Freshmen's Technological Expertise and Distance Learning Readiness: A Convergent Parallel Design

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ABSTRACT

This convergent parallel mixed methods study primarily focused on technological expertise and distance learning readiness of freshmen students. The study had two phases: the quantitative phase and the qualitative phase. In the quantitative phase, results found that technological expertise and distance learning readiness were highly correlated with each other, with an R-value of .828 and a p-value of 0.000. In the qualitative phase, four themes were extracted: Technological Tools as a Significant Factor in Distance Education, Technological Expertise as Influenced by Minor Skills and Educational Courses, Technological Use Due to Education's Status Quo, Challenges in Technological Availability, and Technological Background. The results showed a merging and converging characteristic of both data. The lived experiences of the freshmen students showed that technological tools, which are an indicator of technological expertise, are also a factor to be considered in distance learning readiness.

INTRODUCTION

The COVID-19 pandemic prompted a significant overhaul of the education system worldwide, with countries implementing distance learning measures such as online tools, television broadcasts, and video lectures (UNESCO, 2020; Bana et. al). Mitchell (2020) noted that only a third of global universities offer full online courses, impacting students significantly. UNESCO's data (2020) indicated that at its peak in April 2020, over 91% of students globally were affected by school closures, highlighting the pandemic's profound impact on education. Gabor (2020) emphasized the dual challenges of school closures and students' lack of technological access and skills. Llego's (2020) report revealed a decline in student enrollment for the school year 2019-2020, indicating difficulties in adjusting to the new learning mode. A study among medical students (Baticulon, 2020) showed that only 41% felt capable of engaging in online learning, with technological barriers cited. The data also highlighted many students in Region XI facing potential challenges due to a lack of technological expertise.

Freshmen students, being more susceptible to changes in learning (Olutola *et al.*, 2016), require careful examination of their readiness for distance learning. Studies (Kaymak, 2013; Beyth-Marom *et al.*, 2013; Kitsantas & Chow, 2010) emphasized the relationship between online learning readiness, learning preferences, and psychological attitudes toward technology use. Learning motivation, study habits, and technological attributes were identified as key factors influencing distance learning performance (Horzum *et al.*, 2015; Joosten & Cusatis, 2020; Olutola *et al.*, 2016).

The sudden shift to online learning, particularly affecting first-year tertiary-level students, raised concerns at international, national, and local levels. Urgent action is needed to understand how freshmen's technological expertise correlates with their learning readiness (Olutola *et al.*, 2016). Recognizing the gaps between students' readiness and technological aspects is crucial for the successful implementation of e-learning (Olutola *et al.*, 2016). This paper aims to help higher education institutions assess student readiness in the online learning environment by considering technological factors.

Research Questions

This study investigates the correlation between freshmen students' technological expertise and readiness for distance learning. Additionally, it seeks to derive codes and themes from participants' experiences and ultimately integrate and validate both quantitative and qualitative data. Specifically, the study will address the following objectives:

1. What is the level of technological expertise in terms of:
    1.1 Technological spaces;
    1.2 Computer skills; and
    1.3 Perception of the use of technology-enabled learning?

2. What is the level of distance learning readiness in terms of:
    2.1 Self-direction;
    2.2 Learning preference;
    2.3 Study habit;
    2.4 Technology skills; and
    2.5 Computer equipment capabilities?

3. Is there a significant relationship between the level of technological expertise and the level of distance learning readiness?

4. Based on the experiences of participants, what is the role of technological expertise in the distance learning readiness of freshmen students?

5. How do the qualitative data corroborate with the quantitative data?

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LITERATURE REVIEW

Technological Expertise

Farley (2019) provides a comprehensive definition of technological expertise, encompassing the skills necessary for intricate computer and physical technology operations within diverse industries. He specifically highlights its significance in enhancing students' learning experiences and extending their capabilities in mathematical research. Additionally, Beers (2011) underscores the importance of integrating technological expertise into students' learning preferences for e-learning encounters, defining it as the ability to utilize technology efficiently, effectively, and ethically for accessing and managing information.

Ziefle and Schaar (2010) highlight the positive impact of technological expertise on understanding modern technologies, particularly in the information and communication technology field. Larson and Miller (2011) argue that increasing expertise in digital technologies is essential as technology becomes more prevalent in society, especially in researching, organizing, assessing, and communicating information. However, the Australian Council for Educational Research (2016) notes that despite its growing importance, technological expertise faces challenges due to revisions in hierarchical structures and production methods, leading to uncertainty, particularly in critical economic sectors like financial services.

The level of technological expertise has three indicators: technological spaces, computer skills, and perception of technology-enabled learning.

Technological Spaces

As defined by Srivastava (2015), encompass the availability of technology equipment for students, representing an essential factor in education. These spaces facilitate efficient learning and effective teaching by providing technical capacity for applying external knowledge (Ottenbreit-Lefwich, 2014). Alsied and Pathan (2013) liken technological spaces to the dominance of the English language, emphasizing their role in creating opportunities for efficient learning and teaching. Despite government initiatives, the shortage of computer resources can impede technology experiences, leading to a decrease in technological expertise (Buabeng-Andoh, 2012). Gilakjani (2013) supports this, noting the shortage of information technology as a contextual factor affecting computer hardware/software for learners and instructors. The Office of Educational Technology (2016) highlights that technology-enabled learning environments, or technological spaces, enable less experienced learners to access specialized communities, fostering increased engagement in learning. The societal context plays a crucial role in the use of technology in distance learning, establishing a direct association between technological spaces and the independent variable.

Computer Skills

Refer to the ability and speed to locate, gather, and provide data in the graphical user interface of computers, enabling individuals to perform basic operations (Goldhammer et al., 2013). Israel (2010) emphasizes the significance of computer skills in the effective use of the Internet. Paino and Renzulli (2012) underscore the role of computer skills in perpetuating inequality in schools, while Guclu (2020) views them as crucial skill sets for technological proficiency and career success. Baker (2013) supports this by characterizing computer skills as a set of abilities encompassing the use of programs for accounting, databases, email, web, programming, spreadsheets, and word processing. Lowe's (2019) report suggests that computer skills acquired in high school contribute to success in college, particularly in processing and presenting information, aligning with the concept of technological expertise in the current study.

Perception of Use of Technology-Enabled Learning

Perceived usefulness, as defined by Peart, et al. (2017), is a relevant factor influencing the acceptance of technology. It guides research in understanding students' characteristics and how they define usefulness, encompassing their attitude and acceptance of e-learning training methods. These factors are crucial for the effectiveness of instructional processes, influenced by individual learning styles, available technical tools, learners' opinions on technological assistance, and technology sophistication in online learning (Parai et al., 2015). Beckman et al. (2014) case study of 12 students from Australian secondary schools supports these findings. The study provides detailed accounts of students' technology experiences in various contexts, highlighting the heterogeneous and complex network of factors influencing technology practices. The study concludes that students' perceptions of technology use directly impact their technological expertise for learning. In the current study, students' perceptions of technology are used as an indicator of the independent variable, aligning with the claim that perception is a direct factor in determining the level of technological expertise. All the previous studies presented reiterate the researchers' aim to regard technological expertise as a determinant variable. However, it is notable that these studies only involved a minimal description of the level of technical experience and how it correlates to the level of distance learning readiness that this current study will attempt to provide.

Distance Learning Readiness

Distance learning readiness, as specified by Hashim and Tasir (2014), refers to the preparedness of an institution or organization for various aspects of e-learning technology before implementing the entire e-learning environment for diverse purposes. Ngampornchai and Adams (2016) highlight that sufficient e-learning readiness can offer educational opportunities to students who cannot access higher education, contributing to a country's competitiveness in the Southeast Asian Nations Association. This readiness variable significantly

influences students' perspectives on education, as suggested by Yilmaz's study (2017), which indicates that student motivation is directly affected by the level of distance learning readiness. Bovermann *et al.* (2018) identify technological components and computer skills as critical predictors of social interaction, social communication, and learning outcomes in online learning. Additionally, Rasouli *et al.* (2016) highlight the flexibility in methodology, content management, synchronous and asynchronous interactions, organization of courses, educational projects, student projects, and assessment between teachers and students facilitated by distance learning readiness.

The level of technological expertise has five indicators: self-direction, learning preference, study habits, technological skills, and computer equipment capabilities.

Self-Direction

Self-direction in education, as highlighted by Petro (2017), encompasses diverse activities such as exploring new knowledge, critical thinking, active participation in learning groups, and creating one's learning path. Boyer *et al.* (2014) emphasize the efficiency of self-direction in engaging and training adult learners. Self-directed learning, as described by Garland (2017), allows students to decide what and how they learn with teacher guidance. Murad *et al.* (2010) consider it a suitable approach to keep practitioners informed about recent literature. The effectiveness of self-directed learning extends to medical students, patients, physicians, nurses, and healthcare practitioners. Schiller's (2020) findings emphasize the importance of self-direction in a student's ability to adapt to distance learning, particularly in completing assignments and handling technological tasks. Online classes, as mentioned in the research, require students to navigate virtual spaces independently, indicating the relevance of self-direction to students' distance learning readiness.

Learning Preference

Learning preference, as defined by Liew, Barua, and Sidhu (2015), refers to the adopted learning style or methods preferred by learners for acquiring, evaluating, and interpreting insight. James, Thomas, and D'Amore (2011) characterize learning preference as an individual's favored way of acquiring knowledge and comprehending information, aligning with the psychological type theory of Jung. Jain, Sharma, and Joachims (2015) suggest that student learning preferences are complex and influenced by the context of various objects and human interactions in their environment. Battalio's study (2010) indicates that learners with healthy learning preferences exhibit more success and better adaptation to online courses compared to other learning dimensions tested. This underscores that learning preference serves as a valuable indicator of students' readiness and performance in distance education.

Study Habit

Study habits, as defined by Uju and Paul (2017), encompass how an individual approaches their studies, emphasizing the importance of good study habits for academic success. Rabia *et al.* (2017) further explain that study habits determine the extent of learning, one's academic goals, and the level of achievement. Olatula *et al.* (2016) note that study habits can be systematic, efficient, or inefficient, with good study habits contributing to better academic performance and a lack thereof leading to inadequacies. Somuah and Dankyi's study (2014) focused on the study habits of University of Cape Coast Distance Education learners in Ghana. The results revealed habits such as reading while lying in bed, studying for less than three hours a day, not seeking additional materials from the internet, and reviewing notes before face-to-face meetings. The study suggests that study habits play a role in the distance learning readiness of students, with implications for online learning, where unhealthy study habits may be manifested.

Technology Skills

Computer skills, defined as the ability to use computers and technology effectively (Resume.com, 2019), involve acquiring expertise in performing physical or digital tasks (Indeed Career Guide, 2017). Wikiversity (2020) stated that technological abilities, especially computer skills, are crucial for effectively utilizing computers and related technology. In the study by Somuah and Dankyi (2014) on University of Cape Coast Distance Education learners, computer skills were considered vital, particularly in the context of distance learning education. The study suggests that those who do not develop their computer expertise may lag behind in the digital revolution, emphasizing computer skills as fundamental predictors of a student's readiness for engagement in distance learning.

Computer Equipment Capabilities

Digital accessibility, as defined by Kulkarni (2018), pertains to the extent to which people with disabilities or special needs can access and navigate products, devices, services, or environments. Foley and Ferri (2012) note that accessible technologies enhance access and flexibility for students and adults. However, Haines *et al.* (2018) suggest that technology availability has minimal and fleeting effects on group development.

Mitchell (2020) emphasizes the importance of computer capabilities in online learning, where distance education relies on electronic communications. The research indicates that a lack of computer capabilities among students can result in decreased performance and engagement in online learning, suggesting a direct correlation between computer equipment capabilities and distance learning readiness. Notably, while many studies on online learning readiness focus on college students and their relationship with variables like perception and satisfaction, research on the potential connection between online learning readiness and technological expertise is limited. The researchers aim to address this

gap and contribute to the growing literature on the topic.

Correlation between Variables

Halili's (2019) study, "Technological Advances in Education," explores the use of advanced technology in teaching and learning to enhance the education system and engage students in distance learning. The research suggests that the efficient utilization of advanced technology is crucial for student engagement in online schooling, contributing to the readiness for distance learning. A quantitative approach revealed a lack of efficient technology usage in Malaysia's education system, urging improvements for global competitiveness. Cigdem and Yildirim's (2014) study investigates the relationship between students' technological approaches and online learning readiness at a vocational college. The research implies that students' technological expertise may positively relate to their readiness for online learning, affecting dimensions of online learning readiness.

Wei and Chou's (2020) study explores the structural model determining the impact of distance learning perceptions and readiness on students' online learning performance. Results suggest that students' computer efficacy and motivation positively influence online performance, indicating a positive relationship between computer skills (a component of technological expertise) and online readiness. Contrary to these findings, Mafenya (2013) presents empirical evidence opposing the idea that technological spaces or resources significantly impact students' readiness for e-learning. The study at the University of South Africa indicates a high level of acceptance despite resource shortages, challenging the assumption that technological spaces directly affect readiness.

Lai, Wang, and Lei (2012) suggest in their study that adapting technology indirectly affects computer self-efficacy and perceived utility in online education. This contradicts the notion that technology use positively relates to student performance and engagement in online learning, providing an alternative perspective. Raes and Dapaepae's (2019) study explores how exposure to technology can improve students' performance in school. The results suggest that students exhibit a positive predisposition to educational technology's usefulness and ease of use, with perceptions significantly improving after technology exposure.

In summary, these studies offer varying perspectives on the relationship between technological expertise, readiness for online learning, and the impact of technology on students' performance and engagement in distance education.

MATERIALS AND METHODS

A convergent parallel mixed-method design was utilized in this study. Creswell and Clark (2011) stated that mixed methods research includes at least one quantitative and one qualitative strand. For the quantitative phase, this study employed a descriptive correlational research model to explore relationships between variables, specifically examining if changes in one variable corresponded to changes in another (Tan, 2014). In the qualitative phase, a phenomenological design was employed, concentrating on individual experiences through in-depth, occasionally repeated interviews with participants. This approach allowed researchers to extract insights for generating themes and codes, facilitating cross-referencing of data from both researches.

This study focused on freshmen students from diverse courses and schools in Davao City during the 2020-2021 academic year. For the quantitative phase, due to the unspecified total freshmen population, the researchers utilized a purposive snowball sampling method, particularly the maximum variation sampling technique, resulting in a sample size of one hundred (100) freshmen students. Purposive sampling, also known as judgmental or selective sampling, involves researchers using their judgment to choose participants based on prior knowledge of the study's purpose (Foley, 2018). By combining this with snowball sampling, where participants nominate others, the researchers ensured diversity in the sample. Maximum variation sampling, guided by researchers' judgment, was employed to select participants with diverse characteristics (Dudovskiy, 2010). For the qualitative phase, fourteen participants were purposively chosen, nine for in-depth interviews and 5 for focus group discussion. The selection criteria ensured maximum variation of responses, aligning with the vulnerability of freshmen students to learning changes (Olutola et al., 2016). Open-ended, discovery-oriented interviews were conducted to explore participants' feelings and perspectives deeply (Guion et al., 2015). Focus group discussions, recommended for understanding issues at a deeper level than surveys (Prasad & Garcia, 2015), complemented the qualitative aspect of the research.

The data analysis method applied in this study, as per Spaulding (2011), was unilaterally chosen and had a significant impact on the questionnaire's form and purpose. The research instrument, the questionnaire, was adapted from Das and Mishra (2016) for technological expertise and Penn State University (2015) for distance learning readiness. The adapted questionnaire comprised two sections, with the first divided into three segments and the second into five, each addressing specific indicators of the independent and dependent variables. Each category contained thirty questions, totaling sixty in the questionnaire. Respondents expressed their agreement with statements on a scale from one to five, reflecting varying levels of agreement. Three experts validated the questionnaire, yielding a mean score of 4.57 out of 5, indicating excellent quality. For determining technological expertise, a test questionnaire adapted from Das and Mishra (2016) was used, and the level was calculated based on the mean scores of the independent variable indicators. For assessing distance learning readiness, a standardized questionnaire from Penn State University (2015) was adopted, and the level was determined using

the mean scores of the dependent variable. Pilot testing with fifty individuals ensured the questionnaire's credibility and reliability, as confirmed by a Cronbach's alpha of .928, indicating excellent reliability and internal consistency for all sixty items (Institute for Digital Research and Education, 2020). In the qualitative phase, the researchers employed an interview guide for in-depth and focus group discussions. This guide, according to Menzies *et al.* (2016), is a list of high-level topics with corresponding questions designed to address specific aspects during the interview. The interview guide utilized in this study consisted of one central question with seven sub-questions.

RESULTS AND DISCUSSION
Technological Expertise of Freshmen Students
Table 1 shows the level of technological expertise

Table 1: Technological Expertise of Freshmen Students

Indicators	Mean	Standard Deviation	Descriptive Level
Technological spaces	3.6460	.66049	High
Computer skills	3.5492	.74251	High
Perception of the use of technology-enabled learning	3.8143	.86038	High
Overall	**3.6698**	**.64627**	**High**

concerning its three (3) indicators: technological spaces, computer skills, and perception of the use of technology-enabled learning. All indicators had a mean of more than 3.49 but less than 4.50, which gave us a high overall mean of 3.6698 for the independent variable. This indicated that the level of technological expertise was manifested by the freshmen students oftentimes. Further, students had a strong foundation of expertise in using technology in distance learning.

Table 2 mirrored the level of distance learning readiness

concerning its three (5) indicators: self-direction, learning preference, study habit, technological skills, and computer equipment capabilities. All indicators except for the computer equipment capabilities had more than 3.49 but less than 4.50, which gave us a high overall mean of 3.7018 for the dependent variable. This indicated that the freshmen's level of distance learning readiness is manifested oftentimes. Further, this meant that the students had a high readiness level for distance learning education.

Table 2: Distance Learning Readiness of Freshmen Students

Indicators	Mean	Standard Deviation	Descriptive Level
Self – Direction	3.8660	.79952	High
Learning Preference	3.8871	.61865	High
Study Habit	3.5386	.67001	High
Technological Skills	3.7940	.83434	High
Computer Equipment Capabilities	3.4233	.90435	Moderate
Overall	**3.7018**	**.61266**	**High**

Table 3 illuminates a robust and statistically significant relationship between freshmen's technological expertise and their distance learning readiness, as evidenced by the high R-value of .828. This substantial correlation suggests a direct proportionality, signifying that an increase in technological expertise corresponds to an elevated level of distance learning readiness, and conversely, a decrease in technological expertise corresponds to a decline in distance learning readiness. This observed relationship holds true for freshmen students at the tertiary level.

Notably, the p-value of 0.000 underscores the significance of the relationship between technological expertise and distance learning readiness. This low p-value affirms that the observed association is not due to chance, further reinforcing the validity and importance of the identified link between these two variables.

Experiences and Insights on Technological Expertise and Distance Learning Readiness
The data gathered from in-depth interviews and focus

Table 3: Significant Relationship between Technological Expertise and Distance Learning Readiness

Variables	r - value	p-value	Decision	Interpretation
Technological Expertise	.828	.000	Reject H_0	Significant
Distance Learning Readiness				

group discussions were transcribed, coded, and organized into themes. For this particular research question on technological expertise and distance learning readiness, four themes were generated. The themes are as follows:

Technological Tools as a Significant Factor in Distance Education, Technological Expertise as Influenced by Minor Skills and Educational Courses, Technological Use Due to Education's Status Quo, and Challenges in

Technological Availability and Technological Background.

Technological Tools as a Significant Factor in Distance Education

When freshmen students were interviewed about their technological expertise and distance learning readiness, their responses reflected that Technological Tools as a Significant Factor in Distance Education became a reoccurring theme. The said theme includes three codes, namely: Efficiency of Technological Tools, Time Management as an Effect of Utilizing Technology, and Learning Independence during Distance Education.

Technological Expertise as Influenced by Minor Skills and Educational Courses

When the participants were asked what experiences influenced them to have the level of technological expertise they have at the moment, researchers found out that their experiences are influenced by two major factors. First, are their minor skills from using the internet and technological tools. Secondly, are the educational courses they went through back in Junior High School and Senior High School. Besides, two codes were generated from the theme: Minor Technological Skills Influences Students' Technological Learning Skills and Technology Education in High School as Major Influence to Students Technological Expertise.

Technological Use Due to Education's Status Quo

When freshmen students were interviewed about their technological expertise and distance learning readiness, their responses reflected that the technological use due to education's status quo became a reoccurring theme. The said theme has two codes: More Frequent Technological Use and LMS as Common Factor of Technological Use.

Challenges in Technological Availability and Technological Background

When the participants were interviewed about their difficulty in using technology during their distance learning education, their responses revealed that particular challenges in technological availability and technological background became an essential theme.

This theme has two codes which include accessibility of technology affects the level of difficulty, and students' insufficient technological knowledge affects the level of difficulty.

Corroboration of the Qualitative and Quantitative Findings
Merging

The nature of data in the given focal point is merging. The results from the quantitative and qualitative phases were integrated using a joint display.

In the process, the researcher evaluates and analyzes first the quantitative findings and then discusses them with the qualitative findings to either confirm or not the statistical results (Todd, 2016). According to Creswell (2006), the data are merged when the researcher takes the two data sets and explicitly brings them together or integrates them.

Converging

Table 6: Joint Display of Salient Qualitative and Quantitative Findings

Aspects/Focal Point	Quantitative Data Findings	Qualitative Data Findings	Nature of Data Integration	Axiological Implications
Relationship Between Technological Expertise and Distance Learning Readiness	R-value is .828 which indicates that the two variables are highly correlated by 82.8% The P-value is 0.000 which indicates that the relationship between two variables is significant. Thus, rejecting the null hypothesis, means that there is a significant relationship between the freshmen's technological expertise and distance learning readiness.	Technological Tools as a Significant Factor in Distance Education with Codes: • Efficiency of Technological Tools • Time management as an Effect of Utilizing Technology • Learning Independence during Distance Education	Merging - Converging	Freshmen students should have enough technological knowledge and skills to be ready in distance learning.

The findings of the study show that the integration of the quantitative and qualitative data is converging. This trend occurs when both data are collected at different times and evaluates them separately. Afterwards, equating the result to approve the findings (Demir & Pismek, 2017).

Relationship between Technological Expertise and Distance Learning Readiness

As illustrated in the table, column 2 provides quantitative results, which shows that there is a significant relationship between the technological expertise and distance learning readiness of students. There is a high correlation between the two variables with 82.8% of correlation. Their relationship is also significant with a 0.000 p-value.

The corroborated findings approved the mentioned study by Halili (2019), where they found that the usage of

technology can improve student's engagement in online learning. Further, Cigdem and Yildirim's (2014) report supported the claim as it was inferred from their findings that technological expertise could be positively related to their learning readiness in an online setting. Moreover, the current study's findings complemented the results of Wei and Chou's (2014) study. Their results showed that computer skills relate to the independent variable of the current study as a reason or a mediating variable for a high level of distance learning readiness among freshmen students.

CONCLUSION

Based on the findings of the study, freshmen students manifested a very strong foundation of technological expertise. Students also showed sufficient technological availability in their learning environment. Further, freshmen students had enough computer skills and had a positive perception of technology-enabled learning. Moreover, students also showed a very strong readiness level for distance learning. To elucidate, they manifested healthy self-directed thinking towards distance education. Freshmen students also had a good learning preference and healthy study habits during their education in the distance learning mode. Further, their skills in utilizing technologies were also sufficient. However, their usage of computer equipment was not that highly manifested all the time. The lived experiences of freshmen students, on the other hand, imply that they become more efficient, time-bounded, and independent while learning online with respect to their high level of technological expertise. Thus, it corroborates positively with the statistical results from the quantitative phase. Therefore, freshmen students possess technological skills such that they become more ready to engage in distance learning. These skills have been used to help them be more effective despite the struggles they encounter online.

Based on the findings that freshman students have a strong technological foundation and readiness for distance learning, the researchers would make the following research recommendations:

Expand the study to include students from various demographics and backgrounds to see if there are differences in technological expertise and distance learning readiness based on other factors. Survey professors and university administrators about their perspectives on students' technology skills and needs related to distance learning. Identify any gaps between student capabilities and instructor expectations. Investigate the technology training and support provided by colleges/universities to identify gaps and areas for improvement in preparing freshman students for online learning. Research the influence of high school experiences with technology on freshman students' university preparation. Determine what capabilities students gain before college.

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