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TECHNOLOGICAL CHALLENGES FOR HISTORICALLY UNDERREPRESENTED, ECONOMICALLY DISADVANTAGED, AND FIRST-GENERATION STUDENTS TRANSITIONING TO COLLEGE: A PILOT STUDY

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ABSTRACT

Aim/Purpose	Access to technology is critical for college students, especially those from marginalized groups (O'Sullivan & Forgette, 2024). This study aims to identify gaps in technological capital that expose inequities in the use and comprehension of technology and to assess their impact on measurable college persistence among historically underrepresented, economically disadvantaged, and first-generation incoming first-year college students in New York State.
Background	Historically underrepresented, economically disadvantaged, and first-generation students often lack social, cultural, and technological capital and live in minoritized communities with low socioeconomic status (Whitcomb &

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	Singh, 2020). These students encounter educational obstacles, particularly in post-secondary education, resulting in difficulty in maintaining persistent in higher education (Whitcomb & Singh, 2020).
Methodology	The study will adopt the Solomon Two-Group Design methodology to investigate whether increased instruction and technical interventions lead to enhanced academic or personal achievement, potentially fostering academic persistence (Solomon, 1949). A total of 14 randomized historically underrepresented, economically disadvantaged, and first-generation incoming first-year college students at a major university center in New York State will participate.
Contribution	This paper contributes to the body of existing knowledge by highlighting the significant of technological instruction, including workshops and training, to assist historically underrepresented, economically disadvantaged, and first-generation students in their transition to college.
Findings	In this study, the results indicate that the historically underrepresented, economically disadvantaged, and first-generation students who received technological instruction during the experiment demonstrated improved proficiency in using basic technology essential for college.
Recommendations for Practitioners	The results of this experiment indicate an increased number of students who understand how to operate technology between the pre- and post-test results. Colleges should offer targeted workshops to help historically underrepresented, economically disadvantaged, and first-generation students develop essential technological skills for academic success.
Recommendations for Researchers	Due to time constraints, we conducted an experiment with a two-day workshop to educate participants on using technology before completing the post-survey. Hence, it is important to acknowledge that a two-day workshop may be insufficient to educate participants on how to use certain technology essential for the transition into college. Future studies should consider a larger experiment consisting of at least 60 students, with four groups of 15 participants, a one-week instruction course, and an evaluation of the participants' academic progress after four semesters to ensure they gain understanding and proficiency in technology for college success.
Impact on Society	It is worth noting that historically underrepresented, economically disadvantaged, and first-generation students face disadvantages regarding technology-based equipment and knowledge (Gillis & Krull, 2022). Colleges should pay special attention to adopting technology to support these students during their first year (Mavroudi et al., 2022). Recognizing this need is not only the responsibility of educational institutions but also the students' social networks must also provide support to facilitate their success in higher education.
Future Research	In the future, it is recommended to conduct a larger experiment involving at least 60 students, divided into four groups of 15 participants, with a one-week instruction course. After four semesters, the participants' academic progress should be evaluated. This experiment should utilize the Solomon Four-Group Design (Solomon, 1949) to eliminate bias and determine whether instruction in using technology can increase academic achievement for historically underrepresented, economically disadvantaged, and first-generation students as they navigate their first year of college.

Keywords historically underrepresented students, economically disadvantaged students, first-generation students, information technology, college transition

INTRODUCTION

With the advanced developments in technology, all sectors have integrated technological tools into their daily operations, including the educational sector (Gillis & Krull, 2022). The use of technology is crucial to facilitate daily operations and requires that individuals possess the ability to utilize it. One such tool is a learning management system (LMS), a web-based platform designed to enhance the development, management, and delivery of education inside educational institutions (Ma et al., 2024). In addition to using an LMS, video conferencing tools like Zoom Cloud Meeting are also essential to support online learning and communication between students and instructors (Chung et al., 2020). Video conferencing became popular, especially during the Covid-19 pandemic starting in 2020, not only to facilitate online communication but also to facilitate instructors to deliver course materials (Sari et al., 2022).

Some students are exposed to technology in their daily lives due to coming from well-educated families or being economically advantaged. However, other students are unable to access technology due to various circumstances. Students who lack access to technology that supports their learning processes may be classified as historically underrepresented, economically disadvantaged, and first-generation students. This group often lacks social, cultural, and technological capital and tends to reside in minoritized communities with low socioeconomic status (Gillis & Krull, 2022). In most cases, students from historically underrepresented, economically disadvantaged, and first-generation backgrounds face significant challenges in both secondary and post-secondary education because of their lack of access to technology. These challenges, as described by Bourdieu (1986) and Portes (1998), hinder their transition from high school to higher education and their ability to persist in academic programs. Recent research has verified these findings, emphasizing that systemic educational inequities disproportionately affect these students, affecting their academic performance and progression (Alqahtani et al., 2022).

Previous studies have explored the challenges encountered by historically underrepresented, economically disadvantaged, and first-generation students, along with program design to facilitate their success in higher education. Walsh et al. (2021) identified that minority graduate students faced challenges in accessing resources and engaging in online learning during the Covid-19 pandemic due to inadequate support systems. Their research highlighted the critical role of support systems in promoting graduate school persistence. Their research highlighted the critical role of support systems in promoting graduate school persistence. Similarly, Arif et al. (2021) emphasized the importance of creating accessible learning environments for underrepresented students, which includes fostering connections with educators and ensuring access to technology to enhance their academic experiences. Additionally, Franklin et al. (2020) called for a reevaluation of student self-confidence in information technology domains, identifying potential disparities in self-confidence among underrepresented students.

Lewine et al. (2019) examined predictors of academic success among economically disadvantaged first-year college students, revealing that gender plays a significant role in academic performance. The study found that poverty levels influence the relationship between affect and GPA; in cases of extreme poverty, increased affect positively correlates with GPA, whereas in moderate poverty, increased affect negatively correlates with GPA. This highlights the importance of offering financial support to economically disadvantaged students to improve their persistence in higher education. However, addressing student persistence also requires multifaceted approaches. For example, Wilson et al. (2012) emphasized the value of professional development and advising as alternative strategies to support undergraduate persistence, including skill-building activities such as training in

information technology. More recent research by Li et al. (2020) explored learning motivation among economically disadvantaged versus non-disadvantaged college students. Additionally, the study also examines the relationship between two variables: learning modes and learning outcome. Their findings indicate that non-disadvantaged students tend to achieve higher outcomes in various dimensions, including exploratory learning and academic identity, highlighting the need for tailored interventions to bridge the gap for disadvantaged students. The findings indicate that students' learning motivation may not substantially enhance their learning outcomes, and exploitative learning exerts a complete mediation impact on students' motivation.

Research conducted by Hagler (2023) on first-generation college students found that these individuals often receive more proactive mentoring from adults with educational capital. However, the study also recognizes that other adults may play significant roles not reflected by the college-specific measures included in the research. This aligns with findings by Peña et al. (2022), who emphasize that advisors, mentors, and professors are essential resources for first-generation and low-income students, helping to facilitate and support their transition into college. Similarly, Phillips and Deleon (2022) examine Latin (X) students in higher education, emphasizing the importance of directors, mentors, and administrators to comprehend and adequately support first-generation students to advance programmatic goals and foster professional development.

Expanding on prior research addressing historically underrepresented, economically disadvantaged, and first-generation students, along with initiatives to support their success in higher education, it is clear there exists a significant gap in research examining technological capital and its impact on these groups. To address this gap, this study seeks to identify disparities in technological capital that highlight inequities in the use and comprehension of technology. It also aims to assess how these disparities influence measurable college persistence among historically underrepresented, economically disadvantaged, and first-generation first-year college students in New York State. The study focuses on historically underrepresented minority and first-generation students, as defined by the New York State Education Department (n.d.) and the Code of Federal Regulations (CFR), specifically 34 C.F.R. § 646.7. These regulations classify low-income individuals, first-generation college students, and individuals with disabilities participating in postsecondary education as part of the targeted groups (Student Support Services Program, 2024).

The study will incorporate an instructional component on technology designed to enhance students' understanding and perception of technological capital. It hypothesizes that if students in these populations develop greater awareness, perspective, and confidence following the instructional component, their self-efficacy will improve. The research question guiding this study is: "Does increased instruction in technology-based tools impact the level of technological proficiency for historically underrepresented, economically disadvantaged, and first-generation students?"

BACKGROUND

HISTORICALLY UNDERREPRESENTED, ECONOMICALLY DISADVANTAGED, AND FIRST-GENERATION STUDENTS

This study uses the term "historically underrepresented groups" as defined by the New York State Department of Education, which includes African Americans, Hispanics, and Native Americans. Additionally, the Federal Government defines historically underrepresented groups as "those who are considered underserved, marginalized, and adversely affected by persistent poverty and inequality" (Environmental Protection Agency, 2021). In the United States, the terms "historically underrepresented" and "minoritized" often refer to racial and ethnic groups that have faced historical discrimination and marginalization (Walsh et al., 2021). The term "historically underrepresented" is sometimes used interchangeably with "underrepresented minority." The National Center for Science and Engineering Statistics (2023, p. 68) defines underrepresented minorities as racial or ethnic groups in

education and employment that are represented at levels below their demographic proportions, including African Americans, Hispanics or Latinos, and American Indians or Alaska Natives.

The New York State Education Department defines economically disadvantaged students as individuals who participate in, or whose families participate in, economic assistance programs such as free or reduced-price lunch programs, Social Security Insurance (SSI), Food Stamps, Foster Care, Refugee Assistance (cash or medical assistance), Earned Income Tax Credit (EITC), Home Energy Assistance Program (HEAP), Safety Net Assistance (SNA), Bureau of Indian Affairs (BIA), or Family Assistance: Temporary Assistance for Needy Families (TANF). Similarly, the Higher Education Act of 1965 defines a low-income individual as "an individual from a family whose taxable income for the preceding year did not exceed 150 percent of an amount equal to the poverty level, as determined using the criteria of poverty established by the Bureau of the Census" (U.S. Department of Education, 2025).

The Code of Federal Regulations (CFR), under the Student Support Services Program 34 (2024) CFR § 646.7, defines first-generation students as those whose parents did not obtain a baccalaureate degree, those who lived with and received support from only one parent who did not receive a baccalaureate degree, or those who, before the age of 18, did not regularly reside with or receive support from any parent with post-secondary education. Also, US Code Title 20 §1070a-11 (Title 20 U.S. Code, 2012) further defines first generation student as, "In the case of any individual who regularly resided with and received support from only one parent, the individual's only such parent did not complete a baccalaureate degree."

Solomon Group Design

The Solomon Four-Group experimental design is a true experimental method that maximizes internal validity (Solomon, 1949). Key components of a true experiment include the manipulation of the independent variable, comparisons between conditions exposed to different levels of the independent variable, and random assignment, all of which are used to assess whether a technological intervention increases academic achievement. However, Solomon (1949) also notes that a pre-test can create sensitization, leading to higher scores due to a practice effect. The Solomon Four-Group design accounts for this by incorporating both the two-group design and the two-group pre- and post-test design, while capturing the sensitization caused by the pre-test. In this study, the experimental group will receive one week of technology-based instruction, while the control group will not receive any instruction.

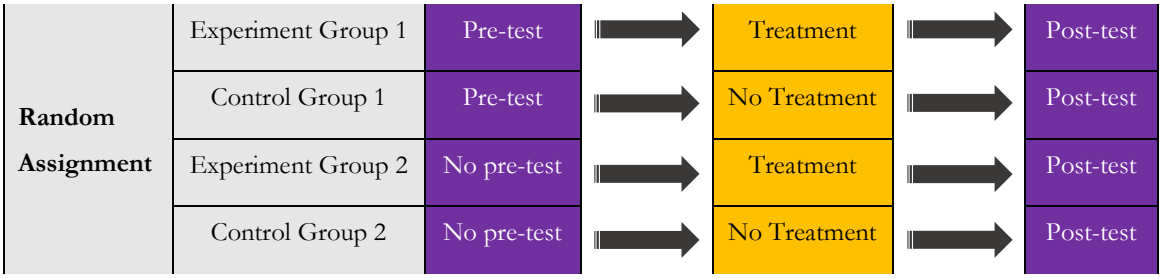

Figure 1. Solomon four-group experimental design

Method

In this study, the independent variables are training, technology-based instruction, and skill capability, while the dependent variable is the participants' perceived knowledge of using technology. The research aims to explore the correlation between technology-based instruction and the participants' perception of their ability to use technology.

Study Participants

A total of 14 historically underrepresented, economically disadvantaged, and first-generation incoming first-year college students from New York State were randomly assigned to four groups. Group #1 consists of three students, Group #2 consists of four students, Group #3 consists of three students, and Group #4 consists of four students. However, since Group #3 failed to take the post-test and post-survey, we can only analyze Group #1 and Group #2, resulting in a Solomon two-group design instead of the originally four-group design.

Experiment Procedure

The experiment for this study will be conducted in person, pending approval from the institutional review board (IRB). A pilot study was initially conducted to test the experiment before proceeding with the full study. Originally, the plan was to adopt the Solomon Four-Group methodology to examine whether increased instruction and technological interventions would improve academic or personal achievement, with a focus on students' awareness of technology used to support their first-year college experience, potentially promoting academic persistence. However, due to unforeseen circumstances, we were unable to implement the Solomon Four-Group methodology and instead conducted the Solomon Two-Group methodology (Solomon, 1949). The Solomon two-group design is a research methodology used in experimental studies to assess the effects of a treatment or intervention while controlling for potential biases, particularly those related to pretesting. It is an extension of the classic pretest-posttest control group design and is named after Richard L. Solomon, who introduced it.

In this study, the experimental groups consist of two groups, with varying numbers of participants ranging from two to four students per group. Before the experiment began, participants completed a pre-experiment survey consisting of 42 questions. The survey covered demographics, computer skills, technology usage and frequency, technology access, technical proficiency, video conferencing tools and learning management systems usage, internet and device access, and online learning experience.

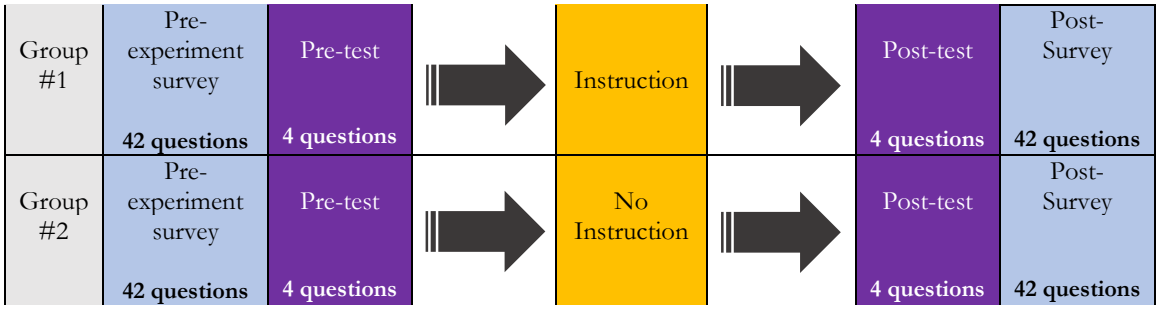

Figure 2. Study experiment design

After the pre-experiment survey, according to the Solomon Two-Group design, two groups—Groups #1 and #2—received a pre-test. The pre-test consisted of four questions, which are described below:

1. **First Question:** Participants were required to save and update files and documents to flash drive.

   Instruction: Students were taught about file structure and saving documents. The instructor also included the use of an external drive for backing up materials.

2. **Second Question:** Participants were asked to search for information on Google about the topic college success found on government websites. This task was divided into three sections:

   a. The first section instructed participants to access www.google.com.

   b. The second section tasked participants with creating a search to find research information on college success found on government websites.

   c. The third section required participants to copy and paste the found information into a Microsoft Word document.

   Instruction: Instructor included search strategies for more efficient results by using techniques and academic vocabulary. This included teaching about the use of quotations for phrase searching and those of top level domains (TLDs). For example, site: .gov for retrieving government sites.

3. **Third Question:** Participants were asked to log into a Zoom Cloud Meeting and take a screenshot of the session. This task was divided into two sections:

   a. The first section instructed participants to login to a Zoom meeting provided during the experiment.

   b. The second section required participants to save the screenshot Microsoft Word document and a Zoom meeting.

   Instruction: Basics of Zoom meeting were taught how to access student account, profile, and need to use student account for faculty Zoom meetings.

4. **Fourth Question:** Participants were tasked with accessing a web essay and saving it to a new Microsoft Word document. This task was divided into two sections:

   a. The first section instructed participants to access the provided link in the instruction document (via Google Docs).

   b. The second section required participants to copy the content from the provided website into a new Microsoft Word document.

   Instruction: Introductory instruction on Microsoft Word, paste special, double spacing, and so on.

At the end of the study, all participants from the two groups were required to complete a post-experiment survey. This survey consisted of the same questions as the pre-experiment survey to assess whether the treatment (instruction or no instruction) affected their perception of technology.

SURVEY

The survey includes both a pre-test and post-test questionnaire, primarily using a 5-point Likert scale (a. Strongly Agree, b. Agree, c. Undecided, d. Disagree, e. Strongly Disagree). Additionally, the questionnaire contains open-ended questions designed to identify patterns related to participants' perceptions of technology. The 32 survey questions aimed to identify the perception of technological capital for historically underrepresented, economically disadvantaged, and/or first-generation students in New York State. The survey questions were designed based on discussions with faculty teaching in the Freshman Year Experience course, who observed that students often struggle to use certain software or applications essential for their academic success. One such example is the difficulty students face when uploading assignments through the LMS. In our study, the survey measures student's perception, while pre- and post- test measure proficiency and technological capacity.

RESULT

PARTICIPANTS DEMOGRAPHIC

At the start of the study, 15 students participated. However, by the end of the study, 14 participants successfully completed it. One participant from Group #1 withdrew from the pre-test and did not return for the post-test or final survey due to unforeseen circumstances. Upon reviewing this

participant's responses, it was found that they had not answered all the questions in the pre-test. As a result, we decided to exclude this participant's pre-test data from our analysis.

Table 1. Study participants

Group #	Female	Male	Non-binary
1	3	0	0
2	4	0	0
3	1	1	1
4	3	1	0

The majority of participants in this study were female, making up 79% of the sample, followed by two male participants and one non-binary participant. The next demographic question in the survey asked about the participants' age. Most of the participants, 13 in total, were 18 years old, with only one participant being over 19. Regarding the highest level of education attained by the participants' parents, 71% had a high school diploma, followed by 14% with a bachelor's degree and another 14% with less than a high school diploma. As mentioned in the experimental procedure, this study ultimately followed a two-group design because, inadvertently, Group #3 did not take the post-survey. Therefore, our subsequent analysis only includes data from Group #1 and Group #2, which consists of seven participants.

Technological Devices

The survey indicates that all participants in the study have access to the internet at home and own an internet-enabled device. Therefore, it is not surprising that all of them have used the internet to complete a school-related task.

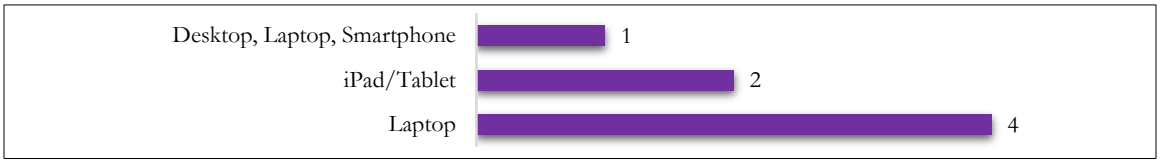

Figure 3. Device usage for learning

The surveys reveal that all participants in the study use handheld devices during their learning process. The majority use laptops, followed by iPads/Tablets. The widespread use of laptops for educational purposes is not surprising, as they have become a standard tool in higher education, and this trend continues to grow (Weaver & Nilson, 2005). A 2021 Educause QuickPoll found that 81% of students primarily use laptops for academic purposes, with 56% using smartphones as secondary devices (Denoyelles et al., 2023). Additionally, iPads/Tablets, which can also be used as eReaders, serve as alternative technologies for higher education due to their convenience, accessibility, portability, flexibility, and interactivity (Sari et al., 2015).

During the COVID-19 pandemic, video conferencing tools became increasingly important due to social distancing, online learning, and remote work policies. For example, Zoom Communications experienced a nearly 300% increase in revenue at the start of the pandemic compared to the previous year (Richter, 2024). We believe that many students continue to use video conferencing tools for collaboration with peers and instructors, making these platforms essential to their learning process. Therefore, the surveys included three questions about the use of different video conferencing tools, including Zoom, Microsoft Teams, and Google Meet.

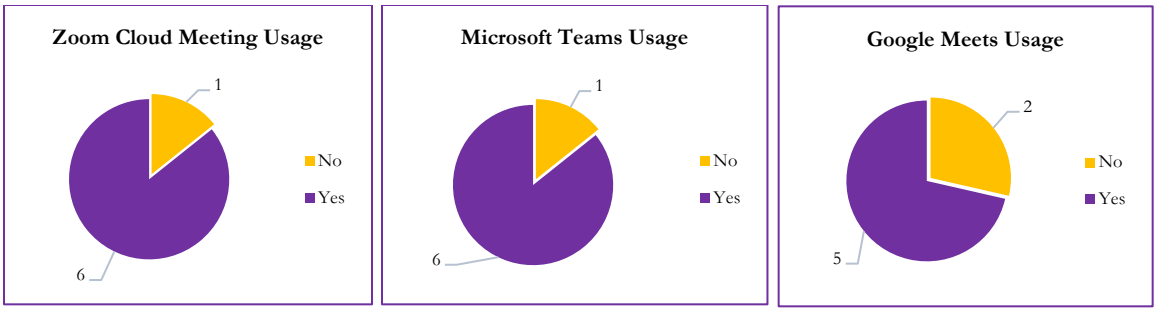

Figure 4. Video conferencing tool usage

The surveys show that the participants are most familiar with Zoom Cloud Meeting and Microsoft Teams, with six out of seven participants using these two video conferencing tools. Google Meets usage follows closely behind. Sari et al. (2023b) also highlight Zoom Cloud Meeting as the most widely used video conferencing tool among college students to facilitate online learning. Fajri et al. (2020) assert that Zoom Cloud Meeting improves the efficacy of online learning, particularly during the Covid-19 pandemic. Additionally, Assidiqia and Sumarni (2020) indicate that Google Meets, alongside Zoom Cloud Meeting, is another frequently used tool by college students.

In addition to video conferencing tools, this study also examined the participants' use of Learning Management Systems (LMS). The findings demonstrate that BrightSpace is more commonly used than Google Classroom. All participants have used BrightSpace, however only six out of seven have experience with Google Classroom. Although most participants are familiar with LMS platforms such as Google Classroom and BrightSpace, the survey reveals that two out of seven participants require assistance acclimating to online learning.

Computer Skills

In our pre-experiment survey, a question asked participant to rate their computer skills. In general, the study's participants perceive their computer skills as average, with an average score of 3.4 out of 5.0. The survey indicates a difference in participants' self-assessment of their computer skills between the pre-test and post-test, particularly between those receiving instruction (Group #1) and those who did not (Group #2). The ability to adopt and effectively use technology, including computers, is critical for college students, as a lack of these skills can impact academic performance. Zhao (2022) argues that first-generation and other underrepresented students face significant challenges in pursuing higher education, which can hinder their academic success. Therefore, it is essential to expand the knowledge base and provide support to help these students develop college readiness, including confidence-building activities.

On average, the survey results show a 0.3-point increase in participants' self-assessment of their computer skills for those who received instruction. As shown in Table 2, two participants reported an improvement in their computer skill assumptions. Initially, during the pre-experiment test, these participants rated their computer skills as average (3.0 points). After receiving instruction, their self-assessment rose by one point, to 4.0 points, or above average. This suggests that the instruction provided during the experiment enhanced the participants' competency. However, one participant lowered their self-assessment, shifting from average to below average. This may indicate that the participant perceived their computer skills as lower than expected after receiving the instruction.

Based on Table 2, Group #2, which did not receive instruction, showed a decrease in their self-assessment of computer skills. Table 2 above illustrates the varying levels of self-assessment across the groups. The average self-assessment of computer skills differed between the groups that received instruction and those that did not. Overall, the results suggest that instruction contributed to an increase in participants' self-perception of their computer skills.

Table 2. Computer skills

	Pre-test	Post-test		Pre-test	Post-test
Group #1 Instruction	3	2	**Group #2** No instruction	4	3
	3	4		3	3
	3	4		5	5
				4	3
Average	**3.0**	**3.3**	**Average**	**4.0**	**3.5**

Technology Usage

The survey indicates that participants believe using technology in learning is important. Four participants consider it very important, while three participants think it is important to have technology supporting learning. This suggests that all participants recognize the essential role of technology in supporting students' education. This finding is further supported by the result showing that most participants feel motivated to use technology for their schoolwork. Specifically, the survey reveals an average rating of 4.4 out of 5.0, of participants who agree or strongly agree that they are encouraged to use technology for academic purposes.

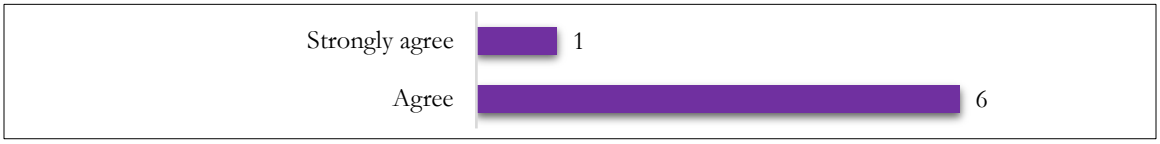

Figure 5. Adequate access to technological tools for learning from school

As shown in Figure 5, 6 out of 7 participants stated that their school currently provides adequate access to technological tools for learning. This percentage represents six out of seven participants who agree that their school offers sufficient access to these tools. Based on the survey results, we can conclude that most schools provide adequate technological resources to support student learning. Providing appropriate technology resources can help higher education institutions assist historically underrepresented, economically disadvantaged, and first-generation students in their transition to college. This aligns with research by Huff-Eibl and Teetor (2023), which highlights that colleges are increasingly adopting more consistent and reliable methods for assessing the technological needs of incoming first-generation and underrepresented students.

Table 3. Technology usage

	Importance of technology in learning		Motivation to use technology for schoolwork	
Group #1 Instruction	**Pre-test**	**Post-test**	**Pre-test**	**Post-test**
	4	5	4	5
	4	4	4	5
	3	4	5	4
Average	3.7	4.3	4.3	4.7
Group #2 No Instruction	**Importance of technology in learning**		**Motivation to use technology for schoolwork**	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
	5	5	5	5
	4	4	4	4
	5	5	5	5
	4	5	4	5
Average	4.5	4.8	4.5	4.8

This pilot study reveals differences between the pre- and post-experiment survey results, as shown in Table 3 above. Specifically, the results highlight a difference in participants' perceptions of the importance of technology in learning, comparing the pre-test and post-test responses from those who participated in the instruction (Group #1) and those who did not (Group #2). For Group #1, the results show an average increase of 0.7 points in participants' assumptions about the importance of technology in learning. One participant's belief about the relevance of technology in learning improved by one point, from "moderately important" to "important," while another participant's belief increased from "important" to "very important." One participant's perception remained unchanged. In contrast, Group #2's results show a smaller increase of 0.3 points in their assumptions about the importance of technology in learning.

Additionally, Table 3 illustrates the difference in participants' motivation to use technology for schoolwork between those who attended instruction sessions and those who did not. For Group #1, there was a 0.3-point increase in motivation. Interestingly, one participant's motivation to use technology for schoolwork decreased after attending instruction, changing from "strongly agree" to "agree." Conversely, among Group #2, three participants showed no change in their motivation level, but one participant increased their motivation by one point, from "agree" to "strongly agree," in the post-survey.

Beyond the perceived importance of using technology in learning and the motivation to use technology for schoolwork, the survey also reveals that 86% of participants frequently or almost always use a computer outside of school. One participant reported using a computer sometimes outside of school. Furthermore, all participants indicated they almost always use the internet to complete assignments.

Technical Proficiency

The surveys include 11 questions assessing participants' technical proficiency levels. These proficiency areas cover keyboard shortcuts, Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Google Docs, Google Sheets, Google Slides, Pages, Numbers, Keynote, and internet information searching.

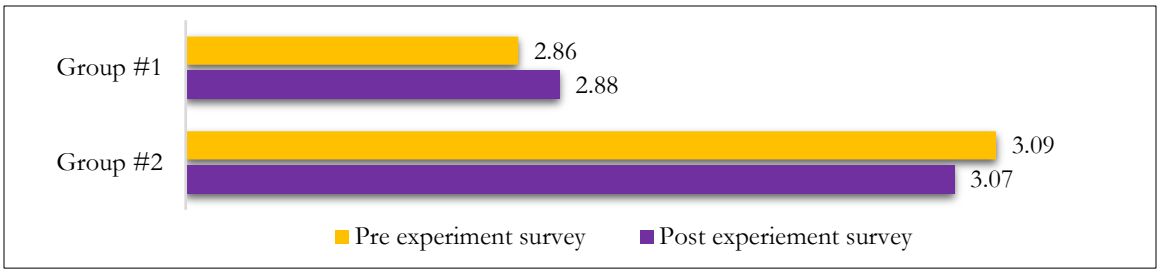

Figure 6. Technical proficiency

Based on the pre- and post-experiment survey results, the participants in Group #1 showed a fairly proficient average technical perception score of 2.86 out of 5.0 on the pre-survey. Overall, participants' perception levels in keyboard shortcuts, Microsoft Word, Microsoft Excel, Microsoft PowerPoint, and Numbers decreased from the pre-survey to the post-survey. However, the overall proficiency level of participants increased from pre- to post-survey. The post-survey average score was slightly higher at 2.88, reflecting 0.02 points increase between the pre-test and post-test. This suggests that the instruction conducted before the post-survey may have impacted their technical proficiency.

In contrast, Group #2 had a higher average technical proficiency score of 3.09 out of 5.0 on the pre-survey compared to Group #1. Compared to Group #1's results, Group #2 showed an increase in proficiency in Google Slides and internet information searching from pre- to post-survey. Overall, the post-test score for Group #2 was slightly lower at 3.07, showing 0.02 points decrease between the pre- and post-survey. As shown in Figure 5, we observed that the groups with and without

instruction had different results. The data indicates that instruction played a role in improving participants' technical proficiency.

Table 4. Sourcing relevant information on internet

	Pre-test	Post-test		Pre-test	Post-test
Group #1 Instruction	2	2	**Group #2** No Instruction	3	3
	2	3		2	2
	3	2		3	3
	2			3	3
Average	**2.25**	**2.33**	**Average**	**2.8**	**2.8**

Table 4 shows that there was an increase of 0.1 for Group #1 participants between their pre-and post-survey. On the other hand, Group #2 participants showed no increase in their assumption of their capability to search relevant information on the Internet. Table 4 shows the score for participant's convenience with sourcing relevant information on the internet vary among groups regardless the treatment that they received during the experiment. Similar with the post-survey technical proficiency score result, we also learned that the groups with pre-test receiving and not receiving instruction had different results. The number seems to show that instruction matters to increase the study's participant's technical proficiency.

DISCUSSION AND CONCLUSION

Historically underrepresented, economically disadvantaged, and first-generation students often face barriers that contribute to low academic achievement and high dropout rates. These barriers can be mitigated through technology-based instruction, which can potentially enhance technological proficiency among this study population. Research suggests that technology use can influence students' attitudes and perceptions toward their academic success (Scott et al., 2004). In this study, the experiment demonstrated that instruction in technology-based tools positively impacted the technological proficiency of historically underrepresented, economically disadvantaged, and first-generation students. Ensuring the success of these students during their first year of college is not solely the students' responsibility; higher education institutions must also provide support. Colleges must develop strategies to enhance student achievement by providing professional development opportunities in information technology training (Wilson et al., 2012). Furthermore, Mohammadi et al. (2020) suggest that policymakers and college administrators should offer training to a diverse student population, including both traditional and non-traditional students, as well as ethnic minorities. Additionally, online learning platforms such as massive open online courses can help economically disadvantaged students (Ma & Lee, 2023). However, students need the technological skills necessary to access and navigate these online resources. Along with offering technology training, higher education institutions must prioritize enhancing their technological infrastructure to support student learning, particularly in online environments, to ensure adequate student participation (Sari et al., 2023a).

At the start of the study, eight students participated in the pre-test, with four participants in each group. However, due to unforeseen circumstances, one participant could not complete the pre-test or attend the post-test, and one group inadvertently did not receive the post-test. As a result, the Solomon Two-Group design was not implemented, and instead, a Solomon Two-Group design was used. We collected and analyzed the pre-survey, pre-test, post-test, and post-survey data for the seven students who completed the entire experiment in our pilot study. The results show that most participants in Group #1 struggled to answer questions one, three, and four correctly. On the other hand, participants in Group #2 performed better than those in Group #1, answering all the pre-test questions correctly. With these differing pre-test results between Groups #1 and #2, we used the data to examine the percentage increase in correct answers between the two groups after receiving and not receiving instruction.

The results also demonstrate that several participants in Group #1, who initially had difficulty answering the pre-test questions correctly, were able to answer them correctly in the post-test. This indicates a noticeable improvement compared to the pre-test. Contrary to our initial expectation of no changes between the pre- and post-test results for Group #2, differences were observed in both sets of results.

The results of our pilot study indicate that Group #1, which received instruction before the post-test, outperformed Group #2, which did not receive instruction. Therefore, we can infer that the instruction influenced students' perceptions of technology following the treatment. This outcome aligns with Banerjee's (2020) research, which suggests that groups of experienced learners with prior technological experience exhibit higher levels of technological efficacy than groups without previous technology experience. Given that Group #2 was the control group and did not receive instruction, it is expected that their post-test outcomes would differ from those of Group #1, even if their pre-test results were similar.

In this study, the results show that students in the historically underrepresented, economically disadvantaged, and first-generation categories who received technological instruction during the experiment demonstrated improved proficiency in using basic technology essential for college success. Therefore, we believe that providing support for students in these categories will ease their transition during the first year of college and positively influence their academic success.

The findings of this experiment show an increase in the number of students who understand how to operate technology, as reflected in the pre- and post-test results. It is highly recommended that colleges recognize the importance of offering training or workshops to assist historically underrepresented, economically disadvantaged, and first-generation students in navigating their transition to college. Our study contributes to existing knowledge by emphasizing the importance of technology instruction, such as workshops and training, to support these students' transition to college.

However, our study has limitations related to the design methodology and the number of voluntary participants and limited timing for conducting the instruction. Due to unforeseen circumstances, we modified our four-group design to a two-group approach to explore whether augmented instruction and technical interventions lead to improved academic or personal success, potentially fostering academic persistence. This modification increased the limitation as the pilot study participants went from 14 to 7 participants. This indicated that the two-group design limits the opportunity to fully assess the effects of the instruction provided to the experimental group. Furthermore, the sample size in our pilot study needs to be increased in future research to ensure more diverse results, thereby enhancing the reliability of our findings. Additionally, due to time constraints, we conducted the experiment with a two-day workshop to educate participants on using technology before completing the post-survey. We realized that a two-day workshop may be insufficient for participants to fully grasp and master the technology necessary for a successful college transition. Future studies should consider extending the duration of the workshop to ensure participants acquire the skills and proficiency needed for academic success.

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