

EXPLORING PRESCHOOL TEACHERS' PERSPECTIVES ON THE INTEGRATION OF TECHNOLOGY-ENHANCED LEARNING IN BASIC SCIENCE

Victoria Olubola Adeyele

Department of Science and Technology Education, University of Johannesburg (South Africa)

Abstract

The rapid advancement of technology has led to an increased prevalence of digital devices in the lives of young children, who now view these tools as indispensable and valuable components of their everyday routines. Integrating technology-enhanced learning has emerged as a pivotal theme in early childhood education, reshaping the pedagogical approaches in preschool education. Preschool education is a critical stage for fostering foundational knowledge and a curiosity for scientific concepts. The role of technology in facilitating this educational journey has gained prominence in recent years. Therefore, this study explores preschool teachers' perspectives on integrating technology into basic science instruction for young children. This aims to examine preschool teachers' attitudes towards integrating technology in Basic science education and investigate the perceived benefits of technology integration in Basic science education from the perspective of preschool teachers. The study employed a survey approach. The survey used a 4-point Likert scale to elicit information from 63 preschool teachers. Responses from the data collected were analyzed using descriptive statistics, t-tests, and Pearson correlations. The study findings reveal a positive attitude of preschool teachers towards integrating technology-enhanced learning into basic science. The mean score shows the preschool teacher found technology to be a valuable tool for enhancing the learning experience in basic science ($\bar{x} = 3.65$), technology in basic science lessons at preschool can make learning more engaging for young children ($\bar{x} = 3.67$), integrating technology into Basic science education is essential for preparing preschoolers for the digital age ($\bar{x} = 3.46$), and the preschool teacher perceives technology as a valuable resource for adapting my teaching methods to the individual needs of preschool students ($\bar{x} = 3.52$). Furthermore, the findings show a strong positive and statistically significant correlation ($r = .608, p = .00$) between teachers' attitudes and perceived benefits of technology integration in preschool science. Conclusively, the study shows that preschool teachers hold a positive attitude toward integrating technology-enhanced learning into preschool Basic science education and recognize its benefits for student learning outcomes. Based on the result, the study recommends prioritizing professional development for teachers to improve their technological skills and pedagogical approaches and allocating resources for educational technology tools.

Keywords: *Preschool teachers, technology-enhanced, basic science, preschool children.*

1. Introduction

The integration of technology has become paramount at all levels of education including early childhood education. Preschool settings play a crucial role in laying the foundation for a child's academic and cognitive development, and the utilization of technology in this critical stage has garnered increasing attention. Recent literature underscores the transformational impact of technology in early childhood education (Nurdiantami & Agil, 2020). The 21st century has witnessed a paradigm shift in the way children engage with and perceive technology. With the prevalent presence of digital devices in daily life, young children now view technology as an integral and indispensable aspect of their learning environment (Graafland, 2018).

The impetus for integrating technology into preschool education is not solely driven by its ubiquity but also by its potential to enhance learning experiences. Technology offers interactive and engaging platforms that can cater to diverse learning styles, promoting active participation and knowledge retention among young learners (Raja & Nagasubramani, 2018). Furthermore, technology integration aligns with the evolving nature of literacy, encompassing not only traditional skills but also digital literacy crucial for navigating the modern world (Vodá et al., 2022).

In the realm of science education, early exposure to technology can provide preschoolers with a dynamic and interactive approach to understanding fundamental scientific concepts. Science education at the preschool level lays the groundwork for a lifelong curiosity and appreciation for scientific inquiry (Ramanathan et al., 2022). Therefore, understanding the perspectives of preschool teachers becomes imperative in navigating the integration of technology-enhanced learning into basic science education. Despite the potential benefits, challenges and concerns surround the integration of technology in early childhood education. Issues such as screen time, age-appropriate content, and teacher preparedness necessitate careful examination (Graafland, 2018). Preschool teachers, being key facilitators of early learning, are central to this discourse. Their attitudes, current technology use, and perceived benefits in integrating technology into basic science education necessitate exploration. To this end, this study addresses three research questions and one hypothesis: (1) What are the attitudes of preschool teachers towards the integration of technology in basic science education? (2) To what extent is technology currently used in preschool science classrooms? (3) What do preschool teachers perceive as the key benefits of technology integration in basic science education? and (4) Ho: Positive attitudes among preschool teachers toward integrating technology in basic science correlate with a perception of increased benefits.

2. Theoretical framework

The study is underpinned by Rogers' Diffusion of Innovations (DoI) theory to understand teachers' adoption and integration of technology-enhanced learning (Rogers, 1983). In applying the DoI theory to the study, several key components are considered. Firstly, the study explores preschool teachers' attitude towards technology integration and perceived benefits of integrating technology in the context of basic science in preschool education. This exploration aligns with Rogers' framework, which identifies these attributes as crucial determinants of innovation adoption. The study also delves into the categorization of preschool teachers into adopter categories. The adopter categories are defined as "the classifications of members of a social system on the basis of innovativeness" (Rogers, 2003, p. 22). The adopter categories include innovators, early adopters, early majority, late majority, and laggards. Individuals belonging to each adopter category exhibit similar innovation characteristics: an individual's innovativeness is determined by how early they adopt new ideas in comparison with other members of a system (Sahin, 2006).

First are the Innovators, characterized by their adventurous nature and eagerness to experiment. New ideas were welcomed by innovators. In the context of technology integration, these are the trailblazing teachers who boldly explore technological tools in their teaching practices. Following them are the Early Adopters, opinion leaders respected within their social system. These leaders play a crucial role in mobilizing resources that carry innovation forward, from initiation to implementation (Light, 1998). These individuals play a crucial role in influencing their peers, advocating for, and successfully integrating technology into teaching practices. As we move to the Early Majority, a pragmatic group that adopts innovations after careful observation. The early majority adopt innovation before their peers do; they are in the second half of the process. The Late Majority adopts innovations when they become a norm or necessity, and investigating their concerns and motivations reveals potential barriers and strategies for wider acceptance. Finally, the Laggards resist change due to fear of technology or a preference for traditional methods. Understanding why some teachers resist integrating technology-enhanced learning uncovers deep-seated concerns that need addressing for comprehensive adoption (Rogers, 2003).

Relevant to this study, the DoI Theory offers a structured framework for understanding the stages of adoption among teachers regarding technology-enhanced learning integration. Widely applied in educational technology research, particularly by Rogers (2003), this theory remains pertinent in understanding the dynamics of technology-enhanced learning adoption in educational contexts. Through this theoretical lens, this study aims to unravel the intricacies of technology integration, providing nuanced insights into the attitude of teachers and their perceived benefits of embracing innovative technology in their pedagogical practices.

3. Method

This study employed a survey approach. This approach comprehensively explores preschool teachers' perspectives on integrating technology-enhanced learning into basic science. The participants include 63 preschool teachers from diverse educational settings for the study. A simple random sampling was utilized to ensure representation across different demographics, such as gender, years of teaching experience, and qualifications. The survey consisted of 18 items, prompting preschool teachers to express their agreement or disagreement on a four-point Likert-type scale to attitude and perceived benefit of integrating technology-enhanced learning in basic science. The scale ranged from 1, indicating 'Strongly disagree,' to 4, representing 'Strongly agree.' Six items focused on attitudes toward technology integration in basic science, another six addressed perceived benefits, and the remaining six items explored the current use of technology in preschool science classrooms, with the scale ranging from 1 'Never' to 4 'Always'.

4. Result and discussion

The demographic composition of the participants reveals that 6.3% were male, while 93.7% were female. In terms of age distribution, 24.4% fell within the 25-34 age range, 31.1% were between 35-44 years old, 7.8% were aged 45-54, and 6.7% were in the 55-64 age bracket. Regarding teaching experience, 4.4% had less than a year of experience, 35.6% had 1-5 years, 7.8% had 11-15 years, 7.8% had 16-20 years, and 6.7% had more than 20 years. In terms of qualifications, 7.8% held a National Certificate in Education (NCE), 54.4% had a Bachelor of Education (B.Ed.), 3.3% had a master's degree, and 4.4% possessed a Postgraduate Diploma in Education.

The outcomes of Likert-type statements regarding preschool teachers' attitudes, current technology usage, and perceived benefits in integrating technology-enhanced learning in basic science, are presented in Tables 1, 2, and 3. The calculation of the mean score results in a value of between 3.10 to 3.67. Scores exceeding the minimum of 2.5 points indicate positive attitudes, usage, and benefits.

Table 1. Preschool teachers' attitude towards integrating technology-enhanced learning in basic science.

S/N		Frequency and Percentage				Mean	Std. Deviation
		SD	D	A	SA		
1	Technology is a valuable tool for enhancing the learning experience in basic science (AT1).	-	-	22 (34.9%)	41 (65.1%)	3.65	.481
2	I believe that using technology in preschool science lessons can make learning more engaging for young children (AT2).	-	-	21 (33.3%)	42 (66.7%)	3.67	.475
3	I believe integrating technology into basic science education is essential for preparing preschoolers for the digital age (AT3).	-	-	34 (54%)	29 (46%)	3.46	.502
4	I am open to experimenting with new technology tools and resources in my preschool science curriculum (AT4).	-	9 (14.3%)	39 (61.9%)	15 (23.8%)	3.10	.615
5	I am enthusiastic about the potential of technology to enhance the quality of preschool science education (AT5).	-	3 (4.8%)	46 (73%)	14 (22.2%)	3.17	.493
6	I perceive technology as a valuable resource for adapting my teaching methods to the individual needs of preschool students (AT6).	-	-	30 (47.6%)	33 (52.4%)	3.52	.503

Table 1 reveals the preschool teachers' attitude towards adoption of technology. The mean score shows the preschool teachers' found technology to be a valuable tool for enhancing the learning experience in basic science ($\bar{x} = 3.65$), technology in basic science lessons at preschool can make learning more engaging for young children ($\bar{x} = 3.67$), integrating technology into Basic science education is essential for preparing preschoolers for the digital age ($\bar{x} = 3.46$), open to experimenting with new technology tools and resources in my preschool science curriculum ($\bar{x} = 3.10$), enthusiastic about the potential of technology to enhance the quality of preschool science education ($\bar{x} = 3.17$), and perceives technology as a valuable resource for adapting my teaching methods to the individual needs of preschool students ($\bar{x} = 3.52$). Based on this, preschool teachers are positive about using technology to enhance basic science learning. It supports the findings of Ramadan et al. (2019) and Tiede et al. (2022) that teachers show a positive attitude towards technology adoption in the classroom.

Table 2. Preschool teachers' current use of technology in basic science.

S/N		Frequency and Percentage				Mean	Std. Deviation
		Never	Rarely	Sometimes	Always		
1	How often do you use technology, such as computers, mobile phone, or tablets, as a teaching tool in your preschool science lessons?	3 (4.8%)	4 (6.3%)	23 (36.5%)	33 (52.3%)	3.56	1.028
2	How frequently do you incorporate educational apps designed for science learning into your preschool classroom activities?	3 (4.8%)	13 (20.6%)	25 (39.7%)	22 (34.9%)	3.11	.969
3	How often do you utilize digital resources, such as multimedia presentations or videos, to support science lessons in your preschool classroom?	4 (6.3%)	12 (19.0%)	25 (39.7%)	22 (34.9%)	3.16	1.081
4	How frequently do you incorporate technology tools for teaching science with preschool children?	4 (6.3%)	10 (15.9%)	24 (38.1%)	25 (39.7%)	3.11	.900
5	How frequently do you use technology to customize science instruction to meet the individual needs of preschool children?	3 (4.8%)	16 (25.4%)	25 (39.7%)	19 (30.2%)	3.17	.493
6	How often do you integrate technology tools to promote scientific inquiry and exploration among preschool children?	7 (11.1%)	21 (33.3%)	11 (17.5%)	24 (38.1%)	3.52	.503

Table 2 presents the preschool teachers' current use of technology in preschool science classroom. The mean score shows the preschool teachers' use you uses computers, mobile phone, or tablets as a teaching tool in your preschool science lessons ($\bar{x} = 3.56$), frequently incorporate educational apps designed for science learning into your preschool classroom activities ($\bar{x} = 3.11$), often utilize digital resources, such as multimedia presentations or videos, to support science lessons in your preschool classroom ($\bar{x} = 3.16$), frequently incorporate technology tools for teaching science with preschool children ($\bar{x} = 3.11$), frequently use technology to customize science instruction to meet the individual needs of preschool children ($\bar{x} = 3.17$), and often integrate technology tools to promote scientific inquiry and exploration among preschool children ($\bar{x} = 3.52$). This study implies that preschool teachers currently utilize technology in preschool science classrooms. It corroborates the findings of Konca and Tantekin Erden (2021) that teachers demonstrated utilization of technology in the classroom.

Table 3. Preschool teachers perceived benefits of technology integration in basic science.

S/N		Frequency and Percentage				Mean	Std. Deviation
		SD	D	A	SA		
1	Technology integration enhances preschool students' engagement and interest in basic science concepts.	-	-	39 (61.9%)	24 (38.1%)	3.38	.490
2	Integrating technology in basic science education fosters a sense of curiosity and exploration among preschool students.	-	-	38 (60.3%)	25 (39.7%)	3.40	.493
3	Technology allows for individualized learning experiences, catering to different learning styles and abilities among preschoolers.	-	-	27 (42.9%)	36 (57.1%)	3.57	.499
4	The use of technology in preschool science education helps prepare children for future technological advancements and digital literacy.	4 (6.3%)	-	24 (38.1%)	35 (55.6%)	3.43	.797
5	Preschoolers' exposure to technology in science education promotes a positive attitude toward science as they grow.	-	4 (6.3%)	31 (49.2%)	28 (44.4%)	3.38	.607
6	Technology allows preschool teachers to stay updated with current scientific discoveries and teaching methods.	-	-	31 (49.2%)	32 (50.8%)	3.51	.504

Table 3 shows the preschool teachers perceived benefits of technology integration in basic science. The mean score shows technology integration enhances preschool students' engagement and interest in basic science concepts ($\bar{x} = 3.38$), fosters a sense of curiosity and exploration among preschool students ($\bar{x} = 3.40$), allows for individualized learning experiences, catering to different learning styles and abilities among preschoolers ($\bar{x} = 3.57$), helps prepare children for future technological advancements and digital literacy ($\bar{x} = 3.43$), exposure to technology in science education promotes a positive attitude toward science as they grow ($\bar{x} = 3.38$), and allows preschool teachers to stay updated with current scientific discoveries and teaching methods ($\bar{x} = 3.51$). The study implies that preschool teachers perceive technology-enhanced learning as beneficial to science classrooms. It supports the findings that teachers perceive technology-enhanced learning to benefit their classroom.

Table 4. Positive attitudes among preschool teachers toward integrating technology in basic science correlate with a perceived benefits.

Correlations			
		Grouped Attitude	Grouped Perceived Benefit
Grouped Attitude	Pearson Correlation	1	.608**
	Sig. (2-tailed)		.000
	N	63	63
Grouped Perceived Benefit	Pearson Correlation	.608**	1
	Sig. (2-tailed)	.000	
	N	63	63

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4 illustrates the correlation between preschool teachers' attitudes toward integrating technology in basic science and the perceived benefits of technology integration. The findings show a strong positive and statistically significant correlation ($r = .608$, $p = .00$) between teachers' attitudes and perceived

benefits of technology integration in preschool science. This indicates a significant correlation between preschool teachers' attitudes toward technology-enhanced learning and their perceptions of the benefits of technology-enhanced learning in the science classroom.

5. Conclusion and recommendation

Overall, the study shows that preschool teachers hold a positive attitude toward the integration of technology-enhanced learning into preschool basic science education and recognize the benefits it will have for their students' learning outcomes. Taking into account the results of the study, it is recommended that teachers prioritize professional development to improve their technological skills and pedagogical approaches in order to improve student outcomes. Also, allocating resources for educational technology tools and utilizing them should be done.

References

- Graafland, J. H. (2018). New technologies and 21st century children: Recent trends and outcomes. *OECD Education Working Papers* (Vol. 179). <http://dx.doi.org/10.1787/e071a505-en>
- Konca, A. S., & Tantekin Erden, F. (2021). Digital Technology (DT) Usage of Preschool Teachers in Early Childhood Classrooms. *Journal of Education and Future*, 19, 1–12. <https://doi.org/10.30786/jef.627809>
- Light, P. C. (1998). *Sustaining innovation*. Jossey-Bass.
- Nurdiantami, Y., & Agil, H. M. (2020). The Use of Technology in Early Childhood Education: A Systematic Review. In D. Utari, F. T. Maharani, R. H. Nurriszka, F. Bachtiar, & F. Ladesvita (Eds.), *Proceedings of the International Conference of Health Development. Covid-19 and the Role of Healthcare Workers in the Industrial Era (ICHD 2020)*. Advances in Health Sciences Research: Vol. 30 (pp. 258-261). <https://doi.org/10.2991/ahsr.k.201125.045>
- Raja, R., & Nagasubramani, P. C. (2018). Impact of Modern Technology. *Journal of Applied and Advanced Research*, 3(Suppl. 1), S33–S35. <https://doi.org/10.21839/jaar.2018.v3S1.165>
- Ramadan, K., Elatresh, J., Alzain, A., & Tokeser, U. (2019). Investigating Instructors' Attitude towards the Adoption of ELearning Technology in Libyan Higher Education Institutes: Case Study; Misurata University. *Australian Journal of Basic and Applied Sciences*, 13(5), 43-54. <https://doi.org/10.22587/ajbas.2019.13.5.5>
- Ramanathan, G., Carter, D., & Wenner, J. (2022). A Framework for Scientific Inquiry in Preschool A Framework for Scientific Inquiry in Preschool. *Early Childhood Education Journal*, 50, 1263-1277. <https://doi.org/10.1007/s10643-021-01259-1>
- Rogers, E. M. (1983). *Diffusion of innovations* (3rd ed.). Free Press.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
- Sahin, I. (2006). Detailed review of Roger's Diffusion of innovations theory and educational technology. *The Turkish Online Journal of Educational Technology*, 5(2), 14–23. <https://files.eric.ed.gov/fulltext/ED501453.pdf>
- Tiede, J., Grafe, S., & Mangina, E. (2022). Teachers' Attitudes and Technology Acceptance Towards AR Apps for Teaching and Learning. *Proceedings of 2022 8th International Conference of the Immersive Learning Research Network, ILRN 2022*, 1–8. <https://doi.org/10.23919/iLRN55037.2022.9815918>
- Vodă, A. I., Cautisanu, C., Grădinaru, C., Tănăsescu, C., & de Moraes, G. H. S. M. (2022). Exploring Digital Literacy Skills in Economics and Social Sciences and Humanities Students. *Sustainability (Switzerland)*, 14(5), 1-31. <https://doi.org/10.3390/su14052483>