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Level of Computational Thinking and Technological Literacy Skills to Improve pre-Service Teacher Learning Innovation

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Abstract: This study aims to assess the extent to which teachers' technology literacy skills contribute to their ability to implement innovative teaching methods through computational thinking. This study used a quasi-experimental method with a 2x2 factorial design. This research used 84 samples of prospective teacher students from the Educational Technology Study Program. The instrument used questionnaires to assess the level of instructional innovation demonstrated by aspiring teachers, utilizing three indicators: the utilization of interactive learning media, the incorporation of information technology, and the diversity of learning resources. The statistical method employed to examine the hypothesis is a two-way analysis of variance (two-way ANOVA). The results of this study showed significant correlation between the level of students' Instructional Learning Innovation skills and Computational Thinking; the statistical analysis reveals a p-value greater than 0.05. Additionally, the research findings indicate that the level of Technological Literacy Skills has an impact on Instructional Innovation Learning skills. This research made significant contributions, such as the introduction of the Computational Thinking Level, which enables teachers to enhance their capacity to create effective learning strategies that align with the most recent advancements in technology. Technological Literacy Skills assist educators in incorporating digital tools and resources into the educational process, fostering a cutting-edge and dynamic classroom setting.

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Introduction

Amidst globalization and the Industrial Revolution 4.0, the advancement of information technology (I.T.) has significantly transformed all facets of life, including the realm of education. Education, a crucial component in the advancement of a nation's intellectual capabilities, can no longer function independently from technological advancements (Arlinwibowo et al., 2022; Sahertian & Effendi, 2023). With technologies such as the Internet and various digital platforms, learning resources are no longer limited to textbooks and traditional classrooms (Sukmawati et al., 2023). This opens up opportunities for educators to integrate more dynamic and interesting learning methods, which can adjust to the needs, one of which is skills in technology literacy.

In the future, teachers must possess technological literacy abilities, which will allow them to both stay updated with advancements and effectively use innovative methods in instruction. Technological literacy encompasses proficiency in utilizing technological tools and the comprehension, evaluation, and incorporation of technology into an efficient educational process (Norström & Hallström, 2023; Rupnik & Avsec, 2020). Technology literacy abilities assist future teachers in designing more flexible and responsive teaching approaches based on students' needs and learning styles in the digital age. By possessing technological literacy, prospective educators can provide an educational setting abundant in digital resources, thus broadening their pupils' intellectual and imaginative boundaries. By gaining a solid understanding of technology literacy, educators and aspiring educators can enhance their instructional efficiency and set an example for students on responsible and creative use of technology (Lemut Bajec, 2023).

Modern educators use technological tools in their instructional strategies, resulting in a more engaging, dynamic, and suitable classroom setting that caters to the requirements of digital-native students (Vaičiūtė et al., 2022). Future educators can create engaging and educational resources that pique students' interest and encourage creativity by using digital technologies to design them. The integration of literacy technology in learning design enables aspiring educators to effectively communicate intricate ideas through visualization, simulation, and interactive media (Cabero-Almenara et al., 2023; Febriyanti et al., 2023). Teachers aspiring to be adept in literacy technology can modify their teaching approaches to accommodate diverse student learning styles, from visual to kinesthetic. Prospective teachers incorporate literacy technology into their learning design to provide advanced and interactive exams, enabling a comprehensive evaluation of student comprehension. By utilizing literate technology, aspiring educators can equip pupils with the necessary tools to confront the obstacles in an ever-evolving digital society, imparting crucial proficiencies in inefficient learning and computational thinking.

In contemporary society, characterized by the prominent role of technology, it is increasingly imperative to possess a profound comprehension of technology and the capacity to engage in computational thinking (Christensen, 2023; Malčík et al., 2023). These skills enable individuals to not only understand technology but also to create new and efficient technological solutions. To fully prepare future educators for teaching in the digital era, they need to possess a comprehensive understanding of Computational Thinking (C.T) (Kourti et al., 2023; Saltali et al., 2023). To promote computational literacy in students, it is necessary to acknowledge the importance of integrating C.T. into Education. This method is equally relevant for aspiring instructors. An all-encompassing education in technology literacy should involve developing computational thinking skills, enabling students to not only use but also understand and have an impact on the technology in their environment. To foster technological literacy in future educators, it is essential to possess a thorough understanding of computational Thinking (C.T) (Chookhampaeng et al., 2023). This is notably stressed by proponents who underscore the importance of technology in enabling social learning and pedagogical approaches for computational thinking and digital literacy in teacher training. To effectively teach and participate in digital literacy education in the field of teacher education, prospective teachers need to be highly proficient in C.T. (Paucar-Curasma, Villalba-Condori, et al., 2023).

Despite the fact that technology has become an essential component of contemporary education, there are still several aspiring teacher students who lack a comprehensive understanding of the significance of technological literacy in enhancing the quality of classroom learning (Chan et al., 2022). Inadequate comprehension of technical literacy among educators frequently leads to the utilization of suboptimal technology in the educational process, squandering the potential benefits digital resources can provide. The study revealed that a substantial proportion of teachers have a limited comprehension of the importance of integrating technology and information literacy into the educational process. It investigates how technology integration models can influence the quality of lessons developed and taught by future teachers. Studies have shown that prospective teacher students lack a complete understanding of how to effectively incorporate technology into the literacy curriculum. This is due to the insufficient recognition of teacher perspectives and the lack of dedicated time for collaborative efforts in studying technology integration. Researchers have also observed that one of the biggest obstacles to the adoption of digital learning in the wake of the Covid-19 pandemic is the ignorance and reluctance of prospective teachers to use technology tools and figure out how to meaningfully integrate them into the classroom. Teachers' opinions regarding the usage and incorporation of technology in the school remain diverse, indicating that the level of comprehension and acceptance of technological literacy among future teachers still differs.

In higher education, aspiring teachers frequently do not receive enough assistance to advance their technical literacy, which causes a gap between their present skill set and what's needed to teach in the digital age. According to Nordlöf et al. (2022), raising teachers' information literacy is essential to transforming teacher-student relationships and rethinking conventional teaching methods. Technology literacy is essential for teacher preparation, yet higher learning environments frequently do not offer enough resources to help students reach their full potential (Lind et al., 2022). The absence of integration of technological literacy in teacher education programs at the higher education level makes it difficult for future teachers to successfully use technological tools in their teaching(Alda et al., 2020).

Computational Thinking (C.T.) skills are essential in contemporary education, namely for the integration of technology and the promotion of innovative problem-solving. Nonetheless, an intriguing contradiction exists in that during their schooling and training, prospective teachers frequently pay insufficient attention to C.T. levels (Peel et al., 2021). This raises issues over the preparedness of teacher candidates to confront educational challenges in the digital era, as well as how teacher education institutes may better use computer technology as a crucial element in their professional training. Furthermore, intervention studies carried out with pre-service instructors indicate that demanding projects result in improved computational thinking abilities for all students, regardless of their initial level of ability (Peters-Burton et al., 2023). Prospective teachers' proficiency in computational thinking is a matter of concern, necessitating focused interventions and professional development programs to enhance their competency in this domain (H. Moon & Cheon, 2023).

The subject of innovation in educational approaches at universities has attracted significant attention. However, there is a significant lack of research on the use of the connective learning theory in the context of learning practices. Several institutions have not fully incorporated or analyzed the ideology of collectivism, which prioritizes learning through networks and digital connections, into their educational methods (Moya & Camacho, 2023; Zhao et al., 2018). Most existing learning strategies predominantly focus on traditional approaches and do not fully harness the potential of digital technologies and social networks, which are essential for connective (Hamel et al., 2013; Keppell et al., 2010; Nantha et al., 2022). This study focuses on the lack of research on the practical application of connective theory in higher education learning methods to improve the quality and relevance of education in the modern digital age. The presence of this research gap is apparent in the limited educational resources employed in the classroom, mostly depending on textbooks and restricting students from accessing materials from diverse sources (Choiriyah & Dhieni, 2022; Kelly et al., 2009; Lema et al., 2015; Myers et al., 2008). In addition, learning tends to focus on the cognitive realm, neglecting the development of soft skills and character (Kondrla et al., 2023). Higher education institutions need interventions to help teachers develop

Pedagogical Content Knowledge Technology (TPACK) to support learning (Major & McDonald, 2021).

The educators' limited understanding in implementing novel learning methods that are based on the concept of learning connectedness may be attributed to various factors. At first, the lack of technologically skilled educators hinders the adoption of innovative approaches to education (Kee & Zhang, 2022; Ratnawati & Idris, 2020). Educators confront issues with digital competency and a lack of enthusiasm to teach with technology, undermining technology's promise to help teaching and learning (Agustina et al., 2022; Myers et al., 2008; Peschl, 2023). Furthermore, the inflexibility of teachers in integrating ICT into collaborative learning models and the need for clear instruction and supervision hinder the effectiveness of implementing ICT-based learning (Amanah et al., 2023). Incorporating contemporary technologies and instructional approaches into the curriculum poses significant challenges. Connectivism principles, such as the use of learning networks, digital collaboration, and efficient use of information resources, should serve as the foundation for this integration.

This research is important for education because it can raise future teachers' levels of computational thinking, which improves their technology literacy (C.T.). It is imperative to tackle the educational issues in the digital era (Lai & Ellefson, 2023a; Peng et al., 2023a; Pimdee & Pipitgool, 2023). This research is expected to impact the ability of future educators to develop innovative teaching methods that can adjust to the challenges and intricacies of modern times. Research that has been conducted by (Nandiyanto et al., 2022). The implementation of novel learning methods has a notable effect on enhancing student learning activities in vocational secondary schools. This suggests that similar innovations can improve the capacity of teachers and aspiring teachers to establish a more engaging and adaptable learning environment. Prospective instructors will be provided with sophisticated materials and methodologies to create an engaging and interactive learning environment for their pupils (Ediansyah et al., 2019; Sholikah & Harsono, 2021; J. Zhang, 2010). This study aims to assess the extent to which teachers' technology literacy skills contribute to their ability to implement innovative teaching methods through computational thinking.

Research Method

This study used a quasi-experimental method with a quantitative approach. This study analyze the variables Computational Thinking (X1) and Technological Literacy Skills (X2) and analyze the impact of Computational Thinking (X1) on instructional Innovation (Y), the influence of Technological Literacy Skills (X2) on Understanding Learning Innovation (Y), and the combined influence of Computational Thinking (X1) and Technological Literacy Skills (X2) on Understanding Learning Innovation (Y). The utilized study design was a 2×2 factorial design.

Table 1. Research Design Table

Technology Literacy (X) (TL)	Computational Thinking (Y)	
	High CT (Y1)	Low CT (Y2)
High TL (X1)	X1Y1	X1Y2
Low TL (X2)	X2Y1	X2Y2

Information:
X1Y1: High Literacy Technology and High Computational Things have an impact on innovative instructional teacher candidates
X2Y1: Low Literacy Technology and High Computational Thing Impact Innovative Instructional Teacher Candidates

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X1Y2: High Literacy Technology and Low Computational Thing Impact Innovative Instructional Teacher Candidates
X2Y2: Low Literacy Technology and Low Computational Thing have an impact on innovative instructional teacher candidates

The 120 students enrolled in the Educational Technology Study Program, Faculty of Teacher Training and Education, Universitas Sebelas Maret, make up the study's population, which is all aspiring teachers. The sampling technique employed in this study was cluster random sampling, which involved selecting random groups using a lottery. The classes that were sampled included class A and class B, with a total sample size of 84 individuals.

The instrument uses questionnaires to assess the level of instructional innovation demonstrated by aspiring teachers, utilizing three indicators: the utilization of interactive learning media, the incorporation of information technology, and the diversity of learning resources (X. Zhang et al., 2023). The statistical method employed for hypothesis testing is a two-way analysis of variance (ANOVA). This technique aims to ensure that the final test results obtained by the study subject are solely influenced by the therapy administered during the research procedure, with a significance threshold of α = 0.05. If the test findings indicate an interaction, more testing must be conducted. When using ANOVA, two lines must satisfy the following criteria: (1) The data must follow a normal distribution; therefore, it is required to assess normality using the Lillifors test. (2) The data must have equal variances across the population, so the homogeneity of variance is tested using the Fisher test and Bartlett test (Aragón, 2020).

Results and Discussion

Hypothesis testing is performed using the analysis of variance (ANOVA) technique. For variance analysis purposes, the required data can be seen in Table 2.

Table 2. Results of Data Analysis skills in applying learning innovation

Technology Literacy (X)	Computational Thinking(Y)		Marginal Average
	High CT (Y1)	Low CT (Y2)	
High TL (X1)	79,60	70,30	75,95
Low TL (X2)	73,50	67,50	70,50
Marginal Average	76,55	68,90	

Based on Table 2, prospective teacher students' skills in applying innovative instruction with high C.T. show descriptive mean results 76.55, higher than low C.T. candidate students 68.90. Meanwhile, High TL shows a descriptive mean result of 75.95, higher than Low TL of 70.50. Furthermore, for low T.L., learning with high C.T. showed a mean effect of 73.50, descriptively higher than everyday C.T. learning of 67.50. Meanwhile, for high T.L. learning with high C.T., the value of 79.60 is more elevated than the low CT of 70.30.

After conducting a normality test and a homogeneity test for variance data on problem-solving learning outcomes, it has been shown that both variables exhibit normal and homogeneous distribution. Therefore, this condition satisfies the requirement for hypothesis testing using ANOVA (Analysis of Variance) statistical analysis. The outcomes of hypothesis testing using ANOVA statistical analysis can be referred to as indicated in Table 3.

Table 3. Hypothesis Testing

Source	Type II Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2149.721	3	716.574	10.511	.000
Intercept	412902.010	1	412902.010	6.0507	.000

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Technology Literacy (TL)	512.011	1	512.011	7.043	.018
Computational Thinking (CT)	1804.30	1	1804.30	25.999	.000
TL*CT	33.471	1	33.471	.491	.485
Error	6817.269	100	68.173		
Total	421869.000	104			
Corrected Total	8966.990	103			

Based on the summary in Table 3, hypothesis testing will be detailed as follows. The first null hypothesis test found no difference in the application of instructional innovation skills between students who received learning treatment with high C.T. and low C.T. The results of the analysis of Instructional Learning skills between groups of prospective teacher students who are treated with Low CT and High CT are presented in Table 3. The analysis results found that the value of F was calculated = 25.999 with probability (p) = 0.000. Because the probability value is less than 0.05 ($p<0.05$), H_0 is rejected. Thus, the hypothesis test decides to leave H_0. The results of the test can then be interpreted as a difference in instructional innovation skills between prospective teacher students in learning with high C.T. and low C.T.

The second null hypothesis is to assess whether there is a lack of disparity in the Instructional Innovation skills among prospective teacher students who possess high and low Technological Literacy (T.L.). Table 3 presents the findings of analyzing the gap in Instructional Innovation capabilities between groups characterized by high T.L. and low T.L. The research reveals that the F count is 7.050, accompanied by a probability value (p) of 0.018. Given that the probability value is below 0.005 ($p<0.05$), the null hypothesis (H0) is rejected. Therefore, the decision was made to reject the null hypothesis (H0) based on the results of the hypothesis test. According to the exam results, there are variations in the Instructional Innovation skills of prospective teacher students who possess high and low T.L.

The third null hypothesis tested is whether there is no interaction between C.T. (Low CT and High CT) and T.L. (high and low) on instructional innovation skills. The results of the analysis of the difference in interaction between C.T. (High CT and Low CT) and T.L. (high and low) on instructional innovation skills are presented in Table 3. The analysis results showed that the calculated F value is equal to 0.491 with a probability (p) of 0.485. Since the probability value is more significant than 0.05 ($p>0.05$), H_0 is accepted. This means there is no interaction between *C.T.* (High CT and Low CT) and T.L. (high and low) in the skill of applying Instructional Innovation Learning.

The results of this study demonstrate a strong correlation between students' capacities for instructional innovation and their C.T. levels. This demonstrates that the student's capacity to creatively and effectively handle their learning is influenced by their level of critical thinking. The factors of confidence and drive to innovate are crucial components in the field of instructional technology, as they significantly influence the enhancement of learning abilities related to instructional innovation (Aminah et al., 2023; Melro et al., 2023; Peng et al., 2023b; Piedade & Dorotea, 2022; Tikva & Tambouris, 2023). As a result, learning design that allows students to express themselves and innovate in the practice of controlling classroom learning is critical (Robledo-Castro et al., 2023). Moreover, the ability to analyze problems and the ability to systematically and logically suggest solutions greatly boost students' ability for creative approaches in the field of educational administration (Piedade et al., 2020); (J. Moon et al., 2020); (Lai & Ellefson, 2023b).

Research findings state that the level of Technological Literacy Skills affects the skills of Instructional Innovation Learning. Proficiency in technological literacy, encompassing knowledge of software and hardware, adeptness in digital information management, and the capacity for critical thinking in relation to technology, empowers aspiring educators to develop new and contextually relevant instructional approaches to the advancement of educational and professional development initiatives for educators is crucial, particularly in enhancing their proficiency in technology literacy. The integration of technology and learning theory in modern education can enhance the quality of learning by fostering innovative talents (Jia et al., 2022). Teachers' ability to innovate in the application of learning will be enhanced when they have ample access to technology and software. Learning innovation skills refer to the ability of prospective teachers to create fun, inventive, flexible, and relevant teaching methods (Mulaudzi et al., 2023; Nedzinskaite-Maciuniene et al., 2022).

The findings indicated that there is not always a direct correlation between enhancing the technological literacy of aspiring educators and their ability to improve learning innovation abilities via the use of computer technology. Additional aspects, such as institutional backing, educational environment, and individual drive, also contribute to the stimulation of educational innovation. Nevertheless, the research revealed that male prospective teachers with elevated levels of cognitive Thinking (C.T.) and high levels of teacher leadership skills (TLS) exhibited the most advanced abilities in learning innovation. On the other hand, women with low levels of cognitive Thinking (C.T.) and task learning skills (TLS) have the least proficiency in learning innovative skills. Prospective teachers with a restricted degree of Computational Thinking skills will encounter challenges when it comes to creating learning techniques that make use of analytical approaches and creative solutions (Demarle-Meusel et al., 2017; Jacob et al., 2020; Lampropoulos et al., 2023; Paucar-Curasma, Cerna-Ruiz, et al., 2023). A lack of proficiency in technological literacy may hamper the effective incorporation of digital materials and technologies into the curriculum. As a result, the learning materials offered become less interactive, repetitive, and less able to effectively incorporate technology to increase student involvement (del Olmo-Muñoz et al., 2023; Ehsan et al., 2023).

Furthermore, the ingenuity of students as aspiring educators also plays a significant role in shaping innovation. Creativity is a cognitive power that empowers aspiring educators to think beyond conventional boundaries, generate novel concepts, and discover solutions to current challenges (Aragón, 2020; Fox-Turnbull, 2019; Masarwa et al., 2023; Park & Kwon, 2023; Supriyadi, Julia, et al., 2020). When it comes to learning, those who aspire to become teachers and have a high level of creativity tend to be more open to new ideas, experimentation, and unconventional teaching techniques. Creativity empowers students to recognize connections between ideas, form innovative connections, and develop deep understanding (Haviz & Maris, 2020; Rottenhofer et al., 2022; Supriyadi, Saptani, et al., 2020). Instructors who can cultivate student creativity as prospective teachers by providing chances for exploration, giving thought-provoking tasks that stimulate inventive cognition, and delivering constructive critique possess the capacity to generate a favorable learning environment that fosters ingenuity. Therefore, cultivating student creativity is essential in promoting innovation within an educational background (Basuki & Perdinanto, 2023; English, 2023; Mangkhang et al., 2022).

The availability of adequate computer facilities and internet networks is critical in supporting learning innovation. This facility is crucial in fostering enjoyable, groundbreaking, and efficient learning experiences. By utilizing computers and reliable internet access, educators can incorporate technology into their teaching methods, deliver multimedia content, and make use of online resources (Hwang et al., 2020; Maru et al., 2021; Moll et al., 2022). The presence of such amenities also enables the utilization of interactive, cooperative, and adaptable learning models, fostering an environment for more dynamic and pleasurable learning encounters (Koningstein & Azadegan, 2021; Parry et al., 2020; Salim et al., 2018).

Enhancing students' Computational Thinking and Technology Literacy skills can be accomplished by employing learning methodologies that foster their creative aptitude (Kannadass et al., 2023; Lane et al., 2023; Villalustre & Cueli, 2023). Computational thinking involves identifying problems, developing solutions using computational concepts, and implementing them in a computer-executable format (Acosta et al., 2023; Remshagen & Huett, 2023; Zitouniatis et al., 2023). Technology literacy refers to a deep understanding of technology, including the wise use of digital tools and resources (Caregivers & Technology: What They Want and Need, 2016; Oravec et al., 2022; Rice & Ortiz, 2021; Setyaningsih & Sukono, 2022).

Utilizing learning practices that actively include learners in assignments that require inventive solutions, hence fostering their creativity. Implementing project-based learning fosters an atmosphere that allows students to refine their creative abilities, including critical thinking, problem-solving, and peer collaboration. The significance of Computational Thinking and Technology Literacy is highlighted in this study's findings. This study emphasizes the need for Computational Thinking and Technological Literacy Skills as crucial qualities for future educators in large-scale data analysis. Within this specific context, the role of the teacher goes beyond simply sharing information and includes analyzing data and creatively using technology. The Computational Thinking degree enables educators to develop analytical skills, handle intricate problems, and create teaching methods that are in line with the latest technological breakthroughs. Literacy technology enables the integration of digital tools and resources into the learning process, hence promoting a creative and dynamic classroom environment.

Conclusion

The results of this study conclude that a significant correlation between the level of students' Instructional Learning Innovation skills and C.T.; the statistical analysis reveals a p-value greater than 0.05. Additionally, the research findings indicate that the level of Technological Literacy Skills has an impact on Instructional Innovation Learning skills. This research makes significant contributions, such as the introduction of the Computational Thinking Level, which enables teachers to enhance their capacity to create effective learning strategies that align with the most recent advancements in technology. Technological Literacy Skills assist educators in incorporating digital tools and resources into the educational process, fostering a cutting-edge and dynamic classroom setting.

Recommendation

In the teacher recruitment process, school agencies need to consider CT level and technological literacy tests need to be carried out so that teachers are able to manage the teaching and learning process in an innovative and enjoyable manner. Hence, it is imperative for future studies to take into account this component in order to offer a more all-encompassing understanding of the correlation between these abilities and the standard of learning. Furthermore, the constraints in this study also pertain to the absence of sufficient learning resources and infrastructure without any conditions. Subsequent investigations should incorporate these elements to offer a comprehensive and pertinent portrayal of the impact of technical abilities and computational thinking on diverse student groups and educational settings.

References

Acosta, Y., Alsina, Á., & Pincheira, N. (2023). Computational thinking and repetition patterns in early childhood education: Longitudinal analysis of representation and justification. *Education and Information Technologies*. https://doi.org/10.1007/s10639-023-12051-6

Agustina, W., Degeng, I. N. S., Praherdhiono, H., & Lestaric, S. R. (2022). The Effect of Blended Project-Based Learning for Enhancing Student's Scientific Literacy Skills: An Experimental Study in University. *Pegem Egitim ve Ogretim Dergisi*, *13*(1), 223–233. https://doi.org/10.47750/pegegog.13.01.24

Alda, R., Boholano, H., & Dayagbil, F. (2020). Teacher education institutions in the philippines towards education 4.0. *International Journal of Learning, Teaching and Educational Research*, *19*(8), 137–154. https://doi.org/10.26803/ijlter.19.8.8

Amanah, S., Sadono, D., Fatchiya, A., Sulistiawati, A., Aulia, T., & Seminar, A. U. (2023). Strengthening the Competencies of Gen-Z Students as Future Change Agents: Learning from Extension Science and Communication of Innovation Course (KPM121C). *International Journal of Information and Education Technology*, *13*(10), 1646–1655. https://doi.org/10.18178/ijiet.2023.13.10.1973

Aminah, N., Sukestiyarno, Y. L., Cahyono, A. N., & Maat, S. M. (2023). Student activities in solving mathematics problems with a computational thinking using Scratch. *International Journal of Evaluation and Research in Education*, *12*(2), 613–621. https://doi.org/10.11591/ijere.v12i2.23308

Aragón, L. (2020). Assessment of the Perceptions of Pre-service Teachers towards Practical Work in the Context of Scientific-technological Literacy. *HighTech and Innovation Journal*, *1*(3), 121–128. https://doi.org/10.28991/HIJ-2020-01-03-04

Arlinwibowo, J., Retnawati, H., & Kartowagiran, B. (2022). The impact of ICT utilization to improve the learning outcome: A meta-analysis. *International Journal of Evaluation and Research in Education*, *11*(2), 522–531. https://doi.org/10.11591/ijere.v11i2.22112

Basuki, S., & Perdinanto. (2023). The Role of School Supervisors in Encouraging Teachers to Manage Postflood Recovery Actions. *Journal of Educational and Social Research*, *13*(1), 248–261. https://doi.org/10.36941/jesr-2023-0023

Cabero-Almenara, J., Gutiérrez-Castillo, J. J., Palacios-Rodríguez, A., & Guillén-Gámez, F. D. (2023). Digital Competence of university students with disabilities and factors that determine it. A descriptive, inferential and multivariate study. *Education and Information Technologies*, *28*(8), 9417–9436. https://doi.org/10.1007/s10639-022-11297-w

Caregivers & Technology: What They Want and Need. (2016). https://doi.org/10.26419/res.00191.002

Chan, E., Khong, M. L., Torda, A., Tanner, J. A., Velan, G. M., & Wong, G. T. C. (2022). Medical teachers' experience of emergency remote teaching during the COVID-19 pandemic: a cross-institutional study. *BMC Medical Education*, *22*(1). https://doi.org/10.1186/s12909-022-03367-x

Choiriyah, M., & Dhieni, I. (2022). The effectiveness of multimedia learning for distance education toward early childhood critical thinking during the COVID-19 pandemic.

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
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European Journal of Educational Research, *11*(3), 1553. https://doi.org/10.12973/eu-jer.11.3.1553

Chookhampaeng, C., Kamha, C., & Chookhampaeng, S. (2023). Problems and Needs Assessment to Learning Management of Computational Thinking of Teachers at the Lower Secondary Level. *Journal of Curriculum and Teaching*, *12*(3), 172–178. https://doi.org/10.5430/jct.v12n3p172

Christensen, D. (2023). Computational Thinking to Learn Environmental Sustainability: A Learning Progression. *Journal of Science Education and Technology*, *32*(1), 26–44. https://doi.org/10.1007/s10956-022-10004-1

del Olmo-Muñoz, J., Bueno-Baquero, A., Cózar-Gutiérrez, R., & González-Calero, J. A. (2023). Exploring Gamification Approaches for Enhancing Computational Thinking in Young Learners. *Education Sciences*, *13*(5). https://doi.org/10.3390/educsci13050487

Demarle-Meusel, H., Sabitzer, B., & Sylle, J. (2017). The Teaching-Learning-Lab - Digital Literacy and Computational Thinking for Everyone. *Proceedings of the 9th International Conference on Computer Supported Education*, 166–170. https://doi.org/10.5220/0006367001660170

Ediansyah, E., Kurniawan, D. A., Perdana, R., & Salamah, S. (2019). Using problem-based learning in college: Mastery concepts subject statistical research and motivation. *International Journal of Evaluation and Research in Education*, *8*(3), 446–454. https://doi.org/10.11591/ijere.v8i3.20243

Ehsan, H., Ohland, C., & Cardella, M. E. (2023). Characterizing Child–Computer–Parent Interactions during a Computer-Based Coding Game for 5- to 7-Year-Olds. *Education Sciences*, *13*(2). https://doi.org/10.3390/educsci13020164

English, L. D. (2023). Ways of thinking in STEM-based problem solving. *ZDM - Mathematics Education*. https://doi.org/10.1007/s11858-023-01474-7

Febriyanti, D., Widianingsih, I., Sumaryana, A., & Buchari, R. A. (2023). Information Communication Technology (ICT) on Palembang city government, Indonesia: Performance measurement for great digital governance. *Cogent Social Sciences*, *9*(2). https://doi.org/10.1080/23311886.2023.2269710

Fox-Turnbull, W. (2019). Assisting teachers' understanding of student learning in technology. *International Journal of Technology and Design Education*, *29*(5), 1133–1152. https://doi.org/10.1007/s10798-018-9484-x

Hamel, C., Turcotte, S., & Laferrière, T. (2013). Evolution of the conditions for successful innovation in remote networked schools. *International Education Studies*, *6*(3), 1–14. https://doi.org/10.5539/ies.v6n3p1

Haviz, M., & Maris, I. M. (2020). Measuring mathematics and science teachers' perception on thinking and acting in 21st-century learning. *Journal for the Education of Gifted Young Scientists*, *8*(4), 1319–1328. https://doi.org/10.17478/JEGYS.747395

Hwang, A. S., Jackson, P., Sixsmith, A., Nygård, L., Astell, A., Truong, K. N., & Mihailidis, A. (2020). Exploring How Persons with Dementia and Care Partners Collaboratively Appropriate Information and Communication Technologies. *ACM Transactions on Computer-Human Interaction*, *27*(6). https://doi.org/10.1145/3389377

Jacob, S., Nguyen, H., Garcia, L., Richardson, D., & Warschauer, M. (2020). Teaching Computational Thinking to Multilingual Students through Inquiry-based Learning. *2020 Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT)*, 1–8. https://doi.org/10.1109/RESPECT49803.2020.9272487

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Jia, X., He, X., & Wang, J. (2022). Analysis of the current situation and influencing factors of information technology education in middle school. *Applied Mathematics and Nonlinear Sciences*, *7*(2), 1193–1210. https://doi.org/10.2478/amns.2021.2.00321

Kannadass, P., Hidayat, R., Siregar, P. S., & Husain, A. P. (2023). Relationship Between Computational and Critical Thinking Towards Modelling Competency Among Pre-Service Mathematics Teachers. *TEM Journal*, 1370–1382. https://doi.org/10.18421/tem123-17

Kee, T., & Zhang, H. (2022). Digital Experiential Learning for Sustainable Horticulture and Landscape Management Education. *Sustainability (Switzerland)*, *14*(15). https://doi.org/10.3390/su14159116

Kelly, M., Lyng, C., McGrath, M., & Cannon, G. (2009). A multi-method study to determine the effectiveness of, and student attitudes to, online instructional videos for teaching clinical nursing skills. *Nurse Education Today*, *29*(3), 292–300. https://doi.org/10.1016/j.nedt.2008.09.004

Keppell, M., O'Dwyer, C., Lyon, B., & Childs, M. (2010). Transforming distance education curricula through distributive leadership. *ALT-J: Research in Learning Technology*, *18*(3), 165–178. https://doi.org/10.1080/09687769.2010.529112

Kondrla, P., Lojan, R., Maturkanič, P., & Nickolaeva Biryukova, Y. (2023). The Philosophical Context of Curriculum Innovations with a Focus on Competence Development. *Journal of Education Culture and Society*, 78–92. https://orcid.org/0000-0002-5977-4081

Koningstein, M., & Azadegan, S. (2021). Participatory video for two-way communication in research for development. *Action Research*, *19*(2), 218–236. https://doi.org/10.1177/1476750318762032

Kourti, Z., Michalakopoulos, C. A., Bagos, P. G., & Paraskevopoulou-Kollia, E. A. (2023). Computational Thinking in Preschool Age: A Case Study in Greece. *Education Sciences*, *13*(2). https://doi.org/10.3390/educsci13020157

Lai, R. P. Y., & Ellefson, M. R. (2023a). How Multidimensional is Computational Thinking Competency? A Bi-Factor Model of the Computational Thinking Challenge. *Journal of Educational Computing Research*, *61*(2), 259–282. https://doi.org/10.1177/07356331221121052

Lai, R. P. Y., & Ellefson, M. R. (2023b). How Multidimensional is Computational Thinking Competency? A Bi-Factor Model of the Computational Thinking Challenge. *Journal of Educational Computing Research*, *61*(2), 259–282. https://doi.org/10.1177/07356331221121052

Lampropoulos, G., Keramopoulos, E., Diamantaras, K., & Evangelidis, G. (2023). Integrating Augmented Reality, Gamification, and Serious Games in Computer Science Education. *Education Sciences*, *13*(6). https://doi.org/10.3390/educsci13060618

Lane, W. B., Galanti, T. M., & Rozas, X. L. (2023). Teacher Re-novicing on the Path to Integrating Computational Thinking in High School Physics Instruction. *Journal for STEM Education Research*, *6*(2), 302–325. https://doi.org/10.1007/s41979-023-00100-1

Lema, R., Iizuka, M., & Walz, R. (2015). Introduction to low-carbon innovation and development: Insights and future challenges for research. *Innovation and Development*, *5*(2), 173–187. https://doi.org/10.1080/2157930X.2015.1065096

Lemut Bajec, M. (2023). The Role of Formal and Non-formal Education in the Development of Technological Literacy: the Case of an Aeromodelling Club. *Journal of Elementary Education*, *16*(3), 321–338. https://doi.org/10.18690/rei.16.3.2711

Lind, J., Pelger, S., & Jakobsson, A. (2022). Students' knowledge of emerging technology and sustainability through a design activity in technology education. *International Journal of Technology and Design Education*, *32*(1), 243–266. https://doi.org/10.1007/s10798-020-09604-y

Major, C., & McDonald, E. (2021). Developing Instructor TPACK: A Research Review and Narrative Synthesis. *Journal of Higher Education Policy and Leadership Studies*, *2*(2), 51–67. https://doi.org/10.52547/johepal.2.2.51

Malčík, M., Rakowski, R., Miklošíková, M., Zemčík, T., & Feber, J. (2023). Philosophical Background of Computational Thinking. *International Journal of Emerging Technologies in Learning (IJET)*, *18*(17), 126–135. https://doi.org/10.3991/ijet.v18i17.41139

Mangkhang, C., Kaewpanya, N., Jansiri, P., Nuansawan, P., Srichana, M., Anukul, P., & Saaardluan, S. (2022). Advancing Transformative Learning to Develop Competency in Teaching Social Studies Online of Pre-service Teacher Students in Chiang Mai Education Sandbox. *Journal of Curriculum and Teaching*, *11*(5), 128–137. https://doi.org/10.5430/JCT.V11N5P128

Maru, M. G., Pikirang, C. C., Ratu, D. M., & Tuna, J. R. (2021). The Integration of ICT in ELT Practices: The Study on Teachers' Perspective in New Normal Era. *International Journal of Interactive Mobile Technologies*, *15*(22), 44–67. https://doi.org/10.3991/ijim.v15i22.25533

Masarwa, B., Hel-Or, H., & Levy, S. T. (2023). Kindergarten Children's Learning of Computational Thinking With the "Sorting Like a Computer" Learning Unit. *Journal of Research in Childhood Education*. https://doi.org/10.1080/02568543.2023.2221319

Melro, A., Tarling, G., Fujita, T., & Kleine Staarman, J. (2023). What Else Can Be Learned When Coding? A Configurative Literature Review of Learning Opportunities Through Computational Thinking. *Journal of Educational Computing Research*, *61*(4), 901–924. https://doi.org/10.1177/07356331221133822

Moll, I., Dlamini, R., Ndlovu, N. S., Drennan, G., Nkambule, F., & Phakathi, N. (2022). A developing realist model of the pedagogical affordances of ICTs. *South African Computer Journal*, *34*(2), 50–75. https://doi.org/10.18489/SACJ.V34I2.1076

Moon, H., & Cheon, J. (2023). An Investigation of Affective Factors Influencing Computational Thinking and Problem-Solving. *International Journal of Information and Education Technology*, *13*(10), 1513–1519. https://doi.org/10.18178/ijiet.2023.13.10.1956

Moon, J., Do, J., Lee, D., & Choi, G. W. (2020). A conceptual framework for teaching computational thinking in personalized OERs. *Smart Learning Environments*, *7*(1). https://doi.org/10.1186/s40561-019-0108-z

Moya, S., & Camacho, M. (2023). Developing a Framework for Mobile Learning Adoption and Sustainable Development. *Technology, Knowledge and Learning*, *28*(2), 727–744. https://doi.org/10.1007/s10758-021-09537-y

Mulaudzi, M. A., Du Toit, A., & Golightly, A. (2023). Hybrid problem-based learning in Technology teacher preparation: Giving students a voice in their learning process. *Journal of Education (South Africa)*, *90*, 128–148. https://doi.org/10.17159/2520-9868/i90a07

Myers, D. R., Sykes, C., & Myers, S. (2008). Effective learner-centered strategies for teaching adults: Using visual media to engage the adult learner. *Gerontology and Geriatrics Education*, *29*(3), 234–238. https://doi.org/10.1080/02701960802359466

Nandiyanto, A. B. D., Hofifah, S. N., Girsang, G. C. S., Trianadewi, D., Ainisyifa, Z. N., Siswanto, A., Putri, S. R., Anggraeni, S., Maryanti, R., & Muslimin, Z. (2022). Distance Learning Innovation in Teaching Chemistry in Vocational School Using the Concept of Isotherm Adsorption of Carbon Microparticles. *Journal of Technical Education and Training*, *14*(1), 14–26. https://doi.org/10.30880/jtet.2022.14.01.002

Nantha, C., Pimdee, P., & Sitthiworachart, J. (2022). A Quasi-Experimental Evaluation of Classes Using Traditional Methods, Problem-Based Learning, and Flipped Learning to Enhance Thai Student-Teacher Problem-Solving Skills and Academic Achievement. *International Journal of Emerging Technologies in Learning*, *17*(14), 20–38. https://doi.org/10.3991/ijet.v17i14.30903

Nedzinskaite-Maciuniene, R., Stasiunaitiene, E., & Simiene, G. (2022). Through Thick and Thin: Lower Secondary School Students' Barriers to Learning under Covid-19 Conditions. *Center for Educational Policy Studies Journal*, *12*(3), 167–189. https://doi.org/10.26529/cepsj.1103

Nordlöf, C., Norström, P., Höst, G., & Hallström, J. (2022). Towards a three-part heuristic framework for technology education. *International Journal of Technology and Design Education*, *32*(3), 1583–1604. https://doi.org/10.1007/s10798-021-09664-8

Norström, P., & Hallström, J. (2023). Models and modelling in secondary technology and engineering education. *International Journal of Technology and Design Education*, *33*(5), 1797–1817. https://doi.org/10.1007/s10798-023-09808-y

Oravec, N., Schultz, A. S. H., Bjorklund, B., Gregora, A., Monnin, C., Dave, M. G., Duhamel, T. A., Arora, R. C., & Chudyk, A. M. (2022). A Virtual, Multi-Session Workshop Model for Integrating Patient and Public Perspectives in Research Analysis and Interpretation. *International Journal of Qualitative Methods*, *21*. https://doi.org/10.1177/16094069221124402

Park, W., & Kwon, H. (2023). Bringing computational thinking to technology education classrooms: Hacking car activity for middle schools in the republic of korea. *International Journal of Technology and Design Education*, *33*(3), 863–881. https://doi.org/10.1007/s10798-022-09750-5

Parry, K., van Rooyen, A. F., Bjornlund, H., Kissoly, L., Moyo, M., & de Sousa, W. (2020). The importance of learning processes in transitioning small-scale irrigation schemes. *International Journal of Water Resources Development*, *sup1*, 1–25. https://doi.org/10.1080/07900627.2020.1767542

Paucar-Curasma, R., Cerna-Ruiz, L. P., Acra-Despradel, C., Villalba-Condori, K. O., Massa-Palacios, L. A., Olivera-Chura, A., & Esteban-Robladillo, I. (2023). Development of Computational Thinking through STEM Activities for the Promotion of Gender Equality. *Sustainability (Switzerland)*, *15*(16). https://doi.org/10.3390/su151612335

Paucar-Curasma, R., Villalba-Condori, K. O., Mamani-Calcina, J., Rondon, D., Berrios-Espezúa, M. G., & Acra-Despradel, C. (2023). Use of Technological Resources for the Development of Computational Thinking Following the Steps of Solving Problems in Engineering Students Recently Entering College. *Education Sciences*, *13*(3). https://doi.org/10.3390/educsci13030279

Peel, A., Sadler, T. D., & Friedrichsen, P. (2021). Using Unplugged Computational Thinking to Scaffold Natural Selection Learning. *The American Biology Teacher*, *83*(2), 112–117. https://doi.org/10.1525/abt.2021.83.2.112

Peng, H. H., Murti, A. T., Silitonga, L. M., & Wu, T. T. (2023a). Effects of the Fundamental Concepts of Computational Thinking on Students' Anxiety and Motivation toward K-

12 English Writing. *Sustainability (Switzerland)*, *15*(7). https://doi.org/10.3390/su15075855

Peng, H. H., Murti, A. T., Silitonga, L. M., & Wu, T. T. (2023b). Effects of the Fundamental Concepts of Computational Thinking on Students' Anxiety and Motivation toward K-12 English Writing. *Sustainability (Switzerland)*, *15*(7). https://doi.org/10.3390/su15075855

Peschl, M. F. (2023). Learning from the future as a novel paradigm for integrating organizational learning and innovation. *Learning Organization*, *30*(1), 6–22. https://doi.org/10.1108/TLO-01-2021-0018

Peters-Burton, E. E., Tran, H. H., & Miller, B. (2023). Design-Based Research as Professional Development: Outcomes of Teacher Participation in the Development of the Science Practices Innovation Notebook (SPIN). *Journal of Science Teacher Education*. https://doi.org/10.1080/1046560X.2023.2242665

Piedade, J., & Dorotea, N. (2022). Effects of Scratch-based activities on 4th-grade students' computational thinking skills. *Informatics in Education*. https://doi.org/10.15388/infedu.2023.19

Piedade, J., Dorotea, N., Pedro, A., & Matos, J. F. (2020). On teaching programming fundamentals and computational thinking with educational robotics: A didactic experience with pre-service teachers. *Education Sciences*, *10*(9), 1–15. https://doi.org/10.3390/educsci10090214

Pimdee, P., & Pipitgool, S. (2023). Promoting Undergraduate Pre-Service Teacher Computational Thinking. *TEM Journal*, *12*(1), 540–549. https://doi.org/10.18421/TEM121-64

Remshagen, A., & Huett, K. C. (2023). Youth Hackathons in Computing for the Community: A Design Case. *TechTrends*, *67*(3), 508–520. https://doi.org/10.1007/s11528-023-00852-y

Rice, M. F., & Ortiz, K. R. (2021). Parents' use of digital literacies to support their children with disabilities in online learning environments. *Online Learning Journal*, *25*(3), 208–229. https://doi.org/10.24059/olj.v25i3.2407

Robledo-Castro, C., Hederich-Martínez, C., & Castillo-Ossa, L. F. (2023). Cognitive stimulation of executive functions through computational thinking. *Journal of Experimental Child Psychology*, *235*, 105738. https://doi.org/10.1016/j.jecp.2023.105738

Rottenhofer, M., Kuka, L., Leitner, S., & Sabitzer, B. (2022). Using Computational Thinking to Facilitate Language Learning: A Survey of Students' Strategy Use in Austrian Secondary Schools. *IAFOR Journal of Education: Technology in Education*, *10*(2), 51–70.

Rupnik, D., & Avsec, S. (2020). Effects of a transdisciplinary educational approach on students' technological literacy. *Journal of Baltic Science Education*, *19*(1), 121–141. https://doi.org/10.33225/jbse/20.19.121

Sahertian, P., & Effendi, Y. R. (2023). Principal's Academic Supervision Based on Humanistic Spiritual Values to Increase Student Achievement Motivation. *International Journal of Innovation and Learning*, *34*(1), 1. https://doi.org/10.1504/ijil.2023.10054867

Salim, H., Lee, P. Y., Ghazali, S. S., Ching, S. M., Ali, H., Shamsuddin, N. H., Mawardi, M., Kassim, P. S. J., & Dzulkarnain, D. H. A. (2018). Perceptions toward a pilot project on blended learning in Malaysian family medicine postgraduate training: A qualitative study. *BMC Medical Education*, *18*(1). https://doi.org/10.1186/s12909-018-1315-y

Saltali, N. D., Özmutlu, E. B., Ergan, S. N., Özsoy, G., & Korkmaz, Ö. (2023). An Evaluation of the Effect of Activity-Based Computational Thinking Education on Teachers: A Case Study. *Participatory Educational Research*, *10*(2), 1–25. https://doi.org/10.17275/per.23.26.10.2

Setyaningsih, S., & Sukono, S. (2022). Analysis of factors affecting lecturer performance at a university during the COVID-19 pandemic using logistic regression and genetic algorithms. *Cypriot Journal of Educational Sciences*, *17*(2), 542–561. https://doi.org/10.18844/CJES.V17I2.6694

Sholikah, M., & Harsono, D. (2021). Enhancing Student Involvement Based on Adoption Mobile Learning Innovation as Interactive Multimedia. *International Journal of Interactive Mobile Technologies*, *15*(8), 101–118. https://doi.org/10.3991/ijim.v15i08.19777

Sukmawati, F., Santosa, E. B., & Rejekiningsih, T. (2023). Design of Virtual Reality Zoos Through Internet of Things (IoT) for Student Learning about Wild Animals. *Revue d'Intelligence Artificielle*, *37*(2), 483–492. https://doi.org/10.18280/ria.370225

Supriyadi, T., Julia, J., Aeni, A. N., & Sumarna, E. (2020). Action research in hadith literacy: A reflection of hadith learning in the digital age. *International Journal of Learning, Teaching and Educational Research*, *19*(5), 99–124. https://doi.org/10.26803/ijlter.19.5.6

Tikva, C., & Tambouris, E. (2023). The effect of scaffolding programming games and attitudes towards programming on the development of Computational Thinking. *Education and Information Technologies*, *28*(6), 6845–6867. https://doi.org/10.1007/s10639-022-11465-y

Vaičiūtė, K., Katinienė, A., & Bureika, G. (2022). The Synergy between Technological Development and Logistic Cooperation of Road Transport Companies. *Sustainability (Switzerland)*, *14*(21). https://doi.org/10.3390/su142114561

Villalustre, L., & Cueli, M. (2023). Assessing the Computational Thinking of Pre-Service Teachers: A Gender and Robotics Programming Experience Analysis. *Education Sciences*, *13*(10). https://doi.org/10.3390/educsci13101032

Zhang, J. (2010). Technology-supported learning innovation in cultural contexts. *Educational Technology Research and Development*, *58*(2), 229–243. https://doi.org/10.1007/s11423-009-9137-6

Zhang, X., Chen, S., & Wang, X. (2023). How can technology leverage university teaching & learning innovation? A longitudinal case study of diffusion of technology innovation from the knowledge creation perspective. *Education and Information Technologies*. https://doi.org/10.1007/s10639-023-11780-y

Zhao, J., Zhu, C., Peng, Z., Xu, X., & Liu, Y. (2018). User willingness toward knowledge sharing in social networks. *Sustainability (Switzerland)*, *10*(12). https://doi.org/10.3390/su10124680

Zitouniatis, A., Lazarinis, F., & Kanellopoulos, D. (2023). Teaching computational thinking using scenario-based learning tools. *Education and Information Technologies*, *28*(4), 4017–4040. https://doi.org/10.1007/s10639-022-11366-0