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Beyond Skills: Understanding Teachers' Technology Integration Through Self-Determination Theory in Low-Resource Contexts

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ABSTRACT

Despite the growing integration of technology in education, many elementary school teachers particularly those in suburban areas continue to demonstrate limited ICT proficiency. While previous studies have extensively examined technology integration and teacher motivation, there remains a lack of in-depth qualitative research exploring how senior teachers with limited digital competence experience and negotiate technology adoption through the lens of Self-Determination Theory (SDT), especially in under-resourced contexts. Addressing this gap, this study investigates senior elementary school teachers' experiences in integrating technology into classroom practices, focusing on both the challenges encountered and the perceived benefits. Grounded in SDT, the study emphasizes the roles of autonomy, competence, and relatedness in shaping teachers' motivation for technology use. A qualitative case study approach was employed, involving nine elementary school teachers from suburban areas in North Sumatra, Indonesia. The findings reveal that although teachers recognize the potential of technology to enhance teaching effectiveness and student engagement, they face significant barriers, including limited infrastructure, insufficient training, and difficulties aligning technology with pedagogy. The results further highlight that teachers' motivation to adopt technology is strongly influenced by the fulfillment of their psychological needs. This study contributes to the literature by providing contextualized insights into how SDT operates in low-resource educational settings and underscores the importance of sustained professional development and systemic support to improve technology integration among teachers.

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1. INTRODUCTION

In today's world, human-computer interaction has become common, because he evolution of interfaces and advanced technologies has significantly improved the quality of human life. However, it is necessary to select the most appropriate approach for different interactive scenarios. Additionally, over the past few years, the role of technology, especially in elementary education has grown essential (Teräs, 2022); (Tatnall & Fluck, 2022). It is due to the fact that technology presents considerable opportunities to improve the processes of teaching and learning. For K-12 teachers, incorporating technology into their instructional practices is not merely a professional expectation but also an opportunity to create more engaging and student-centered learning environments (Chiu et al., 2022); (Chiu et al., 2024); (Chiu et al., 2025). However, many elementary school teachers face challenges, particularly senior teachers who are not familiar with technology. These include limited professional development opportunities and insufficient infrastructure, which hinder their ability to meet this need (Zickafoose et al., 2024). Nevertheless, when teachers are empowered with adequate training and access to resources, they are more likely to perceive technology as an asset, enhancing their teaching practices and professional growth.

Self-Determination Theory (SDT), which emphasizes the psychological needs for autonomy, competence, and relatedness, provides a valuable perspective for understanding human motivation, personality, and psychological well-being (Ryan & Deci, 2000); (Ryan & Deci, 2020). This framework has been widely applied to various fields, including education (Chiu et al., 2022); (Chiu et al., 2024); (Jeon & Lee, 2023). Meanwhile, the successful integration of technology aligns closely with SDT's concept of competence, as teachers must acquire the skills and confidence needed to navigate digital tools (Chiu et al., 2022); (Chiu et al., 2024). With adequate training and access to resources, teachers will have higher motivation to adopt and apply technology in their teaching. Teachers who feel competent in using digital tools, supported by appropriate training and resources, are more likely to integrate technology effectively into their classrooms. This not only satisfies their own psychological needs but also promotes better learning outcomes for their students. Additionally, the need for autonomy is critical, as teachers benefit from having the freedom to experiment with and adapt technology to suit the unique needs of their classrooms. SDT's emphasis on relatedness also plays a significant role in teachers' willingness to embrace technology. Peer collaboration, mentorship, and institutional support are vital in creating a sense of community where educators can share experiences and learn from one another.

Self-Determination Theory (SDT) identifies three essential psychological needs that are central for fostering motivation and personal growth: autonomy, competence, and relatedness (Ryan & Deci, 2020); (Ryan & Deci, 2000). First, autonomy pertains to the necessity of feeling in control of one's actions and decisions, thus fostering a sense of volition. Second, competence involves feeling effective and capable in one's activities, which contributes to a sense of mastery. Third, relatedness reflects the need to feel connected to others, fostering a sense of belonging and community. When these three needs are met, individuals are more likely to thrive and achieve their full potential (Deci & Ryan, 2000). In elementary school classrooms, teachers can utilize technology to address these needs by designing interactive activities that allow students to make choices, which enhances their autonomy and sense of engagement. It is because digital tools, such as educational apps and games, can provide immediate feedback, helping students build competence and master new skills (Flynn, 2021); (Behnamnia et al., 2020); (Gan et al., 2015). Other than that, virtual collaboration platforms can foster relatedness by allowing students to work together on projects, even in remote or hybrid learning settings. Teachers can also use multimedia presentations and creative software to engage diverse learning styles, making students feel more capable and included (Sadik, 2008); (Wu et al., 2024). Furthermore, personalized learning programs enable teachers to tailor lessons to individual student needs, empowering them to take ownership of their learning (Chiu et al., 2025); (Basham et al., 2016). Thus, through thoughtful integration of technology, teachers can create an environment that nurtures motivation and promotes holistic development.

Previous studies highlight that elementary education teachers are more motivated to incorporate technology effectively and consistently when they perceive it as valuable and supportive of their teaching practices (Abedi, 2024) ; (Ertmer et al., 2012) ; (Foon & Thomas, 2007). This is because technology can enhance teachers' autonomy by offering diverse instructional methods (Chiu et al., 2024). It also heightens their competence through access to innovative tools and resources while strengthening relatedness by fostering improved communication and collaboration with students (Chiu et al., 2025). Furthermore, studies emphasize the importance of providing teachers with adequate support, such as professional development opportunities, collaborative engagement with peers, and administrative assistance (Newmann et al., 2008); (Tatnall & Fluck, 2022). These forms of support address teachers' psychological needs, resulting in more effective and student-centered technology integration practices. Consequently, elementary school teachers who feel valued and supported are more likely to embrace innovative teaching approaches. This, in turn, enhances the overall learning participation for students.

The integration of technology in elementary education involves navigating various challenges that hinder its effective implementation. Technical barriers, such as inadequate infrastructure, unreliable internet connectivity, outdated hardware, and insufficient technical support, often disrupt instructional activities and hinder the smooth integration of educational technology (Tatnall & Fluck, 2022). Also, elementary schools teacher preparedness is another significant issue, as many educators lack training in the technical and pedagogical skills necessary for meaningful technology integration (Ertmer et al., 2012); (Pareja & Braak, 2017). Limited time and expertise may discourage these elementary teachers from adopting digital tools. According to previous studies, many experienced elementary teachers lack the technological skills needed to effectively implement technology in their classrooms (Johnson et al., 2016); (Ertmer et al., 2012); (Kopcha, 2012). Next, resource constraints intensify these challenges. Budget limitations in underfunded schools often result in reliance on outdated technologies, widening the "digital divide," particularly in underserved communities where students lack equitable access to devices and internet connectivity (Kvasny & Keil, 2006); (Reynolds et al., 2022). This disparity is further highlighted by research showing that students in lower-income areas often perform worse academically due to limited access to technological resources (Cross et al., n.d.). Additionally, attitudinal barriers, such as resistance to change, stem from educators' preference for traditional methods or fear of failure when using unfamiliar tools, often compounded by concerns about reducing experiential learning opportunities. To this end, elementary schools' teachers need access to and opportunities to enhance their professional development programs. Studies indicate that professional development programs significantly increase teachers' confidence and willingness to integrate technology into their teaching (Ertmer & Ottenbreit-Leftwich, 2010); (Ertmer et al., 2012); (Guggemos & Seufert, 2021). To tackle these challenges, schools and government must prioritize investments in infrastructure, targeted professional development, equitable resource allocation, and fostering positive attitudes toward technology adoption. Undeniably, schools need support from local or central government to provide the necessary funding and policy frameworks that facilitate these initiatives. This includes allocating funds for digital resources, providing support for professional development programs, and establishing policies that encourage equitable access to educational opportunities.

Accordingly, this study explores how Elementary teachers' skill and perceptions of digital technology in education are shaped by their ability to meet the psychological needs outlined in SDT. Focusing on elementary school teachers in a suburban area In North Sumatra, the research examines how autonomy, competence, and relatedness influence their preparedness and willingness to adopt technology in their teaching practices. Our research study focuses on senior teachers who have successfully completed the government-provided in Teacher Professional Development Program "Digital Learning Models" workshop. For many of these teachers, the transition from traditional methods to technology-based learning activities presents significant challenges, as it requires a shift in pedagogical approaches and adaptation to new tools. From the perspective of SDT, this transition is

particularly meaningful, as it engages the psychological needs of competence (mastery of new skills), autonomy (freedom to engage with technology in teaching), and relatedness (collaboration and support among peers). Addressing the objectives of this study, two central research questions were formulated. The first examines the ways in which senior teachers, despite having limited technological proficiency, make efforts to prepare for technology integration in their instructional practices, analyzed through the framework of Self-Determination Theory (SDT). The second explores the perceived benefits and encountered challenges during the implementation of technology in the teaching and learning process, and how these experiences reflect the fundamental constructs of SDT, namely autonomy, competence, and relatedness.

2. METHODS

This study employs a qualitative case study research approach, which seeks to investigate and comprehend the interpretations that individuals or groups assign to social or human issues (Creswell & Creswell, 2017). Specifically, the authors employed a case study, a qualitative research method aimed at grasping and portraying the lived experiences of individuals from their own viewpoints (Paley, 2016). It focuses on exploring how individuals perceive, understand, and interpret their experiences, emphasizing the subjective nature of human consciousness. In this context, our study explores elementary school teachers' perceptions of digital technology-based learning. The research focuses on uncovering the lived experiences of teachers in incorporating digital tools into their classroom practices.

2.1 Participants and setting

Nine female elementary school teachers from various schools in a suburban area of North Sumatera, Indonesia participated in the study. Participants were selected through purposive sampling, a qualitative research technique that ensures the inclusion of individuals capable of providing rich, in-depth insights into the research problem and questions (Ahmad & Wilkins, 2024) (Creswell, 2017) suggests that phenomenological research typically requires between 5 and 25 participants. The inclusion of 9 teachers in this research is considered adequate to generate detailed and insightful data that support the study's objectives. The selected participants, aged between 26 and 53 years were identified as senior teachers based on their extensive teaching experience and permanent positions within their respective schools as seen in table 1. However, to protect their identities, the authors anonymized their information. Each teacher holds a bachelor's degree in education and some of them are currently pursuing a master's degree. Before conducting this study, all participants completed a "Learning Strategy-Digital Learning Models" course offered by Teacher Professional Development Program, which equipped them with foundational knowledge and practical skills for incorporating digital technology into their teaching practices. The course provided educators with the confidence and skills to adopt advanced digital teaching strategies. Prior to this course, most teachers had limited familiarity with advanced digital tools.

Table 1. Participant demographic background

Participants	Age (Years Old)	Teaching Experiences	Technology Skills
P1	50	17 Years	Beginner
P2	31	7 Years	Proficient
P3	46	22 Years	Beginner
P4	33	3 Years	Intermediate
P5	26	4 Years	Proficient
P6	53	17 Years	Beginner
P7	48	21 Years	Beginner
P8	37	5 Years	Intermediate

P9	51	25 Years	Beginner

Technology competencies are classified based on the International Society for Technology in Education (ISTE) Standards for Educators, which serve as the foundation for the Technology Skills Scale, as presented in Table 2

Table 2. Technology Skills Scale

Level	Description
Beginner	Begins practicing digital citizenship and simple digital collaboration
Intermadiate	Capable of designing and developing digital learning experiences (Designer)
Proficient	Manages technology-integrated classrooms and facilitates technology-enhanced learning (Facilitator)
Advanced	Analyzes learning data, collaborates across communities, and leads innovation in digital education

2.2 Instrumentation and data collection

In this study, the authors employed the in-depth interviews method, which involves conducting one-on-one interviews to explore participants' thoughts, feelings, and experiences in great detail. The authors also employed open-ended questions to gain primary information from the participants. Open-ended questions allow participants to express themselves in their own words, allowing researchers to interpret facts, behaviors, or reactions during interviews (Ahmad & Wilkins, 2024) .In addition, the authors used a verbal probing approach to explore the participants' cognitive responses in this context. The authors developed questions based on the formulation of the problem to be solved, then validated them through rearrangement linked to previous studies and discussions with experts in technology education field. To ensure a conducive environment, the researcher and participants collaboratively scheduled the sessions, allowing time in a suitable setting. The interviews, conducted one-on-one at different times and locations, were held in a coffee shop or restaurant. This setting allowed participants to express their views freely and enabled deeper exploration of their responses.

2.3 Data analysis

This research adopted a case study methodology, in which the data were examined using qualitative analysis. A case study enables a comprehensive investigation into the behaviors and processes of individuals or groups. To generate the final findings, the researchers employed multiple data analysis techniques, incorporating thematic qualitative analysis as outlined by (Creswell & Creswell, 2017), with Self-Determination Theory serving as the analytical framework, as illustrated in Figure 1. The first step of the data analysis involved gathering data from participants while writing memos. In the second step, the authors interpreted the data, organizing it into themes and repeatedly reorganizing it. While describing findings and forming themes, the authors also read through the data again, creating broad categories that combined the themes emerging from the collected data. The emerging themes were then categorized into main and sub-themes, merging into more significant categories according to the research objectives. In the final step, systematically structured the final reports, reporting the findings and providing relevant and logical justifications and explanations for the results.

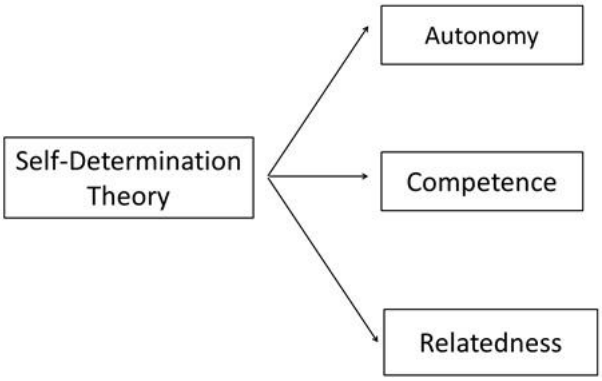

Figure 1. Self-determination theory framework

2.4 Credibility and truthfulness

This study used data triangulation through multiple sources, including previous related research. Multiple data collection instruments were used to ensure the accuracy and validity of the data Credibility refers to the precision of the data or participants' perspectives and how these perspectives are interpreted and presented. To ensure the rigor of this study, several credibility strategies were implemented, such as extensive and diverse field experience, time sampling, triangulation, and member checking (Merriam & Tisdell, 2015). Member checking employed to ensure the data analysis was accurate and consistent with their beliefs and perceptions of the studied context. In addition, the authors employed discussions with experts in the same field of knowledge further strengthened the validity of the data and study findings.

3. FINDINGS AND DISCUSSION

The results reveal three main themes: autonomy in utilizing technology for instruction, the development of new competencies, and the presence of peer collaboration and support, as illustrated in Figure 2.

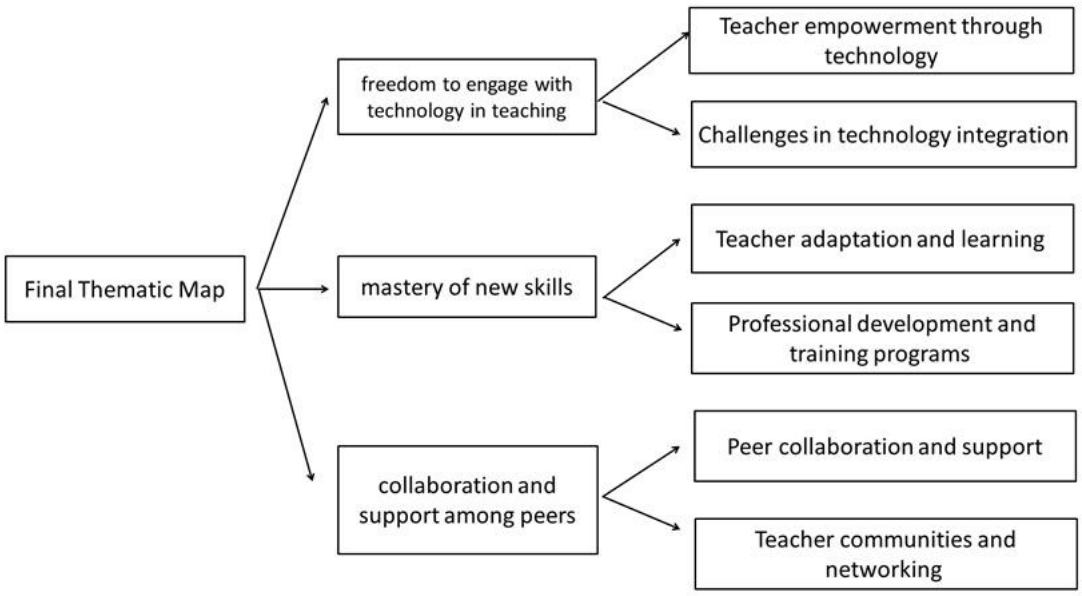

Figure 2. Thematic analysis

3.1 Pedagogical Autonomy in Technology Use

Teacher empowerment through technology

Technology integration allows teachers the freedom to design creative and interactive learning environments that cater to students' needs. Applications like Prezi and Canva enable educators to develop dynamic lesson plans and inspire students to think critically and explore independently. Our study aligns the previous study who found that applications like Prezi and Canva not only inspired students to actively participate in valuable language learning activities but also promoted the development of the social aspects of autonomy for students' learning. Also, AI tools can help create tailored lesson materials that cater to individual student needs, making the learning process more efficient and effective. Based on the findings of this study, teachers have also acknowledged the integration of AI into their classroom activities. As is widely known, many K-12 educators currently incorporate AI into their teaching practices. Previous studies have shown that the use of AI enhances teachers' autonomy in delivering subject matter to their classrooms (Hyeon et al., 2020); (Chiu et al., 2024); (Chiu, 2022). These teachers employed generative AI also offers interactive and engaging content, such as quizzes and simulations, that can enhance student understanding and retention. However, teachers with limited knowledge of AI technology face significant challenges. Therefore, more workshops on how to use AI are needed for elementary school teachers in Indonesia, as the current curriculum places less emphasis on integrating AI technology. As they noted:

After joining the workshops, I use the Canva application to design my learning materials to make them more attractive and manageable for students to understand. I want my classes interactive (P4).

As a teacher, I am pleased when I introduced the lessons through YouTube (P3).

I know it is impossible to apply AI-based educational tools in my classroom due to limited facilities, but I ask AI to create more meaningful materials (P5).

Among the three statements above, only one teacher is familiar with integrating AI into their classroom, while most others rely on basic applications to make lessons more engaging. In contrast, countries like Taiwan, Singapore, and Hong Kong have already introduced robots into their K-12 classrooms to improve learners' learning performance (Sullivan & Umaschi, 2017); (Yang et al., 2024). Even though she is familiar with AI technology, this teacher still faces limitations in applying it due to a lack of adequate resources provided by her school. Therefore, the government should support the integration of AI tools, such as robots, to enhance teaching and learning for both teachers and students. This is because integrating technology in classrooms empowers teachers to craft engaging and dynamic learning experiences that address students' needs. Tools like YouTube and Canva, or even AI, aid these elementary schools' teachers in creating interactive lesson plans that stimulate critical thinking and foster independent exploration. As illustrated by one teacher's experience, using images to strengthen learning to design visually appealing learning materials not only facilitates student comprehension but also encourages students to harness their creativity and take an active role in their learning. She also incorporated 3D animations into her lessons. Thus, such technological integration will enhance the educational process, making it more enjoyable and effective for both teachers and students. Meanwhile, empowering teachers to integrate technology into elementary education is essential, particularly for students who are new to technology or come from rural areas. According to a previous study, the application's unique 3D AR features created an immersive learning environment, making the learning process more engaging and enjoyable for elementary students a finding consistent with the present study.

Obstacles to Digital Technology Adoption

Despite its advantages, integrating technology into learning presents challenges such as limited internet access, power outages, and insufficient resources. Teachers often rely on personal hotspots to support game-based learning activities or organize students into groups to share devices. In fact, many public schools in Indonesia lack internet access, which contributes to the lag in education compared to developed countries. As we are now in the digital age, this disparity remains significant.

The unequal distribution of resources exacerbates the issue, as elite private schools typically have better facilities. Therefore, it is not surprising that many upper-class parents in Indonesia choose to send their children to elite private schools. Moreover, managing time constraints and maintaining student engagement required strategic classroom management. One teacher shared:

> *The learning process with mandatory technological integration requires an internet connection and each student's cell phone. Unfortunately, however, the learning process was disrupted due to a sudden power outage. Unfortunately, we had to repeat the series of activities from the beginning, for example, taking tests through game-based learning (P6).*

The integration of technology into learning, despite its significant benefits, presents various challenges such as limited internet access, power outages, and insufficient resources. Teachers often compensate by using personal hotspots and organizing students into groups to share devices. Time management and maintaining student engagement demand strategic classroom practices. One teacher highlighted how technological reliance can backfire during a power outage, leading to disruptions and the need to repeat activities, such as game-based tests. These hurdles underscore the importance of having contingency plans and flexible teaching strategies to navigate the unpredictabilities of technology in education. Therefore, schools must take this as a consideration, implementing robust backup systems, providing adequate resources, and offering ongoing professional development to ensure teachers are prepared for unforeseen challenges.

3.2 Acquisition of New Skills

Teacher adaptation and learning

The adoption of technology in education has advanced considerably, with teachers increasingly adopting diverse digital tools to enrich learning experiences. With advancements in personalized learning, immersive experiences, and collaborative tools, some teachers are willing to master how to use technology in their classroom. Teachers are eager to incorporate technology into their classrooms as it enables them to adapt lessons to suit student's needs, improving both engagement and academic performance. Additionally, technology supports interactive and collaborative learning, making education more engaging and accessible (Jeong & Hmelo-silver, 2016). However, although technology offers many benefits, integrating it successfully requires careful planning and ample support to tackle issues like resource availability and teacher readiness. This study found that integrating technology into classroom learning activities presents significant challenges for some of teachers, as it takes time for them to familiarize themselves with digital tools before implementing them. Despite years of teaching experience, these teachers must remain adaptable to evolving pedagogical practices driven by technological advancements. This is due to the fact that embracing a mindset of adaptability is a vital step for teachers in the digital era. Teachers not only gain an understanding of technology's role in learning but also recognize its benefits in enhancing processes and outcomes. One teacher shared:

> *After attending the workshops, I gained knowledge on how to incorporate animation in the classroom. I often use animated videos or other audio-visual aids to explain learning material, making it easier for students to understand. I can do this with the internet access available in my school environment. Besides, it encourages students to be explorative to get more learning sources (P3).*
>
> *I usually learn how to use technology in my classroom like how to use interactive games online, then I apply it into the classroom (P8).*

From the statement above, it is evident that technology plays a transformative role in education, necessitating elementary school teachers to adapt and integrate digital tools into their teaching practices. Despite their experience, these elementary schools' teachers must continuously evolve with technological advancements and fostering an adaptable mindset. The use of tools like animated videos demonstrates how technology can enhance educational processes and outcomes by making learning more engaging and accessible. Teachers who embrace these innovations can create dynamic, interactive learning environments that encourage student exploration and understanding, as exemplified by one teacher's use of animated videos and audio-visual aids.

Professional development and training programs

Overcoming initial challenges in technology integration requires consistent effort and training. Teachers addressed these challenges by organizing schedules to study tools independently, watching video tutorials, and participating in group discussions twice a week. These sessions provided opportunities to practice applications, create classroom content, and exchange knowledge. Teachers also attended workshops and mentoring sessions, which were instrumental in enhancing their competence and confidence. A teacher reflected:

> *I spend more time understanding some of the applications that I can use as learning media in learning activities in class. I had to consult several times for several applications with school administrators who were younger than me and familiar with operating several applications. They also taught me to implement a trial of the application (P9).*

Therefore, the importance of ongoing professional development and training programs for teachers to effectively integrate technology into their classrooms. Initially, teachers tackled initial challenges by independently studying digital tools, watching video tutorials, and engaging in bi-weekly group discussions. Our research aligns with prior studies, which demonstrate that elementary teachers not only generally have a positive view of the effectiveness of ICT, but also underscore the necessity for ongoing professional development and strategic support to overcome the barriers they face while incorporating technology into their classrooms (Ghavifekr et al., 2015); (Hermans et al., 2008). These collaborative efforts provided them with the necessary practice and exchange of knowledge to enhance their technological proficiency. Workshops and mentoring sessions further boosted their competence and confidence, enabling them to implement digital tools in their teaching. One teacher's reflection highlights the value of seeking guidance from younger colleagues and practicing applications to facilitate learning. Meanwhile, training programs focused on incorporating technology into primary education hold significant value. This is because stablishing a collaborative setting where teachers can exchange knowledge and remain informed about emerging technological innovations can greatly enhance primary education.

Furthermore, ongoing professional development guarantees that all educators reap the benefits of technological progress, fostering dynamic and engaging classrooms that support both teachers and students. Through their involvement in the collaborative process, the teachers gained hands-on experience and knowledge in digital education, boosting their competence and confidence in integrating it into their lessons. The collaboration provided them with an opportunity to exchange ideas, receive support from colleagues, and share expertise, making them feel more prepared to incorporate technology into their teaching methods. Previous studies have highlighted the critical role of peer collaboration in building teachers' technological competence and fostering a supportive environment for professional growth (Ramos et al., 2022). Research also indicates that collaborative learning communities can reduce teachers' resistance to adopting new technologies by addressing their concerns and promoting a shared sense of purpose. Moreover, sustained collaboration has been shown to positively impact teachers' long-term integration of technology by reinforcing both technical skills and pedagogical adaptability (Ertmer & Ottenbreit-Leftwich, 2010)

3.3 Collaboration and support among peers

Peer collaboration and support

During the workshop, these elementary teachers gained valuable knowledge and discussed how collaboration promotes shared learning and mutual support in adapting to technological advancements. They frequently organized group discussions, practiced using new applications, and shared experiences to improve their skills. This collaborative effort fostered a supportive environment, enabling them to overcome challenges together. Teachers also sought guidance from school administrators and younger colleagues proficient in technology. This collaborative approach not only allowed teachers to learn from each other but also built a sense of camaraderie, which is crucial for overcoming the challenges of adapting to new technologies. Through discussions, collaborative practice, and mentorship from tech-savvy colleagues, teachers enhanced their skills and

competency with digital tools. Accordingly, cultivating an open and collaborative school culture thus equips teachers to adopt technological advancements, leading to a more effective and engaging learning experience for students. Based on relevant previous research, it is clear that educators engaged effectively and maintained reciprocal relationships in collaborative learning activities within practice communities (Akinyemi et al., 2019). The findings suggest that teachers should work together and actively participate in learning activities in practice communities at schools to advance their professional development. Therefore, the government should continue to support teachers in building the community to help them become more professional and tech-savvy.

Teacher communities and networking

Building teacher communities and networks enhances the exchange of knowledge and ideas. Schools can facilitate this by establishing groups focused on technology integration and organizing workshops to provide technical assistance. Teacher communities and networks are vital for professional growth, offering teachers chances to engage, cooperate, and exchange materials (Macià & García, 2016). These groups can be structured or casual, often leveraging both online and face-to-face methods to enable interaction and support among educators. By fostering a culture of collaboration, teachers feel supported in their professional growth and are better equipped to implement innovative practices. One teacher said:

Through the community, we shared many insights on how to incorporate technology into the classroom (P8).

Yes, we do have an online group where some colleagues regularly share their ideas on everything related to teaching and learning (P2).

From the statements above, the benefits of networking and the importance of equitable dissemination of information and resources are clear. By sharing ideas and experiences through an online group, educators can ensure that all teachers have access to the knowledge and tools needed to benefit from technological advancements in education. This collaborative exchange fosters a more inclusive environment where every educator can improve their practice and contribute to the collective growth of the teaching community. As a result, both teachers and students experience the positive impacts of technology integration in creating effective and engaging learning environments. What is more, building teacher communities and networks is essential for facilitating the exchange of knowledge and ideas. Schools play a crucial role in this by creating groups dedicated to technology integration and organizing workshops for technical assistance. By promoting a culture of collaboration, teachers feel more supported in their professional development and are better equipped to implement innovative practices. This environment of mutual support helps educators overcome challenges and enhances their ability to integrate technology effectively in the classroom. Furthermore, the initiatives described emphasize the importance of equitable dissemination of information and resources. Ensuring all educators have access to the benefits of technological advancements in education is key. As a result, technology integration creates more effective and engaging learning environments, benefiting the entire educational community.

Discussion

The findings of this study reveal that the development of technology skills among elementary school teachers with limited digital competence can be effectively understood through the lens of Self-Determination Theory (SDT). Teachers' motivation to adopt technology was strongly influenced by the fulfillment of their psychological needs for autonomy, competence, and relatedness. Participation in digital learning workshops played a crucial role in enhancing their confidence and basic technology skills. These professional development opportunities allowed teachers to feel more capable and supported, which in turn increased their willingness to integrate technology into their instructional practices.

However, the study also highlights persistent challenges that hinder the effective use of educational technology. Limited access to digital infrastructure, such as unreliable internet connections and a lack of updated devices, remains a significant barrier. Moreover, the absence of ongoing mentoring or follow-up after training often results in stagnant or regressing digital practice. These findings suggest that a one-time intervention is insufficient; instead, a sustained and supportive ecosystem is necessary to foster long-term growth in teacher digital competence.

The results also imply that any effort to promote technology integration must be aligned with teachers' intrinsic motivations. When teachers feel autonomous, competent, and socially connected in their learning environments, they are more likely to embrace innovation and adapt to new pedagogical approaches. Therefore, policymakers and educational stakeholders should consider not only technical training but also the psychological and contextual factors that affect teachers' engagement with digital tools.

4. CONCLUSION

This study is grounded in Self-Determination Theory and investigates the experiences of senior elementary teachers in integrating technology into their classrooms.. The findings reveal that while teachers recognize the potential benefits of technology, they face significant challenges, especially in terms of limited resources and inadequate infrastructure. However, when teachers' psychological needs for autonomy, competence, and relatedness are supported, they demonstrate a greater willingness to adopt technology and enhance their teaching practices. Teachers who participated in the "Digital Learning Models" workshop gained foundational technical skills and developed the confidence to incorporate digital tools. This empowerment, alongside autonomy in deciding how to integrate technology, competence in using digital tools, and relatedness through support from peers and the school community, contributed to more effective technology adoption. Despite these positive influences, barriers such as insufficient training, outdated hardware, and limited access to essential resources like computers and projectors remain significant obstacles to technology integration.

REFERENCES

Abedi, E. A. (2024). Tensions between technology integration practices of teachers and ICT in education policy expectations: implications for change in teacher knowledge, beliefs and teaching practices. *Journal of Computers in Education*, *11*(4), 1215–1234. https://doi.org/10.1007/s40692-023-00296-6

Ahmad, M., & Wilkins, S. (2024). *Purposive Sampling in Qualitative Research : A Framework for the Entire Journey*. 1–19.

Akinyemi, A. F., Rembe, S., Shumba, J., & Mary, T. (2019). Collaboration and mutual support as processes established by communities of practice to improve continuing professional teachers ' development in high schools Collaboration and mutual support as processes established by communities of practice to improve continuing professional teachers ' development in high schools. *Cogent Education*, *6*(1). https://doi.org/10.1080/2331186X.2019.1685446

Basham, J. D., Hall, T. E., Jr, R. A. C., & Stahl, W. M. (2016). *An Operationalized Understanding of Personalized Learning*. *31*(3), 126–136. https://doi.org/10.1177/0162643416660835

Behnamnia, N., Kamsin, A., Akmar, M., Ismail, B., & Hayati, A. (2020). *Children and Youth Services Review The e ff ective components of creativity in digital game-based learning among young children : A case study*. *116*(March).

Chiu, T. K. F. (2022). School learning support for teacher technology integration from a self-determination theory perspective. *Educational Technology Research and Development*, *70*(3), 931–949. https://doi.org/10.1007/s11423-022-10096-x

Chiu, T. K. F., Ahmad, Z., & Çoban, M. (2025). Development and validation of teacher artificial intelligence (AI) competence self-efficacy (TAICS) scale. *Education and Information Technologies*, *30*(5), 6667–6685. https://doi.org/10.1007/s10639-024-13094-z

Chiu, T. K. F., Falloon, G., Song, Y., Wong, V. W. L., Zhao, L., & Ismailov, M. (2024). A self-determination theory approach to teacher digital competence development. *Computers and Education*, *214*(February), 105017. https://doi.org/10.1016/j.compedu.2024.105017

Chiu, T. K. F., Meng, H., Chai, C. S., King, I., Wong, S., & Yam, Y. (2022). Creation and Evaluation of a Pretertiary Artificial Intelligence (AI) Curriculum. *IEEE Transactions on Education*, *65*(1), 30–39. https://doi.org/10.1109/TE.2021.3085878

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Cross, J. R., Ph, D., Frazier, A. D., Ph, D., & Cross, T. L. (n.d.). *No Title*.

Deci, E. L., & Ryan, R. M. (2000). *The " What " and " Why " of Goal Pursuits : Human Needs and the Self-Determination of Behavior*. *11*(4), 227–268.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher Technology Change. *Journal of Research on Technology in Education*, *42*(3), 255–284. https://doi.org/10.1080/15391523.2010.10782551

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers and Education*, *59*(2), 423–435. https://doi.org/10.1016/j.compedu.2012.02.001

Flynn, S. (2021). Academia in liquid modernity : Digital overload , cultivation , and authenticity in teaching work Academia in liquid modernity : Digital overload ,. *Review of Education, Pedagogy, and Cultural Studies*, *0*(0), 1–17. https://doi.org/10.1080/10714413.2021.2007208

Foon, K., & Thomas, H. Æ. (2007). *Integrating technology into K-12 teaching and learning : current knowledge gaps and recommendations for future research*. 223–252. https://doi.org/10.1007/s11423-006-9022-5

Gan, B., Menkhoff, T., Smith, R. R., Enhancing, R. R., Gan, B., Menkhoff, T., & Smith, R. (2015). *Institutional Knowledge at Singapore Management University Enhancing students ' learning process through interactive digital media : New opportunities for collaborative learning Computers in Human Behavior Enhancing students ' learning process through interactive digital media : New opportunities for collaborative learning*. 652–663.

Ghavifekr, S., Athirah, W., Rosdy, W., & Teaching, W. A. W. (2015). *Teaching and Learning with Technology : Effectiveness of ICT Integration in Schools Teaching and Learning with Technology : Effectiveness of ICT Integration in Schools*.

Guggemos, J., & Seufert, S. (2021). Computers in Human Behavior Teaching with and teaching about technology – Evidence for professional development of in-service teachers. *Computers in Human Behavior*, *115*(May 2020), 106613. https://doi.org/10.1016/j.chb.2020.106613

Hermans, R., Tondeur, J., Braak, J. Van, & Valcke, M. (2008). *The impact of primary school teachers ' educational beliefs on the classroom use of computers*. *51*, 1499–1509. https://doi.org/10.1016/j.compedu.2008.02.001

Hyeon, S., Reeve, J., & Vansteenkiste, M. (2020). When teachers learn how to provide classroom structure in an autonomy-supportive way : Bene fi ts to teachers and their students. *Teaching and Teacher Education*, *90*, 103004. https://doi.org/10.1016/j.tate.2019.103004

Jeon, J., & Lee, S. (2023). Teachers ' use of motivational strategies in the synchronous online environment : A self - determination theory perspective. *Education and Information Technologies*, *0123456789*. https://doi.org/10.1007/s10639-023-11656-1

Jeong, H., & Hmelo-silver, C. E. (2016). *Seven Affordances of Computer-Supported Collaborative Learning : How to Support Collaborative Learning ? How Can Technologies Help ? Seven Affordances of Computer-Supported Collaborative Learning : How to Support Collaborative Learning ? How Can Technologies Help ? 1520*(November 2017). https://doi.org/10.1080/00461520.2016.1158654

Johnson, A. M., Jacovina, M. E., Russell, D. G., & Soto, C. M. (2016). *Challenges and solutions when using technologies in the classroom*. 13–29.

Kopcha, T. J. (2012). *Computers & Education Teachers ' perceptions of the barriers to technology integration and practices with technology under situated professional development*. *59*, 1109–1121.

https://doi.org/10.1016/j.compedu.2012.05.014

Kvasny, L., & Keil, M. (2006). *The challenges of redressing the digital divide : a tale of two US cities*. 23–53.

Macià, M., & García, I. (2016). *Informal online communities and networks as a source of teacher professional development : a review*. 1–41.

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation*. John Wiley & Sons.

Newmann, F. M., King, M. B., Youngs, P., Newmann, F. M., King, M. B., & Youngs, P. (2008). *Professional Development That Addresses School Capacity : Lessons from Urban Elementary Schools*. *108*(4), 259–299.

Paley, J. (2016). *Phenomenology as qualitative research: A critical analysis of meaning attribution*. Routledge.

Pareja, N., & Braak, V. (2017). *Preparing beginning teachers for technology integration in education : ready for take-off ? Author Griffith Research Online*. https://doi.org/10.1080/1475939X.2016.1193556

Ramos, J. L., Cattaneo, A. A. P., Jong, F. P. C. M. De, & Gonçalo, R. (2022). Pedagogical models for the facilitation of teacher professional development via video-supported collaborative learning . A review of the state of the art. *Journal of Research on Technology in Education*, *54*(5), 695–718. https://doi.org/10.1080/15391523.2021.1911720

Reynolds, R., Aromi, J., Mcgowan, C., & Paris, B. (2022). *Digital divide , critical- , and crisis-informatics perspectives on K-12 emergency remote teaching during the pandemic*. *October 2021*, 1665–1680. https://doi.org/10.1002/asi.24654

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

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective : Definitions , theory , practices , and future directions. *Contemporary Educational Psychology*, *61*(April), 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Sadik, A. (2008). *Digital storytelling : a meaningful technology-integrated approach for engaged student learning*. 487–506. https://doi.org/10.1007/s11423-008-9091-8

Sullivan, A., & Umaschi, M. (2017). in Singapore ' s early childhood centers. *International Journal of Technology and Design Education*. https://doi.org/10.1007/s10798-017-9397-0

Tatnall, A., & Fluck, A. (2022). Twenty-five years of the Education and the Information Technologies journal: Past and future. *Education and Information Technologies*, *27*(2), 1359–1378. https://doi.org/10.1007/s10639-022-10917-9

Teräs, M. (2022). Education and technology: Key issues and debates. *International Review of Education*, *68*(4), 635–636. https://doi.org/10.1007/s11159-022-09971-9

Wu, J., Liao, C., Tsai, C., & Kwok, O. (2024). Computers & Education Using learning analytics with temporal modeling to uncover the interplay of before-class video viewing engagement , motivation , and performance in an active learning context. *Computers & Education*, *212*(November 2023), 104975. https://doi.org/10.1016/j.compedu.2023.104975

Yang, W., Yeter, I. H., & Lee, J. C. (2024). *Artificial intelligence education for young children : A case study of technology-enhanced embodied learning*. *April 2023*, 465–477. https://doi.org/10.1111/jcal.12892

Zickafoose, A., Ilesanmi, O., Diaz-Manrique, M., Adeyemi, A. E., Walumbe, B., Strong, R., Wingenbach, G., Rodriguez, M. T., & Dooley, K. (2024). Barriers and Challenges Affecting Quality Education (Sustainable Development Goal #4) in Sub-Saharan Africa by 2030. *Sustainability (Switzerland) , 16*(7). https://doi.org/10.3390/su16072657