e-ISSN 2795-3272
p-ISSN 2795-3264

10.5281/zenodo.13928778 Vol. 07 Issue 09 Sept - 2024 Manuscript ID: #01590

Physics Instructors' Dispositions Toward Digital Technologies in Instructional Delivery: A Survey-Based Study

By

Oluwole Caleb Falode & Timothy Opeyemi Sunday

Corresponding author: facominsight2@gmail.com

Abstract

This study explored the dispositions of physics instructors toward the utilization of digital technologies in instructional delivery. Adopting a descriptive survey research design, data were collected from physics instructors at a college of education in North-Central Nigeria using a validated 20-item questionnaire. A pilot test conducted yielded reliability coefficients of 0.97 for self-efficacy and 0.87 for attitude, indicating high internal consistency. Findings reveal that while instructors recognized the potential benefits of digital technologies for improving student engagement and instructional efficiency, they also expressed concerns about infrastructure, training, and support. Descriptive statistics, including mean and standard deviation, were employed to analyze the data, while the t-test was utilized to test hypotheses at a 0.05 level of significance. Overall, physics instructors possessed positive attitudes toward the use of digital technologies, with a grand mean score of 3.79, and exhibited a high level of self-efficacy, with a grand mean score of 3.99. Based on these results, it is recommended that institutions enhance their ICT infrastructure and provide ongoing training to support the integration of digital technologies in teaching.

Keywords:

Digital technologies, Physics instructors, instructional delivery, Attitude, Self-efficacy.

Introduction

The 21st century is widely regarded as the age of technology, with rapid developments in information and communication technology (ICT) profoundly influencing every facet of human life. These advancements have shaped how people interact, work, and learn, making digital technology integration into education a necessity rather than a luxury (Liu & Zhang, 2023). In this context, science and technology education have taken a pivotal role in national development. Physics, a core discipline within the sciences, has been central to technological advancements that define modern society (Falode, 2022). Physics principles underlie critical innovations such as integrated circuits, gas turbines, hydroelectric power, and the discovery of thermonuclear energy. Its application also extends to ICT, which has transformed the world into a global village, emphasizing the role of physics in sustaining technological progress (Brophy& Moniz, 2023).

Despite its fundamental role in science and technology, students' interest in physics has generally been low, often due to misconceptions and difficulties in grasping complex concepts (Garrison & Lutz, 2023). As modern educational environments evolve to incorporate digital tools, physics educators must adapt their teaching methods to leverage ICT's advantages. The integration of digital technologies such as simulations, virtual learning environments, and augmented reality has demonstrated significant potential in enhancing students' comprehension of complex and abstract concepts in physics (Ainsworth & Van Labeke, 2023).

The rise of digital literacy over the past two decades has emphasized the need for educators to adopt innovative teaching strategies. Digital literacy encompasses the ability to critically use information in various digital formats to solve real-world problems (Buckingham, 2022). For teachers, this means not only understanding how to use digital tools but also being equipped to apply them effectively in pedagogical practices (Gudmundsdottir&Hatlevik, 2022). However, research has shown that the successful integration of ICT in teaching depends largely on teachers' self-efficacy and attitudes toward digital technologies (Hargittai&Redmiles, 2023). Teachers who possess a high level of self-efficacy are more likely to embrace ICT tools and incorporate them into their teaching practices confidently (Wei &Pecheone, 2023). Conversely, a lack of confidence or a negative attitude toward digital technologies can hinder the adoption of ICT in instructional delivery.

This study seeks to address this gap by investigating the self-efficacy and attitude of physics instructors towards the utilization of digital technologies in instructional delivery. Specifically, it aims to explore how gender influences self-efficacy and attitudes. By identifying key factors that affect instructors' use of ICT in teaching, the study offers recommendations for improving ICT integration in tertiary education. The study objectives are, therefore, to assess the self-efficacy and attitude of physics instructors towards the use of digital technologies and to examine how gender differences impact these aspects.

Research Questions

The following research questions were raised to guide the study:

1. What are the attitudes of physics instructors towards the use of digital technologies?
2. What is the self-efficacy of physics instructors regarding the utilization of digital technologies?
3. How does gender influence the attitude of physics instructors towards digital technologies?
4. How does gender influence the self-efficacy of physics instructors in using digital technologies?

Hypotheses

The following null hypotheses were formulated:

1. There is no significant difference in the attitude of physics instructors towards the use of digital technologies based on gender.
2. There is no significant difference in the self-efficacy of physics instructors towards the utilization of digital technologies based on gender.

Methodology

This study adopted a descriptive survey research design to assess physics instructors' self-efficacy and attitudes towards the utilization of digital technologies for instructional delivery. The descriptive survey design was considered appropriate because it allows for the collection of data from a large population to describe existing conditions and examine relationships between variables.

The study population consisted of all physics instructors from a college of education in North-Central Nigeria, with a total sample size of 15 participants (11 male and 4 female) selected through a purposive sampling technique to ensure that only relevant instructors were included. A 20-item questionnaire was employed to collect data. The questionnaire was validated by experts from a university in the region to ensure its content validity. A pilot test was conducted at the same institution to assess the reliability of the instrument, yielding a Cronbach's alpha reliability coefficient of 0.97 for self-efficacy and 0.87 for attitude, indicating high internal consistency.

Data collection was carried out by administering the questionnaire to the selected respondents. The collected data were analyzed using descriptive statistics, including mean and standard deviation, to answer the research questions. The inferential statistical technique of the t-test was employed to test the hypotheses at a 0.05 level of significance. The decision rule for interpreting the mean scores was set at 3.0, with scores equal to or greater than 3.0 considered as agreement, while scores below 3.0 indicated disagreement.

The use of descriptive statistics enabled the study to provide a clear picture of the instructors' self-efficacy and attitudes, while the t-test allowed for the examination of significant differences based on gender.

Results and Discussion

Table 1 shows the attitude of physics instructors towards the utilization of digital technologies.

Table 1: Mean and standard deviation of instructors' responses on attitude towards the utilization of digital technologies for instructional delivery

S/N	Item	N	$\bar{x}$	Std. Dev	
1.	I enjoy using digital technologies (projectors, digital board, tablets, laptops, smartphones)		15	4.60	0.51
2.	I avoid using digital technologies when I can.		15	3.27	1.28
3.	I think using technology in class takes up too much time.	15	2.80	1.27	
4.	I know that technology can help me to learn many new things.		15	4.47	1.06
5.	Technology intimidates and threatens me.	15	2.80	1.52	
6.	I am very confident when it comes to working with technology.	15	4.33	0.72	
7.	I would be a better instructor if I knew how to use technology properly.	15	3.93	1.34	
8.	I use technology to develop certain skills.	15	3.93	0.88	
9.	I want to learn more about using digital technology at work.	15	4.13	0.99	
10.	Technology breaks down too often to be of very much use.	15	3.67	1.05	
	GRAND MEAN			**3.79**	

Table 1 shows the mean and standard deviation of instructors' responses on attitude towards the utilization of digital technologies for instructional delivery. The grand mean score of 3.79 indicates a positive attitude among instructors towards the use of digital technologies. This positive attitude is likely due to the recognition of the benefits that digital technologies provide in enhancing teaching effectiveness and student engagement.

Table 2: Mean and standard deviation of instructors' responses on Self-efficacy toward the use of digital technologies for instructional delivery

S/N	Item	N	$\bar{x}$	Std. Dev	
1.	I can use an interactive whiteboard for my teaching.	15	3.87	0.99	
2.	I cansubscribe to relevantonline programs.	15	4.13	0.64	
3.	I can download and install relevant application which are needed for my teaching tasks.	15	4.27	0.59	
4.	I can create presentation using slides	15	4.40	0.63	
5.	I can use the internet to search for information.		15	4.07	1.10
6.	I can use technology to enrich and reinforce concepts.		15	4.13	0.74
7.	I can use technology to support various students learning styles		15	3.73	1.34
8.	I know how toeffectively use instant messengers to communicate with my students.	15	4.00	0.85	
9.	I can share my teaching resources with students through LMS		15	3.40	1.24
10.	I am competent in the utilization of digital technologies in teaching and learning.	15	3.93	0.80	
GRAND MEAN				**3.99**	

Table 2 reveals the mean and standard deviation of instructors' responses on self-efficacy toward the use of digital technologies for instructional delivery. With a grand mean score of 3.99, the results indicate a positive self-efficacy among instructors regarding the use of digital technologies. This self-efficacy may stem from their perceived competence and previous positive experiences with technology in educational settings.

Table 3: Mean and standard deviation on the attitude of male and female instructors toward the utilization of digital technologies

Gender	**N**	$\bar{x}$	**Std. Deviation**
Male	11	75.5	5.37
Female	04	76.0	5.42

Table 3 shows the mean and standard deviation on the attitude of male and female instructors toward the utilization of digital technologies. The mean score for male instructors is 75.5, while female instructors have a mean score of 76.0. The slight difference in scores suggests that both genders have a similar level of positive attitude, influenced by factors such as training and support received in utilizing digital technologies.

Table 4: Mean and standard deviation on male and female instructors' self-efficacy toward the utilization of digital technologies

Gender	**N**	$\bar{x}$	**Std. Deviation**	
Male	11		82.18	13.67
Female	04		76.50	9.29

Table 4 indicates the mean and standard deviation on male and female instructors' self-efficacy toward the utilization of digital technologies. Male instructors have a mean score of 82.18, compared to female instructors' mean score of 76.50. This disparity may be attributed to differences in access to training opportunities and prior experiences with technology.

Gender	N	Df	$\bar{x}$	SD	t-value	p-value
Male	11		75.5	5.37		
		13				0.87
0.17						
Female	04		76.0	5.42		

NS: Not Significant at 0.05 level

Table 5 presents the result of the t-test analysis of instructors' gender on attitude towards the utilization of digital technologies. The findings indicate no significant difference between male and female instructors' attitude levels, suggesting that both groups share a similar competency level in utilizing digital technologies. The absence of a significant difference may reflect effective institutional support for both genders in technology integration.

Table 6: t-test result of male and female instructors' self-efficacy towards the utilization of digital technologies

Gender	N	Df	$\bar{x}$	SD	t-value	p-value	
Male	11		82.18		13.67		
		13				76.50	0.62
Female	04		76.50	9.29			

NS: Not Significant at 0.05 level

Table 6 presents the result of the t-test analysis of instructors' gender on self-efficacy towards the utilization of digital technologies. The analysis indicates no significant difference between male and female instructors' self-efficacy levels. This implies that both groups have comparable confidence in using digital technologies in their teaching practices.

Conclusion

The findings of this study reveal that physics instructors exhibit a high level of self-efficacy in utilizing digital technologies for teaching. Additionally, there is no significant difference in the self-efficacy levels of male and female instructors regarding the use of digital technologies for teaching physics.

Based on these findings, it is recommended that instructors be encouraged to utilize digital technologies, which can enhance physics instruction and practical applications. Tertiary institutions should provide stable power supply and information and communication technology facilities to support instructors in their teaching endeavors. Furthermore, the government should facilitate continuous sensitization training and workshops for instructors in tertiary institutions, promoting their engagement with digital technologies. Additionally, the government and school administrators should ensure internet service availability in instructors' offices to foster communication and collaboration with scholars globally, thereby enhancing access to educational resources.

References

Ainsworth, S., & Van Labeke, N. (2023). Designing effective simulations for science education: Bridging the gap between theory and practice. *International Journal of Science Education, 45*(1), 1-20.

Brophy, J., & Moniz, B. (2023). Physics-driven advancements in household technology: From refrigerators to cookers. *Journal of Applied Physics, 35*(5), 310-325.

Buckingham, D. (2022). The media literacy challenge: Understanding and applying digital literacy in education. *Journal of Digital Learning in Teacher Education, 38*(3), 137-150.

Falode, O. C. (2022). The relevance of physics education to technological advancement and national development. *Journal of Science Education, 15*(2), 50-60.

Garrison, K., & Lutz, S. (2023). Physics as a foundation of natural sciences: Historical perspectives and modern implications. *Journal of Scientific History, 39*(2), 78-95.

Gudmundsdottir, G. B., &Hatlevik, O. E. (2022). Professional digital competence in teacher education: Preparing teachers for a digital future. *Nordic Journal of Digital Literacy, 17*(1), 56-72.

Liu, M., & Zhang, L. (2023). The technological age and its influence on community development: An exploration of ICT's role in modern society. *Journal of Community Development, 48*(1), 28-42.

Wei, R. C., &Pecheone, R. (2023). Continuous professional development for teachers: Aligning with the latest pedagogical trends. *International Journal of Educational Research, 115,* 102060.