JOURNAL OF EDUCATION AND INNOVATION

Research Article

FACTORS AFFECTING TECHNOLOGY USE IN TEACHING FUNCTIONS IN HIGHER EDUCATION INSTITUTIONS: A REGRESSION ANALYSIS

Received: April 29, 2023 **Revised:** September 20, 2023 **Accepted:** December 25, 2023

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Abstract

This study identifies the factors that affect teachers' technology use in school-based, classroom-based, and class-based teaching functions. Through descriptive regression study, college teachers (N=536) from higher education institutions from Central and Western Visayas, Philippines, responded to standardized tools. Ten constructs were derived from these tools and subjected to regression analysis set at a 95% confidence level. Study findings revealed that the teachers have high extents of enabling factors, including resource use, design, and motivators. They promote and enhance technology integration in various teaching functions. However, deterring factors such as letting the teachers use reading resources and design multimedia resources consume their time and limit them from putting technology into work. Regression analysis showed that technology integration and intrinsic and extrinsic motivation significantly affect technology use, whereas use, design of some resources, and lack of self-reliance negatively impact technology use. In conclusion, technology is an essential component of higher education, which needs necessary support, motivation, and attitudes. As such, training is recommended for teachers to cope with these educational changes and provide a better learning experience.

Keywords: Technology Use, Teaching Functions, Higher Education, Regression Analysis, Philippines

Introduction

Technology plays a vital role in all aspects of life (Daghan, 2017). It ushers in fundamental structural changes integral to achieving significant productivity improvements. Technology infuses the classroom with digital tools like computers and hand-held devices to support teaching and learning (Szymkowiak et al., 2021). It enhances students' learning by increasing motivation and engagement. It transforms teaching by providing richer experiences and materials, available twenty-four hours a day, seven days a week. It paves the way to connect teaching and links professional content to personalized learning. The changing role of the teacher from didactic maestro to knowledge facilitator suggests that digital innovations and effective use of technology can help all teachers become 21st century teachers.

Research shows that the successful integration of technology in instruction depends on many factors. One of the primary considerations is the instructors' perceptions of the benefit of technology to help engage learners in classroom activities. Another is the knowledge of technology instructors use to integrate teaching endeavors (Dougherty, 2015; Johnson, 2019). Currently, faculty members of colleges and universities across the country face the major challenge of finding ways to engage, motivate, and coach today's learners inside and outside the classroom (Rutledge et al., 2018). This scenario caters to the current educational changes and the idea of learning anywhere, anytime. Adaptive Learning Anytime Anywhere (ALAA) communities have sprouted, which embraced innovations in all their guises and creative capacities, accommodating students of today’s generation. Undeniably, these students are digital natives who are very much akin to the use of technology.

Today's learners consider social media an innovation because it is educational and engaging. They are always connected and are on social media (Bagarukayo, 2018). They grew up with information readily available via information and computing technology (ICT) systems and tools (Toothaker & Taliaferro, 2017; Sanchez et al., 2023). With the Internet or the World Wide Web, it has become relatively easy for instructors to create sites, list links, and tailor-made exercises and activities for students to access via the Internet (Mananay, 2018). As they are exposed to different technologies, they become confident and comfortable using smartphones, social media, game boxes, digital readers, personal computers, and tablets. With this, institutions nationwide are ignited to equip the faculty with the skills and capabilities to use and integrate technology in teaching and learning to deal with digital native students (Boholano et al., 2021). Part of capacitating the faculty is by giving varied support services and training to boost their knowledge system on the value and use of technology (Mananay et al., 2022). Therefore, as the use of technology in education has become more widespread, faculty training and professional development must take center stage. For this to happen, it is imperative to identify and understand the factors of technology use among teachers.

Although technology is now more common in higher education, more is needed to know the elements that influence its utilization in instructional tasks. According to a review of the literature (e.g., Almaiah et al., 2019; Li et al., 2019; Spiteri & Chang Rundgren, 2020), there is no universal agreement on what factors are most crucial for influencing the use of technology in teaching. While some studies emphasize

the importance of institutional-level factors like access to resources and support (e.g., Boholano et al., 2022; Sanchez et al., 2023), others emphasize the importance of individual-level factors like technology skills and attitudes (e.g., Kaarakainen & Saikkonen, 2021). Furthermore, it is challenging to extrapolate findings from previous research to a larger population of college professors because they were often done in particular disciplinary or institutional contexts. To close this gap, a survey of college instructors might be carried out to learn more about their views toward proficiency with and institutional support for the technology. The most important predictors of the use of technology in teaching can be found using regression analysis, revealing the elements that can be targeted to enhance technology integration in higher education.

With this, the study intends to identify the different factors that affect the different teaching functions of teachers in higher education. Through this study, the administrators and policymakers can make educated choices about the distribution of resources and support for adopting technology-based teaching and learning techniques by identifying these characteristics. The findings from this study can also be used to direct the creation of professional development programs that enhance teachers' technological proficiency, encourage their motivation to incorporate technology into their instruction, and address barriers to technology use in the classroom.

Research Methodology

Research Design and Instruments

The study employed quantitative research, specifically the descriptive-regression study, to investigate the factors that affect technology use in teaching functions in higher education institutions. In this study, the use, design, and integration of technology and motivators and barriers were the independent variables, while technology use in teaching functions constituted the dependent variables. These measures were collected using appropriate adapted tools: (1) the tools for the independent variables were from the Questionnaire for Faculty Use of Technology for Teaching and Learning, and (2) the tool for the dependent variable was based on the report of the National Center for Educational Statistics. These tools were pilot-tested on 50 teachers from major universities to test validity and reliability. Principal component analysis was used to determine the inherent constructs from these tools, and the results are presented in Table 1.

Table 1 Constructs derived from the research tools

Tool	Constructs	Item No.	Rot. Sq. Load. (%Cum)	Assumptions	Cronbach's alpha
Resource Use (*I use...*)	Multimedia resources	4-6, 8-10	3.15 (26.2)	< .001; 0.768	0.842
	Productivity resources	1-3, 7	2.43 (46.5)		
	Reading resources	11-12	1.73 (61.0)		
Design (*I design...*)	Multimedia resources	4-7	2.34 (29.2)	< .001; 0.691	0.719
	Productivity resources	1-3, 8	1.95 (53.6)		

Tool	Constructs	Item No.	Rot. Sq. Load. (%Cum)	Assumptions	Cronbach's alpha
Integration *(I can integrate...)*	Technology	1-10	4.63 (51.4)	< .001; 0.833	0.879
Motivators *(I am motivated by...)*	Extrinsic factors	5-12	4.93 (41.1)	< .001; 0.877	0.920
	Intrinsic factors	1-4	3.18 (67.6)		
Barries *(I am challenged by...)*	Lack of administrative support	3-9, 15-16	5.96 (37.3)	< .001; 0.918	0.947
	Lack of self-reliance	1-2, 10-14	4.48 (65.3)		
Teaching Functions *(I use technology in...)*	School-based functions	7, 9, 11-15	4.00 (26.7)	< .001; 0.862	0.894
	Classroom-based functions	1-4, 8, 10	3.34 (48.9)		
	Class-based functions	5-6	2.25 (63.9)		

Table 1 shows resource use has three constructs, while the design has two and integration only has one. The motivators and barriers have two constructs, while the teaching functions have three. All these constructs passed the assumptions for principal component analysis and the reliability test based on acceptable Cronbach's alpha values.

Data Collection and Analysis

The study was conducted in 13 higher educational institutions in Central and Western Visayas, Philippines. A total of 536 teachers from these institutions participated in the study. Most of the teachers were aged between 20-35 years old (20-25, 17.16%; 26-30, 36.57%; 31-35, 20.15%) and males (58.96%). They specialize in six fields, namely education (53.73%), Business, HRM, and Tourism (11.19%), Information Technology and Engineering, and Sciences (9.70%), Arts (8.21%), and Philosophy and Political Science (7.46%). They are primarily full-time faculty (76.87%), come from local colleges and universities (77.61%), and are located within Cebu (tri-cities, 35.82%; province, 38.81%), Bohol (20.90%), and Leyte (4.48%).

The researchers submitted the paper for ethics review. After being given the certification, they sought permission from the heads of the HEIs to conduct the research in their respective institutions. Once permitted, they asked for informed consent from the teacher participants for voluntary participation in the study. Afterward, the online survey was administered to the respondents. The survey was sent to the respondents via Google Forms, and the results were collected by downloading the .csv file derived from Google Forms.

The collected data were stored and organized in Microsoft Excel and analyzed through the Jamovi (version 2.3). The data were analyzed using frequency and percentages for demographic profiles and percentages, means, and standard deviations for the Likert-scaled questionnaires. Regression analysis was also conducted to determine the impact of possible factors on the use of technology in teaching functions. This analysis was conducted at a 95% confidence level, and all p-values less than .05 are considered significant.

Ethical Considerations

The study followed the ethical considerations stipulated by the university ethics committee. Permission from HEI heads and informed consent from the teacher respondents were obtained before data gathering began. The participation of the teachers was voluntary, the data obtained were kept confidential, and names remained anonymous at all times.

Results and Discussion

Extent of Use, Design, & Integration of Technology and Motivators & Barriers in Technology

The extent of higher education teachers' use, design, and integration of technology, as well as motivators and barriers to technology, is presented in Table 2.

Table 2 Extent of use, design, & integration and motivators & barriers in technology

Construct	No. of Items	Mean	SD	Description
(R1) I use multimedia resources.	6	3.55	0.80	High[1]
(R2) I use productivity resources.	4	4.50	0.49	Very High[1]
(R3) I use reading resources.	2	3.89	0.79	High[1]
(D1) I design multimedia resources.	4	2.07	0.56	Moderate[2]
(D2) I design productivity resources.	4	2.76	0.33	High[2]
(I) I integrate technology.	10	4.09	0.63	High[1]
(M1) I am motivated by extrinsic factors.	8	3.98	0.75	High[1]
(M2) I am motivated by intrinsic factors.	4	4.49	0.51	Very High[1]
(B1) I am challenged by a lack of administrative support.	9	3.58	0.85	High[1]
(B2) I am challenged by a lack of self-reliance.	7	3.75	0.74	High[1]

[1]Legend: 1.00-1.80 (Very Low), 1.81-2.60 (Low), 2.61-3.40 (Moderate), 3.41-4.20 (High), 4.21-5.00 (Very High)

[2]Legend: 1.00-1.33 (Low), 1.34-2.67 (Moderate), 2.68-3.00 (High)

Based on Table 2, the teachers had a High extent of using multimedia and reading resources and a Very High extent of using productivity resources. This result means that digital resources have been used for teachers' work. This work includes auxiliary teaching and support functions that facilitate learning in higher education (Morais et al., 2015; Tulinayo, 2018). Aside from this, the teachers had a Moderate extent in designing multimedia resources but a High extent in designing productivity resources. Not only are these designed, but these resources are also shared with others. Digital resources are shared for teaching and learning purposes in higher education; however, some resources may not be shared due to copyright issues and personal content (Geladze, 2015). In terms of skills in integrating technology, the college teachers had a High extent as they can integrate technology resources in their teaching. Learning management systems and online technology resources are highly integrated because these resources are easily accessible, enrich the teaching-learning process, and provide convenience to the work of teachers in higher education (Rhode et al., 2017; Turnbull et al., 2019; König et al., 2020). Due to the pandemic, teachers have become familiar with these technology resources and

become proficient in integrating these resources into their teaching as these resources become instrumental in the new normal learning (König et al., 2020; Rapanta et al., 2020).

Moreover, the teachers had High motivation due to extrinsic factors. They are motivated to use technology because it can improve their work in teaching, support, and even administrative functions. Work improvement affects teacher use of technology as it also affects the teaching-learning process and their teaching life in general (Ghavifekr & Rosdy, 2015; Raja & Nagaubramani, 2018). However, intrinsic factors are higher than extrinsic factors. The teachers had a Very High extent of motivation due to intrinsic factors. Personal intents or self-motivation are essential factors that motivate teachers to adopt technology in higher education (Copriady, 2014; Sharma & Srivastava, 2019).

Furthermore, the teachers also had barriers, and they consider these barriers to have a High extent of affecting their use of technology in their workplace. Lack of administrative support, as shown in teacher development challenges and lack of school resources, hinder the use of technology in higher education. School resources such as human (faculty), material (technologies), and latent (policies) resources may be developed and put in place for efficient technology use in teaching (Ghavifekr & Rosdy, 2015). In addition, professionals who resist adapting to new technologies can add to the present problem (Sumalinog, 2022).

Extent of Technology Use in Teaching Functions

The extent of technology use in teaching functions is shown in Table 3.

Table 3 Extent of technology use in teaching functions

Construct	No. of Items	Mean	SD	Description
(T1) I use technology for school-based functions.	7	4.61	0.47	Very High[1]
(T2) I use technology for classroom-based functions.	6	4.78	0.34	Very High[1]
(T3) I use technology for class-based functions.	2	4.59	0.63	Very High[1]

[1]Legend: 1.00-1.80 (Very Low), 1.81-2.60 (Low), 2.61-3.40 (Moderate), 3.41-4.20 (High), 4.21-5.00 (Very High)

According to Table 3, the teachers rated themselves "Very High" regarding their use of technology in school-based, classroom-based, and class-based functions. This result means that teachers can highly use technology in their general teaching functions in school. They can employ technology to keep administrative records, access lesson exemplars, communicate with parents, students, and colleagues, and search for best teaching practices. Technology can help teachers deliver efficient services to the school stakeholders and effectively impact teaching functions (Egemen, 2018; Hero, 2019).

In addition, the teachers also have very high use of technology in classroom-based functions. This result means that the teachers have employed technology to help them prepare for the class, deliver instruction, create instructional materials, and grade the students. Technology has helped teachers in lesson designing, implementation, and assessment, making technology an indispensable component of classroom teaching (Hero, 2019; Backfisch et al., 2021). Aside from this, the teachers also have a very high utilization of technology in class-based functions. This finding suggests that teachers use technology in specific classes, like

languages, sciences, and home economics. They employ technologies like interactive activities and videos and require their students to use technology-mediated applications to create their outputs. With this, technology has become a helpful tool for teachers and students as they deliver effective instruction and produce quality outputs for specific classes (Okoye et al., 2021).

Regression Analysis of Technology Use in Teaching Functions

Regression analysis was used to determine the impact of the independent variables (use, design, integration, motivators, and barriers) on the dependent variable (teaching functions). The model fit measures of the three teaching function models are highlighted in Table 4.

Table 4 Characteristics of regression models on teaching functions

Model	R	R^2	F-value	p-value
(T1) School-based functions	0.638	0.407	36.1*	< .001
(T2) Classroom-based functions	0.520	0.270	19.5*	< .001
(T3) Class-based functions	0.581	0.338	26.8*	< .001

*Significant at α=.05

Three regression models illustrate good fit measures reflected in the R and R^2 values. Also, the models have significant F-values, predicting the extent of use of technology in the different teaching functions in school, classroom, and class.

School-based Teaching Functions

The impact of the constructs on school-based teaching functions is presented in Table 5.

Table 5 Impact of technology on school-based teaching functions

Construct	B	t-value	p-value
(R1) I use multimedia resources.	0.03	0.956	.340
(R2) I use productivity resources.	0.20	4.996*	< .001
(R3) I use reading resources.	0.01	0.215	.830
(D1) I design multimedia resources.	- 0.04	- 1.068	.286
(D2) I design productivity resources.	0.23	4.445*	< .001
(I) I integrate technology.	0.11	3.033*	.003
(M1) I am motivated by extrinsic factors.	0.14	5.137*	< .001
(M2) I am motivated by intrinsic factors.	0.12	3.110*	.002
(B1) I am challenged by a lack of administrative support.	0.15	4.657*	< .001
(B2) I am challenged by a lack of self-reliance.	- 0.23	- 6.318*	< .001

*Significant at α=.05

The model also shows that extrinsic (p=<.001) and intrinsic motivation (p=.002) can significantly affect the teachers' use of technology in school-based functions. This finding means that if teachers are self-motivated and externally motivated, they can use technology efficiently in school. Extrinsic and intrinsic motivators can improve teachers' use of technology (Ghavifekr & Rosdy, 2015; Raja & Nagaubramani, 2018). Interestingly, the challenge due to lack of administrative support (p=<.001) positively affects the teachers' use of technology. Although there is a lack of support due to financial constraints, teachers still find ways to integrate technology into their functions to make their work efficient. Lastly, the challenges due to lack of self-reliance (p=<.001) have negatively affected their use of technology. When teachers do not believe in themselves due to incompetence, they may not use technology in their work. Therefore, they must be trained on how to use this technology so that they can rely on themselves concerning technology. Challenges can affect the use of technology among teachers in their general functions (Sumalinog, 2021).

Classroom-based Teaching Functions

The impact of the constructs on classroom-based teaching functions is presented in Table 6.

Table 6 Impact of technology on classroom-based teaching functions

Construct	B	t-value	p-value
(R1) I use multimedia resources.	0.03	1.275	.203
(R2) I use productivity resources.	0.17	5.338*	<.001
(R3) I use reading resources.	-0.05	-2.337*	.020
(D1) I design multimedia resources.	-0.10	-3.062*	.002
(D2) I design productivity resources.	0.09	2.217*	.027
(I) I integrate technology.	0.12	4.212*	<.001
(M1) I am motivated by extrinsic factors.	0.01	0.281	.779
(M2) I am motivated by intrinsic factors.	0.12	3.841*	<.001
(B1) I am challenged by a lack of administrative support.	0.00	0.122	.903
(B2) I am challenged by a lack of self-reliance.	0.03	1.126	.261

*Significant at α=.05

As presented in Table 6, the use (t=5.338; p=<.001) and design (t=2.217; p=.027) of productivity resources as well as integration of technology (t=4.212; p=<.001) can significantly affect the teachers' use of technology in the classroom. This result means that their skills in making documents, worksheets, and slides are crucial in their task as classroom instructors. Through this integration, teachers can increase efficiency and productivity in the classroom in lesson planning, grading, and record-keeping. With this, they are given ample time to improve their instructional practices, including student engagement. Effective technology integration leads to enhanced outcomes, which can positively impact their classroom roles (Rathore & Sonawat, 2015; Hero, 2019).

However, the model found that the teachers' use of reading resources (t=-2.337; p=.020) and the design of multimedia tools (t=-3.062; p=.002) have a negative impact on their use of technology in the classroom. This result could be explained by the fact that these teachers may have difficulty using them and rely on other tools that are easier to employ. Even though they do not use these reading and multimedia resources, they still have high utilization of technology as they use the more familiar and easy-to-use tools in the classroom. Training on the use and design of reading and multimedia resources must be conducted so that teachers can become competent and improve their teaching practices in the classroom. Through this, the integration of novel technology can help teachers in their daily instruction in the classroom (Rana & Rana, 2020). Intrinsic motivation (t=3.841; p=<.001) significantly impacts the teachers' use of technology in the classroom. When teachers are internally motivated due to the positive effects of technology, they do their best to use technology as a vital component of their teaching strategies. Due to this, their instruction becomes creative and innovative, leading to a more engaged and practical student learning experience. Intrinsic motivation offers a sense of ownership in technology integration, resulting in greater effectiveness and sustainability over time (Bailey et al., 2021).

Class-based Teaching Functions

Table 7 shows how the components affect technology use in specific classes.

Table 7 Impact of technology on class-based teaching functions

Construct	B	t-value	p-value
(R1) I use multimedia resources.	0.33	7.216*	<.001
(R2) I use productivity resources.	0.03	0.528	.597
(R3) I use reading resources.	-0.19	-5.568*	<.001
(D1) I design multimedia resources.	-0.27	-4.755*	<.001
(D2) I design productivity resources.	-0.15	-2.088*	.037
(I) I integrate technology.	0.43	8.371*	<.001
(M1) I am motivated by extrinsic factors.	-0.06	-1.665	.096
(M2) I am motivated by intrinsic factors.	0.04	0.717	.474
(B1) I am challenged by a lack of administrative support.	0.03	0.739	.460
(B2) I am challenged by a lack of self-reliance.	0.01	0.245	.806

*Significant at α=.05

Based on Table 7, the use of multimedia resources (t=7.216; p=<.001) and integration of technology (t=8.371; p=<.001) have a significantly positive impact on the teachers' use of technology in their specific classes. This finding can be attributed to the interactive and personalized nature of technology resources teachers want to employ in their respective classes. They employ this technology to cater to diverse learning needs and preferences, leading to better learning outcomes. Effective technology integration can facilitate innovative instructional practices that positively impact student progress (Hero, 2019).

However, negative effects are also observed from the use of reading resources (t=-5.568; p=<.001) and the design of multimedia (t=-4.755; p=<.001) and productivity resources (t=-2.088; p=.037). These results signify that teachers may have difficulty using these resources in their specific classes because of a lack of constructive alignment, insufficient student guidance, and technical difficulties. The said issues may have impeded the effective use of such resources that they use other readily available and accessible resources in the classroom to implement their specific classes. Like classroom-based functions, teachers need to be trained on using and designing reading, multimedia, and productivity resources to facilitate better use of technology in class-specific roles and yield better learning outcomes (Rana & Rana, 2020).

Conclusions and Suggestion

College teachers in Central and Western Visayas, Philippines, heavily rely on digital resources, such as multimedia and productivity tools, when instructing students. They are motivated to do this and have mastered incorporating technology into their instruction. However, they also need help with obstacles, such as a lack of administrative support, teacher development difficulties, and school resources. Additionally, instructors heavily rely on technology for school-related, classroom-related, and class-related tasks, and their use of productivity resources, design of those resources, and integration of technology substantially impact their school-related tasks. The use of technology by instructors is significantly influenced by intrinsic and extrinsic motivation, whereas a lack of independence has a detrimental effect. In conclusion, while college teachers have been found to possess high levels of enabling factors for technology integration in various teaching functions, there are still deterring factors that limit their ability to effectively put technology into practice, such as the time-consuming nature of using reading resources and designing multimedia resources. Educators and institutions must continue to address and mitigate these obstacles to leverage technology's benefits in the classroom fully.

The institutions should improve teacher development programs, offer sufficient school resources, and provide administrative support to solve teachers' challenges while utilizing technology. Teachers can work together and exchange technology resources and expertise. Additionally, the institutions can hold training sessions on the efficient use of technology in the classroom, particularly concerning productivity resources. They can offer rewards to people who create and distribute digital resources. Teachers can be pushed to become more independent to change their negative impression of technology use.

Especially in the modern learning environment, technology has become an essential teaching tool in higher education. Teachers need to receive the necessary support, training, and incentives to utilize technology's potential for teaching and learning fully. To effectively promote technology integration in education, intrinsic and extrinsic motivation should be fostered. Negative attitudes toward technology use should also be addressed.

Acknowledgments

The Commission on Higher Education (CHED), through the Institute for Research in Innovative Instructional Delivery (IRIID) at Cebu Normal University (CNU), has the researchers' sincere gratitude for the research grant that made it possible for them to conceptualize and finish this relevant article.

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