

Developing Digital Agency through Informal Peer-Assisted Learning

Eli Blouin
eblouin@falcon.bentley.edu

Mark Frydenberg
mfrydenberg@bentley.edu

Bentley University
Waltham, MA, 02451, USA

Abstract

Peer-assisted learning offers students opportunities to build confidence, ask questions, and learn from their peers in ways that may differ from instructor-led, traditional learning. In technology education, informal peer-led spaces may be especially valuable because they allow students to experiment with unfamiliar tools in a lower-pressure environment. This study examines peer-assisted learning through Sandbox After Dark, a pilot workshop series in which undergraduate peer tutors facilitated evening technology workshops for first-year students at a business-focused university. Using a mixed-methods approach, the study draws on post-session survey data from 189 students and focus groups responses to examine role modeling, reciprocity, digital agency, relatability, and the learning environment. Results indicate that all peer-learning constructs were rated above neutral, with digital agency receiving the highest mean score and reciprocity receiving the lowest. Spearman correlations suggest that digital agency was closely associated with the informal learning environment and peer role modeling, while reciprocity appeared to function as a weaker but distinct dimension of the experience. These findings suggest that informal peer-led technology workshops can support student confidence, comfort, and perceived ability to use new tools, while also highlighting opportunities to strengthen reciprocal learning between tutors and participants.

Keywords: Peer-Assisted Learning, Informal Learning, Digital Agency, Technology Skills, Skills Workshops

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1. INTRODUCTION

Sandbox After Dark is a co-curricular pilot program introduced during the Spring 2026 semester, designed to build digital literacy and agency among first-year college students at a business-focused university in New England. Sandbox After Dark exposes students to practical technology skills and topics chosen and delivered by student peer tutors in an informal, evening setting. Moving beyond traditional classroom instruction, Sandbox After Dark empowers student tutors to act as colleagues who facilitate a series of technology skills workshops.

Goals of Sandbox After Dark are to build digital literacy and agency among first-year college students in co-curricular topics not covered in CS 100, a required information technology course, and to elevate the role of tutor from instructor to guide, mentor, and co-problem solver. CS 100 covers Excel and current technology concepts including file management and managing one's laptop, an introduction to coding, artificial intelligence, and virtual reality. CS 100 students select one workshop on a topic of their choice to attend during the semester. Sandbox After Dark is a new, hands-on, evening alternative to the daytime Topics in Tech series, which features talks by alumni on their careers in information technology. CS 100 students could choose either option to fulfill their course requirements.

The Sandbox After Dark skills workshops were held in the university's "Sandbox," a technology social learning space which provides tutoring support as well as several experiential learning opportunities for students outside of class time. Sandbox After Dark features six 90-minute skills workshops, each co-taught by two student tutors, and offered in the evening hours (hence the name "After Dark"). Adding to the social aspect of the program, cookies and soft drinks were served at each workshop. To provide consistent branding across the series in promotional materials and PowerPoint presentations, tutors developed the promotional logo shown in Figure 1.



Figure 1. Sandbox After Dark logo.

At the start of the semester, tutors worked in pairs to submit proposals with a brief session description and outline. Six workshop proposals were accepted for the initial offering. Tutors received a coaching session from one of the university's instructional designers, to ensure that all Sandbox After Dark sessions, regardless of topic or who was facilitating them, had the same structure and difficulty level, and used a common visual template. Coaching included how to describe the purpose of the workshop, how to design an effective demo, and how to develop a project that participants could complete within the allotted time. Appendix C summarizes the coaching session content.

For the pilot offering during the Spring 2026 semester, each workshop, facilitated by two tutors, was offered four times during four consecutive weeks before or after spring break. Students could sign up to attend one or more workshops of interest. Each workshop was capped at 25 students. To encourage social learning and meeting new people, all workshops met in-person and were not offered online or recorded. After CS 100 students had first opportunity to sign up, the workshops were opened to all students to fill any remaining seats.

For the pilot offering, workshop topics included using AI tools to create polished presentations, Excel shortcuts, home automation, CoPilot in Excel, and data privacy. Full descriptions appear in Table 1.

Workshop Title	Workshop Description
<i>Think Before You Click!</i>	Keep your computer and your data safe from hackers! Learn how phishing scams work and how to spot them quickly using a simple checklist.
<i>Pitch Like a Pro – Generate Slides with AI</i>	While many students are caught up in the broader “AI wave,” the use of AI to generate high-quality professional assets remains largely unexplored.
<i>Learn Excel with Copilot AI</i>	This workshop introduces students to core Excel concepts while demonstrating how Microsoft Copilot can be used as a learning and productivity tool within Excel.
<i>Design 3D Objects in Virtual Reality</i>	In this hands-on activity, you will gain practical experience using the Meta Quest 3 headset to explore immersive virtual environments. You will use the virtual design platform ShapesXR to create and manipulate objects.
<i>Practical Skills for Excel Users</i>	Learn advanced Excel shortcuts to streamline your workflow and work more efficiently. Apply these shortcuts, together with other Excel tools, to build powerful budgeting and planning workbooks for practical, real-world use.
<i>Automate Your Life with IFTTT</i>	This beginner friendly workshop introduces students to If This Then That (IFTTT) and how simple automations can save time and streamline everyday tasks. Participants will learn how triggers and actions work and see real world examples.

Table 1. Sandbox After Dark Workshops

These workshops go beyond how to use technology tools, but also address the impact of technology across disciplines, as students consider the multidisciplinary contexts in which they can use their newly acquired skills. Sandbox After Dark provides a learning experience designed to increase student confidence to solve interdisciplinary problems using technology.

2. LITERATURE REVIEW

This literature review considers research on peer-assisted learning and informal technology education to position Sandbox After Dark as a peer-led initiative that extends digital agency, supports problem solving, and advances the role of tutors as collaborators, mentors, and co-learners. Previous research focused on the impact of extracurricular technology learning (Frydenberg, 2013a) and the impact of peer tutoring (Frydenberg, 2013b) in a collaborative, technology-focused social learning space at a business university. Social learning spaces foster a sense of belonging and support active learning (Syvänen et al., 2014). A 2015 study reports that near-peer STEM mentoring strengthens identity, self-efficacy, and a sense of belonging among mentors, while also improving learner’s engagement and confidence (Hufnagel, 2015).

Peer-Assisted Learning (PAL) is a student-centered approach where peers help one another learn by explaining ideas, answering questions, and working through problems together. It is grounded in social learning theory, which emphasizes that individuals learn by observing and modeling the behaviors of others in social contexts (Bandura, 1976). PAL is beneficial to both the student who takes on the role of teacher/facilitator and the learner by strengthening understanding, communication, collaboration, and confidence while making learning interactive and relevant (Herrmann-Werner et al., 2017).

Capstick extends this notion beyond teaching by portraying PAL “as an open, informal, cooperative environment” where students can raise concerns with “a trusted and approachable individual” while building confidence in their transition to university learning (Capstick, 2004, p. 48). Digital agency in peer-assisted learning can be understood as the learner’s ability to control, adapt, and make informed

decisions within digital environments, where technology supports collaboration and shared knowledge building. (Jenkins, 2009; Passey et al., 2018).

Although PAL is often studied in health professions (Guraya & Abdalla, 2020; Herrmann-Werner et al., 2017), computing and technology education offers similar opportunities through pair programming, peer tutoring, and collaborative problem solving (Yildiz Durak, 2022). In pair programming, students work in pairs on the same programming task, alternating between creating and reviewing code, which promotes explanation, feedback, and collaborative problem solving. (Williams & Kessler, 2000).

Recent research shows learning computer programming from a peer to be effective in K-12 education (de la Hera et al., 2022). St. John and St. John (2024) describe a peer-assisted learning exercise in a project management class where senior project management students worked with first-year introductory programming students, mentoring them to create code for a gaming application. Through this experience, senior students learned to manage teams, and introductory students received instruction at their level. In higher education computing courses, undergraduate teaching assistants often function as peer tutors, who must be cautious not to give answers while supporting students with their programming assignments. Tutors also gain experience in mentoring and instructional support (Villegas Molina et al., 2025).

Sandbox After Dark models a peer-assisted learning environment in which tutors introduce technology concepts and students reinforce and extend their own learning and develop digital agency by supporting others in small groups as they complete technology-assisted tasks. This structure also reflects reciprocal learning principles positioning participants as both providers and recipients of knowledge in a collaborative format (Gazula et al., 2017). By combining tutor-led workshops, peer support within student groups, and an informal evening setting that encourages social learning, with an co-curricular focus on topics related to the use of information technology distinct from programming skills, tutors and students develop skills in digital agency, ethics, AI, and problem solving.

Co-curricular activities provide educational experiences that extend beyond traditional classroom instruction. Alexaki et al. (2026) describes these settings as built for social connections, engage in applied learning, and develop transferable competencies. The Sandbox After Dark workshops represent this type of setting, combining technology learning with informal peer assistance. Although the broader extracurricular literature does not directly establish a relationship between digital agency and these co-curricular settings, it identifies adjacent concepts including peer collaboration, motivation, self-efficacy, belonging, and skill development that may help explain how informal peer-assisted environments support students' capacity to engage more confidently and independently with technology.

This study uses the Sandbox After Dark program to investigate how peer-assisted learning exists within an informal, skill-focused technology environment. The concepts of interest include peer tutors as fitting role models, the extent to which reciprocal learning emerges despite natural differing levels of expertise, and how these peer relationships and the surrounding learning environment associate with students' perceived digital agency.

The following research questions form the basis of this study to examine the key constructs of peer-assisted learning, including role modeling, reciprocity, digital agency, and the learning environment.

RQ1 (Role Modeling). How do student perceptions of peer tutors as role models impact students' confidence in using and teaching technology skills?

RQ2 (Reciprocity). How do participants perceive reciprocal learning in peer-led technology workshops, and what factors appear to impact reciprocity when tutors possess greater technical expertise?

RQ3 (Digital Agency). How are peer role modeling, reliability, and informal learning environment associated with student's perceived digital agency?

RQ4 (Reliability and Learning Environment) How do peer leadership and informal learning environments support students' comfort, inclusion, and willingness to seek future peer assistance?

3. METHODOLOGY

3.1 Design

This study used a mixed-methods approach to examine student perceptions of Sandbox After Dark sessions. This study was approved by the Institutional Review Board (IRB) at Bentley University (Protocol #260218051). Data came from a quantitative post-session survey administered through Qualtrics. To better understand student perspectives on the sessions through the lens of this research study, a focus group was held to dive deep into these key ideas. Generally, focus group participants helped shed light on the various ways in which having a tutor rather than a professor helped to ease the pressure of performance, and created a space where students could explore. Focus group questions are provided in Appendix B.

The findings draw on data from these research methods as well as prior scholarship on peer-assisted learning and learning experiences.

3.2 Participants

The survey was administered at the end of each Sandbox After Dark workshop to all participants; a total of $n = 255$ students participated in 24 workshop sessions throughout the semester; of those, 227 responses were complete. In all, 189 total students (male = 112, female = 77) opted in to the post-session survey – these 189 responses are what the quantitative results in this paper are based on. All attendees of each workshop participated as a requirement for their CS 100 course. To ensure that the study contained independent observations and further validate the test, students were able to participate in exactly one Sandbox After Dark session.

3.3 Survey

The post-session survey design included a variety of demographic, Likert-scale, and open-ended questions, aimed at analyzing not only the session's general effectiveness, but also the constructs that we hoped to research surrounding peer-assisted learning, reciprocal learning, and the benefit of perceived environment on engagement. Demographic questions sought to understand the technology background of each student to understand if there are differences in outcomes for each student group; the survey collected information regarding gender, major, comfort-level with learning new software, and prior knowledge through enrolling in a computer science course in high school. The complete survey is shown in Appendix A.

4. RESULTS

4.1 Analysis of PAL Constructs

Participants rated their level of agreement to the following statements, which were derived from the initial research questions (based on a five-point Likert-scale, Strongly Disagree (1) to Strongly Agree (5)):

Relatability: Because the session was led by a student, I felt more comfortable asking questions.

Reciprocity: I felt like the tutors were learning alongside me as we tackled the project.

Role Modeling: Seeing a peer lead this session makes me feel like I could teach these skills to others.

Environment: The informal evening setting made learning feel less stressful than a traditional classroom.

Digital Agency: I feel more capable of using this tool in tonight's session after attending this session.

Lab Help: I am likely to return to the CIS Sandbox for individual help after meeting the tutors in this workshop.

The constructs were split into two distinct categories: peer relationships and learning experiences. Figure 2 highlights the mean Likert score of each construct, on a 1-5 scale, as mentioned above.

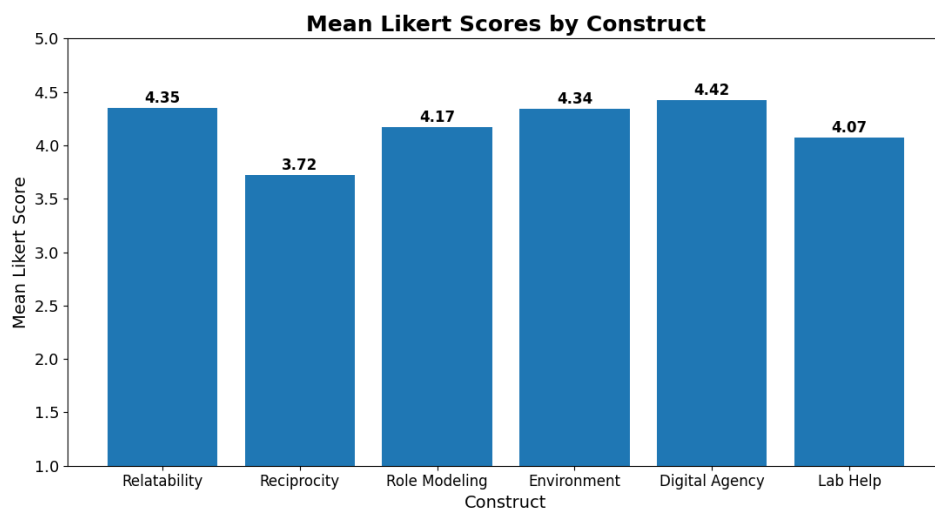


Figure 2. Peer Relationship and Learning Experience Constructs.

Although Figure 2 reports all six survey constructs, the research questions focus on four central dimensions of the peer-learning experience: role modeling, reciprocity, digital agency, and learning environment. Relatability and lab help are supporting indicators that add context to the peer-assisted learning experience.

While all six PAL constructs in Figure 2 were found to be significantly greater than neutral, two stood out: reciprocity had the lowest mean response value (mean = 3.72) and digital agency had the highest (mean = 4.42). Students perceive working with their peers as highly relatable (mean = 4.35). In a peer-assisted learning environment, relatability implies students are comfortable asking questions and encourages openness and engagement.

The environment has a positive influence on learning (mean = 4.34) and are likely to return to the lab after connecting with the tutors (mean = 4.07).

Role modeling also has a strong positive influence (mean = 4.17) suggesting that tutors are modeling confidence, effective learning behaviors, and agency. This is consistent with the social cognitive theory that observational learning can influence academic engagement (Woreta et al., 2025).

An important question to consider in this study is whether the workshop topic played a factor in the participants responses; did a specific tutor's behavior have an impact on outcomes? Did students in one workshop report stronger outcomes than in another? The non-parametric Kruskal-Wallis test fits this use cases because each construct is measured on a 1-5 Likert-scale, meaning it is ordinal. Additionally, the Kruskal-Wallis Test does not require nearly as many assumptions to be met as ANOVA or other parametric tests (Kruskal & Wallis, 1952). The null hypothesis states that there is no statistically significant difference between workshop each outcome. Because we are comparing multiple constructs at once (six separate hypothesis tests, one for each construct), we must adjust the p-value accordingly using the Holm correction. Table 3 outlines the results of these tests. We accept the null hypothesis for all constructs and conclude that there is no statistically significant difference in outcomes between the workshop sessions.

Commented [EB1]: Taken from section 4.3 - another use of the Kruskal-Wallis test!

Kruskal Wallis Test – Differences Between Workshops by Construct			
	Test Statistic	Adjusted p-value	Result ($\alpha = 0.05$)
Relatability	4.409	1.000	Accept, No Significance
Reciprocity	2.429	1.000	Accept, No Significance
Role Modeling	13.696	0.106	Accept, No Significance
Environment	7.924	0.642	Accept, No Significance
Digital Agency	11.837	0.185	Accept, No Significance
Lab Help	4.887	1.000	Accept, No Significance

Table 3. Kruskal-Wallis Test

4.2 Correlation Matrix

The heat map in Figure 3 shows Spearman correlations (Spearman, 1904) among the six peer-learning constructs: relatability, reciprocity, role modeling, environment, digital agency, and lab help. The correlation coefficient r indicates the strength of relationship between two factors. The value of $r = +1$ indicates a perfect positive relationship; $r = -1$ indicates a perfect negative relationship; $r = 0$ indicates no relationship. Survey results show all values are positive, ranging between 0.33 and 0.62.

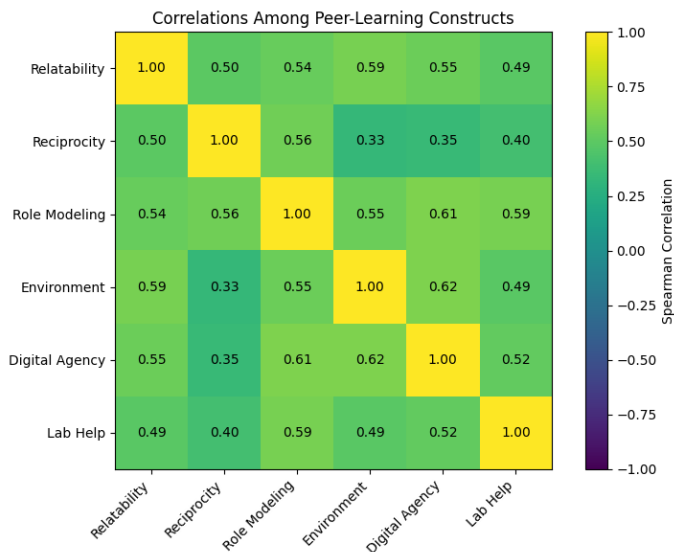


Figure 3. Spearman Correlations.

In Figure 3, correlations indicate moderate positive relationships across all six constructs, with the strongest associations found between environment and digital agency ($r = 0.62$), role modeling and digital agency ($r = 0.61$), and lab help and role modeling and reliability and environment, (both $r = 0.59$).

Reciprocity had the lowest correlation with environment (0.33), digital agency (0.35), and lab help (0.40). Peer interactions were less fully mutual, and more one-directional. While the students perceived their peers as relatable, they are learning with each other, but not necessarily from each other. On the other hand, reciprocity had a stronger correlation with role modeling (0.56) compared with the constructs mentioned above. Reciprocity lends itself to role modeling: when students learn alongside the tutor, they learn the content as well as how to explain that content to others.

4.3 Comfort with New Technology and Digital Agency

The post-session survey collected information about learner's comfort-level with mastering new technologies. Relating this to digital agency provides an interesting insight as to whether general self-reported comfort levels with new technology have any impact on the learner's digital agency.

This analysis examines the differences in digital agency between the five self-reported comfort-levels: Novice, Beginner, Intermediate, Proficient, and Advanced. The Kruskal-Wallis Test once again fits here - the null hypothesis states that there is no significant difference in post-session digital agency between comfort-level groups. The Kruskal-Wallis test resulted in the null hypothesis not to be rejected ($p = 0.1855$) i.e. there was no statistically significant difference in post-session digital agency between the five comfort levels.

While the Kruskal-Wallis test resulted in no evidence for a statistically significant difference, Figure 4 outlines a general increase in digital agency as comfort-level increases; that is, participants who self-reported to be more advanced when it comes to learning new technology felt more capable of using the new tool after completing the workshop. This may signal a need to incorporate new learning strategies to target the "novice" participants who only use technology when they must.

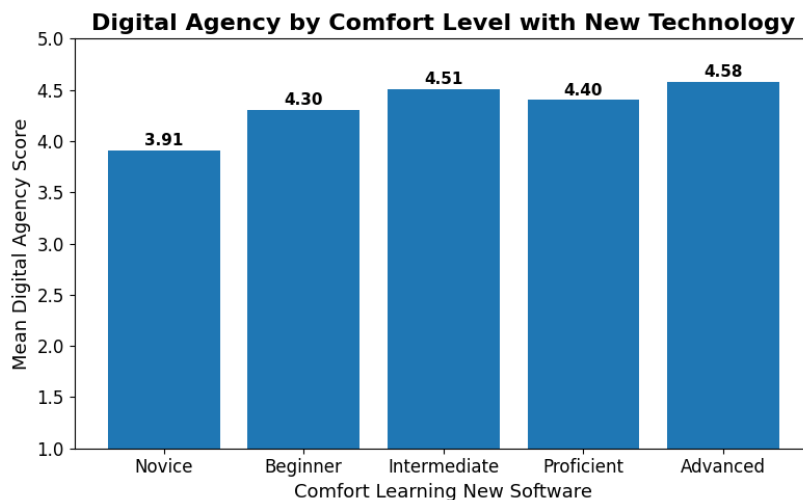


Figure 4. Digital Agency by Comfort-Level

5. DISCUSSION

This study examined peer-assisted learning across four key dimensions: peer role modeling, reciprocity, digital agency, and the learning environment. Results show that these four dimensions form a connected system with strong support for observational learning and environmental influence, and weaker evidence for reciprocal engagement.

Student learning takeaways within these peer-assisted workshop sessions fall into two overarching categories: (1) the learning of practical new technology content/tool usage, (2) the learning of behaviors and problem-solving skills (peer-learning etc.).

Students who feel like they relate to the tutors, also feel strongly about the other five indicators. When students feel like they can relate to their peers, other processes also improve. Relatability thus is a foundational condition upon which all peer-assisted learning is built.

Interpreting the survey results provides insights into this study's research questions:

5.1 Relatability and Informality as Conditions for Peer Learning

In response to RQ4, the findings suggest that peer leaders support comfort and inclusion by reducing perceived social pressure associated with asking questions. Survey results demonstrate this finding as learning environment outcomes have a strong correlation with perceived relatability ($r = 0.59$) and digital agency ($r = 0.62$). These findings highlight the importance of a supportive and socially connected learning context and suggest that digital agencies are closely linked to peer role modeling and the learning environment. When students feel like they can relate to their peers, other processes also improve. Relatability is a foundational condition upon which all peer-assisted learning is built. This also aligns with the fact that relatability had the second highest mean out of all constructs in Figure 2.

Students reflected:

- "In the Sandbox, we got to mess around and do what we want ... and have fun."
- "[Tutors] went through learning this stuff themselves... so it kind of made it easier to trust them... it was easier to go up to them and just ask questions about anything."
- "Fostering a warm, welcoming environment... teaching this thing that we maybe have never heard of... it made it feel like it was a beginner course, like a true beginner course."

5.2 Peer Tutors as Attainable Models of Technology Expertise

In response to RQ1, students were more likely to perceive themselves as capable of teaching technology skills when they also viewed peer tutors as relatable and the learning experience as accessible. The findings indicate strong support for this because role modeling correlated with digital agency ($r = 0.61$) and lab help ($r = 0.59$). Students not only observe tutors but also engage with them and the Sandbox lab, and through that engagement they develop their skills. This is consistent with social learning theory (Bandura, 1976) which promotes student learning through observing and modeling behaviors in social contexts.

Reflecting on being instructed by a peer tutor rather than an instructor, focus group participants commented:

- "Being a student kind of gives you that unique insight... you're trying to teach other students who have been in your shoes."
- "They're in our current position... going through the cycle of just being confused and learning things, so there's no pressure, there's no embarrassment of asking a question."

5.3 Expertise Asymmetry Limits Reciprocity

In response to RQ2, participants perceived some mutual learning, but reciprocity was weaker than the other peer-learning indicators, suggesting that differences in expertise may preserve an instructional imbalance even when tutors and learners share peer status. Reciprocity has significantly lower associations to both environment ($r = 0.33$) and digital agency ($r = 0.35$) suggesting that while peer interactions support learning, the tutors are doing more teaching than learning. The lower mean score and weaker correlation with the learning environment suggests that interactions are more one-directional. Students appear to be receiving more instruction from tutors than they are contributing to each other's learning.

At its core, PAL provides a model for a mutual learning partnership between individuals. This study shows that for there to be a sense of mutual learning through peer-assisted learning, the knowledge gap between participant and individual must be small. Sandbox After Dark naturally placed tutors in an instructor role, and participants in a learning role – a mold that may be hard to break away from when trying to examine PAL. This limitation in workshop design is mentioned briefly in the conclusion.

5.4 Digital Agency Emerges Through Peer and Environmental Factors

In response to RQ3, perceived digital agency was most strongly associated with the informal learning environment and peer role modeling, suggesting that students' confidence with technology may be

supported by the combination of hands-on participation, attainable peer expertise, and a low-pressure setting. With strong associations with environment ($r = 0.62$) and role modeling ($r = 0.61$), digital agency is a central construct. Students' ability to act with technology is not learned independently but is part of the process of learning with and from their peers. The correlation with environment suggests that informal, supportive learning spaces and scenarios play an important role in encouraging students to experiment and develop their skills. This aligns with social cognitive theory, which highlights the relationship between environmental, behavioral, and cognitive factors in learning (Bandura, 1976).

Students in the focus group commented; "By the time you got to doing it [a task] yourself... you'd been exposed to it twice in two different ways, and you were able to do it by yourself confidently."

6. CONCLUSIONS

The findings from this study highlight the potential of informal peer-assisted learning as a model for technology education. Sandbox After Dark created an environment in which students could explore unfamiliar technology tools with guidance from peer tutors in a social, informal setting. Survey results and focus group responses suggest that this structure supported students' perceived digital agency, comfort asking questions, and willingness to engage with the Sandbox as a learning space. The strongest quantitative findings centered on digital agency, relatability, and the informal learning environment, suggesting that students' confidence with technology may be shaped by both the instructional approach and the surrounding social context.

While these areas produced positive student support, the study results also reveal areas for refinement. Reciprocity was positive but weaker than the other constructs, indicating that participants may have viewed tutors primarily as approachable instructors rather than as co-learners. This finding does not weaken the value of the program; rather, it clarifies room for growth in future iterations. Workshop designs that include participant-led sharing, collaborative troubleshooting, or reflection activities may strengthen the reciprocal dimension of the peer-assisted learning model.

These conclusions should be interpreted considering several limitations. The analysis is based on one semester at one university, and survey responses reflect students' self-reported perceptions. Focus group participation was limited, and tutor feedback remains a valuable future source of program strengths and weaknesses when evaluating peer-assisted learning.

Other factors, including topic appeal, tutor preparation, group cohesiveness, session size, and workshop quality, may have influenced student responses. Additionally, while Spearman correlations identify relationships among constructs, they cannot establish causation.

Nevertheless, this study offers practical insight into how informal, peer-led, technology-enhanced learning environments such as Sandbox After Dark can make technology exploration more accessible and confidence-building for students.

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8. REFERENCES

Alexaki, A., Michalopoulos, D., Papadopoulos, D., & Giotopoulos, K. C. (2026). Extracurricular Activities and Academic Performance: A Systematic Review with a Focus on AI and Machine-Learning Applications in Education. *Education Sciences*, 16(7), 1067. <https://doi.org/10.3390/educsci16071067>

Bandura, A. (1976). *Social Learning Theory*. Prentice Hall.

- de la Hera, D. P., Zannoni, M. B., Sigman, M., & Calero, C. I. (2022). Peer tutoring of computer programming increases exploratory behavior in children. *Journal of Experimental Child Psychology*, 216, 105335. <https://doi.org/10.1016/j.jecp.2021.105335>
- Frydenberg, M. (2013a). Creating a collaborative learning community in the CIS Sandbox. *Interactive Technology and Smart Education*, 10(1), 49–62. <https://doi.org/10.1108/17415651311326446>
- Frydenberg, M. (2013b). Peer Tutoring in the CIS Sandbox: Does It Work? In *International Association for Development of the Information Society*. International Association for the Development of the Information Society. <https://eric.ed.gov/?id=ED562321>
- Gazula, S., McKenna, L., Cooper, S., & Paliadelis, P. (2017). A Systematic Review of Reciprocal Peer Tutoring within Tertiary Health Profession Educational Programs. *Health Professions Education*, 3(2), 64–78. <https://doi.org/10.1016/j.hpe.2016.12.001>
- Guraya, S. Y., & Abdalla, M. E. (2020). Determining the effectiveness of peer-assisted learning in medical education: A systematic review and meta-analysis. *Journal of Taibah University Medical Sciences*, 15(3), 177–184. <https://doi.org/10.1016/j.jtumed.2020.05.002>
- Herrmann-Werner, A., Gramer, R., Erschens, R., Nikendei, C., Wosnik, A., Griewatz, J., Zipfel, S., & Junne, F. (2017). Peer-assisted learning (PAL) in undergraduate medical education: An overview. *Zeitschrift Für Evidenz, Fortbildung Und Qualität Im Gesundheitswesen*, 121, 74–81. <https://doi.org/https://doi.org/10.1016/j.zefq.2017.01.001>
- Hufnagel, E. (2015). Preservice elementary teachers' emotional connections and disconnections to climate change in a science course. *Journal of Research in Science Teaching*, 52(9), 1296–1324. <https://doi.org/10.1002/tea.21245>
- Jenkins, H. (2009). *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century*. The MIT Press. <https://library.oapen.org/handle/20.500.12657/26083>
- Kruskal, W. H., & Wallis, W. A. (1952). Use of Ranks in One-Criterion Variance Analysis. *Journal of the American Statistical Association*, 47(260), 583–621. <https://doi.org/10.1080/01621459.1952.10483441>
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory* (3rd Edition). McGraw-Hill. <https://archive.org/details/dli.scoerat.1556psychometrictheorysecondedition>
- Passey, D., Shonfeld, M., Appleby, L., Judge, M., Saito, T., & Smits, A. (2018). Digital Agency: Empowering Equity in and through Education. *Technology, Knowledge and Learning*, 23(3), 425–439. <https://doi.org/10.1007/s10758-018-9384-x>
- Spearman, C. (1904). The proof and measurement of association between two things. *The American Journal of Psychology*, 15(1), 72–101. <https://doi.org/https://doi.org/10.2307/1412159>
- St. John, J., & St. John, K. (2024). A Process-Focused Experiential Approach to IT Education Using Peer Learning. *Journal of Information Systems Education*, 35(2), 148–159. <https://doi.org/https://doi.org/10.62273/ORES9068>
- Syvänen, A., Frydenberg, M., Poutanen, J., Turunen, M., & Walton, G. (2014). *Interactive and Engaging Social Learning Spaces for Collaboration*. 1435–1440. <https://www.learnlib.org/primary/p/147673/>
- Villegas Molina, I., Kim, J., Montalvo, A., Larragoitia, A., Lim, R. S., Guo, P. J., Krause-Levy, S., & Porter, L. (2025). Undergraduate Computing Tutors' Perceptions of their Roles, Stressors, and Barriers to Effectiveness. *Proceedings of the 56th ACM Technical Symposium on Computer Science Education V. 1, SIGCSETS 2025*, 1155–1161. <https://doi.org/10.1145/3641554.3701784>

- Williams, L. A., & Kessler, R. R. (2000). All I really need to know about pair programming I learned in kindergarten. *Communications of the ACM*, 43(5), 108–114. <https://doi.org/10.1145/332833.332848>
- Woreta, G. T., Zewude, G. T., & Józsa, K. (2025). The Mediating Role of Self-Efficacy and Outcome Expectations in the Relationship Between Peer Context and Academic Engagement: A Social Cognitive Theory Perspective. *Behavioral Sciences*, 15(5), 681. <https://doi.org/10.3390/bs15050681>
- Yildiz Durak, H. (2022). Flipped classroom model applications in computing courses: Peer-assisted groups, collaborative group and individual learning. *Computer Applications in Engineering Education*, 30(3), 803–820. <https://doi.org/10.1002/cae.22487>

APPENDIX A

Survey Instrument

INFORMED CONSENT

- ☐ Yes, I will participate
- ☐ No, I will not participate

Please Enter Your Age. *Skip to End of Survey if Age < 18*

What CS course are you currently taking?

What is your gender?

- ☐ Male
- ☐ Female
- ☐ Other
- ☐ Prefer not to say

What is your intended or current primary Major?

How would you describe your comfort level with learning new software?

- ☐ Novice (I only use tech when I have to)
- ☐ Beginner (I can perform simple tasks but need guidance)
- ☐ Intermediate (I can figure things out with a tutorial)
- ☐ Proficient (I learn new tools comfortably and rarely need help)
- ☐ Advanced (I enjoy troubleshooting and exploring new tools)

Did you take a computing or computer science course in high school?

- ☐ Yes
- ☐ No

Please rate your level of agreement with the following statements regarding your overall thoughts on the session.

Scale: Strongly disagree; Somewhat disagree; Neutral; Somewhat agree; Strongly agree.

- This topic was relevant to my interests.
- This session provided valuable information.
- This session was well-organized and the organizers were prepared.
- The tutor used examples that were easy for me to understand

Rate your experience during the Sandbox After Dark session:

Scale: Strongly disagree; Somewhat disagree; Neutral; Somewhat agree; Strongly agree.

- *Relatability:* Because the session was led by a student, I felt more comfortable asking questions.
- *Reciprocity:* I felt like the tutors were learning alongside me as we tackled the project. (
- *Role Modeling:* Seeing a peer lead this session makes me feel like I could teach these skills to others.
- *Environment:* The informal evening setting made learning feel less stressful than a traditional classroom.
- *Digital Agency:* I feel more capable of using this tool in tonight's session after attending this session.
- *Lab Help:* I am likely to return to the CIS Sandbox for individual help after meeting the tutors in this workshop

Describe one specific moment during the workshop where you felt your confidence with the technology increase. What caused that shift?

How did having a "colleague" (tutor) rather than an "instructor" change the way you approached the project?

APPENDIX B

Focus Group Questions

1. How did having a student tutor rather than an instructor affect your willingness to ask questions in the session?
2. What did the tutors do, would you say, that helped or didn't help the session? Was there anything unclear?
3. Was there a moment you felt the tutor understood your perspective in a way a professor might not?
4. Did seeing a peer lead the session make teaching seem more achievable for you?
5. What qualities of the tutors made learning feel accessible or not?
6. Did you imagine yourself in the role at all during the session?
7. How prevalent do you think a session like this is at XXXXXX?
8. How did the evening informal setting affect your engagement or comfort with attending the session?
9. If this same content were taught in a traditional classroom, what would feel different?
10. Did attending this workshop make you more likely to come back to the Sandbox for help? Why or why not?
11. What would encourage you to attend another Sandbox After Dark session?
12. Would you say there has to be some level of skill-based learning involved in order for you to go?
13. Was there ever a moment in the workshop where you thought, "this is being taught by a tutor, is there a possibility that they are not as knowledgeable as a professor"?
14. What elements of the workshop were most helpful for your learning?
15. If you could redesign the session, what would you change or keep?
16. Any final comments before we head out?

APPENDIX C Instructional Design Training



Agenda

- 1 Describing the purpose of your workshop
- 2 Designing an effective demo
- 3 Designing your project

Designing your project

- Provide a clear procedure, and suggest within that procedure places where students have opportunities to be creative.
 - Give ideas for different ways to utilize your technique
- Provide an outline of project steps either as a handout or a slide to be displayed while students are working.
- If possible, break your project up into stages.
- Build in time for students to share their work.



Outline your project timeline. Include timestamps to the best of your ability.

“Why am I learning this?”

- Take a moment to tell students...
 - What they should be able to do
 - Why this will be useful to them in coursework, their careers, and possibly their day-to-day lives
- Learning outcomes
 - What should learners be able to do after your workshop—stick to observable/measurable actions
 - Helps identify specific skills involved in the skills you are teaching and gives students a clearer picture of what you want from them.



Draft 2-3 learning outcomes for your workshop + use cases for your skill

Designing an effective demo



- Keep your initial demonstration short and simple
- Take time beforehand to ID key moments to pause and indicate different choices you could make or check for comprehension
- Incorporate potential stumbling blocks and how to overcome them

Draft an outline of your demo!