# EMPOWERING TEACHERS FOR THE DIGITAL AGE: PROFESSIONAL DEVELOPMENT AND PEDAGOGICAL INNOVATION IN EDUCATION TRANSFORMATION

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## ABSTRACT

The study observes the role of a teacher as empowered in the digital age with the help of professional development and pedagogical innovations. Furthermore, the teacher can empower mechanisms that will change the face of the education system. Utilizing secondary qualitative data taken from peer-review journals, academic articles and reports published between 2020 and 2025, this research examines how continuous professional development CPD improves teachers' digital competencies and confidence to integrate technology in the classroom. Another aspect of the study has analysed how pedagogical innovation helps improve teaching efficacy and student engagement learning outcome while also identifying the barriers to the adoption of digital devices and innovative pedagogical practice among the educators. The research finds that technology has made the educational path more creative and interactive. It helped the students to think and practice beyond the bookish knowledge. Teachers must be trained about the usage of technology. It must be used wisely so that it could not have a negative impact upon the thinning process of students. Educational leaders must be digitally empowered to foster the learning process. Pedogeological creativity has been suggested at the end of this study that helped the future students as well as teachers for enhancing the culture of learning.

**Keywords:** Teacher Empowerment, Digital Competence, Professional Development, Pedagogical Innovation, Education Transformation

## INTRODUCTION

Due to the advancement of technology, the process of education has faced severe changes and the mode of education has gone through a huge transformation. Technology is used rapidly in the process of education in every institution. Today, students have a new way to learn in a class. This new way is not boring like traditional. Technology can perform numerous tasks. However, it requires technological experts who have been trained and educated in that respective field to think outside the box. Therefore, technology will always need a human presence. To improve education, the skills of teachers must be enhanced due to which it becomes necessary for them to continue with teaching. All around the world, everything is going digital. As a result, teachers need to develop competencies along with digital literacy in growing numbers. They also need to implement innovative methods to meet the learning requirements of students.

Competent teachers need to integrate technology not only in lesson planning but also in teaching. It is not the technology but the teacher who affects whether learning technology will enhance learning. Educational reforms and digital programs do not succeed at times because of technical issues, but because of teachers lacking sufficient preparation to change their ways of teaching. Thus, carrier programs should parliament states in inherited training models to introduce modern compos programs and common destinies involved. people need to teach teachers how to cook up a recipe so that others can have a positive impact with computers in education. Teacher development should become a lifelong process where teachers are always in need of new information and technologies because this would always be changing.

Changing how something is taught is as important as the development of tools. Traditional ways of teaching are not used as often anymore. Nowadays people focus on "you do it", learning through experience, not just sitting there. The use of digital tools, like artificial intelligence, computer learning, scoring, and blended learning models lets teachers reinvent the way they teach. Mostly, teachers do not

just teach any more. For instance, the use of digital training platforms causes a teacher to connect really to her students, to teach them in a way that fits. When a teacher learns something, they should teach and stays flexible, they inspire the student to succeed. Those problems happen because of inappropriate ideas or new tools. Also, just plain stupid and unfair rejection by corrupt policies. Job seekers and college students continuously desire educational change. Schools and governments need to invest in technology infrastructure to create a positive change in our education system. If the schools are connected to the tech companies, colleges, or research centres, teachers will be able to learn and evolve.

Overall, changes in the educational system in the digital era are reliant on the teacher as a learning facilitator, designer of digital experiences and agent of change. Teachers see them as technology gap enablers who will ultimately close ranks through their ability, confidence, and creativity to make the most of technology. As teachers are empowered through this methodology, their teaching quality improves. The education system is changing across the globe so professionals can prepare the students for an unpredictable future and a world that keeps changing.

The objectives of this study are to examine the role of professional development in enhancing teachers' digital competencies and effective use of technology, to evaluate the impact of pedagogical innovation on improving teachers' effectiveness in technology-enhanced classrooms, and to identify the challenges and barriers faced by both teachers and students in the use of digital tools in education. In addition, the study aims to propose effective strategies for promoting sustainable education and empowering teachers in the digital era.

## THEORETICAL FRAMEWORK

As per **The Technological Pedagogical Content Knowledge (TPACK) framework** by Mishra and Koehler (2006), Teachers today do not just give students knowledge, but also show students how to learn the knowledge. They make learning easier and fun by using technology. This helps students understand their learning better. Teaching assistance initiatives are making all teachers more difficult. Teachers today benefit from CPD systems to get technology into the classroom as successfully as possible.

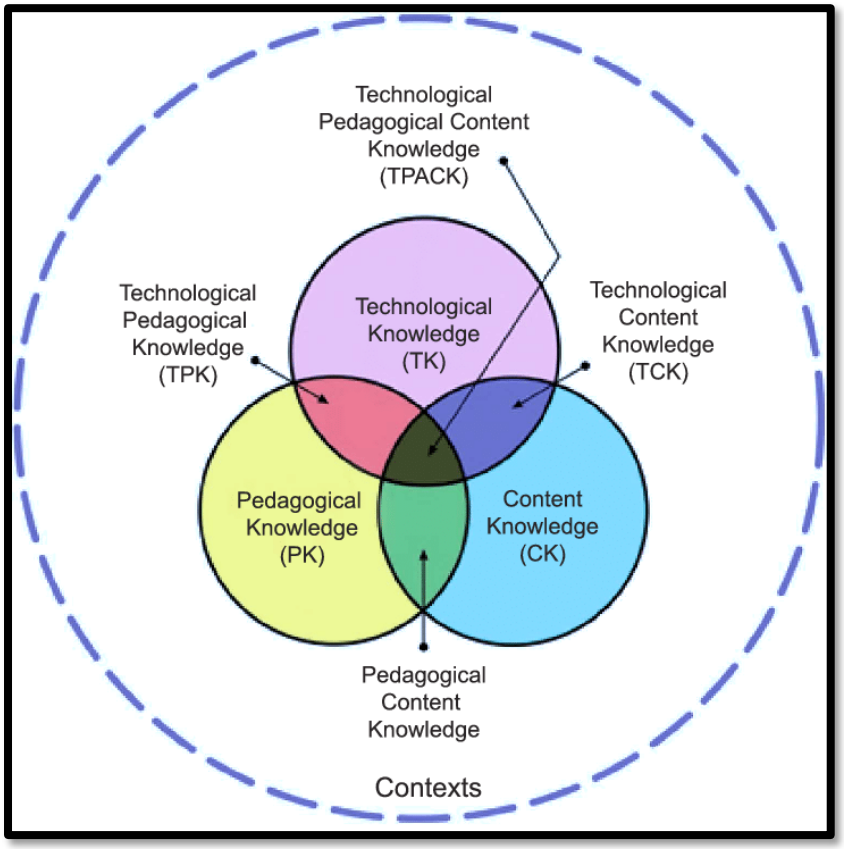


Figure 1. The Technological Pedagogical Content Knowledge (TPACK) framework
(Source: Aithal & Aithal, 2023)

As per Mushadi, Usman & Bahrun (2025), teachers need to have the mindset to use technology without being intimidated by it. CPD systems have to help generate that mindset. It is not a tech upgrade training but a learning cycle for life. Professional development is critical for the use of technology in learning contexts. Moreover, it enables teachers to develop the awareness, confidence and technical skills to use technology in transformational ways, rather than simply using it as an add-on.

A key impact of CPD on teachers is helping them become more confident in using technology for teaching purposes. Being familiar with a device or software does not really matter. According to Aithal & Aithal (2023), confidence is about having self-efficacy, that is the ability to control the performance using devices and software. Technology causes anxiety, fear or reluctance among many teachers, especially those from 'non-digital' generations and those from schools with less technological equipment. Well-designed professional development programs can help in overcoming psychological barriers.

As professionals apply their knowledge, skills and understanding, they are internally transformed and they see the world differently (Ovcharuk et al., 2020). The CPD team helps teachers convert innovative technologies and digital techniques into actions with hands-on practices, peer mentoring, and reflection. When teachers observe how digital tools enhance the learning experience of students, it inspires them to be confident to try new things and do things differently.

Schools need to train teachers, if they wish to use digital technology. The goal is to teach students online. Teachers should understand how to utilize digital tools to improve instruction, promote active learning and facilitate various types of learning. For example, with the help of multimedia, gamification, LMS, and data analytics, teachers can easily transform the traditional teaching process into an interactive process. For teachers to effectively integrate technology into their teaching, Continuous Professional Development (CPD) programs that use models like Technological Pedagogical Content Knowledge (TPACK) and the SAMR framework (Substitution, Augmentation, Modification and Redefinition) provide them with a useful framework (Fischer, Lundin & Lindberg, 2023). By using these frameworks, educators can evaluate whether their digital practices meet curriculum expectations, value the digital tools for specific contexts today and design a learning experience that promotes creativity, critical thinking and collaboration. Through continuing professional learning in the context of the frameworks, teachers learn how to scaffold technology and teach towards it. Learning quality is improved in the process of teaching.

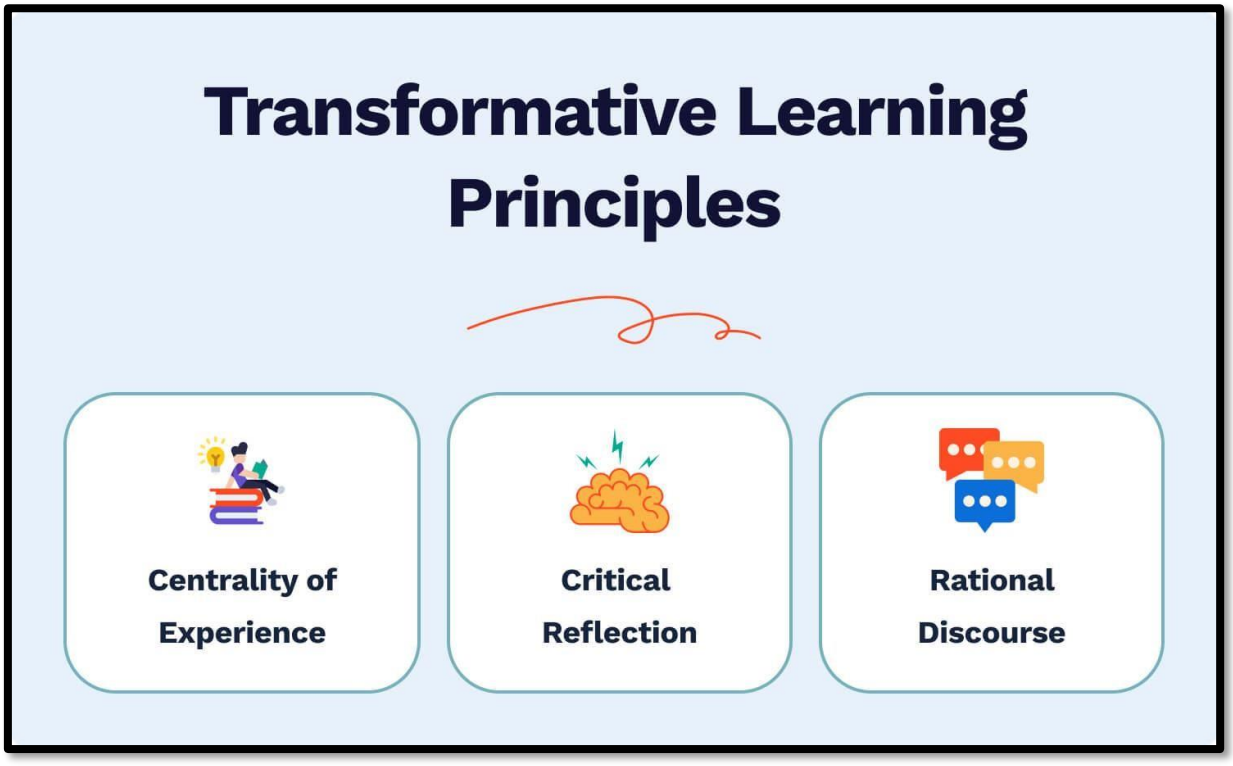


Figure 2. Transformative Learning principles
(Source: Gisbert Cervera & Caena, 2022)

Another important aspect of CPD is peer learning and collaboration. As per ***Transformative Learning Theory,*** Professional development programs that build communities of practice, mentoring relationships, and collective inquiry can help teachers discuss their experiences, struggle, and successes in the digital classroom. Helping professionals to learn more with the feeling of connectedness. It lessens the feeling of isolation that often occurs when using technology. Join Forces with Educators Around the Globe Through Digital Networking Professional learning networks, webinars, and online education communities can help to make connections far beyond the walls of educational institutions. It is becoming easier and easier to share ideas and innovations through these professional development opportunities. As per Gisbert Cervera & Caena (2022), when teachers or professionals share and collaborate with one another they learn and develop digital literacy. The digital skills of these professionals improve and they become more confident and practice new applications because they belong to a wider professional ecosystem for improvement.

Also, continuous training must have relevance to the teacher's and learning contexts' needs. What works for one class or school may not work for another, as different schools will have different levels of infrastructure. CPD programs are more meaningful when designed to keep in mind contextual realities such as device access, connectivity and institutional support. Teachers in rural or low-resource contexts are more likely to benefit from mobile learning methods and offline digital resources than AI (Sliwka et al., 2024). In other words, professional development must adapt to the teachers' experiences and the environments in which they work. Teachers will grow motivated and confident when they see a link between what they learn and what they do in the classroom.

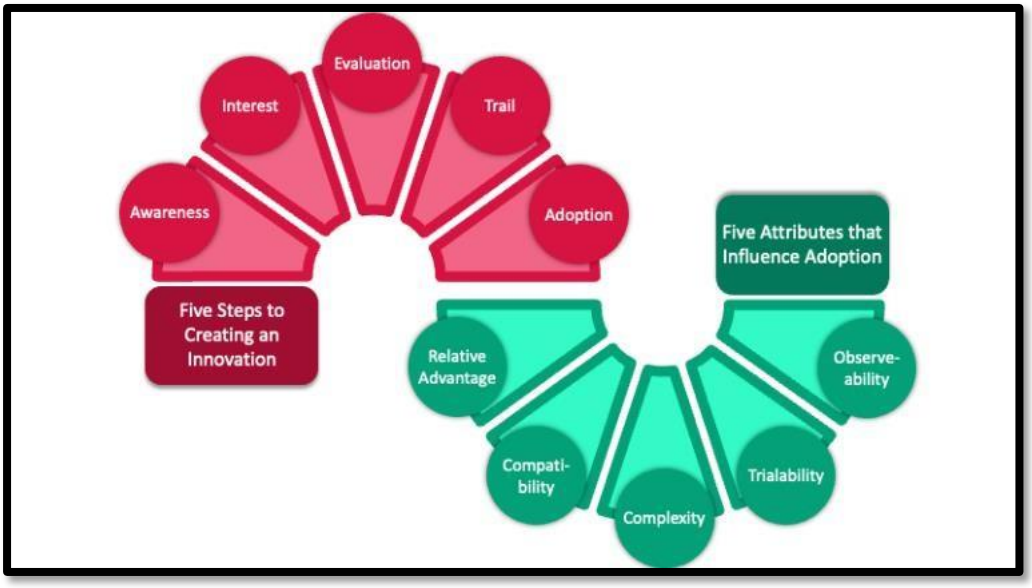


Figure 3: Diffusion of Innovation Theory
(Source: Kalyani, 2024)

***Rogers' Diffusion of Innovation Theory (2003)*** explored institutional culture in an innovative way that can support digital innovation within the path of learning. The more a teacher understands how a new technique could benefit their classes, the more they become motivated. The head of the institution and the culture of the institution play a key role in enhancing a competence with digital. It is necessary to put more creativity and out-of-the-box thinking in our work. Strong leaders help educators take part in ongoing development activities to get access to time and resources (Kalyani, 2024). Due to feeling surplus and without meaning as their schools do not support them, those great teachers will leave their profession. For educators to achieve higher levels of success, educational leaders have to follow that collegiate professional development is added to already established and high impact strategies like a school improvement schedule that sets the standard in order for educational leaders to keep up with the high demands of being in a well demanded and high employee position.

As per Tan et al., (2021), the advancement of technology and information in today's time is certainly becoming more and more overpowering. This new force in education utilizes preconditioned traditional methods and transforms them to adapt to the ever-changing environment. It is necessary to deal with the many different, smaller parts of education to enhance it today. The use of computers at

school or the notebook of the student are new teaching methods that take the older methods back a notch. When taught in a new way and more, nobody forgets the rest quickly. The transition to online schools is more than just new technology. It's trying to be relevant to what people are using today. It's used to help in education.

Promoting teachers to be more effective, is a very start role effect at school. Traditional teachers measure their success by the amount of content they give out and how well the students have memorized the information in the classroom. Teaching is just a routine in our life, not many people understand effectively. Teachers are trying new ways to teach students, getting rid of what they once used to learn in classrooms (Ismail, Omar & Raman, 2021). These are approaches that encourage students to go down their own path and passively receive the correct answer. In an interactive model, students watch videos or activities at home, then go to class and help each other with a lesson that they completed beforehand together. This change in technology allows teachers to promote more practice to students while teaching the subject correctly, the way it is supposed to be taught in all major countries. Due to this, teachers become easier to learn from because they assist their students better.

Additionally modern teaching binds educational methods to technology for the benefit of both teacher and student. Nowadays, tools like interactive whiteboards, LMS, virtual worlds, and AI tend to make teachers' jobs a little easier when it comes to lesson plans. For example, teachers are able to use AI-powered analytics to detect students' progress in real time due to learning gaps, but to correct ones before it is too late that way it will help students better or faster by using the resources available (Al-Zyoud, 2020). Gamifying learning using elements that are part of games like a VW point system for riding public transportation increases motivation and retention by starting to take learning not as an academic subject but as a personal interest. Technology is helping teachers teach better by letting them pass on information more easily, help with classroom procedures, and look at data which is helping them improve (Kadaruddin, 2023).

Education is a vital key to students and their ability to grow and move on in life giving success and long term motivation. Traditional education is struggling to keep students involved, and it's still trying to use the same methods the old way. Teachers have to find a way to teach each student, and there's no one perfect way of doing things. Innovative teaching methods give students dynamic and participatory learning that captures their attention and keeps them curious (Rodés et al., 2021). Methods such as working together, working on solutions to problems (PBL), and hands-on learning are great ways for students to take more initiative. Through real-world issues, students are able to participate in something new, learn together, and actually use what they know. It lets students work on a project that does something good for the environment and challenges them to think more deeply.

This is true, because "The Technology of Technology" will bring the school to the present day. Through various types of digital technology students are now able to have hands on learning tables, a place to express their opinions and also a place to experiment freely. These online sites help us to communicate with others and have some other people's so called "perspectives" look at our works on the internet. Learning technologies can determine how quickly the learner solves a problem and respond appropriately, giving them interesting problems so they stay challenged. Students really enjoy learning when the stuff they learn is important to them, they get to participate, and it is relevant to their life. They get better grades, are motivated, and actually show up to class (Engeness, 2021).

The influence of pedagogical innovation on learning outcomes is the third dimension. A learning outcome tells how deeply the student has learned and understood and how much skill he has acquired and achieved. Through the innovative pedagogies provided by the best colleges in Mumbai, learners analyze, synthesize, evaluate and create ideas and knowledge. When educators stop focusing student’s attention on memorization and rote learning, the learning outcomes of students can become more inquiry based (Rawas, 2024). Another outcome is that students develop the ability to adapt and problem solve. As a result, the student can transfer their learning to different contexts. Research shows that students who get involved in active and experiential learning outdo their peers in tests that require them to know, do and transfer. Similarly, these days students also get a chance to evaluate their learning practices because of the continuous feedback mechanism which helps them to monitor, reflect, and act on the learning process. As per Mah & Groß (2024), when students learn and collaborate together, they can better understand one another’s presence, leading to an inclusive classroom. For a pedagogical innovation to be successful, people still need several facilitating factors such as teacher readiness, institutional support, and a culture of experimentation. All teachers are expected to have the flexibility

and digital literacy to implement innovative practices. If teachers do not undergo sufficient professional development to use technology in a confident manner, then every innovative approach and project can be put to waste. The school must have the infrastructure, resources, and policies to promote pedagogical innovation and risk-taking.

## METHOD

As the method of data collection, the secondary method is used by the research from qualitative sources. The paper mainly made use of peer-reviewed journal articles, books, reports and policy documents published during the time period 2020-2025. It was appropriate to employ secondary qualitative data since it provided depth of information on current trends, challenges, and strategies in teacher digital empowerment. Furthermore, secondary qualitative data does not involve the time, cost, and accessibility constraints of primary data. The study has synthesized diverse perspectives of existing literature and provided trends to draw conclusions on the basis of existing literature and evidence on professional development and pedagogical innovation, educational transformation, etc.

Researcher collected the data through the use of highly developed sources like Google Scholar, Scopus, ResearchGate, ScienceDirect, and JSTOR which are all secondary data sources. Researcher has used specific keywords and phrases to identify potentially relevant studies, including teacher professional development in the digital age, pedagogical innovation, digital competencies in education, education technology, and education transformation. Only English publications from 2020–2025 were selected so that the findings reflect recent events or responses due to technological changes as affected by COVID-19. people eliminated any studies that were not relevant to our research aim and objective. people only focused on empirical studies, literature or literature reviews and theory-analytical studies related to digital pedagogy. Moreover, people also used studies related to teacher training and knowledge innovation.

The researcher got all the required books, and then people carefully took a look at them together through analysis. A numerous group of selected studies were examined closely and grouped by alike generation meaning. The conference had four various options in themes of interest and research about how to engage, understand, and develop teachers nowadays to survive in such a technological bind in the world. The analysis has been emphasized to understand what could be found in the literature. The researcher was able to capture teachers' experiences over different types of educational settings of digital transformation.

The study checked at only Academic relevant webinar sources to avoid false info from the web. In addition, this showed that some phrases possess a high definition One. Researchers reviewed many articles to check the truth and relevance of information each time. Whenever the CBC can determine a group of researchers conducted special studies examining similar topics with the goal of producing insights that are robust and repeatable. With proper cluttering and crediting to the right owner, each person's thoughts are safeguarded and made known. The study used all of the information sourced from the others' original works without utilizing any persons for test subject matter. The researcher assessed data relating to teacher empowerment in the contemporary digital age through data analysis. The provided input is not complete and appears to have missing information. Please provide complete information or context surrounding the given content to help me do a flawless paraphrasing.

## FINDINGS AND DISCUSSION

### Role of continuous professional development for developing teachers' digital competencies

Secondary qualitative data from various journals, reports, and publications was analysed. Between 2020 and 2025; research showed that empowering teachers has played a role through ideas in the digital age, proving helpful. The study found that consolidation of the current learning methodologies is crucial to enhance the impact of technology and to decrease the current vastly expanding disadvantaged gap occurring in lower family income communities. Teachers need better dissemination. The study stated that "Variário declares that it has grown owing to the divisions felt across the party and sociological factors". The study would further increase issues within. While the entire world is using the same digital tools, teachers are being expected to adapt and these are the ones being equipped by the educational system growing with this rapid transformation (Makinde, Ajani & Abdulrahman, 2024).
It was found that engaging in ongoing professional development was a main factor in teacher's ability to use more technology with their students because it helped them get better at doing things on the

computer and it gave them confidence in using technology in class. Studies almost always showed that when these plans were structured and stayed in place they made teachers better at using technology to teach students. Studies in scientific journals discovered that the minds of supposed "teacher's" of the "modern" world have opened to experience a new world and surpassed successfully the modern education method. The studies also demonstrate that incorporating teamwork into continuing professional programs has created much more confident teachers. The collegial work place let everyone learn from everyone and give out new ideas. Some teachers tried new things while learning the inner workings of a computer or something like that.

These teachers really knew how to use the computer and not just to click on buttons that have a neat picture on it. The result also showed how the creative ways of teaching affect the student teachers, students, and the student's learning. According to various research studies published in reputed journals like Educational Research Review and British Journal of Educational Technology, experimental classes like flipped classroom, blended learning, gamification, project-based learning make classrooms interesting for learners. When students work together to help one another learn (Junaedi et al., 2024). They learn more as time goes on. Using technology in interesting ways to help teachers teach can engage students more and help them learn better. For instance, by utilizing AI, teachers could analyze student progress and adjust their teaching techniques to offer assistance. Furthermore, teachers employ computer simulations to enhance the learning experience by making it more enjoyable. New technologies have enabled students to learn in whatever manner they need to keep up academically. Research shows that students who learn with technology are much more satisfied than those who attend typical classrooms. Students become more engaged and earn higher academic scores by taking online classes.

It was only at that point when they realized that teaching benefited them, the students, and themselves. As per Cheng & Wang (2023), teachers improved their understanding of student academic progress and became more reflective through experimenting with new teaching methods and digital technology. New types of teaching encourage students to take more responsibility for their work. Consequently, there is greater cooperation between teachers and pupils than in years gone by. Their development was promoted by the teachers which led to increasing confidence, willingness to change and continual learning and teaching of new ideas. The effectiveness of pedagogical innovation is greatly influenced by favourable conditions at institutional, technological, and political levels.

Despite positive updates, the third major theme was that education is still a bit stuck on teaching techniques that were designed ages ago. Between the years of 2020 and 2025, a set of studies identified five major causes that happen almost every time. Studies from Education and Information Technologies and Teaching in Higher Education have concluded that many instructors in third worlds and financially frail communities lack enough technical education. The workload of teachers is accomplished by the admin officials of their school unpaid leaving the teacher sometimes overwhelmed any time for them needs to be taken out of their schedule.

**Challenges and barriers teachers face in adopting digital tools and innovative teaching practices within educational institutions**

The modern learning environment of the 21st century blends the use of technologies in education. Despite being increasingly recognized, many teachers still face various challenges or barriers to implementing any new technology in their schools. Roadblocks are not just technical or infrastructural in nature. Teachers' innovation is not only constrained by technical standards but also by educational, psychological, institutional and socio-cultural factors. Educational change depends on teachers willing and able to use digital tools and new ways of teaching (Wang et al., 2024)

Teachers lack sufficient training and digital literacy which is one of the topmost challenges. Today's technology is moving fast. Not all teachers have the knowledge or confidence to use it well. Older teachers are generally not able to understand software, online platforms and other tools for managing digital classrooms (Strielkowski et al., 2025). Poor training chances make the situation worse. A typical training would involve learning the key functions of the device rather than learning pedagogy or how to use the Technology for effective teaching-learning. Given that continuous, hands-on professional learning and mentoring may not be available to teachers, they may feel overwhelmed and uncertain about what innovative practices they should be adopting. When guidance is not provided, teachers all over the world – and especially in Hong Kong – make use of technology in a hit-and-miss manner. As teachers do not have the support they need, they just adapt technology to older ways of teaching rather than develop new pedagogies. In other words, teachers "substitute" old ways with new

technology rather than develop deeper pedagogical change (Pramesworo et al., 2023).

In poor schools, some technical innovation is bad, computers are rare to find, the internet should be okay, and whatnot. Lots of schools have everything they need except for technology to work with it. Students who do not have equal access to the internet and technology experience limitations and are at a disadvantage because of their socio-economic status. Therefore, educators might have some concern that technology usage in class could place a few students at a disadvantage, making problems controlling the class even worse too. Eden, Chisom & Adeniyi (2024) mentioned that institutional culture and resistance to change also play a key role in education. Schools tend to be structured tightly with layers of hierarchy and traditional curriculums instead of letting children use their imagination and create their own things. Instructors who attempt to introduce a new teaching method or digital program may find themselves with no help. Exposing teachers to new methods discourages when they cannot receive a reward for it. The people running the schools sometimes do not even know how using computers can help our learning. Collaborative and experimental teaching methods may be easily halted without supportive leadership.

Being overburdened and time constrained the whole day is another challenge for teachers. Future teachers need to adjust their timing due to the use of digital tools like new teaching methods. Teachers seldom get the chance to explore strategies like training on new technology as they may already be concerned about keeping up with workloads. Examining how technology and its integration impact the classroom and other lessons can be an intensive process. Teachers may view innovation as more stressful than something that would help them (Saborío-Taylor & Rojas-Ramírez, 2024). Teachers may make use of well-established methods to teach conceptual material due to the pressure of test scores and curriculum mandates. The focus on effective achievement of substantial and preplanned material can offer one solution to the curriculum problem.

Another challenge teachers encounter is that regarding personal technology and innovation. Many educators worry about losing their professional image because they think that technology could pose a threat to them. There is an ongoing debate as to if a computer or a pencil is a better learning tool. Resistance to technology in the classroom often has its roots in a student's past negative encounters with a poorly designed technology system or in a student's lack of understanding of how the technology used in class is supported by their curriculum. Teachers believe they can build a good future using technology in their everyday jobs. Teachers with low self-confidence have less of a chance of experimenting with new technology because they are afraid of computer problems, for instance.

Another issue that was added was that of morality. Teachers must help with different digital problems. Teachers are concerned about their students spending too much time on the computer and stopping the bullying there. In communities that are culturally strong, people may also refuse to use some technologies and/or Internet platforms because they fear losing their culture or seeing vile things on the Internet. UOP student. The teachers must develop teaching strategies that greatly respect local cultures while also developing the proper global citizen.

**Impact of pedagogical innovation for increasing teaching effectiveness**

Institutional and cultural challenges also emerged as significant barriers. Most of the schools were hierarchical in nature thus they resisted change. In addition, they had an immutable curriculum and assessments. As a result, they focused too much on standardized tests and did not use creative teaching ideas. As a result, educators with innovative ideas often faced pushback or lack of backing from the school leaders. According to the literature, psychological barriers such as low self-efficacy and fear of failure prevent technology adoption. Some teachers worried technical issues would stop them from being able to teach like experts. The results were consistent in different educational contexts suggesting that the need for stakeholder involvement in digital transformation does not only require financial investment but also a shift in mindset.

The inequity of access and services for professional development was also notable. Research revealed differences between students in rural and urban schools, public and private schools, and developed and developing countries (Rahmat, Syakhrani & Satria, 2021). Teachers in resource-limited environments often lacked the exposure to training and digital resources of their counterparts in well-resourced environments. The unequal access of school teachers to digital technologies caused a digital divide. This affected students' learning opportunities.

The findings highlighted the need for focused policies and equal training opportunities to narrow down the technology gap so every teacher can participate in the digital transformation. In this study, it

is shown that teachers must have an up-to-date education. Instructional methods were changed by teachers introducing new technology in class (Romano, Díaz & Aedo, 2023). They now must learn how to work technology onsite. Research showed that continuous training increases the skill set of teachers from tech to motivation, allowing students to participate in classes more due to better communication. Researchers like Trust and Whalen believe the best way to integrate tech is through sustainable and team work-based training for teachers so the tools can be used properly.

A key consequence of this conversation is the need for system ownership endowed backups. A teacher can only do their job if they have the tools and resources they need to do it, and for that to happen, practically the entire rest of the world has to be working with them instead of against them. The headmaster or other senior figure in the education system believes in the power of acceptance of one's strengths. As opined by Savelyeva & Park (2022), the collaborative team learning, use of programs for innovation and experimentation of new ideas through technology enhances people's motivation to generate new and innovative ideas. The conclusion of this study explains how access to digital tools and training opportunities differ by region and institution. Lasting changes in teaching demand principals be friendly. Teaching offers many advantages. This means teachers have the ability to complete their training as they like. The period after covid showed the world how education systems need to work differently and the teacher is leading.

## CONCLUSION

To summarize, the results of this study show that although going to school is good, there might be a corpus of other things people can get so that people learn more out of life. The classroom is changing to help the teachers get better with technology. Getting education results in many advantages but these advantages can only happen when the people who are trying to get educated can get these advantages equally fairly in the world. Changing one's approach to education is important in a digital conversion. Old-fashioned teaching methods are not as popular anymore. People are often opting for new techniques that make people hands-on, actively involved, and personalized learning experiences. In addition to providing learners with an exchange that goes beyond mere learning, the academics who use such digital tools in their teaching. Barriers are different: computer turn off, cash and rule in a school to owing or having one or two devices to the relatives are against it. The government needs to look at all aspects to fix these problems. For better change to take place, it is important the teachers of the schools are able to learn new things, get access to technology and ensure everyone gets in on it and updates what is being reached. Intermediate teachers have the benefit of keeping up with how the technology works. The use of digital tools like artificial intelligence (AI), virtual learning environments, gamification and blended learning models offers opportunities to rethink pedagogy. Hence, teachers must be motivated to explore different strategies, redesign their curriculum, and adopt evidence-based practices integrating technology to enhance learner outcomes. Digital technology has great potential to increase the richness and quality of learning through an effective design to facilitate the experience for education.

## REFERENCES

Aithal, P. S., & Aithal, S. (2023). How to empower educators through digital pedagogies and faculty development strategies. *International Journal of Applied Engineering and Management Letters (IJAEML)*, *7*(4), 139-183. https://papers.ssrn.com/sol3/Delivery.cfm?abstractid=4674876

Al-Zyoud, H. M. M. (2020). The role of artificial intelligence in teacher professional development. *Universal Journal of Educational Research*, *8*(11B), 6263-6272. https://www.academia.edu/download/65138397/UJER65_19517508.pdf

Cheng, E. C. K., & Wang, T. (2023). Leading digital transformation and eliminating barriers for teachers to incorporate artificial intelligence in basic education in Hong Kong. *Computers and Education: Artificial Intelligence*, *5*, 100171. https://www.sciencedirect.com/science/article/pii/S2666920X23000504

Eden, C. A., Chisom, O. N., & Adeniyi, I. S. (2024). Harnessing technology integration in education: Strategies for enhancing learning outcomes and equity. *World Journal of Advanced Engineering Technology and Sciences*, *11*(2), 001-008. https://www.researchgate.net/profile/Chima-Eden/publication/379429832_Harnessing_technology_integration_in_education_Strategies_fo

r_enhancing_learning_outcomes_and_equity/links/66db744e2390e50b2c7010c3/Harnessing-technology-integration-in-education-Strategies-for-enhancing-learning-outcomes-and-equity.pdf

Engeness, I. (2021). Developing teachers' digital identity: towards the pedagogic design principles of digital environments to enhance students' learning in the 21st century. *European Journal of Teacher Education*, *44*(1), 96-114. https://www.tandfonline.com/doi/pdf/10.1080/02619768.2020.1849129

Fischer, G., Lundin, J., & Lindberg, O. J. (2023). The challenge for the digital age: making learning a part of life. *The international journal of information and learning technology*, *40*(1), 1-16. https://www.emerald.com/ijilt/article-pdf/40/1/1/900926/ijilt-04-2022-0079.pdf

Gisbert Cervera, M., & Caena, F. (2022). Teachers' digital competence for global teacher education. *European Journal of Teacher Education*, *45*(4), 451-455. https://www.tandfonline.com/doi/pdf/10.1080/02619768.2022.2135855

Ismail, S. N., Omar, M. N., & Raman, A. (2021). The Authority of Principals' Technology Leadership in Empowering Teachers' Self-Efficacy towards ICT Use. *International Journal of Evaluation and Research in Education*, *10*(3), 878-885. https://files.eric.ed.gov/fulltext/EJ1313124.pdf

Junaedi, A. T., Panjaitan, H. P., Yovita, I., Veronica, K., Renaldo, N., & Jahrizal, J. (2024). Advancing Digital and Technology Literacy through Qualitative Studies to Bridging the Skills Gap in the Digital Age. *Journal of Applied Business and Technology*, *5*(2), 123-133. https://www.e-jabt.org/index.php/JABT/article/download/170/165

Kadaruddin, K. (2023). Empowering education through Generative AI: Innovative instructional strategies for tomorrow's learners. *International Journal of Business, Law, and Education*, *4*(2), 618-625. https://www.ijble.com/index.php/journal/article/download/215/225

Kalyani, L. K. (2024). The role of technology in education: Enhancing learning outcomes and 21st century skills. *International journal of scientific research in modern science and technology*, *3*(4), 05-10. https://ijsrmst.com/index.php/ijsrmst/article/download/199/22

Mah, D. K., & Groß, N. (2024). Artificial intelligence in higher education: exploring faculty use, self-efficacy, distinct profiles, and professional development needs. *International Journal of Educational Technology in Higher Education*, *21*(1), 58. https://link.springer.com/content/pdf/10.1186/s41239-024-00490-1.pdf

Makinde, S. O., Ajani, Y. A., & Abdulrahman, M. R. (2024). Smart learning as transformative impact of technology: A paradigm for accomplishing sustainable development goals (SDGs) in education. *Indonesian Journal of Educational Research and Technology*, *4*(3), 213-224. https://ejournal.upi.edu/index.php/IJERT/article/download/66097/25549

Mushadi, M., Usman, N., & Bahrun, B. (2025). Empowering Teachers in the Digital Age: Leadership Strategies for Enhancing Pedagogic Competencies in High Schools. *Journal of Educational Management and Learning*, *3*(1), 32-43. https://heca-analitika.com/jeml/article/download/254/198

Ovcharuk, O., Ivaniuk, I., Soroko, N., Gritsenchuk, O., & Kravchyna, O. (2020). The use of digital learning tools in the teachers' professional activities to ensure sustainable development and democratization of education in European countries. http://ds.knu.edu.ua:8080/jspui/bitstream/123456789/2292/1/e3sconf_icsf2020_10019.pdf

Pramesworo, I. S., Fathurrochman, I., Sembing, D., Bangkara, B. A., & Sudrajat, D. (2023). Relevance between Blended Learning and Students' Independent Learning Curriculum: An Overview of Digital Age Education, Student and Teacher Engagement, Technological Resources. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran*, *9*(3), 858-869. https://e-journal3.undikma.ac.id/index.php/jurnalkependidikan/article/view/8320/4869

Rahmat, A., Syakhrani, A. W., & Satria, E. (2021). Promising online learning and teaching in digital age: Systematic review analysis. *International Research Journal of Engineering, IT and Scientific Research*, *7*(4), 126-135. https://www.academia.edu/download/77464247/1636.pdf

Rawas, S. (2024). ChatGPT: Empowering lifelong learning in the digital age of higher education. *Education and Information Technologies*, *29*(6), 6895-6908. https://www.researchgate.net/profile/Tamara-Magash/publication/391459983_ChatGPT_Empowering_lifelong_learning_in_the_digital_ag

e_of_higher_education/links/6819565abfbe974b23c313b2/ChatGPT-Empowering-lifelong-learning-in-the-digital-age-of-higher-education.pdf

Rodés, V., Porta, M., Garófalo, L., & Enríquez, C. R. (2021). Teacher Education in the Emergency: A MOOC-Inspired Teacher Professional Development Strategy Grounded in Critical Digital Pedagogy and Pedagogy of Care. *Journal of Interactive Media in Education*, *2021*(1). https://files.eric.ed.gov/fulltext/EJ1314117.pdf

Romano, M., Díaz, P., & Aedo, I. (2023). Empowering teachers to create augmented reality experiences: the effects on the educational experience. *Interactive Learning Environments*, *31*(3), 1546-1563. https://e-archivo.uc3m.es/bitstreams/0b4b29bd-6371-49c3-aa0d-7a3efcdc38de/download

Saborío-Taylor, S., & Rojas-Ramírez, F. (2024). Universal design for learning and artificial intelligence in the digital era: Fostering inclusion and autonomous learning. *International Journal of Professional Development, Learners and Learning*, *6*(2), ep2408. https://www.ijpdll.com/download/universal-design-for-learning-and-artificial-intelligence-in-the-digital-era-fostering-inclusion-and-14694.pdf

Savelyeva, T., & Park, J. (2022). Blockchain technology for sustainable education. *British Journal of Educational Technology*, *53*(6), 1591-1604. https://www.researchgate.net/profile/Tamara-Savelyeva/publication/363584117_Blockchain_technology_for_sustainable_education/links/64a4c8df8de7ed28ba74b300/Blockchain-technology-for-sustainable-education.pdf

Sliwka, A., Klopsch, B., Beigel, J., & Tung, L. (2024). Transformational leadership for deeper learning: shaping innovative school practices for enhanced learning. *Journal of Educational Administration*, *62*(1), 103-121. https://www.emerald.com/insight/content/doi/10.1108/JEA-03-2023-0049/full/pdf

Strielkowski, W., Grebennikova, V., Lisovskiy, A., Rakhimova, G., & Vasileva, T. (2025). AI-driven adaptive learning for sustainable educational transformation. *Sustainable Development*, *33*(2), 1921-1947. https://onlinelibrary.wiley.com/doi/pdf/10.1002/sd.3221

Sulaimon, J. T., & Adebayo, A. A. (2024). Empowering Educators: Enhancing Teacher Professional Development for Sustainable Education. *As the editors of Transforming Learning: The Power of Educational*, *1*. https://www.researchgate.net/profile/Ravindra-Kushwaha-2/publication/381408076_Transforming_Learning_The_Power_of_Educational_Technology/links/666c0a12b769e7691933ab54/Transforming-Learning-The-Power-of-Educational-Technology.pdf#page=15

Tan, S. C., Chan, C., Bielaczyc, K., Ma, L., Scardamalia, M., & Bereiter, C. (2021). Knowledge building: Aligning education with needs for knowledge creation in the digital age. *Educational Technology Research and Development*, *69*(4), 2243-2266. https://repository.nie.edu.sg/bitstreams/aaddf60c-8de5-45fc-8d28-164582253cc4/download

Wang, C., Chen, X., Yu, T., Liu, Y., & Jing, Y. (2024). Education reform and change driven by digital technology: A bibliometric study from a global perspective. *Humanities and Social Sciences Communications*, *11*(1), 1-17. https://www.nature.com/articles/s41599-024-02717-y.pdf