways that mirror workplace environments, while (b) doing

precious little to stop the intergenerational reproduction of social inequality, i.e., to break the cycle of low socio-economic status (SES) children growing up to be low-SES adults.

Bourdieu (1990), in contrast, focuses more on cultural processes as opposed to structural determinism to explain how schools work to foster the intergenerational reproduction of social inequality. According to him, schools embody the interests of dominant classes by acting to reward the cultural capital of said classes while simultaneously acting to systematically devalue that of marginalized classes. Schools thus become the marketplace where the cultural capital of dominant classes is exchanged for the currency of academic credentials, which is subsequently converted back into economic capital via entry into highly remunerated professions—representing a perfectly legitimized cycle of social reproduction. Giroux (1983) puts a finer point on it when he explains that schools reproduce existing power relations "via the production and distribution of a dominant culture that tacitly confirms what it means to be educated." (p. 87)

Frame Factors

The Molenda–Subramony Framework also takes into account a set of *frame factors* that indirectly impact instructed learning—namely, (a) Official laws, policies, and regulations; (b) Funding; (c) Official/explicit and unofficial/tacit moral and ethical norms; (d) Physical environment; and (e) Learner health and well-being. In Fig. 1, these frame factors are represented by the second-largest dotted box, located just inside the 'Sociocultural Environment' box, and encompassing all of the other elements featuring within the Framework.

The sociocultural facets, dimensions, and ramifications of the aforementioned frame factors should be clearly self-evident to the reader. Consider the impact of the U.S. government's post-9/11 educational policy changes, assorted travel bans based on religious background and national origin, and recent animus-fueled restrictions placed on international students, on the

learners that these legal initiatives have targeted. Consider the impact of basing school funding on property taxes on learners living in low-income, low-net-worth neighborhoods. Consider whose cultural, moral, and ethical values are reflected by the codes of conduct, honor codes, professional standards, and licensing requirements governing various professions and professional bodies. Consider the physical environment of underfunded inner-city and rural schools—the impact of inadequate heating/cooling/ventilation, mold, and broken/nonfunctioning equipment on student learning. The infrastructural divide between rich schools and poor schools and the Digital Divide between rich students and poor students—along with the unequal health and financial impact upon rich students v. poor students—have all come into sharp, brutal, unignorable focus during the current COVID-19 pandemic.

Sociocultural Environment

It will be clearly noticeable from our preceding discussion of the multiple distal factors influencing instructed learning that all of these factors are underlain and impacted by the sociocultural environment within which they are situated. In fact, all of the elements that must come together in order to make instructed learning possible—viz., learners, facilitators, resources, settings, teaching-learning arrangements, and organizational structures—are embedded and operate within a given sociocultural environment.

It is in light of this that Fig. 1 depicts the Sociocultural Environment as the largest dotted box encompassing all of the other elements featuring within the Molenda–Subramony Framework. Our perspective here is congruent with that of the National Academies of Sciences, Engineering, and Medicine (2018, p. 22), who also approach the whole subject of human learning from a sociocultural perspective, pointing out that learning cannot be separated from the culture in which it takes place. “Culture” is defined here in its sociological sense: as a way of life

of a group of people—the behaviors, beliefs, values, and symbols that they accept, generally without thinking about them, and that are passed along from one generation to the next.

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Cultural perspectives on utilizing social media to improve foreign language learning and teaching: A literature review

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Abstract: Positive attitudes towards social media in foreign language learning are found in literature but few studies have addressed the cultural perspectives on the roles of social media in foreign language learning. This article aims to explore how cultural perspectives on the roles of social media in foreign language learning have been addressed in literature by reviewing the theories and frameworks of integrating social media into foreign language learning and exploring the empirical evidence regarding the effectiveness of social media on foreign language learning. Results revealed that theoretical development of integrating social media into foreign language learning was quite slow and there was no solid evidence that social media was effective on foreign language learning, especially on academic performance. This article concludes with recommendations for future research and potential opportunities for international collaboration.
Keywords: cultural perspective, foreign language learning, literature review, social media

Introduction

With the development of technology, more and more language educators have considered using technology, especially social media, to assist with language instruction (Chun, Kern, & Smith, 2016; Golonka, Bowles, Frank, Richardson & Freynik, 2014; Yang, Crook & O'Malley, 2014). Social media are the internet-based services that allow individuals to create a public profile, share connections, and track individual updates (Nadkarni & Hofmann, 2012). There are six types of social media platforms used for educational purposes, including functions for social networking (e.g., Facebook, LinkedIn), bookmarking sites (e.g., Delicious), social news (e.g., Reddit), media sharing (e.g., Instagram, YouTube, Flickr), microblogging (e.g., Twitter), and blogging (e.g., blog website). The ubiquity of social media (e.g., Facebook, Twitter) in educational settings prompts foreign language educators to utilize social media to mediate and enhance foreign language instruction (Hattem & Lomicka, 2016). For example, mobile devices and social networking sites (SNS) were examined in Aladjem and Jou's (2016) study. Facebook was investigated in Aydin's (2014) study to learn learners' interactions with the teachers. Wang and Kim (2016) also studied Facebook to examine the effectiveness of foreign language learning. Instant messenger was used in Baek, Yoo, Lee, Jung and Back's (2017) study to create a peer-tutoring environment that improved students' performance. Twitter posts were investigated in Harmandaoglu's (2012), Lim and Fussell (2017), Liu, Evans, Horwitz, Lee, McCrory, Park and Parrish (2013), and Solmaz (2017) studies.

The relationship between culture and foreign language learning has been widely recognized. The cultural aspects of countries where a foreign language is common in surroundings, plays an essential role in that foreign language's acquisition (Ambrossi, 2015). With the surrounding of the foreign language learners have some immersion to learn how to use

words, rules, and knowledge to see, understand, and communicate through multicultural and cross-cultural activities (Heidari, Ketabi & Zonoobi, 2014; Keesing, 1974). Brown (1994) described that "language is a part of culture and culture is a part of language (*p*. 165)". Language is one of the visible parts of culture and it is shaped and influenced by the culture (Jiang, 1994; Zhong & Xu, 2019). Language serves as the media to make people understand the beauty of diverse culture. In other words, culture and language cannot be independent of each other. Although there is no clear definition of culture, in foreign language learning, culture was interpreted as the deposit of knowledge, beliefs, and artifacts (Samovar, Porter, & Stefani, 2000), the ability to communicate with people in other cultures (Lusig & Koester, 1996; Tananuraksakul, 2015; Zhong, 2016), four senses (Adaskou, Britten, & Fahsi, 1990), and four perspectives (Robinson, 1985).

However, when social media was utilized to design foreign language learning environments, culture as an essential role in learning a foreign language learning has been rarely discussed. Research regarding social media mainly focuses on the effectiveness on academic performance (Barrot, 2016; Jones, 2014; Kamnoetsin, 2014; Mompean & Fouz-Gonzalez, 2016; Wang, 2017; Zhong & Hartsell, 2015), attitudes towards using social media in foreign language learning (Akbari, Eghtesad, & Simons, 2012; Baſöz, 2016; Gamble & Wilkins, 2014; Lin, Warschauer, & Blake, 2016; Momcilovic & Petrovic, 2016; Rahimi, Azhan, Normeza & Baharudin, 2015; Sorensen, 2013), motivation and anxiety (Akbari, Naderi, Simons, & Pilot, 2016; Hsiao & Broeder, 2014; Gabarre, Gabarre, Din, Shah & Karim, 2016; McCarty, 2011), engagement and interaction (Akbari, Naderi, Simons, & Pilot, 2016; Boonkit, 2011; Fewell, 2014; Mondahl & Razmerita, 2014), and online identity (Dressler & Dressler, 2016). Studies regarding the roles of culture in social media environments as well as whether the integration of social media in foreign language learning has improved the language learners' cultural understandings of that new language are scarce. It is still unknown that how instructional designers and language educators should address culture in social media learning environments.

In order to gain a full picture of the effectiveness of foreign language learning in social media environments and to understand the cultural perspectives on the role of social media in foreign language learning, this study (1) reviewed the theories and frameworks of integrating social media into foreign language instruction, (2) examined the empirical evidence of the effectiveness of social media in foreign language learning, and (3) investigated culture's roles in social media environments in foreign language learning. In this study, investigation of foreign language learning focused on four aspects: listening, speaking, reading, and writing. Culture in this study was interpreted by using Robinson's (1985) conceptualization, which includes behaviorist, functionalist, cognitive and symbolic. Robinson's (1985) definition is adopted in this study because this framework considers culture not only as a process of understanding and interpreting a phenomenon but also a cultural product that can be passed from generation to generation. Robinson (1985) noted that the development of cultural versatility is important to help learners meet the demands of an increasingly multicultural world. According to Robinson (1985), behaviorists consider culture as a set of patterned behaviors. Functionalists believe culture is to make sense of the behaviors. Foreign language learning is to understand and make sense of the patterned behaviors through listening, speaking, reading, and writing. Cognitivists view culture as a process of interpretation and symbolists define culture as the product of interpretation. For cognitivists, foreign language learning is to interpret the incoming data from the culture through listening, speaking, reading, and writing. For symbolists, foreign language learning requires the understanding and interpreting of cultural products, such as literacy

achievement, artistic achievement, and historical development, through listening, speaking, reading, and writing. Thus, the following questions are explored in this study:

1. How are theory and framework used to integrate social media into foreign language learning and how have these been developed?
2. What empirical evidence of the effectiveness of social media in foreign language learning is found in research?
3. How have the cultural aspects of countries that use the language been addressed in literature?

Method

This study systematically searched the following specialized database: EBSCHOhost, ERIC, and Education Abstract. Additional Google Scholar searches were performed. Search keywords included Facebook, Twitter, Google plus, foreign language learning, language and cultural learning, social media, social media in language learning, social networking, and blogs. Social media (i.e., ResearchGate) was also used to outsource to other researchers inviting their collective input. Content analysis was performed to identify all the literature published in refereed journals from 2009 to 2018. Content analysis was chosen as the data collection method because this method helps researchers combine the articles that are similar to each other in the light of the themes and helps to convert the themes into readable forms for readers (Bauer, 2000). The article selection criteria are:

(a) Academic publications, including academic journals, conference proceedings, and workshop proceedings;
(b) Articles that focuses on foreign language learning, including reading, writing, listening, and speaking;
(c) Articles that have integrated social media into the foreign language instruction.

There were 221 articles that met the inclusion criteria after duplicated articles were excluded. The quality of the article was assessed with the following rubrics:

(a) Sampling method is representative of the population;
(b) Findings are clearly presented.

After the selection and assessment of the articles, 64 articles were identified for this study. Among the 64 articles, only six articles were identified as empirical studies, most of which were quantitative studies. Most qualitative studies did not meet the requirement of triangulation, which is a common effort to ensure validity and reliability of research. The identified 64 studies were examined based on the research questions. Also, theoretical frameworks, context in which the study was conducted, names of social media, purposes of using social media in foreign language learning, frameworks or theories used in the study, research methods, and the effectiveness of the utilizing social media tools were analyzed in detail to generate possible themes. Next, researchers conducted another round of analysis to check the classification accuracy of the articles. Descriptive analysis was utilized to synthesize all the articles and interpret the emerging themes.

Results

The review of the selected articles identfied 22 different theories and frameworks. Among the 22 theories and frameworks, social constructivist theory is the mostly used theory,

following by technology acceptance model (TAM), sociocultural theory, and social presence & learning community. Other theories, such as self-determination theory, computer-assisted language learning, and social cognitive theory, are also used to study foreign language learning in social media supported learning environment. It is also noticed that most theories and frameworks (69%) were utilized to investigate online interaction, online collaboration, emotional satisfaction such as motivation and confidence, and attitudes towards the ease and usefulness of social media in foreign language learning. Only nine theories or frameworks (31%) were used to examine student's learning performance (see Table 1).

Table 1

Theories and frameworks used to integrate social media in foreign language learning

Theory/Framework	Social Media	Country/Context	Purposes	Literature Sources
Asynchronous learning	Twitter	Saudi EFL learners	EFL writing	Ahmed, 2015
(a) the Input-Interaction-Output (IIO) model (Block, 2003); (b) the sociocultural/activity theory (Lantolf, 2000); (c) current L2 grammar learning theory (Ellis, 2006); and (d) computer-assisted language learning (CALL) theory (Levy & Stockwell, 2006).	Wiki site	Taiwan undergraduate EFL students	Undergraduate EFL grammar achievement	Singman, 2012
E-portfolio theory	Facebook based e-portfolio	Philippine	ESL writing	Barrot, 2016
Task-based language teaching	Facebook	Thai undergraduate students	EFL undergraduate students reading	Boonkit, 2011
Socio-cognitive learning	Facebook	Thai students	Writing behavior	Kamnoetsin, 2014
Mobile learning	WeChat	Chinese EFL students	Utilization evaluation in English pronunciation	Wang, 2017
Long's (1996) social interaction hypothesis	Facebook group	Iranian EFL learners	TOEFL score	Khoshnoud & Karbalaei, 2014

Self-Determination Theory	Facebook	Iranian PhD students	TOEFL score	Akbari, Pilot, & Simons, 2015
Astin's theory of student engagement	Facebook	Iranian PhD students	TOEFL score	Akbari, Naderi, Simons, & Pilot, 2016

From Table 1, Facebook was the most widely used tool which accounted for 73% of the entire social media tools. The study subjects were mainly Saudi EFL students, Iranian EFL students, and Thailand EFL students. However, social media tools used to examine foreign language learning performance as shown in Table 1, Facebook only counts for 50%. Other tools such as Wiki site, WeChat, and Twitter were also used to improve foreign language learning performance. The contexts of using social media tools in foreign language learning were different. Twitter was used in Saudi EFL to improve students' writing while WeChat was utilized to help Chinese EFL students with English pronunciation.

Researchers then examined the six empirical studies that contained social media usage in foreign language learning. The six empirical studies are organized in Table 2 according to different countries, research method, and the effectiveness on foreign language learning performance.

Table 2

Empirical evidence of the effectiveness of social media in foreign language learning

Theory/Framework	Social Media	Country/ Context	Research Method	Effectiveness	Literature Source
Asynchronous learning	Twitter	Saudi EFL learners	Quantitative	Writing	Ahmed, 2015
Long's (1996) social interaction hypothesis	Facebook group	Iranian EFL learners	Quantitative	TOEFL score	Khoshnoud & Karbalaei, 2014
Self-Determination Theory	Facebook	Iranian PhD students	Quantitative	TOEFL score	Akbari, Pilot, & Simons, 2015
Astin's theory of student engagement	Facebook	Iranian PhD students	Quantitative	TOEFL score	Akbari, Naderi, Simons, & Pilot, 2016
Technology Acceptance Model (TAM)	Facebook	Thailand undergraduate students	Quantitative	Writing	Kitchakarn, 2016
(a) the Input-Interaction-Output (IIO) model (Block, 2003); (b) the	Wiki site	Taiwan undergraduate EFL students	Quantitative	Writing	Singman, 2012 (dissertation)

sociocultural/activity theory (Lantolf, 2000); (c) current L2 grammar learning theory (Ellis, 2006); and (d) computer-assisted language learning (CALL) theory (Levy & Stockwell, 2006).	

As shown in Table 2, effectiveness of social media on foreign language learning was found primarily in English writing among the six studies. The other three studies reported effectiveness on TOEFL score. When research methods were examined, all the six articles were found to be quantitative studies. Although qualitative empirical studies were found in literature, no qualitative studies qualified as empirical studies due to methods of validity, especially triangulation. Thus, qualitative evidence was not found from our review. In terms of the context, three studies were conducted in Iran (50%). The other three studies were separately conducted in Taiwan, Saudi Arabia, and Thailand, separately.

Discussion

Research question 1: How are theory and framework used to integrate social media into foreign language learning and how have these been developed?

Result reveals that large amounts of different theories and frameworks have been utilized for different purposes to assist with the integration and utilization of social media in foreign language learning. For example, TAM was used to predict a students' attitudes towards the ease of use and usefulness of using social media in foreign language learning, while social constructivist theory was used to understand students' online interactions and collaborations. Empirical evidence found that social media had the potential to improve students' writing skills, especially grammar and writing fluency (Kitchakarn, 2016). Dizon (2016) reported that students made significant improvement on writing fluency when Facebook was introduced in class. If TOEFL score could be considered as learning performance as reported by Akbari, Pilot, and Simons (2015), Akbari, Naderi, Simons, and Pilot (2016), and Khoshnoud and Karbalaei (2014), we could also make the case that social media, especially Facebook, could improve a student's learning performance.

The utilization of social media was found to have contextual features (Derakhshan, & Hasanabbasi, 2015; Richards, 2015). The use of social media is different and depends on the context. It seems that there was a relationship between the choice of social media tools and the context of using those tools. The analysis also revealed that theoretical development was quite slow in foreign language learning supported by social media. Theoretical understanding of these frameworks and interpretation for subsequent application relied heavily on theories from other disciplines, such as social constructivist theory. However, the borrowed theories may not be not sufficient and appropriate to understand the unique characteristics of the foreign language learning process in social media settings. For example, Akbari, Naderi, Simons, and Pilot (2016) utilized self-determination theory in the study and TOEFL score was examined to determine the

effectiveness of Facebook. Social media environments require foreign language learners to not only remember the language codes but also utilize those codes immediately to make sense of people's behaviors, interpret the symbols, and understand the culture. However, self-determination is a theory of motivation and is concerned with people's inherent growth; it is insufficient to understand the foreign language learning process and conclude that social media is effective in improving foreign language learning performance. Unfortunately, theories or frameworks regarding the foreign language learning process are scarce in literature.

Research question 2: What empirical evidence of the effectiveness of social media in foreign language learning is found in research?

The analysis reveals that the effectiveness of social media in learning depended on the characteristics of the tools chosen and the instructional goals as shown in Liu, Abe, Cao, Liu, Ok, Park, Parrish and Sardegna's (2015) study. Most social media, such as Facebook and Twitter, are text-based tools that require users to make written posts (Dogoriti, Pange, & Anderson, 2014). Students could develop writing skills through making their own posts and reading other students' posts. Few studies have carefully considered the characteristics of the tools and how these tools' characteristics could be utilized to achieve the instructional goals. This may be the reason that why much empirical evidence was only found in English writing, not in the areas of speaking, listening, and reading. Although empirical evidence was found in writing skills, it cannot be generalized that social media was effective in improving foreign language learning and specifically, it cannot be generalized to other areas of speaking, reading, and listening. For future research the effectiveness of social media in reading, speaking, and listening needs further investigation.

Research questions 3: How have the cultural aspects of countries that use the language have been addressed in literature?

Regarding the culture in foreign language learning, although the link between culture and foreign language learning has been widely recognized, the roles of culture have rarely been addressed in the studies focusing on social media supporting foreign language learning. However, there are theoretical discussions in literature that support the potential of social media in the area of functional and cognitive perspectives of the culture. Hasan, Rashid, Yunus, Mohamed, and Zulkifli, (2016) advocated that sociocultural theory could be used as a framework to understand how social media facilitated students to make sense of people's behaviors in another culture. They explained that sociocultural theory emphasized the social and cultural impact on human behaviors and social media was found to provide an environment to understand those social and cultural impacts through social interaction and collaboration. In Saaty's (2015) study, social constructivist theory and affective filter hypothesis were discussed, suggesting that social media could reduce students' risk-taking and enhance motivations and sense-makings of personal experiences, histories, and beliefs through meaningful interactions. However, empirical evidence was insufficient in demonstrating the effectiveness of social media in supporting the functional and cognitive perspectives. Although effectiveness of social media was found in EFL writing and TOEFL scores as shown in Table 2, behavioral and symbolic perspectives of culture were not found in those studies if the details of the exams were investigated. For example, Ahmed (2015), Dizon (2016), and Wang and Chen (2013) examined students' writing but the details of those writing tasks were not included. Thus, we could not determine whether cultural perspectives were considered; consequently, the studies could not be considered as evidence to support the notion. The same issue was found in the Singman's (2012) and Kitchakarn's (2016) studies, which examined students' grammar but details of the grammar exams were absent.

In terms of behavioral and symbolic perspectives of culture, neither theoretical discussions nor empirical studies were found in literature. The possible explanation is the absence of learning activities' details in the studies. Thus, it is difficult to determine if researchers have considered behavioral and symbolic perspectives or not. However, the research team for this study believes that these two perspectives have been addressed to some extent in the studies. In addition, Kitchakarn (2016) mentioned that the instructor gave students the writing topics. Therefore, some of the writing topics may have contained the task of describing the reasons of some patterned behaviors or cultural products, such as artistic achievement. A further instructional content analysis is required to determine behavioral and symbolic perspectives of culture in social media supported foreign language learning.

Summary

In summary, research of social media in foreign language is still in infancy stage and the effectiveness of using social media to improve foreign language learning is not as positive as expected by the authors. Although this article only considered foreign learning performance in empirical studies, it was noticed that positive findings are reported in other areas, such as motivation, engagement, interaction, and collaboration. However, in terms of performance, positive finding in foreign language learning was only found in EFL writing.

This contradicting finding may be attributed to the low transformation rate between foreign language learning performance and motivation, engagement, interaction, and collaboration. It has been demonstrated that there is positive relationship between foreign learning performance and motivation, engagement, interaction, and collaboration (Kitchakarn, 2016). However, how much motivation, engagement, interaction, and collaboration can be transformed to learning performance is uncertain. Based on the studies we have reviewed in this article, it seems that the transformation rate from increased motivation, engagement, interaction, and collaboration to learning performance is quite low. Although students are motivated and highly engaged in social media supported foreign language learning environment, effectiveness was only found in EFL writing because most social media are written communication tools and interaction and collaboration occur in written form. It provides more opportunity for students to observe and practice writing, which has improved student's writing performance.

Conclusion

Although culture does have impact on the choice of social media tools and the subsequent effectiveness of social media in foreign language learning, the main goal remains the same. That is, empowering students with the abilities to communicate with people in other contexts and understand the world from different perspectives through improving students foreign language learning skills, including reading, writing, listening, and speaking. This review has raised some questions that need more research. For example, does social media's presence in foreign language learning classrooms indicate that students are using different ways to construct foreign language in the context of social media? Does the emerging empirical evidence from literature across different cultures confirm the fundamental change of foreign language learning process? More theoretical and and empirical explorations are needed to answer these questions.

Thus, future research can be directed to (a) explore theories and frameworks that developed specifially for integrating social media into foreign language learning, (b) conduct

more rigorous qualitative studies to explore the foreign language learning process, (c) explore the effectiveness of social media in other areas of foreign language learning performance, especially in speaking, listening, and reading, (d) switch the research interest from examining students' attitudes, engagements, and motivations to understanding foreign language learning process in social media environments and appropriateness of characteristics of social media in supporting the learning process, and (e) understand the digital culture in social media environments and whether exposing foreign language students to the social media environments will enhance their understandings and interpretations of the "true" culture.

In addition, potential international collaboration opportunities are provided in this article to help foreign language educators better support students' learning needs. First, international partners are called to notice the importance of using social media in foreign language learning, along with cultural concern. Second, the lack of theoretical and empirical studies on using social media in foreign language learning needs the world's attention. Last, but not the least, Social media helps students break the geographic boundaries in foreign language learning. We encourage instructors, teachers, scholars worldwide to work together to build an integrated foreign language learning environment via social media, in order to provide a place where our students could have a better access to the foreign language, to the culture of the foreign language, and to the people who speak the language.

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