Beyond the Screen: Investigating Students' Digital and Technological Competence

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Abstract: Modern technology has completely altered our way of life. Because of these shifts, technology has made our lives easier, quicker, and more enjoyable. The emergence of the coronavirus (COVID-19) pandemic, however, shocked the world and had a significant influence on people's lives everywhere. This had a profound effect on nearly every facet of life, including education, and the Philippines was not an exception. The purpose of this research was to assess the level of technological and digital literacy among 1,408 undergraduates at a state university in the Philippines using a cross-sectional explanatory design. The results of the study show that students have a very high level of digital competence in terms of communication and collaboration. This implies that the students are well-versed in communicating and collaborating with other people in an online learning environment. Additionally, respondents with a high level of technological skill thought that the use of technology was generally accepted. Given the importance of students being at ease with the use of technological tools in online learning, this finding strongly suggests that educational administrators should extend its support by providing ICT infrastructures to maximize students' potential in using digital tools while learning. Additionally, educational institutions should keep giving students comprehensive training and technical assistance so they can advance their digital and technological knowledge and abilities.

Keywords— digital competence; technology acceptance; communication; collaboration; technological skills

1. INTRODUCTION

In today's digital era, digital skills and competence are becoming increasingly crucial for academic and professional success. Digital competence incorporates a broader range of skills, including critical thinking, problem-solving, and communication in digital contexts. As technology continues to evolve and become more ingrained in our daily lives, it is imperative that students develop these skills and competencies in order to thrive in the digital world.

Research studies demonstrate that students with strong digital skills and competence are better able to navigate the digital landscape, engage in lifelong learning, and succeed in the job market. Nevertheless, many students still lack the necessary digital skills and competencies to completely realize these benefits. In order for students to successfully traverse the digital terrain of the 21st century, acquiring digital skills is becoming increasingly crucial. Students need to be able to use digital tools and applications, as well as conduct research and learning activities online, in order to be successful in both their academic and personal lives. Students need to have strong digital abilities in order to stay up with the constantly shifting digital scene, as technology is continuing to advance at an ever-increasing rate.

Students who are proficient in digital literacy have an easier time learning new material. According to Maderick et al. (2016), a significant number of students who are entering educational settings make the process of learning meaningful by utilizing digital devices in digital surroundings. Ferrari (2012) made the observation that the most important people in the process of educating the next generation for life in a society that is undergoing rapid transformation are the educators and the administrators of the schools. Students run the risk of falling victim to a variety of dangers if they are unable to handle and control the digital and technological instruments at their disposal, including believing false and incorrect information and participating in various forms of cybercrime.

The COVID-19 pandemic has had a significant impact on our daily lives, requiring us to adopt new methods of working, learning, and communicating. One of the most significant changes brought about by the pandemic has been the rapid acceleration of digital transformation, as people throughout the world rely more on digital technology to remain connected and continue with their daily lives. In addition, the pandemic has compelled many schools to adopt online education, highlighting the significance of digital skills and competence for students. Nonetheless, the pandemic has exacerbated existing disparities in access to technology and digital resources, making it more challenging for some pupils to acquire these skills. This situation emphasizes the significance of teachers' roles in fostering digital skills and competence among students. Teachers can help students become more comfortable with technology and develop the critical thinking and problem-solving skills necessary for success in the digital age by incorporating digital tools and resources into their instruction.

It is of the utmost importance to conduct assessments of the levels of digital competence possessed by students and to develop educational programs with the express purpose of enhancing those levels. This will facilitate the movement toward education that is both blended and delivered remotely. As a result, this serves as the drive for this present research investigation.

2. METHODOLOGY

2.1 Research

In accordance with the research problems raised in this investigation, this study employed a cross-sectional explanatory research design. Cross-sectional studies provide data for describing the status of phenomena or relationships among phenomena at a fixed point in time. Generally, the main focus of this study is to determine the level of technological and digital competence of 1,408 college students in a state university in the Philippines. In the context of the present study, a cross-sectional study could be used to analyze whether the technological and digital competence can be correlated to users' behavioral intentions to use innovational technologies.

To gather the data needed, a structured questionnaire intended for student-respondents, consisting of two components, was used. The first section comprises the demographic profile of the students, which includes their age, sex, year level, program, mobile learning device used, and internet connectivity satisfaction. Similarly, the second section examines the technological competence of the student-respondents. In this part of the questionnaire, the researcher adopted the technological competence survey developed and validated by Çebi and Reisoğlu (2020). The internal consistency reliability of this survey questionnaire ranged from 0.83 to 0.90 for the five technological components, namely: (a) Information and Data Literacy; (b) Communication and Collaboration; (c) Digital Content Creation; (d) Safety and Security; and (e) Problem-solving.

Both descriptive and inferential statistics were utilized in the analyses of the data gathered. Descriptive statistics such as mean and standard deviations were used to determine the technological and digital competence of the student-respondents along with the five identified components. On the other hand, Analysis of Variance (AnoVa) was performed to determine whether there are any appreciable variations in the respondents' approval of using technology when they are grouped according to technological knowledge and skills. Statistical Package for Social Sciences (SPSS) Version 23 was used for all statistical analyses, which were all performed at a 0.05 level of significance.

3. RESULTS AND DISCUSSION

To address the issues addressed in the study, the data were presented, analyzed, interpreted, and discussed in this section. The outcomes of the statistical analyses of the hypotheses were also taken into consideration.

Student-Respondents' Technological Competence

The following tables show the student-respondents' perceived technological competence along with the five digital competence components, namely: (a) information and data literacy; (b) communication and collaboration; (c) digital content creation; (d) problem-solving; and (e) safety and security. Moreover, descriptive measures such as frequency

distribution and measures of central tendency were also employed to present the statistical data gathered.

Table 1. Student-Respondents' Technological Competence

Technological Competence Components	Mean Rating	Verbal Interpretation
Information and Data Literacy	3.73	High
Communication and Collaboration	4.48	Very High
Digital Content Creation	4.30	Very High
Problem-Solving	4.11	High
Safety and Security	3.94	High
Over – All Mean Rating	**4.11**	**High**

Legend: 1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High

Table 1 above shows the summary of the student-respondents' technological competence along the five digital components. Based on the analysis, it can be depicted that the student-respondents have very high level of competence in terms of communication and collaboration as indicated by the mean rating of 4.48. This data implies that the students are well-versed in communicating and collaborating with other people in an online learning environment. This supports with the study of Pozo et al. (2021) which revealed that students are highly competent in using technological and digital tools in communicating and collaborating with others. This is also in accordance with Schlichter (2020) which stressed that digital tool is a great way for students to engage with their teachers and peers. Further, the use of digital tools in education helps students to get more useful and updated information to connect with learning groups and other educational systems that make education convenient.

Moreover, the mean rating of 4.30 clearly indicates that the student-respondents have very high level of competence with regard to digital content and creation. This implies that the student-respondents have the ability to create digital content in different formats using technological tools. This supports the findings of Claro et al. (2018) that students are well-equipped with technological knowledge and skills in creating digital content. Contrariwise, the analysis also reveals that information and data literacy got the lowest mean rating of 3.73. This reflects that though the students are well-versed in searching information through digital tools yet they are unable to consider the reliability of those information as well as the credibility of its sources. This corroborates with Durako (2020) which highlighted that social networks are filled with a large amount of misinformation, which often misleads the public to make wrong decisions. Hence, the spread of misinformation in social networks has also become

a widespread concern among students. This finding justifies the importance of media and information literacy in combating false information, and developing and strengthening the capabilities and skills of critical thinking among students to identify reliable and unreliable information.

Table 1.a. Student-Respondents' Perceived Technological Competence
Information and Data Literacy

Indicators	Mean Rating	Verbal Interpretation
1. *I identify my needs when searching for data, information, or digital content in online environments.*	4.33	Very High
2. *I can look for information online using a search engine.*	4.30	Very High
3. *I access the data, information, and digital content I need in online environments.*	4.23	Very High
4. *I use information search strategies to access data, information, and digital content in online environments.*	4.16	High
5. *I critically evaluate the accuracy of the data, information, or digital content I access.*	3.36	Fair
6. *I investigate from different sources whether the data, information, or digital content I access is reliable.*	3.35	Fair
7. *I pay attention to source and citation representations when sharing data, information, or digital content.*	3.30	Fair
8. *I have a strong awareness of the credibility of information when searching online.*	3.29	Fair
9. *I consider the credibility of information online when I quote or share it.*	3.21	Fair
Over – All Mean Rating	**3.73**	**High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

Table 1.a above shows the student-respondents' perceived technological competence in terms of information and data literacy. Based on the statistical analysis, the overall mean rating of 3.73 indicates that the student-respondents have a high degree of competence in the area of information and data literacy. This stresses that the student-respondents

can articulate information needs, and locate, manage, and retrieve digital data, information, and content. Furthermore, it can be seen that the statement "I identify my needs when searching for data, information, or digital content in online environments" obtained the highest mean rating of 4.33. This strongly implies that the respondents have the competence to identify, locate, retrieve, store, organize, and analyze data. This data was followed by the statements "I can look for information online using a search engine" and "I can access the data, information, and digital content I need in online environments", having weighted means of 4.30 and 4.23, respectively. These mean values point out that the respondents can access and navigate information and digital content needed using technological tools. These finding validate the study of Lopes-Meneses et al. (2020) that students demonstrated high competence in using technological and digital tools in searching and accessing the digital content and information they needed.

Contrariwise, the statement "I consider the credibility of information online when I quote or share it" got the lowest weighted mean of 3.21. This reveals that the respondents have fair competence in terms of evaluating the accuracy of the digital information as well as the credibility of the sources of this information. This finding is in tandem with Durako (2020) which emphasized that when media and information literacy becomes a mandatory topic in education institutions, and is taught as a proactive form of literacy education, it will help empower students to become more critical thinkers and resilient towards misinformation. With this, there is a need to train students on media and information literacy to develop their ability to understand, distinguish, criticize, and verify the content and sources of media messages and information.

Table 1.b. Student-Respondents' Perceived Technological Competence
Communication and Collaboration

Indicators	Mean Rating	Verbal Interpretation
1. *I use digital technologies to communicate in online environments.*	4.75	Very High
2. *I use digital technologies to collaborate with people for learning.*	4.69	Very High
3. *I easily organize and store data, information, and content in online environments.*	4.70	Very High
4. *I share data, information, or digital content using different digital technologies.*	4.63	Very High

5.	I use digital technologies to collaborate in online environments.	4.61	Very High
6.	I can use collaboration tools and contribute to e.g. shared documents/files someone else has created.	4.57	Very High
7.	I can use advanced features of communication tools (e.g. video conferencing, data sharing, application sharing)	4.52	Very High
8.	I comply with behavioral norms (ethical rules/ policies) when interacting in online learning environments.	3.38	Fair
	Over – All Mean Rating	**4.48**	**Very High**

Legend: 1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High

As pertains to communication and collaboration, Table 1.b above depicts that the student-respondents have a very high level of technological competence in terms of communication and collaboration. The overall mean rating of 4.48 strongly justifies that the respondents have a high level of confidence in communicating in digital environments, sharing resources and digital information, and collaborating and linking with each other through digital tools. Furthermore, the statement *"I use digital technologies to communicate in online environments"* got the highest mean rating of 4.75, indicating that the student-respondents have very high competence in communicating with other people in an online environment through the use of digital technologies. This was followed by the statement *"I use digital technologies to collaborate with people for learning"* having a mean rating of 4.69, which also shows that the respondents can use digital tools and technologies for collaborative processes and the construction and creation of data, resources, and knowledge. Contrariwise, the statement *"I comply with behavioral norms (ethical rules/policies) when interacting in online learning environments"* got the lowest weighted mean of 3.38, which indicates that the student-respondents have a fair level of competence in terms of applying behavioral norms and netiquette while using digital technologies and interacting in digital environments.

Table 1.c. Student-Respondents' Perceived Technological Competence
Digital Content Creation

Statements		Mean Rating	Verbal Interpretation
1.	I can develop content in different formats (video, visual, animation, etc.) using digital technologies.	4.68	Very High
2.	I develop content in simple forms using digital technologies.	4.59	Very High
3.	I can apply basic formatting (e.g. insert footnotes, charts, tables) to the content I or others have produced	4.56	Very High
4.	I can use advanced formatting functions of different tools (e.g. mail merge, merging documents of different formats, using advanced formulas).	4.43	Very High
5.	I produce digital content by making changes to ready-made content.	4.35	Very High
6.	I can use software programs to deal with data visualization, edit pictures, and make a video.	4.28	Very High
7.	I can produce complex digital content in different formats (e.g. text, tables, images, audio files)	4.18	High
8.	I pay attention to copyrights and licensing when developing digital content.	3.36	Fair
	Over – All Mean Rating	**4.30**	**Very High**

Legend: 1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High

Table 1.c shows that the overall mean rating of 4.30 indicates that the student-respondents have very high competence in terms of digital content creation. This implies that the respondents can create content, and produce creative and relevant content and media outputs using digital technologies. Further analysis also reveals that the statement *"I can develop content in different formats (video, visual, animation, etc.) using digital technologies"* got the highest mean rating of 4.68, whereas the item *"I pay attention to copyrights and licensing when developing digital content"* got the lowest mean rating of 3.36.

This finding implies that the student-respondents have the competence to create original and relevant content and knowledge through digital technologies. However, they have fair competence in applying intellectual property rights and licensing while creating content and knowledge using digital tools.

Table 1.d. Student-Respondents' Perceived Technological Competence
Problem Solving

Statements	Mean Rating	Verbal Interpretation
1. I identify the causes of technical problems I encounter when using digital media and devices.	4.18	High
2. I solve the technical problems I encounter when using digital media and devices.	4.17	High
3. I use different digital technologies to create innovative solutions.	4.14	High
4. I identify opportunities for the development of my digital competencies.	4.12	High
5. I develop my digital competence by following new developments.	4.09	High
6. I can deal with computer and software problems by searching online	4.07	High
7. I frequently update my digital skills to decrease my limits and increase my digital knowledge.	4.01	High
Over – All Mean Rating	**4.11**	**High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

With regard to student-respondents' technological competence in terms of problem-solving, the overall mean of 4.30, as shown in Table 1.d above, indicates that the respondents can recognize technical problems when operating digital tools and devices and using digital environments and can solve them, from troubleshooting to solving more complex problems.

Added to this, the item *"I identify the causes of technical problems I encounter when using digital media and devices"* got the highest mean of 4.18, while the item *"I frequently update my digital skills to decrease my limits and increase my digital knowledge"* obtained the lowest mean of 4.01. This signifies that the respondents can analyze technical issues and can identify, evaluate, select, and use digital tools and technology solutions to address them.

Table 1.e. Student-Respondents' Perceived Technological Competence
Safety and Security

Statements	Mean Rating	Verbal Interpretation
1. When sharing personal information online, I take precautions to protect the personal data of others.	4.36	Very High
2. I am aware of the effects of digital technology use on health (physical and psychological).	4.34	Very High
3. I can use a variety of programs to deal with Antivirus problems on the computer.	4.30	Very High
4. I am aware that I leave a digital footprint when I navigate online environments.	4.22	Very High
5. I take precautions about safety and privacy in online environments.	3.61	High
6. I frequently check the security configuration of my devices regularly.	3.49	High
7. I am familiar with the data policies of the digital services that I am a user of.	3.28	Fair
Over – All Mean Rating	**3.94**	**High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

The overall mean rating of 3.94, as shown in Table 1.e above, reveals that the student-respondents have a high level of competence as pertains to safety and security. This suggests that the respondents have the competence, along with personal protection, data protection, security measures, and the safe and sustainable use of digital technologies. Further, the data also reveals that the statement *"When sharing personal information online, I take precautions to protect the personal data of others"* has the highest mean of 4.36, whereas the item *"I am familiar with the data policies of the digital services that I am a user of"* has a mean score of 3.28. This implies that though the respondents can protect personal data and privacy in digital environments, they have a fair knowledge of safety and security measures for using digital tools and have due regard for reliability and privacy.

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