Exploring the Impact of Customized Academic Technology Resources on First-Year University Students' Digital Competency: Preliminary Results

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Abstract

In response to the growing demand for digital competency among university students, this study examines the effectiveness of customized academic technology resources in enhancing first-year students' technology skills within a Canadian post-secondary context. Many incoming students struggle with essential academic technology due to limited digital literacy or unfamiliarity with specific tools. To bridge these gaps, we developed tailored resources to support their learning. This research employs a pre- and post-test comparison study to assess the impact of these resources. An intervention group with access to the materials is compared to a control group without access. By measuring changes in students' technology skills and confidence, the study highlights the potential benefits of targeted support and discusses implications for improving students' transitions to university.

Keywords: academic technology, digital competency, educational technology, first-year university students, technology proficiency, customized learning resources

Introduction

In today's technology-driven academic environment, digital competency is essential for student success. However, first-year students often have varying levels of proficiency with academic technology, impacting their ability to navigate tasks such as submitting assignments, accessing materials, and conducting research (Inamorato dos Santos et al., 2023). These challenges can hinder their academic transition, performance, and sense of belonging.

This study examines the effectiveness of tailored academic technology resources designed for first-year students at a Canadian university. These resources include instructional guides and video tutorials that address skills such as navigating the learning management system (LMS), word processing, and digital research tools. The intervention aims to enhance students' technology skills while reducing reliance on instructors for support.

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This study builds on a 2023 initiative by the Centre for Teaching and Learning (CTL) designed to address instructors' needs. Preliminary results from that effort were promising—students reported that the resources were helpful and the instructor noted fewer technology-related questions. Building on these findings, the current study uses a pre- and post-test design to evaluate the resources' impact on first-year English students. The research addresses the following questions:

1. How do students perceive the effectiveness of customized academic technology resources in addressing their technology needs?
2. What benefits and challenges do students encounter when using these resources?

Literature Review

While numerous studies have focused on supporting and preparing current and future educators' technology confidence and competence, fewer have investigated the direct impact of customized, targeted technology resources on first-year students' self-identified technology skill levels (Bećirović, 2023; Smestad et al., 2023). Research focusing on students tends to examine the relationship between technology competency and academic success factors such as collaboration (Kwiatowska & Wiśniewska-Nogaj, 2022) and creativity (Wu et al., 2023). Other studies centre on measuring students' competency levels either in isolation or with other factors, such as course content and instructors, rather than developing and assessing a specific resource aimed at addressing these gaps (Hamid et al., 2024; Koyuncuoglu, 2022).

In the Canadian context, Weingarten et al. (2018) found that a higher percentage of first-year students scored at level 1 proficiency in technology-rich problem-solving environments compared to final-year students. These findings highlight early-stage gaps that could hinder students' ability to navigate academic platforms or perform tasks such as submitting assignments and conducting research. Similarly, Inamorato dos Santos et al. (2023) emphasized that students' digital challenges may affect their academic confidence and engagement. Despite this, universities often treat younger students as inherently digitally capable, based on the digital native narrative popularized by Prensky (2001), without systematically assessing or supporting their actual skill levels.

Research Design and Methodology

This study employs a quasi-experimental framework to assess the impact of customized academic technology resources on first-year university students' digital competency. The research design involves both intervention and control groups, using pre- and post-test measurements to evaluate changes in students' technology skills and perceptions.

Intervention design

The study involves two groups:

- Control group (413 students): Students receive standard university technology support without access to customized resources.
- Intervention group (415 students): Students have access to tailored academic technology resources integrated into their courses. These resources include instructional guides and video tutorials covering essential digital skills.

We discussed whether we should create a stand-alone course, add the customized technology resource, and then give students in the intervention group access to it. However, we decided against that approach, as our primary goal was to increase students' access by integrating the resources directly into each instructor's courses in the LMS. This decision ensures that the resources are embedded in students' existing learning environments, making them more readily accessible and contextually relevant.

Course selection

To maintain consistency and to minimize confounding variables, the study focuses on in-person, first-year English courses. First-year English courses were selected because they are a common requirement across all programs, ensuring a diverse representation of first-year students. Additionally, the assignments in these courses often require foundational technology skills, such as opening, saving, and submitting files within learning management systems, as well as converting word processing files to PDF format. These tasks provide an ideal context for assessing and addressing gaps in students' digital competency, as these skills are essential not only for success in English courses but also for navigating academic tasks across disciplines. This focus aligns with the study's goal of equipping students with the practical technology skills needed for their academic journey.

To enable within-instructor comparisons, each instructor was assigned to teach one control and one intervention course. Online and hybrid courses as well as subject-specific courses were excluded to ensure the technology resources would be applicable to a general first-year population. A total of 20 instructors (each assigned two sections of the same course) were invited to participate, and 12 agreed to participate in the study.

Data collection tools

1. Socio-Demographic Survey: This survey collects background information on participants to understand demographic factors that may influence technology proficiency and resource use. The survey was developed by the first and second authors and reviewed by the third author.

2. Technology Proficiency Self-Assessment Questionnaire for 21st Century Learning (TPSA C-21): The original Technology Proficiency Self-Assessment (TPSA) was

developed by Ropp (1999) to measure teachers' confidence in using technology for educational purposes. The TPSA was later applied to students and demonstrated reliability and validity (Christensen & Knezek, 2000, 2014; Mayes et al., 2012; Morales et al., 2008; Swain, 2006). In response to technological advancements, Christensen and Knezek (2017) updated the TPSA by adding 14 items related to Web 2.0 tools, mobile learning, social media, and cloud-based environments, renaming it the TPSA for 21st Century Learning (TPSA C-21). The latest version was confirmed to have an acceptable level of reliability and validity.

To enhance relevance and accuracy, the survey questions were modified to incorporate examples of technology software and tools commonly used at our institution. These tailored examples help students understand each item better and provide more accurate self-assessments. Six educational developers were invited to review the modified survey, and two provided feedback.

3. Resource Access Reports: Usage data from the intervention group is collected through access reports to track how frequently students engage with the customized resources, providing insight into resource utilization and its potential impact on students' perceived technology competency.

Data collection procedure

To ensure consistent implementation, classroom visits were coordinated so we could administer the pre-tests and introduce the intervention resources in the intervention group's courses. This in-person setup would minimize discrepancies in data collection across classes and ensure that students would understand the purpose and scope of the study.

While it is challenging to complete 24 classroom visits, we experienced that instructor buy-in was crucial for the participation rate. However, to mitigate potential pressure on students, we emphasized during classroom visits that participation was entirely voluntary and confidential, and students had the option to complete the survey outside of class if they preferred. While we did not ask the instructors participating in the research to solicit participation on our behalf, some instructors took it upon themselves to further explain the research by linking it to their own course content, emphasizing the importance of the research and its connection to higher education, and setting aside time for students to complete the surveys. This additional effort from instructors likely contributed to the observed participation rates and highlights the value of faculty engagement in facilitating research initiatives. To reduce potential perceived influence, instructors were advised to frame their explanations neutrally, without implying an expectation of participation or a preferred response.

Students were informed that the survey was anonymous, voluntary, and unrelated to their course performance. They were also reminded that they could withdraw at any time without penalty. Additionally, investigators reiterated this information independently of the instructors to

ensure clarity and minimize potential pressure. Completing the survey was presented as an opportunity to contribute to research rather than an obligation, and instructors were not given access to students' individual survey responses to further safeguard anonymity.

Preliminary findings

Participation rates were 30% for the control group and 33% for the intervention group. Most participants (83%) were aged 17–20, with smaller percentages in the 21–24 and 25+ age ranges. The gender distribution was 65% female, 31% male, and 4% nonbinary.

A majority (69%) identified as first-generation university students, while 31% reported prior family experience with post-secondary education. Only 15% indicated receiving previous technology training.

In terms of technology access, 48% rated it as "excellent," 48% as "good," and 4% as "fair or poor." Students expressed low confidence in specific technology-related tasks, including:

- Setting up a simple website or blog for class projects: 45% (intervention) vs. 55% (control)
- Using spreadsheets (e.g., Excel or Google Sheets): 33% in both groups
- Organizing information in databases: 30% (intervention) vs. 24% (control)
- Using collaborative tools (e.g., wikis, blogs): 24% (intervention) vs. 25% (control)

Preliminary discussion

By analyzing socio-demographic data, pre- and post-test survey results, and resource access reports, this study evaluates whether tailored academic technology resources effectively bridge confidence gaps in foundational technology skills, thereby facilitating first-year students' academic transitions. The analysis also sheds light on the pace at which students develop confidence and competence in these skills. Furthermore, the findings may reveal how these resources decrease students' reliance on instructors for support with digital skills and technical challenges related to assignments, research, and accessing course materials.

General technology support services are often reactive, addressing issues as they arise (Cassidy et al., 2011). In contrast, this study examines proactive, targeted resources embedded within course structures to equip students with essential skills during their transition to university life. By offering timely access to tools and guides tailored to immediate academic technology needs, these resources aim to reduce the demand for on-demand support services. This proactive approach represents a departure from traditional reactive support models and positions the study as an innovative strategy for addressing gaps in digital competency and student preparedness (Rashid & Asghar, 2016).

By evaluating these customized resources, this study seeks to contribute to the growing body of literature and propose actionable strategies for improving student support. The potential

benefits of these targeted interventions are substantial, enabling universities to transition from reactive service models to approaches that anticipate and address the technological challenges students encounter throughout their academic journey.

Conclusion and Next Steps

This study explores the potential of customized academic technology resources to enhance first-year university students' digital competency. Preliminary findings suggest that, despite good access to technology, many students lack confidence in essential skills. These results highlight the need for targeted interventions to address gaps in foundational technology skills and support students' academic success.

The post-test, to be administered in November 2024, will evaluate changes in students' technology proficiency and confidence following the intervention. The next steps include a thorough analysis of qualitative and quantitative data to identify areas for improvement and refine the intervention. These findings could guide universities in developing and integrating customized technology resources into course platforms to better support students' transition to higher education.

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Appendix A - Pre-Test for both Control and Intervention Group

- What is your MacEwan Student ID?
- Please provide your MacEwan email address if you wish to receive the results.
- How old are you?
- How do you identify your gender?
- How would you rate your proficiency in English?
- Are you a first-generation university student (i.e., neither of your parents has completed a university degree)?
- Have you ever received any formal training in technology (e.g., computer courses, digital literacy programs)?
- How would you describe your access to technology (e.g., computers, internet)?
- What is your primary device for completing academic work?
- Do you have any disabilities that might affect your use of technology?
- I feel confident in sending an email to a professor or peer using tools like Gmail or Outlook.
- I feel confident in joining and contributing to online discussion forums through the university's learning management systems - mêskanâs (Moodle).
- I feel confident in creating a group chat or email list for a group project.
- I feel confident in attaching documents to emails when submitting assignments.
- I feel confident in submitting electronic assignments through the university's learning management systems - mêskanâs (Moodle).
- I feel confident in saving copies of important emails for future reference.
- I feel confident in using search engines like Google or Bing to find academic resources.
- I feel confident in locating specific websites related to my courses.
- I feel confident in setting up a simple personal website or blog for a class project.
- I feel confident in bookmarking and organizing important websites for my studies.
- I feel confident in using spreadsheets like Google Sheets or Microsoft Excel to organize and visualize data for a class.
- I feel confident in designing a document that includes text and images, such as a project report using Canva, Google Doc, Microsoft Word, or others.
- I feel confident in saving files in different formats (e.g., PDF, Word) for different purposes using Google Doc or Microsoft Word.
- I feel confident in creating a Google Slide, PowerPoint or similar slideshow for a class presentation.
- I feel confident in organizing information in a database (e.g., tracking sources for an essay).
- I feel confident in creating a study plan that incorporates different technological tools.
- I feel confident in using technology to work with classmates on group projects remotely.
- I feel confident in identifying and using apps that help me with my coursework.
- I feel confident in using my smartphone or tablet to assist with my studies.

- I feel confident in using collaborative tools like wikis or blogs for group projects.
- I feel confident in using online tools like Google Meet or Zoom to participate in classes or study sessions remotely.
- I feel confident in using my smartphone to participate in interactive polling systems, such as Kahoot or Mentimeter, during class.
- I feel confident in using mobile devices to reach out for academic support.
- I feel confident in using mobile devices to access online lectures, readings, or other learning activities.
- I feel confident in downloading and listening to podcasts or audiobooks related to my studies.
- I feel confident in downloading and reading e-books for my courses.
- I feel confident in downloading and watching educational videos or clips for my classes.
- I feel confident in transferring photos or data between devices for academic purposes.
- I feel confident in saving and retrieving files from a cloud storage service like Google Drive or Microsoft OneDrive.

Appendix B - Post-Test for Control Group

- What is your MacEwan Student ID?
- Please provide your MacEwan email address if you wish to receive the results.
- Compared to the start of the term,
    - I am more confident in my ability to use technology to support my academic work.
    - I feel more prepared to use technology to complete academic tasks.
    - I feel more prepared to use technology to complete academic tasks.
    - I feel confident in troubleshooting common technical issues independently.
    - I feel more confident in identifying new tools that could improve my productivity and learning experience.
- I have learned new digital skills through this course that I didn't know before.
- If you answered "Yes" to the above question, please provide a description.
- I feel confident in sending an email to a professor or peer using tools like Gmail or Outlook.
- I feel confident in joining and contributing to online discussion forums through the university's learning management systems - mêskanâs (Moodle).
- I feel confident in creating a group chat or email list for a group project.
- I feel confident in attaching documents to emails when submitting assignments.
- I feel confident in submitting electronic assignments through the university's learning management systems - mêskanâs (Moodle).
- I feel confident in saving copies of important emails for future reference.
- I feel confident in using search engines like Google or Bing to find academic resources.

- I feel confident in locating specific websites related to my courses.
- I feel confident in setting up a simple personal website or blog for a class project.
- I feel confident in bookmarking and organizing important websites for my studies.
- I feel confident in using spreadsheets like Google Sheets or Microsoft Excel to organize and visualize data for a class.
- I feel confident in designing a document that includes text and images, such as a project report using Canva, Google Doc, Microsoft Word or others.
- I feel confident in saving files in different formats (e.g., PDF, Word) for different purposes using Google Doc or Microsoft Word.
- I feel confident in creating a Google Slide, PowerPoint or similar slideshow for a class presentation.
- I feel confident in organizing information in a database (e.g., tracking sources for an essay).
- I feel confident in creating a study plan that incorporates different technological tools.
- I feel confident in using technology to work with classmates on group projects remotely.
- I feel confident in identifying and using apps that help you with my coursework.
- I feel confident in using my smartphone or tablet to assist with my studies.
- I feel confident in using collaborative tools like wikis or blogs for group projects.
- I feel confident in using online tools like Google Meet or Zoom to participate in classes or study sessions remotely.
- I feel confident in using my smartphone to participate in interactive polling systems, such as Kahoot or Mentimeter, during class.
- I feel confident in using mobile devices to reach out for academic support.
- I feel confident in using mobile devices to access online lectures, readings, or other learning activities.
- I feel confident in downloading and listening to podcasts or audiobooks related to my studies.
- I feel confident in downloading and reading e-books for my courses.
- I feel confident in downloading and watching educational videos or clips for my classes.
- I feel confident in transferring photos or data between devices for academic purposes.
- I feel confident in saving and retrieving files from a cloud storage service like Google Drive or Microsoft OneDrive.

Appendix C - Post-Test for Intervention Group

- What is your MacEwan Student ID?
- Please provide your MacEwan email address if you wish to receive the results.
- Compared to the start of the term,
    - I am more confident in my ability to use technology to support my academic work.
    - I feel more prepared to use technology to complete academic tasks.
    - I feel more prepared to use technology to complete academic tasks.
    - I feel confident in troubleshooting common technical issues independently.
    - I feel more confident in identifying new tools that could improve my productivity and learning experience.
- As a reminder, the customized academic technology resources you had access to throughout this course are designed to support your development of essential technology skills. These resources, including instructional guides and video tutorials, were integrated directly into your course materials to help you navigate tools such as the paskwâwi-mostos mêskanâs, word processing software, and other digital tools. Please take a moment to reflect on how these resources may have impacted your technology skills as you complete this survey.
    - On a scale of 1 to 10, how would you rate your experience using the Student Technology Skills Resource? (1 being very poor and 10 being excellent)
    - On a scale of 1 to 10, how frequently did you access the Student Technology Skills Resource? (1 being never and 10 being very frequently)
    - What aspects of the Student Technology Skills Resource in this course did you find most helpful?
    - Were there any additional technology-related topics or skills you wish had been covered in this resource?
    - On a scale of 1 to 10, how likely are you to use the technology skills you learned in this course in other courses or future work? (1 being very unlikely and 10 being very likely)
- I have learned new digital skills through this course that I didn't know before.
- If you answered "Yes" to the above question, please provide a description.
- I feel confident in sending an email to a professor or peer using tools like Gmail or Outlook.
- I feel confident in joining and contributing to online discussion forums through the university's learning management systems - mêskanâs (Moodle).
- I feel confident in creating a group chat or email list for a group project.
- I feel confident in attaching documents to emails when submitting assignments.
- I feel confident in submitting electronic assignments through the university's learning management systems - mêskanâs (Moodle).
- I feel confident in saving copies of important emails for future reference.
- I feel confident in using search engines like Google or Bing to find academic resources.

- I feel confident in locating specific websites related to my courses.
- I feel confident in setting up a simple personal website or blog for a class project.
- I feel confident in bookmarking and organizing important websites for my studies.
- I feel confident in using spreadsheets like Google Sheets or Microsoft Excel to organize and visualize data for a class.
- I feel confident in designing a document that includes text and images, such as a project report using Canva, Google Doc, Microsoft Word, or others.
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- I feel confident in using technology to work with classmates on group projects remotely.
- I feel confident in identifying and using apps that help you with my coursework.
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