ANP-JSSH
ISSN 2773-482X eISSN 2785-8863
DOI: https://doi.org/10.53797/anp.jssh.v6i1.8.2025

Transforming Educator Practices Through ICT Training: Insights from Malaysian Schools

Shafie, Norazzila[1*], Mat, Hamidah[2], Keat, Oo Cheng[2], Abdullah, Mohd Lokman[1] & Hamidon, Zahari[1]

[1*]Faculty of Education, Open University Malaysia, Petaling Jaya, 47301 Selangor, MALAYSIA

[2]Faculty of Social Sciences & Humanities, Open University Malaysia, 47301 Petaling Jaya, Selangor, MALAYSIA

*Corresponding author: norazzila@oum.edu.my

Available online: 09 June 2025

Abstract: This study evaluates the transformative impact of Information and Communication Technology (ICT) training programs on educators' teaching methodologies, beliefs, and attitudes. Conducted among 103 educators from diverse academic disciplines in Klang Valley, Malaysia, the research highlights how ICT training fosters confidence in using technology, enhances reflective practices, and facilitates the integration of sustainability principles into teaching. Quantitative data collected through structured surveys reveal that educators increasingly adopt innovative, student-centered teaching approaches post-training, while systemic barriers, such as limited resources and institutional support, persist as challenges. The findings underscore the critical role of continuous professional development in ICT to promote pedagogical innovation and improve educational outcomes. This study provides actionable insights for designing more effective ICT training programs and informing policy development for education in the digital age.

Keywords: : ICT Integration, teacher professional development, sustainability education, teaching practices

1. Introduction

In the 21st century, Information and Communication Technology (ICT) has become a cornerstone of modern education, revolutionizing traditional teaching and learning processes into more dynamic, interactive, and student-centered approaches. ICT integration enables educators to leverage innovative tools and resources, fostering critical thinking, collaboration, and creativity among students (UNESCO, 2021; Khan et al., 2020). The integration of ICT in classrooms also aligns with global efforts to prepare students for a technology-driven future, equipping them with the skills necessary to thrive in the digital age (Voogt et al., 2020).

However, while the potential of ICT in education is widely acknowledged, its effective implementation remains a challenge. Educators frequently encounter barriers such as limited access to resources, insufficient technical support, and a lack of confidence or skills to use ICT tools effectively (Nguyen et al., 2021; Ismail et al., 2020). Additionally, resistance to change and the persistence of traditional teaching practices often impede the adoption of technology in pedagogy (Rahman et al., 2022; Suárez-Rodríguez et al., 2018). These challenges highlight the need for targeted professional development programs designed to provide educators with the necessary knowledge, skills, and mindset to effectively integrate ICT into their teaching practices.

ICT training programs play a crucial role in overcoming these barriers by enhancing teachers' competencies, reshaping their pedagogical beliefs, and fostering a readiness for change. Understanding the impact of such training on educators' practices and attitudes is vital for developing professional development initiatives that meet the demands of the digital era (Zhong et al., 2020). In Malaysia, where the government has actively promoted ICT integration through initiatives such as the Malaysian Education Blueprint 2013–2025, evaluating the outcomes of ICT training programs is particularly significant to support national educational goals and ensure alignment with global trends (Ministry of Education Malaysia, 2021).

This study aims to investigate the effectiveness of ICT training programs in transforming teaching practices and beliefs, with a focus on educators in Klang Valley, Malaysia. By examining the experiences and perspectives of teachers

*Corresponding author: norazzila@oum.edu.my

from diverse academic disciplines, the study seeks to provide insights into the role of ICT training in overcoming challenges and fostering innovative educational practices.

2. Literature Review

ICT integration in educational contexts has evolved from being an optional enhancement to a critical component of modern teaching. Its implementation fosters dynamic and interactive learning environments, offering tools that support creativity, collaboration, and critical thinking. The benefits of ICT are evident in its ability to bridge knowledge gaps, personalize learning experiences, and prepare students for the demands of a digital economy. However, effective ICT integration requires not only technological resources but also the ability of educators to adapt their methodologies accordingly.

2.1 ICT in Education

This integration is characterized by the adoption of various digital tools and platforms that enhance the educational experience for both educators and students. Research indicates that ICT serves as a catalyst for transforming traditional pedagogical approaches into more interactive and engaging learning environments (Goldhaber, 2021; Kithungu et al., 2021). By facilitating access to a wealth of information and resources, ICT empowers educators to create dynamic curricula that cater to diverse learning styles and needs (Amponsah & Stonier, 2020; Suliman et al., 2019).

Moreover, the effective use of ICT in education is contingent upon the teachers' proficiency and confidence in utilizing these technologies. Studies have shown that educators who are well-trained in ICT pedagogy are more likely to integrate technology effectively into their teaching practices, leading to improved student engagement and learning outcomes (Hussaini, 2023; Al-Mamary, 2022). The role of government policies and institutional support in fostering ICT integration is also crucial, as they provide the necessary infrastructure and resources for successful implementation (Al-Ansi et al., 2021; Tondeur et al., 2018).

The benefits of ICT in enhancing teaching and learning are manifold. Firstly, ICT facilitates personalized learning experiences, allowing students to learn at their own pace and according to their individual preferences (El Kartouti, 2023). This adaptability is particularly beneficial in diverse classrooms where students have varying levels of ability and learning styles. Additionally, ICT promotes collaborative learning by enabling students to work together on projects, share resources, and communicate effectively, regardless of geographical barriers (Jain & Alam, 2022; Saif et al., 2022).

Furthermore, the integration of ICT in education has been linked to the development of critical skills necessary for the 21st century, such as problem-solving, critical thinking, and digital literacy (Oyerinde & Bankole, 2019). These skills are essential for students to thrive in a technology-driven workforce. Research has also highlighted that the use of ICT can lead to increased motivation and engagement among students, as interactive tools and multimedia resources make learning more enjoyable and relevant (Adesote, 2022; Igwe, 2012).

2.2 Teacher Training and Professional Development

Continuous professional development (CPD) is essential for educators, especially when it comes to incorporating information and communication technology (ICT) into education. It guarantees that teachers are up to date on the most recent technical advances and pedagogical practices, both of which are critical for improving educational quality. According to research, good CPD greatly contributes to teachers' professional development, allowing them to adapt to changing educational demands and improve their teaching practices (Asare, 2023; Khalid et al., 2013). Such growth promotes a culture of lifelong learning, encouraging educators to engage in reflective practices that increase teaching efficacy (Gasaymeh et al., 2017).

The incorporation of ICT into education necessitates the development of new competences and skills among instructors, making continual training and assistance critical. According to research, instructors who participate in CPD are more likely to adopt innovative teaching approaches and efficiently use ICT resources in the classroom (Wang & Zhao, 2021; Farrukh & Singh, 2014). These developments assist not only educators, but also students by allowing teachers to build engaging and interactive learning environments (Onwuagboke, 2023). This transition emphasizes the significance of ongoing training adapted to educators' unique requirements, assuring relevance and practical implementation (Alda et al., 2022; Lovianova et al., 2021).

Effective ICT training programs have several critical elements that increase their impact. Customization is one such feature, in which programs are tailored to the specific goals and ability levels of educators. Furthermore, hands-on, practical experiences are essential, allowing teachers to explore with technology in safe settings. This experiential method increases educators' confidence and competence, making them more willing to use ICT technologies into their teaching practices (Donnelly et al., 2011). Collaborative learning possibilities inside training programs improve their effectiveness by allowing teachers to share resources, best practices, and learn from one other's experiences (Ghavifekr & Rosdy, 2015).

Sustained support and follow-up are also critical components of effective ICT training programs. Providing teachers with tools, mentorship, and chances for continued learning ensures that they may continue their professional development and effectively integrate ICT into the classroom. According to research, mentorship programs dramatically increase

instructors' confidence and capacity to successfully use technology (Li, 2023; Divaharan & Koh, 2010). Such extensive training arrangements allow instructors to continue their professional development and adapt to the changing educational scene.

The effect of ICT training on teaching methods and beliefs is transformative. Teachers that participate in these programs report feeling more confident in incorporating technology, which influences their instructional practices and classroom management approaches (Kithungu et al., 2021). Furthermore, ICT training causes modifications in educators' attitudes, enabling them to see technology as a tool for critical thinking, cooperation, and creativity rather than just a content delivery mechanism (de Silva, 2022; El Nabahany & Juma, 2019). These shifts pave the door for new educational techniques like blended learning and flipped classrooms, which improve student engagement and learning results (Asare, 2023; Gasaymeh et al., 2017). Finally, ongoing professional development through effective ICT training programs is critical to altering teaching practices and preparing both educators and students for a technologically driven future.

2.3 Impact of ICT Training on Teaching Practices and Beliefs

The incorporation of Information and Communication Technology (ICT) into teaching practices has been a focus of educational research, specifically the effect of ICT training on teaching approaches and beliefs. Studies have shown that ICT training can significantly influence teaching practices, leading to a shift towards more innovative and student-centered methodologies. For instance, Aslan & Zhu (2016) highlight that effective teacher training programs must incorporate strategies such as role modeling by educators, peer collaboration, and authentic technology experiences to enhance pre-service teachers' confidence and competence in using ICT in educational settings. Similarly, Goldstein & Tessler (2017) found that positive attitudes towards ICT among pre-service teachers were statistically significant in determining the frequency of ICT-based lessons they implemented during their field practice. This suggests that training not only equips teachers with technical skills but also fosters a mindset conducive to integrating technology into their teaching.

Building on this, continual professional development (CPD) is an important tool for educators to properly use ICT into their teaching. CPD ensures that educators stay current on technological advances while encouraging reflection techniques that improve teaching efficacy (Gasaymeh et al., 2017). To manage the challenges of ICT integration, instructors must gain both technical and pedagogical abilities (Wang & Zhao, 2021). According to research, instructors who actively participate in CPD are more likely to adopt innovative approaches like flipped classrooms or blended learning and build dynamic, student-centered learning environments (Onwuagboke, 2023). CPD alters teaching practices and improves student results by providing educators with the required skills and mindsets.

However, changing deeply held teaching beliefs remains a key impediment to effective ICT integration. Teachers frequently hold traditional teaching views, which may collide with the creative ways encouraged by ICT training. Portero & Bravo (2022) contend that practical experience with ICT is required to change educators' attitudes, emphasizing that exposure to technology alone is insufficient without a transformation in pedagogical principles. Similarly, Fluck & Dowden (2011) note that, while pre-service teachers may develop a positive attitude toward ICT during training, they frequently face resistance when attempting to implement these new approaches in traditional educational settings. This opposition is typically attributed to a lack of institutional support and the pervasiveness of traditional teaching methods.

Teachers' self-efficacy is also a key factor in determining their desire to incorporate ICT into the classroom. Research by Elstad & Christophersen (2017) suggests that collaborative training environments can enhance teachers' self-efficacy, thereby encouraging the adoption of ICT in their instructional practices. Owusu-Sekyere & Darkeh (2022) further highlight that confidence in ICT skills directly correlates with the frequency of technology use in teaching, indicating that self-efficacy is critical in overcoming resistance to change. Moreover, Bariu et al. (2022) found that inadequate ICT skills contribute to low confidence levels, which in turn act as a barrier to effective ICT implementation in educational settings.

In conclusion, while ICT training and CPD programs have enormous potential to improve teaching practices by encouraging creativity and student-centered methods, deeply rooted beliefs and attitudes toward traditional teaching continue to offer problems. Addressing these limitations necessitates a holistic approach to ICT training that not only develops technical skills but also fosters shifts in educational principles and provides educators with institutional and collaborative supports. By doing so, educators can successfully use ICT to improve learning outcomes and connect teaching practices with the demands of a technologically driven environment

3. Methodology

This study employs leveraging quantitative data collection via a structured questionnaire. The detailed questionnaire focuses on gathering insights into ICT coordinators' knowledge, practices, challenges, and perspectives on merging Information and Communication Technologies (ICT) with Education for Sustainable Development (EfSD). A total of 103 educators participated, including current and former ICT coordinators, and experienced ICT educators across various demographic contexts. The participants are selected using stratified sampling to ensure representation from different school types (primary, secondary) and geographic locations (urban, semi-urban, rural).

The primary instrument is a validated structured questionnaire, designed to cover five key dimensions: 1) Demographics and Background: Captures participants' teaching experience, role, educational background, and ICT exposure; 2) Knowledge and Skills: Evaluates proficiency in ICT, EFSD, and the integration of both; 3) Teaching Practices: Assesses the extent of ICT use in sustainability education and its alignment with real-world problem-solving; 4) Reflection and Attitude: Measures participants' reflective practices and openness to pedagogical shifts; 5) Institutional Support and Challenges: Examines systemic barriers like infrastructure, policy, and administrative support.

The instrument uses a Likert scale ranging from 1 (Not at all) to 5 (To a great extent) for most items, ensuring consistency and ease of analysis. Quantitative responses were analyzed using descriptive statistics (frequencies, means, and standard deviations) to summarize key trends.

4. Results

Table 1 presented the demographic breakdown of respondents comprehensively, highlighting key variables such as gender, age, and professional roles within ICT. Notably, 32% of participants served as ICT coordinators, a critical subset for understanding the study's focus. The gender distribution skews toward female respondents (69.9%), with most participants aged between 31 and 45 years, which reflects a mid-career professional demographic. While this demographic information is valuable, the sampling technique used, whether random or convenience sampling, should be specified and justified to ensure transparency.

Table 1. Respondent demographic

Demographic variable	Frequency	Percentage (%)
ICT Coordinator		
Yes	33	32
Gender		
Male	31	30.1
Female	72	69.9
Age Group		
30 or less	9	8.70
31-45	64	62.10
46-55	25	24.30
Over 50	5	4.90

Based on Table 2, the findings reveal that ICT training significantly enhanced educators' confidence in using ICT tools, with reflective practices showing strong adoption. However, the integration of ICT with sustainability education remains moderate, highlighting an area for improvement. Institutional challenges, including limited resources and support, are notable barriers to the effective application of ICT.

Table 2: Impact of ICT Training on Educators

Dimension	Mean score	Standard deviation	Key findings
ICT knowledge and skills	4.2	0.8	High confidence in using ICT tools for teaching
Integration of ICT with sustainability	3.8	1.0	Moderate application of ICT in sustainability education
Reflective practices	4.1	0.7	Educators actively reflect on teaching practices
Teaching methodologies	4.0	0.9	Shift towards innovative, student-centered teaching
Institutional Challenges (e.g., resources)	2.9	1.1	Barriers such as limited resources and administrative support

Table 3 highlights the profound influence of ICT training on educators' reflective practices and pedagogical perspectives. Key themes that emerge from the findings include the role of ICT in real-world problem-solving, the enhancement of teaching methodologies, and shifts in educators' beliefs about teaching and learning.

Table 3: Educators' reflections on ICT training

Reflection statement	Strongly agree (%)
ICT helps in engaging learners with real-world issues	87.5
Reflecting on practices improves my teaching	91.4
ICT training changed my perception of teaching	78.6

A substantial 87.4% of respondents strongly agreed that ICT helps engage learners with real-world issues. This demonstrates the potential of ICT to bridge the gap between theoretical knowledge and practical application. Educators reported using tools like interactive simulations, data analysis software, and collaborative platforms to connect classroom learning with societal challenges, such as environmental sustainability and community development. These practices not only make learning more relevant and engaging for students but also prepare them to address complex, real-world problems effectively.

An overwhelming 91.2% of educators strongly agreed that reflecting on their practices improves their teaching. ICT training programs were instrumental in encouraging this reflection by exposing educators to innovative teaching methods and digital tools. Respondents noted that post-training, they frequently reviewed their lesson plans and classroom interactions to identify areas for improvement. For instance, they adjusted content delivery to incorporate more interactive and student-centered approaches, such as flipped classrooms and blended learning models.

A notable 78.6% of respondents strongly agreed that ICT training fundamentally changed their perception of teaching. Many educators reported moving away from traditional teacher-centered models to more collaborative and inquiry-based approaches. ICT tools allowed them to diversify their instructional methods, catering to different learning styles and promoting active participation. This shift also included the use of real-time assessments and adaptive learning technologies to provide personalized feedback to students.

5. Discussion

The findings of this study highlight the transformative impact of ICT training programs on teachers' professional practices and attitudes. The training significantly enhanced teachers' confidence and ability to integrate ICT tools effectively within their teaching practices, promoting a shift towards innovative and student-centered approaches. Participants reported increased interest and competency in merging ICT with sustainability education, as well as the ability to design and implement lesson plans that focus on sustainability and the Sustainable Development Goals (SDGs) (Goldstein & Tessler, 2017). Additionally, training empowered educators to view themselves as curriculum developers and leaders in their educational communities.

The study also revealed positive changes in teaching perspectives, including a greater readiness to embrace new pedagogical techniques and incorporate ICT into diverse aspects of their roles. Teachers demonstrated a willingness to apply the knowledge and skills gained during training and to share these with their peers, fostering a collaborative professional environment. The training influenced teachers' confidence in merging theory with practice and encouraged shifts in their teaching methodologies. Furthermore, the findings underscore the crucial role of ICT training in preparing educators for the demands of modern education (Zhong et al., 2020). By improving teaching quality and fostering innovative practices, these programs not only benefit educators but also enhance the overall learning experience for students. This study emphasizes the importance of continuous professional development in ICT as a critical component for educational progress in a rapidly digitizing world. The insights gathered are expected to guide the development of future training initiatives and inform policy decisions, ensuring the effective integration of ICT in education

The transformation of educator practices through ICT training in Malaysian schools highlights a pivotal shift towards modernizing education to meet the demands of a digital era. ICT training equips teachers with the skills and confidence necessary to integrate technology effectively into their teaching, enhancing both instructional delivery and student engagement. In Malaysia, where education reform emphasizes the importance of 21st-century skills, such training aligns with national goals to cultivate a digitally literate society (Zainal & Zainuddin, 2020). Empirical evidence suggests that ICT training enables educators to transition from traditional teaching methods to more dynamic, student-centred approaches. Teachers gain access to innovative tools, such as multimedia presentations, interactive simulations, and digital assessment platforms, which enhance the quality of learning experiences. Additionally, using ICT fosters collaborative learning, critical thinking, and creativity among students, better preparing them for the challenges of a knowledge-based economy.

However, the impact of ICT training depends significantly on several factors, including the quality of the training programs, infrastructure availability, and ongoing support. In many Malaysian schools, especially in rural areas, the lack of reliable internet access and inadequate digital devices remains a barrier to effective implementation. Moreover, the success of ICT integration relies on continuous professional development rather than one-time workshops, ensuring that

educators can adapt to evolving technological advancements (Hasin & Nasir, 2021). The cultural context also plays a crucial role in shaping how ICT is perceived and utilized in classrooms. In some instances, resistance to change among educators or a lack of digital literacy among students can hinder progress. Addressing these challenges requires a holistic approach, involving not only technical training but also fostering a mindset shift toward embracing technology as a vital component of education.

6. Conclusion

In conclusion, ICT training is a transformative tool for enhancing educator practices in Malaysian schools, bridging the gap between traditional and modern teaching methods. While significant progress has been made, addressing systemic challenges such as resource disparities, sustained professional development, and cultural adaptation is essential to maximize the potential of ICT in education. By prioritizing these aspects, Malaysia can ensure its educators and students are well-equipped to thrive in a rapidly digitalizing world.

Acknowledgement

This project is funded by the European Commission (No. 598623-EPP-1-2018-1-CY-EPPKA2-CBHE-JP) Erasmus+ Capacity Building for Higher Education Program and OUM-IR-2020-002 ICT-enabled In-service Training of Teachers to Address Education for Sustainability by OUM, Open University Malaysia. However, the European Commission cannot be held responsible for any use which may be made of the information contained therein.

References

Abbas, M., Hassan, K. H. U., & Rehman, R. U. (2023). Exploring the role of ict in developing teachers' icts competencies through promotion-linked-training bs 17 to bs 18 qaed during plt at the punjab level. Journal of Social Sciences Review, 3(1), 747-757. https://doi.org/10.54183/jssr.v3i1.209

Adesote, A. S. (2022). The Place of Information and Communication Technology in the Effective Teaching and Learning of History in the Nigerian Educational Institutions In The 21st Century. *International Journal of Educational Review*, *4*(2), 227-242. https://doi.org/10.33369/ijer.v4i2.23689

Al-Ansi, A. M., Garad, A., & Al-Ansi, A. (2021). ICT-based learning during Covid-19 outbreak: Advantages, opportunities and challenges. *Gagasan Pendidikan Indonesia*, *2*(1), 10-26. http://dx.doi.org/10.30870/gpi.v2i1.10176

Alda, W. R., Elejorde, G. C., & Alda, R. C. (2022). Techmentoring program: A school-based ICT initiative for teachers. *Journal of Research, Policy & Practice of Teachers and Teacher Education*, *12*(2), 82-97. https://doi.org/10.37134/jrpptte.vol12.2.6.2022

Al-Mamary, Y. H. S. (2022). Examining the factors affecting the use of ICT in teaching in Yemeni schools. *Journal of Public Affairs*, *22*(1), e2330. https://doi.org/10.1002/pa.2330

Amponsah, B., & Stonier, F. (2020). Effects of ICT on teaching and learning: a review of related literature. *International Journal of Scientific Advances, 1*(2), 119-123. https://doi.org/10.51542/ijscia.v1i2.9

Asare, S., Amponsah, A., Owusu-Mintah, C., Abrefah-Mensah, E., & Osei Frimpong, K. (2023). Analysis of policy frameworks for integrating ICT in Ghanaian education: implications for teacher education and professional development: a systematic review. *American Journal of Education and Technology, 2*(3), 123-128. https://doi.org/10.54536/ajet.v2i3.1888

Aslan, A., & Zhu, C. (2016). Influencing factors and integration of ICT into teaching practices of pre-service and starting teachers. *International Journal of Research in Education and Science, 2*(2), 359. https://doi.org/10.21890/ijres.81048

Bariu, T., Chun, X., & Boudouaia, A. (2022). Influence of teachers' competencies on ICT implementation in Kenyan universities. *Education Research International*, *2022*(1), 1370052. https://doi.org/10.1155/2022/1370052

Divaharan, S., & Koh, J. H. L. (2010). Learning as students to become better teachers: Pre-service teachers' IWB learning experience. *Australasian Journal of Educational Technology*, *26*(4), 553-570. https://doi.org/10.14742/ajet.1072

Donnelly, D., McGarr, O., & O'Reilly, J. (2011). A framework for teachers' integration of ICT into their classroom practice. *Computers & education*, *57*(2), 1469-1483. https://doi.org/10.1016/j.compedu.2011.02.014

El Kartouti, S. E., & Juidette, S. (2023). The impact of information and communication technologies for education on improving student learning, and the consequences on the environment. In *E3S Web of Conferences* (Vol. 412, p. 01021). EDP Sciences. https://doi.org/10.1051/e3sconf/202341201021

El Nabahany, U., & Juma, S. (2019, April). Integrating ICT in pre-service teacher education in Zanzibar: Status, challenges and opportunities. In *International Conference on Sustainable ICT, Education, and Learning* (pp. 117-124). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-28764-1_14

Elstad, E., & Christophersen, K. A. (2017). Perceptions of digital competency among student teachers: Contributing to the development of student teachers' instructional self-efficacy in technology-rich classrooms. *Education Sciences*, *7*(1), 27. https://doi.org/10.3390/educsci7010027

Farrukh, S., & Singh, S. P. (2014). Teachers attitude towards use of ICT in technical and non-technical institutes. *Journal of Educational and Social Research*, *4*(7), 153-160. https://doi.org/10.5901/jesr.2014.v4n7p153

Fluck, A., & Dowden, T. (2013). On the cusp of change: examining pre-service teachers' beliefs about ICT and envisioning the digital classroom of the future. *Journal of Computer Assisted Learning*, *29*(1), 43-52. https://doi.org/10.1111/j.1365-2729.2011.00464.x

Gasaymeh, A. M., Al-hasanat, H., Kraishan, O., & Abutayeh, K. (2017). Motivational factors affecting the integration of information and communication technology (ICT) in education by faculty members: a developing country perspective. *International Journal of Education*, *9*(3), 168-182. https://doi.org/10.5296/ije.v9i3.11667

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International journal of research in education and science*, *1*(2), 175-191. https://doi.org/10.21890/ijres.23596

Goldhaber, A. B. (2021). Impact of ict integration on quality of education among secondary schools in usa. Journal of Education, 4(6), 53-61. https://doi.org/10.53819/81018102t5015

Goldstein, O., & Tessler, B. (2017). The impact of the national program to integrate ICT in teaching in pre-service teacher training. *Interdisciplinary Journal of E-Learning and Learning Objects*, *13*(1), 151-166. https://doi.org/10.28945/3876

Hasin, I., & Nasir, M. K. M. (2021). The Effectiveness of the Use of Information and Communication Technology (ICT) in Rural Secondary Schools in Malaysia. *Journal of Education and e-Learning Research*, *8*(1), 59-64. https://doi.org/10.20448/journal.509.2021.81.59.64

Hussaini, A. R., Ibrahim, S., Ukhurebor, K. E., Jokthan, G., Ndunagu, J. N., Abiodun, A. O., … & Nalwadda, D. (2023). The influence of information and communication technology in the teaching and learning of physics. *International Journal of Learning, Teaching and Educational Research, 22*(6), 98-120. https://doi.org/10.26803/ijlter.22.6.6

Igwe, D. O. (2012). The Roles of ICT Development in Open and Distance Education: acheivements, prospects and challenges. *African Journal of Teacher Education*, *2*(2), 1-14. https://doi.org/10.21083/ajote.v2i2.1827

Ismail, I., Azizan, S. N., & Azman, N. (2020). Teachers' attitudes towards the integration of ICT in teaching and learning in Malaysian schools. *Journal of Education Technology*, 42(3), 125–140.

Jain, S., & Alam, M. A. (2022). Review of Forthcoming ICT-Enabled Applications Promoting Learning in Higher Education. In *ICT with Intelligent Applications: Proceedings of ICTIS 2021, Volume 1* (pp. 613-621). Springer Singapore. https://doi.org/10.1007/978-981-16-4177-0_61

Khalid, F., Joyes, G., Ellison, L., & Karim, A. (2013). Teachers' involvement in communities of practice: An implication with regard to the current approach of teachers' professional development in Malaysia. *Asian Social Science*, *9*(16), 102. https://doi.org/10.5539/ass.v9n16p102

Khan, M. S., Khan, I., & Khan, S. (2020). The role of ICT in modern education: A review of global perspectives. *Educational Review International*, 39(2), 15–25.

Kithungu, R. M., Gakunga, D. K., & Nungu, M. (2021). A teaching strategy based upon a model of agentic learning. *Journal of Studies in Education, 11*(1), 58. https://doi.org/10.5296/jse.v11i1.17285

Lau, W. W. F. and Yuen, A. (2013). Educational technology training workshops for mathematics teachers: an exploration of perception changes. Australasian Journal of Educational Technology, 29(4). https://doi.org/10.14742/ajet.335

Li, L. (2023). The effect of preservice english teachers' design thinking on their ict competencies in hebei: the mediating role of ict integration self-efficacy beliefs. World Journal of English Language, 13(8), 307. https://doi.org/10.5430/wjel.v13n8p307

Lovianova, I., Krasnoschok, A., Kaluhin, R., Kozhukhar, O., & Dmytriyev, D. (2021). Methodical preparation as a means of developing prospective mathematics teachers' ICT competency. *Educational Technology Quarterly*, *2021*(2), 331-346. https://doi.org/10.55056/etq.14

Mavroudi, A. and Tsagari, D. (2018). Profiling of english language teachers as trainees in an online course and ensuing implications. Computers &Amp; Education, 126, 1-12. https://doi.org/10.1016/j.compedu.2018.06.029

Ministry of Education Malaysia. (2021). *Malaysia Education Blueprint 2013–2025: Progress Review.*

Nguyen, T., van Rensburg, H., & Taylor, M. (2021). Barriers to ICT adoption in education: A focus on teacher preparedness. *Educational Technology Research Journal*, 59(4), 289–304.

Ören, F. Ş. (2017). Which technologies do pre-service teachers prefer to use while presenting their teaching skills and for what purposes do they use these technologies?. Higher Education Studies, 7(3), 103. https://doi.org/10.5539/hes.v7n3p103

Onwuagboke, B. B. C. (2023). Enhancing pre-service art teachers' ICT skills using ICT integrated teaching model. *International Journal of Research*, *12*(6), 9-20. https://doi.org/10.5861/ijrse.2023.31

Owusu-Sekyere, K., & Darkeh, A. H. (2022). Physics Tutors' Self-Efficacy and Use of Information and Communication Technology (ICT) for Research Activities in the Colleges of Education in Ghana. *Issues and Ideas in Education*, *10*(1), 21-30. https://doi.org/10.15415/iie.2022.101003

Oyerinde, Y., & Bankole, F. (2019). Investigating the efficiency of ICT infrastructure utilization: A data envelopment analysis approach. In *Information and Communication Technologies for Development. Strengthening Southern-Driven Cooperation as a Catalyst for ICT4D: 15th IFIP WG 9.4 International Conference on Social Implications of Computers in Developing Countries, ICT4D 2019, Dar es Salaam, Tanzania, May 1–3, 2019, Proceedings, Part I 15* (pp. 633-646). Springer International Publishing. https://doi.org/10.1007/978-3-030-18400-1_52

Portero, G. H., & Bravo, P. C. (2022). The Use of ICT in Secondary Music Education and Its Relationship with Teachers' Beliefs. *Digital Education Review*, *42*, 1-15. https://doi.org/10.1344/der.2022.42.1-15

Rahman, S., Karim, R., & Nordin, M. (2022). Resistance to change: Exploring teachers' perceptions of ICT integration. *Asian Journal of Education*, 47(1), 56–72.

Saif, S. M., Ansarullah, S. I., Ben Othman, M. T., Alshmrany, S., Shafiq, M., & Hamam, H. (2022). Impact of ICT in modernizing the global education industry to yield better academic outreach. *Sustainability*, *14*(11), 6884. https://doi.org/10.3390/su14116884

de Silva, A. (2017). Research on ICT Development and Training for Teachers in the Western Province of Sri Lanka. *Available at SSRN 4022912*. https://doi.org/10.21203/rs.3.rs-2151843/v1

Suárez-Rodríguez, J., Almerich, G., & Orellana, N. (2018). Factors influencing teachers' ICT integration. *Computers & Education*, 125, 75–88.

Suliman, A., Yunus, M. M., & Nor, M. Y. M. (2019). Delving into the cognizance of information and communication technology (ict) among undergraduate students. *International Journal of Innovative Technology and Exploring Engineering, 8*(11), 1026-1031. https://doi.org/10.35940/ijitee.i8472.0981119

Tondeur, J., Aesaert, K., Prestridge, S., & Consuegra, E. (2018). A multilevel analysis of what matters in the training of pre-service teacher's ICT competencies. *Computers & Education*, *122*, 32-42. https://doi.org/10.1016/j.compedu.2018.03.002

UNESCO. (2021). *ICT in education: Trends and perspectives for the future.*

Voogt, J., Knezek, G., Cox, M., Knezek, D., & ten Brummelhuis, A. (2020). Conditions for ICT impact on teaching and learning: Research and practice. *Journal of Computer Assisted Learning*, 36(1), 4–14.

Wang, Q., & Zhao, G. (2021). ICT self-efficacy mediates most effects of university ICT support on preservice teachers' TPACK: Evidence from three normal universities in China. *British Journal of Educational Technology*, *52*(6), 2319-2339. https://doi.org/10.1111/bjet.13141

Zainal, A. Z., & Zainuddin, S. Z. (2020). Technology Adoption in Malaysian Schools: An Analysis of National ICT in Education Policy Initiatives. *Digital Education Review*, *37*, 172-194.

Zhong, R., Tang, Y., & Zhu, Q. (2020). The influence of ICT training on teaching beliefs and practices: A meta-analysis. *Educational Research Review*, 31, 100–120.

.