Rethinking Education: An In-Depth Examination of Modern Technologies and Pedagogic Recommendations

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Abstract

Educational technology has changed the teaching and learning process in many ways. As teachers needed new strategies to adapt to emerging technology tools and to interact with students, immediate feedback and digital instructional resources had become the norm. Teaching and learning expectations are growing because of technological improvements. Many digital libraries and online resources are now easily accessible to teachers and students. Therefore, a qualified teacher must be aware of the new teaching requirements and the adjustments related to educational technology trends. Additionally, it is important to adopt a Technological Pedagogical Content Knowledge (TPCK) framework and to clarify how teachers and students can collaborate to achieve learning outcomes through updated educational practices. This collaborative education can occur because technology makes it easier for students and teachers to interact together, despite the physical distance that could separate them. This paper emphasizes the optimum use of educational technologies and the potential of new digital tools that have already been exploited in an unprecedented way. It aims to provide a comprehensive review of current technologies with pedagogic recommendations, to highlight the importance of educational technologies in teaching, and to reconsider strategies for acquiring digital skills in the Artificial Intelligence era. The discussion revolves around identifying and depicting various advanced educational technologies that can be integrated with engaging pedagogical approaches. Furthermore, it explains how each technology can enhance the learning experience, emphasizing the teacher's role in the technology-based educational process.

Keywords: active/interactive learning, education, student-centred approach, teaching strategies, technology, technology-based education

The teaching and learning process is currently undergoing adjustments. How students learn and how knowledge is transmitted globally have both been significantly impacted by the pace at which technological innovations can bring about changes in pedagogy. The use of new and developing technologies is creating challenges to both the traditional approaches to education and instruction as well as the structure of the educational system. Despite the substantial influence of information technology on educational studies and developments, instant access to a wide range of data makes it challenging to assess information. Therefore, modern technology provides a wide range of tools for improving education in the digital age. The adoption of audiovisual instructional devices by teachers is currently recommended, and the variety of educational materials is always growing.

This paper aims to explore the integration of technology in K-12 classroom setting through the lens of Technological Pedagogical Content Knowledge (TPCK). The primary focus is on how technology can be harnessed to support a student-centered learning environment. By examining the intersection of technology, pedagogy, and CK within the TPCK framework, this study elucidates how educators can effectively leverage technology to create engaging learning experiences that prioritize the specific needs of students. The rationale behind this focus lies in the significance of nurturing a technologically enriched learning environment that not only caters to students' diverse learning styles but also prepares them to thrive in an increasingly digital and interconnected world. Emphasizing the K-12 setting within the TCPK framework is crucial as it provides a targeted and tailored approach to address the unique challenges and opportunities present in primary and secondary education. Ultimately, this exploration aims to empower educators with the knowledge and strategies needed to use technology's potential effectively and create impactful educational experiences for students.

Many studies have been conducted on education and technology, specifically after the COVID-19 pandemic due to the huge shift of education to online learning. However, technology in education has always been an area of discussion and exploration. In a study published in 2003, Linn argues that there appears to be no end in sight for the number of technological tools that are being invented. They have also altered the method in which we interact with one another and how we perceive the environment. In another study, Oliver (2005) demonstrates how the integration of digital technology into educational settings has resulted in positive shifts and developments in today's educational environment. Alkhamisi and Monowar (2013) reveal how augmented reality enhances one's view of the real world by superimposing digitally generated visual, audio, or other sensory information. They reckon that technology can help students better capture their ideas, which will ultimately improve their educational qualifications, and that the scope of its influence has a positive impact on the ways in which students learn and collaborate with their instructors. Turgut and Aslan (2021) discuss that there are now more opportunities for the dissemination of learning material and for gaining access to it because of the proliferation of new communication channels brought about by the internet.

Many of the previous studies highlighted the importance of using technological tools as a means of delivering information in the teaching and learning process. This integration of technology into education falls within the realm of TPCK, which emphasizes the critical

interplay between technological, pedagogical, and content knowledge. However, there is a research gap in the literature in studies highlighting the importance of applying different pedagogical approaches centered on the learner using technology and informed by TPCK. Therefore, our discussion focuses on the different pedagogical approaches infused with TPCK that can be used in combination with educational technologies, and how each approach can be used to enhance the learning experience and improve student learning outcomes. We will start our discussion with a theoretical framework about TPCK and a review of the literature, then we will discuss the importance and ways of using technology in teaching strategies as well as the importance of the teacher's role in technology-based education. We will conclude our study by highlighting the role of technology in enhancing a student-centered learning environment and by providing recommendations for future studies.

Theoretical Framework

TPCK is a theoretical framework that intricately weaves three vital components in education: technology, pedagogy, and content knowledge (CK) (Mishra and Koehler, 2006). TPCK emphasizes integrating technology to enrich teaching and learning experiences significantly.

The TPCK framework comprises seven factors, each defining a specific aspect of teacher knowledge for effective technology integration. These components include technology knowledge (TK), referring to knowledge about various technologies; CK, which involves understanding the subject matter to be taught; pedagogical knowledge (PK), encompassing teaching methods and processes; pedagogical content knowledge (PCK), blending content and pedagogy for better teaching practices; technological content knowledge (TCK), understanding how technology can create new representations for content; technological pedagogical knowledge (TPK), knowledge of using technology in teaching; and technological pedagogical content knowledge (TPACK), the integration of technology in any content area.

The TPCK framework emphasizes the importance of teachers having a deep understanding of the interplay between content, pedagogy, and technology to enhance student learning effectively. This understanding serves as a foundation to devise context-specific strategies and representations tailored to individual circumstances. For technology integration to be productive in teaching, it must holistically address the three key elements, recognizing their interdependent relationships within the system (Mishra and Koehler, 2006). Educators with well-developed TPCK can select appropriate technology aligned with learning goals, design engaging lessons that promote active learning and critical thinking, cater to diverse student needs, facilitate assessment and feedback through technology, and foster 21st-century skills such as creativity and collaboration.

This paper presents a comprehensive examination of technology and its role in successful teaching and learning. The discussion provides insights into the development of TPCK through continuous professional development, fostering a growth mindset, and implementing various strategies. Specifically, it offers practical tips on how each technological tool can be effectively utilized in the teaching process to enhance student engagement, improve learning outcomes,

and create personalized and differentiated learning experiences. The focus is to empower educators to leverage TPCK to establish engaging, student-centered learning environments that foster academic success and nurture essential 21st-century skills.

Literature Review

Learning may now be achieved rapidly, and all individuals can receive education in the age of digital technology, which also coincides with the new era of multimedia tools and web networks. The quality of education is supported by new technologies, and more people are given opportunities to learn. Sharing information and enhancing one's ability to communicate are two key aspects of education. Students are more likely to work well together and develop excellent communication skills when they have access to technology. Online collaboration between teachers and students allows for the completion of any project or task. In educational broadcasting, for instance, the utilization of technological instruments as well as recording systems based on computer technology are all important factors. Learners who are unable to attend classes have a better chance of accessing education using distance learning. "The Internet of Things (IoT) is proven to be one of the most cost-effective methods of educating young brains. It is also a robust mechanism for integrating a world-class learning experience for everybody." (Haleem et al., 2022, p. 275) This is certainly relevant for individuals who are home schooled.

In a review of the literature from 1996 through 2008, Means et al. (2010) reported that students in online learning conditions generally performed moderately better than those receiving face-to-face teaching. However, despite this advantage, Mishra and Koehler (2006) argued that simply adopting technology in pedagogical approaches is not enough; rather, they stressed the necessity of developing TPCK, a complex, situated form of knowledge that intertwines content, pedagogy, and TK. While TPCK holds promise, the study published in 2009 recognized the complexity of teaching and the challenges posed by technology integration, indicating the need for a nuanced understanding of the interplay between these domains. Voogt et al. (2013) conducted a systematic literature review, unveiling diverse interpretations of TPCK and technological knowledge, raising concerns about its measurement and emphasizing the importance of subject-specific TPCK understandings. Moreover, Herrington and Kervin (2007) cautioned against ad hoc technology integration, advocating for teachers to adopt technology as cognitive tools to empower students in authentic learning experiences. Nonetheless, the role of teachers remains crucial in providing clear purpose and support for technological integration. The same idea has been explored by Hew and Cheung (2013) in a study emphasizing that the positive effects of Web 2.0 technologies are not solely attributed to the technologies themselves but rather to how they are utilized and conceptualized in the learning process. Meanwhile, Bower et al. (2015) stressed the importance of designing rich-media synchronous technologies for active learning in face-to-face instructions, highlighting considerations of communicative requirements and cognitive load. However, Alharthi's study in 2021 revealed university students' difficulties in using technological tools and emphasized the need for training before taking online courses. Furthermore, the study highlighted the limited use of diverse online activities in university courses, warranting a comprehensive

approach to technology integration in education. While highlighting the widespread acceptance of technology in education, Akram et al. (2022) also identified numerous barriers to effective technology integration, necessitating solutions to resource constraints, lack of leadership support, inadequate infrastructure, and other challenges.

From the above-mentioned examples, the existing literature on technology integration in education primarily focuses on examining the limitations of technology in the classroom. Moreover, numerous studies have concentrated on the shift to online learning, utilizing technology primarily as a means of communication between teachers and students. However, there is a noticeable gap in the literature regarding the necessity of transforming the educational paradigm to keep pace with technological advancements in the context of TPCK. This limited perspective fails to explore the full potential of technological tools beyond communication and their integration within TPCK's dynamic framework. To address this gap, it is crucial to investigate adapted teaching strategies that harness the potential of technology to actively engage students in the learning process while aligning with TPCK principles. In response to this need, our present research sheds light on teaching strategies that effectively incorporate technological tools within the TPCK framework to create and sustain student-centered learning environments.

By conducting this study with a focus on K-12 students and educators, we aim to bridge the gap in the literature and emphasize the integration of technology within TPCK. Our goal is to contribute significantly to the development of effective and forward-looking educational practices that harness technology's transformative power to its fullest extent in the K-12 classroom setting. Through this approach, we strive to empower educators with insights and strategies that can effectively create student-centered, technology-enhanced learning environments for K-12 students, fostering their active participation and success in the educational process.

Engaging Teaching Strategies Using Technology

Engaging teaching strategies start with designing the classroom having the students in mind. The active/interactive learning strategy encourages students to discuss, participate, investigate, and create. It challenges them by questioning them, requiring problem-solving and critical thinking. Adopting this strategy starts by shifting from the traditional classroom setting to the roundtable classroom setting. The latter encourages interactive learning, face-to-face accountability, and verbal immediacy (Parsons, 2017). In addition, active/interactive learning increases the students' CK (see Menekse et al., 2013) and contributes to co-inferring new information with the help of input from one's learning partners enabling students to co-create knowledge (see Chi and Wylie, 2014). While changing the classroom setting can provide a conducive environment for active/interactive learning and a student-centered approach, it is not enough on its own. The success of active and interactive learning largely depends on the instructional strategies and techniques used by the teacher. The teacher needs to use pedagogical approaches that encourage inquiry-based learning, critical thinking, and problem-solving skills. Additionally, integrating technology and multimedia resources into the learning

process enhances active/interactive learning and promotes student-centeredness within the context of TPCK. Therefore, a combination of classroom design, instructional strategies, and technological tools helps create a more engaging and student-centered learning environment. We will focus on the use of active/interactive teaching strategies in the K-12 classroom and the adapted technological tools that further enhance students' engagement.

Brainstorming

Brainstorming is a commonly used technique in education where a group of students work together to generate and share ideas related to a particular topic or problem. The primary goal of brainstorming is to encourage creativity and critical thinking by allowing students to freely express their thoughts and ideas without fear of judgment or criticism. During a brainstorming session, the teacher can collect students' ideas and facilitate a discussion that encourages students to share and respond to each other's ideas. This helps create an open and inclusive learning environment where students can learn from each other and build on their collective knowledge. Moreover, brainstorming allows the teacher to assess the students' prior knowledge and understanding of a topic. By gathering information about what students already know, the teacher can tailor the instruction to meet the needs of individual learners and provide input on what they do not know. Brainstorming can be conducted in various formats, such as verbal discussions, written notes, or using technological tools such as Tricider, AnswerGarden, or MindMeister. When using Tricider[1], the teacher creates a board and invites students to submit their ideas on a topic or problem. The board can be shared with the whole class, and everyone can see and vote on each other's ideas. The teacher can also use the voting feature, which allows students to vote on the most important or relevant ideas. Once the brainstorming session is complete, the teacher can use Tricider to facilitate a discussion on the ideas generated. Students can comment on each other's ideas, and the teacher can provide feedback and guidance. AnswerGarden[2] is another tool that could be used in this teaching strategy. The teacher creates a simple questionnaire and asks students to add words they know related to the topic. These words are displayed on the teacher's board as they are added in the form of a word cloud. The size of each answer in the word cloud depends on how frequently it has been submitted by the students. This makes it easy for the teacher to quickly identify the most common responses and themes. MindMeister[3] is also a tool that could be used for brainstorming, and to organize ideas into themes. The teacher creates a mind map of a topic and asks students to join it and contribute their ideas. Moreover, the teacher can use the voting feature to have students vote on the most important or relevant ideas. This contributes to narrowing down the focus and identifying the most important points for further discussion. Once the brainstorming session is complete, the teacher presents the mind map to the class to summarize the ideas generated during the session. This helps students understand the thinking process behind the ideas and provides a visual representation of the brainstorming session.

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[1] Tricider: https://www.tricider.com/
[2] AnswerGarden: https://answergarden.ch/
[3] MindMeister: https://www.mindmeister.com/

Regardless of the format, the key to successful brainstorming is to create a safe and supportive environment that encourages open and honest communication among students.

Flipped Classroom

The flipped classroom approach involves providing students with access to online video lectures or tutorials before the in-class sessions. This allows students to engage in interactive and collaborative activities, such as debates, problem-solving activities, and discussions. In the classroom, the teacher acts as a facilitator and observes the students' performance, providing individual or group feedback, as needed. The flipped classroom model enhances students' learning experiences by allowing them to engage with the material at their own pace and encouraging them to take an active role in their learning. Additionally, it allows teachers to use classroom time more efficiently and effectively, as they can focus on providing personalized support and guidance to their students (See Loizou, 2022). The technological tools that can be used in this teaching strategy include video creation and sharing tools. These tools can be used to create and share pre-recorded lectures, tutorials, or other instructional videos that students can watch before the classroom session. The most common video creation tools are Camtasia and Adobe Premiere Rush. With Camtasia[1], the teacher can record the computer screen, webcam, and audio simultaneously, allowing the creation video tutorials and demos that show exactly how to complete a task. In addition to recording and editing videos, Camtasia also offers features for sharing and publishing the generated product. The teacher can export the videos in various formats, including MP4, WMV, AVI, and MOV, and share them on YouTube, or other online platforms. Adobe Premiere Rush[2] allows teachers to create and edit high-quality videos. It also includes features such as trimming and splitting clips, adding text overlays and graphics, and creating customized titles and transitions, as well as adding motion graphics and animations. Moreover, this tool includes integration into popular social media platforms such as YouTube, Instagram, and Facebook, making it easy to export videos in the correct format and aspect ratio. Other technological tools used for flipped classroom include online discussion and collaboration tools, such as Flipgrid[3]. The latter is a video-based social learning platform that allows teachers and students to create and share short video responses to prompts or questions. With Flipgrid, the teacher can create a "Grid", which is a collection of topics for discussion or prompts for students to respond to using video. Students can then create video responses to these prompts and respond to their classmates' videos. Subsequently, the teacher provides feedback and assessments on the student videos. Furthermore, students can record and edit their videos using a range of editing tools, including filters, emojis, and text annotations. Flipgrid integrates with other educational tools such as Microsoft Teams, Google Classroom, and Canvas, making it easy to incorporate into existing workflows.

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[1] Camtasia: https://www.techsmith.com/video-editor.html
[2] Adobe Premiere Rush: https://filmora.wondershare.net/alternative-adobe.html
[3] Flipgrid: https://info.flip.com/en-us/blog/product-updates/flipgrid-updates-timeline.html

Inquiry-Based Learning

Inquiry-based learning is an approach that focuses on developing students' problem-solving skills by engaging them in an active and collaborative learning process. In this approach, the teacher plays the role of a facilitator rather than a lecturer. He/she poses questions, situations, and problems that require students to think critically and find solutions. Students are then encouraged to research these topics individually or in groups, using various resources such as books, articles, and websites, to formulate their answers. This research process not only helps students develop their understanding of the topic, but also enables them to practice essential research and information literacy skills. After conducting their research, students present their findings and supporting evidence to the class. This presentation allows them to further develop their answers by listening to what their peers have found, identifying areas that require more attention, and refining their arguments. This also promotes collaboration and teamwork among students, which is essential in today's workforce. Moodle[1], a virtual learning environment, can be used as a tool to support inquiry-based learning strategies. The teacher creates a repository of learning materials such as videos, articles, and case studies that students can access anytime and anywhere. This helps students engage in self-directed learning and explore the topic they are researching. Moodle also provides various tools for collaboration such as discussion forums, wikis, and chat rooms. Moreover, the teacher can create groups and assign group projects, which promotes teamwork and helps students develop important skills such as communication, delegation, and negotiation. This platform also allows teachers to monitor student progress, provide feedback, and assess their learning. The feedback helps students understand their strengths and weaknesses and provides guidance on how to improve their work.

Google Workspace[2] (formerly Google Suite) is another tool that could be used in inquiry-based learning. Students can collaborate, share ideas, and receive feedback in real-time, which enhances their learning experience and improves their critical thinking skills. The tools available in Google Suite can help streamline the inquiry-based learning process and make it more efficient and effective. On the one hand, students can use Google Docs to collaboratively write and edit documents related to their research and inquiry questions. They can also share their documents with their peers and teachers for feedback and suggestions. Students can also use Google Slides to collaboratively create presentations and share their findings and solutions to problems they have investigated. They can also use Google Drive to store and organize their research and inquiry materials, such as articles, videos, and images. On the other hand, teachers can create through Google Forms surveys and quizzes to collect feedback from students on their understanding of a particular topic or to assess their progress in their inquiry-based learning journey. They can also use Google Classroom to create a virtual learning environment where they can share resources, assign tasks, and provide feedback to students. ThingLink[3] is another tool that can be utilized to facilitate engaging and interactive inquiry-based learning

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[1] Moodle: https://moodle.org/
[2] Google Workspace: https://workspace.google.com/business/
[3] ThingLink: https://www.thinglink.com/

experiences for students. By using ThingLink, teachers design interactive images, videos, historical events, scientific experiments, and presentations that students can explore and discover on their own, enabling them to gain a deeper understanding of a wide range of topics. Additionally, teachers can leverage ThingLink to create interactive presentations that encourage collaboration among students. They can invite their peers to add their own information, links, and videos to these presentations, thereby facilitating peer-to-peer learning. By designing interactive images and videos that provide different learning styles and abilities, teachers can ensure that all students have access to the same learning opportunities. For example, by providing links to different types of resources such as text, audio, or video, teachers can accommodate different learning styles and abilities. Nearpod[1] can also support inquiry-based learning as teachers can use its interactive features to design engaging presentations and activities that motivate students to investigate, examine and learn about various topics. Before initiating the inquiry process, teachers can utilize Nearpod to evaluate students' preexisting knowledge and comprehension of a given topic. They can also create interactive lessons that allow students to explore and examine a topic, and work collaboratively to share their discoveries and insights with each other. Furthermore, through Nearpod, teachers can provide students with multimedia materials such as images, videos, and audio files to improve their research and inquiry.

Open-Ended Questions

The technique of using open-ended questions promotes lively class discussions and helps improve students' communication skills. By posing open-ended questions, the teacher prompts students to connect various pieces of information they have acquired or encountered in their lives, enabling them to link related ideas. This approach not only encourages students to express their own views but also allows them to find their own voice. Seesaw[2] is a digital portfolio tool that can be effectively utilized for open-ended questioning in the classroom. By using Seesaw, teachers can present open-ended questions to students and encourage them to respond in various formats, including written responses, audio recordings, and videos. Students can use Seesaw to share their work and ideas with their peers, creating an environment that encourages collaboration. Furthermore, Seesaw's feedback and commenting features provide opportunities for ongoing discussions, promoting critical thinking and reflection among students. Additionally, teachers can use Seesaw to offer personalized feedback to students on their open-ended responses, supporting them in further enhancing their communication and critical thinking abilities. Poll Everywhere[3] is another tool that can facilitate open-ended questions effectively. It allows teachers to ask questions and receive instant responses from their students. Using Poll Everywhere, students can respond anonymously, which can encourage them to express their thoughts and ideas more honestly. Teachers can display the responses in real-time, stimulating class discussions and encouraging students to share their

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[1] Nearpod: https://nearpod.com/
[2] Seesaw: https://web.seesaw.me/
[3] Poll Everywhere: https://www.polleverywhere.com/

opinions. Furthermore, Poll Everywhere enables students to respond with multimedia such as images and videos, providing a platform for creative thinking and self-expression.

Peer and Self-Feedback

Developing the ability to offer and accept constructive feedback is an important aspect of students' learning. Peer feedback plays a crucial role in enabling students to evaluate and assess each other's work, helping them gain insights into the quality of their own work and develop evaluative judgement and self-regulated learning skills (Nicol, 2010). Digital tools such as Canvas Pages, Google Docs, and Peergrade can facilitate peer feedback. Canvas Pages[1] can be utilized for peer feedback in several ways. The teacher can assign group assessments and create a separate Canvas Page for each group to collaborate on. By utilizing the commenting feature, each group can offer feedback on each other's work uploaded on the Canvas Page. Moreover, students can create their ePortfolios on Canvas Pages to share their work and receive constructive feedback from their peers. Canvas Pages allow for multimedia elements like videos, images, and links, which provide students with a variety of options to enhance their feedback. Additionally, Canvas Pages maintains a revision history, enabling students to keep track of their progress over time and make revisions based on the feedback received. Google Docs[2] is a collaborative writing tool that can facilitate peer feedback within a classroom setting. By assigning group writing projects, teachers can encourage students to share feedback and work together in creating a shared document using Google Docs. For peer editing purposes, teachers can pair up students and encourage them to use the commenting and suggesting features in Google Docs to provide feedback and make necessary changes to their peer's writing. Students can also create writing portfolios using Google Docs, which allows them to display their work and receive feedback from their peers. With Google Docs, students can track the revision history of their work, which gives them an opportunity to analyze their progress and make improvements to their writing skills accordingly. Peergrade[3] is an online platform that focuses on peer feedback and evaluation. With Peergrade, teachers can create assignments and rubrics that are distributed to students, who can then submit their work through the platform for peer review. Peergrade ensures that each student receives multiple reviews from his/her peers by assigning grades based on the teacher's rubrics. Anonymous feedback is available in Peergrade, encouraging students to be more honest and constructive. Peergrade reports allow teachers to identify areas for improvement as they monitor the feedback process and view the comments and grades assigned by students.

In addition to peer feedback, self-feedback is also valuable for students as it helps them in their self-regulation and critical self-reflection, which are essential for achieving success (Ryan, 2020). By engaging in self-feedback, students can identify their strengths and weaknesses, set goals, and make necessary improvements to their work. Self-feedback helps students become more self-aware, reflective, and proactive in their learning process. Teachers can facilitate this

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[1] Canvas Pages: https://www.canva.com/
[2] Google Docs: https://www.google.com/docs/about/
[3] Peergrade: https://www.peergrade.io/

process by providing students with clear and specific criteria or rubrics to evaluate their work, using rubrics to provide students with a framework for self-assessment and help them understand the expectations for their work. Using digital tools such as ePortfolios, students can create a personalized space to upload their work, provide self-assessment and reflection, and receive feedback from their teachers and peers. Platforms for creating ePortfolios include Google Sites[1], Weebly[2], and WordPress[3]. Through self-feedback, students gain a deeper understanding of their own learning process, develop self-regulatory skills, and become proactive learners.

Peer Learning

According to Havnes et al. (2016), peer learning can offer several advantages to students, such as enhancing time management, communication, and study skills, encouraging creative and critical thinking, promoting psychological well-being, increasing academic aspirations and expectations, and fostering lifelong learning. To implement this teaching strategy, the teacher can group students and provide them with different pieces of information related to the subject. Each group learns and comprehends the information to explain it to other groups. The process is repeated until every group has a complete understanding of the subject matter. Alternatively, students can select an area of interest within the subject matter and conduct independent research on it. They can then create a PowerPoint presentation to present to the class, which can encourage information sharing and group discussion. Quizlet[4] is an effective digital tool that enhances the learning experience through peer collaboration. This online platform allows students to create digital flashcards, which can be used to test their knowledge and shared with their peers, enabling them to actively participate in the learning process and reinforce their understanding. In addition to flashcards, Quizlet provides several other features that support peer learning. For example, it offers various study modes such as games, quizzes, and audio materials that are aligned with different learning styles, allowing students to engage with the material in diverse ways. This aspect promotes mutual learning and allows students to benefit from the diverse insights and perspectives of their peers.

Project-based learning (PBL)

Project-based learning (PBL) is an instructional approach that offers students a hands-on, real-world learning experience. The teacher proposes a project, and students work together to analyze, research, and develop an action plan to address the given problem. PBL encourages students to engage with the subject matter actively and apply what they have learned to their project. This learning strategy fosters the development of critical thinking, problem-solving, and decision-making skills. The teacher takes on the role of a guide and mentor, supporting students throughout the learning experience. Through PBL, students become more self-directed in their learning, taking ownership of their project, and making decisions about their

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[1] Google Sites: https://workspace.google.com/intl/en/lp/sites/
[2] Weebly: https://www.weebly.com/
[3] WordPress: https://wordpress.com/
[4] Quizlet: https://quizlet.com/

work. This approach also promotes the development of social and emotional skills, such as collaboration and effective communication. Glogster[1] is a tool that could be used in this learning strategy. Students can create glogs to showcase research findings or create visual portfolios of their work, using various media types and external hyperlinks. Collaborative projects are also possible, with students working together to create glogs that represent different aspects of a larger topic. Another tool that could be used in PBL is Edorble[2]. With this platform, students can create their 3D virtual classrooms and interact with various digital resources. For example, in a science class, students can generate their virtual worlds based on a particular topic such as designing a virtual ecosystem that highlights the interdependence of different species. They can populate the ecosystem with various species and create interactive elements that provide more information about their relationships, helping them develop a deeper understanding of the subject matter.

Although technology tools have revolutionized teaching and learning methods, just providing teachers with these tools is insufficient. For technology to have a significant influence on education, it is necessary to train teachers to use them properly. The absence of proper training could lead to difficulties in integrating technology into teaching, which may negatively impact the learning and engagement of students. Hence, it is imperative for educational institutions and schools to emphasize teacher training programs that provide the essential skills and knowledge to use technology tools effectively in the classroom. That being said, it is important to emphasize the crucial role of teachers in technology-based education.

Importance of Teacher's Role in Technology-Based Education

The advancement in education and the enhancement of teaching and learning techniques can greatly contribute to the improvement of students' academic performance, especially in the K-12 setting. However, the evolution of education also presents challenges for K-12 teachers regarding the implementation of new teaching theories and methods. As education continues to evolve, teachers are expected to take on new roles as leaders and facilitators for students, moving away from traditional teaching techniques to become more actively involved in their students' learning process. By adopting this approach in the K-12 setting, teachers will be better equipped to identify their students' interests, encourage their enthusiasm for learning, and develop their critical thinking skills and intellectual curiosity (Kelly and McAnear, 2002). In other words, the transformation in education offers an opportunity for teachers to shift from the traditional role of being just transmitters of knowledge to becoming facilitators of learning. This means that they will not only deliver knowledge but also provide students with a conducive environment to learn actively and independently. Therefore, teachers will better understand their students' individual needs and interests, making learning more engaging and relevant to their lives.

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[1] Glogster: https://edu.glogster.com/
[2] Edorble: https://www.edorble.com/

Although technology has transformed the teaching and learning process, it cannot replace the teacher. In a technology-based and student-centered learning environment, teachers are more than just instructors: they are instructional designers, trainers, and mentors. As instructional designers, teachers plan and organize their classrooms to effectively integrate technology into their curriculum and create well-designed activities to meet the individual needs of their students. They also act as trainers, showing students how to use software tools to accomplish learning tasks. Additionally, they act as team coordinators, creating opportunities for collaborative and social learning activities, peer tutoring, and support among students with varying abilities. As enabling mentors, they offer advice and ask questions to help students find the information they need to complete tasks. They work with students to create a learning environment that is engaging and challenging, using technology to enhance learning and providing support and guidance throughout the process. They create a safe and supportive environment that encourages students to take risks and learn from their mistakes. Through their multiple roles, teachers enable students to become active and independent learners, capable of applying the knowledge and skills they acquire to real-world situations. Eventually, technology is a tool that teachers can use to enhance the learning process, but it is the teacher who plays a crucial role in guiding and supporting students' growth and success.

Therefore, while incorporating educational technology to enhance student learning, teachers must shift their perspectives on teaching and learning and be open to new responsibilities. To effectively address technology challenges and facilitate teaching and learning, they must be willing to learn new skills (Zhu et al., 2010). One such skill is developing computer proficiency to maximize the benefits of interactive and engaging technologies in education and create positive interactions with their students. Nevertheless, for teachers to become proficient and effective users of technology, they require tailored resources, updated training programs, ongoing support, and flexibility (Roschelle et al., 2005). This is essential if they are expected to perform their duties as learning facilitators, especially when integrating technology in the K-12 classroom setting. The purpose of education is to empower rather than to provide knowledge, as Nuyen (1995) succinctly explains. There is now a need to find educators who can both provide knowledge and spark students' creativity, so teachers are required to have a deep understanding of how each student learns and the abilities to adapt the learning systems (Volman, 2005). Educational technologies are practical tools that facilitate teachers' tasks. Nevertheless, rather than being easier, the instructors' responsibility will get more challenging as they need to design various pedagogical approaches, gather educational materials, and organize them in a systematic methodology.

Furthermore, developing TPCK requires continuous professional development, a growth mindset, and various strategies, including attending technology integration workshops, engaging in collaborative learning communities, practicing reflection, and designing technology-integrated lesson plans. By aligning their teaching practices with TPCK principals in the K-12 setting, teachers can leverage technology effectively and create dynamic learning environments that foster active student engagement and meaningful learning experiences. Continuous re-evaluation of teacher education practices is needed to propose new strategies that effectively facilitate technology integration in the classroom.

Conclusion

Technology-based education enables K-12 students to access, analyse, manage, synthesize, evaluate, create, and share information in a variety of forms and media that incorporate a global perspective (McNeil, 2015). This integration of technology and its various applications aligns with the concept of TPCK, which underscores the importance of educators possessing a deep understanding of how technology, pedagogy, and content intersect. It also reinforces a student-centred learning environment that contributes to enhance the students' competencies in creativity, communication, collaboration, digital literacy, critical thinking, and problem solving, all of which are central components of TPCK. Therefore, schools are responsible not only for integrating technology into the curriculum but also for doing so in a way that synergizes pedagogical approaches with technology tools while considering the principles of TPCK.

Advancing technology-based education and integrating technology tools into the teaching and learning process is crucial in achieving this goal of comprehensive student development. This integration, when approached with an awareness of TPCK, empowers educators to design learning experiences that holistically nurture students' abilities. By investing in these areas, schools not only enhance student learning outcomes but also equip educators with the necessary skills and resources to effectively engage students and foster their growth as autonomous lifelong learners. Ultimately, investing in technology-based education becomes an investment in the future success of students, preparing them not only for their future careers but also for the challenges and opportunities they will encounter in higher education and university settings.

Furthermore, additional research studies are needed to address two key areas in education. The first area is designing innovative teaching strategies to address the challenges that students face in a rapidly changing world. Teachers need to adopt creative approaches to instruction to prepare students for their future careers. The second area is the integration of technology into the curriculum to promote student-centred learning and develop critical thinking, problem-solving, and creativity. By conducting further research in these areas, educators can better prepare students for the future, create effective strategies for technology integration, and lifelong learning. In addition, as new technologies, such as the ChatGPT and all OpenAI tools, become increasingly accessible to everyone, it is important to conduct further research to assist educators in integrating Artificial Intelligence into the teaching and learning process.

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