Georgia Gwinnett COLLEGE

School of Science and Technology

Comparison of the Effectiveness of Games at Teaching Binary to Students Online vs In-Person

TAP@ggc TECHNOLOGY AMBASSADOR PROGRAM

Shianne Lesure, Zuberi Thompson, Celeste Echols, Seohyeon Kim / Dr. Cengiz Gunay and Dr. Cindy Robertson / Georgia Gwinnett College

INTRODUCTION

The aim of this study is to determine if video games are a valid medium for instructing students on complex technical concepts. The effectiveness of online vs in-person teaching is also being studied. The study is focused on students of all age ranges from middle school to college students. Many underrepresented students do not get introduced to these technologies and concepts early on and TAP aims to change that.

Technology Ambassador Program:
TAP is a project-based class that strives to increase participation in IT and STEM through numerous outreach activities and workshops to showcase the fun side of technology.

Pixel Arcade

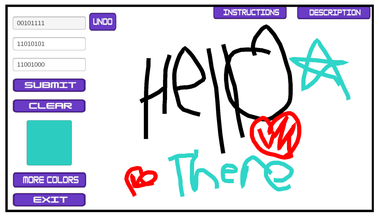
PROJECT DESCRIPTION

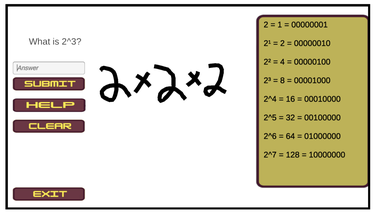
An interactive 2D game that will instruct students about the basics of binary was built using Unity. Binary is the basis of how computers, photo editing, RGB, audio and many other technology work, which is why we wanted to get students familiar with it early on.
Participants will play a tutorial then 3 mini-games.

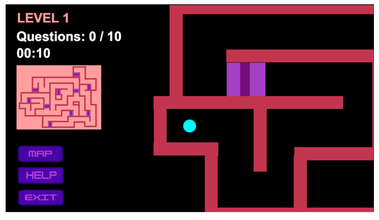
Mini-Game 1:
- A 3 level maze that increases in difficulty with each level

Mini-Game 2:
- A quiz board game where participants race against an NPC by answering binary related questions.

Mini-Game 3:
- A drawing canvas where participants can see how binary relates to RGB







WORKSHOP DESCRIPTION

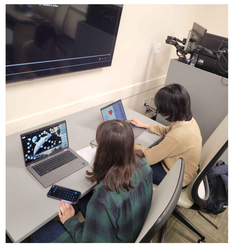
Hosted 4 workshops with 2 being online and 2 being in-person.

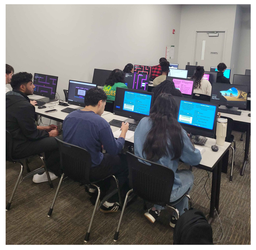
In both online and in-person workshops:
- Students were given an introduction and tutorial on binary.
- One online and one in-person class played Binary Maze and the other online and in-person class played Planet 01000010.
- Students were given awards if successful in winning the game.

Online (2 online workshops):
- Students went into breakout rooms to play with one of the team members
- Students were prompted to post results in the chat

In-person (2 in-person workshops):
- Students were provided paper to solve the problems on
- Team members were walking around assisting

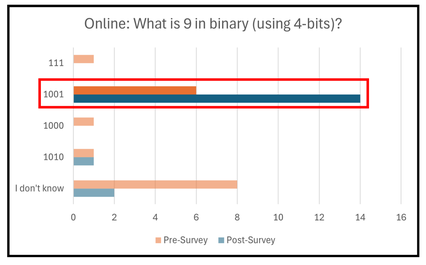
TAP Expo - College students played all 3 mini-games to get an understanding of binary

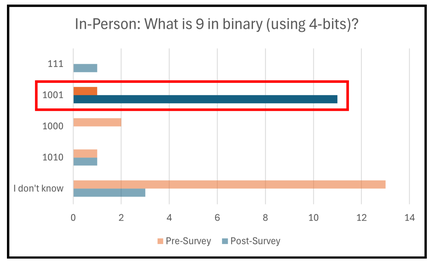




RESULTS

Both online and in-person students showed a gain of knowledge after the workshops by being able to identify the correct answer within the post-survey.



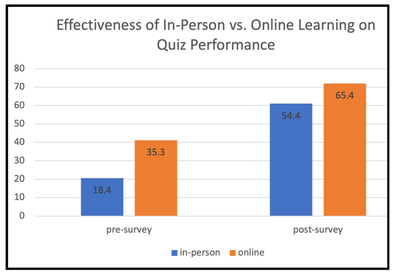


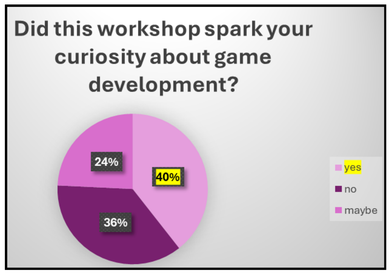
DISCUSSION & CONCLUSION

The workshops yielded outstanding results, with students actively engaged and successfully learning to convert numbers to and from binary.

- Students in-person had **more engagement** because our team was able to walk around helping students.
- Students online utilized the chat and breakout rooms to engage with the team members.
- Most participants achieved impressive completion times and **high accuracy** rates on their questions.
- Interest in programming among college students **rose by 33%**, while interest in game development **increased by 40%.**

- The overall **accuracy is higher online**, but the **Performance growth rate of in-person (36%) is higher than online (30.1%)**





ACKNOWLEDGMENTS

- This project has been partially funded by the National Science Foundation grant #2315804.
- We would also like to thank the Georgia Gwinnett College TAP faculty and students, and the Georgia Gwinnett College School of Science & Technology for supporting the TAP program.

REFERENCES

1. Adipat, S., Laksana, K., Busayanon, K., Asawasowan, A., & Adipat, B. (2021). Engaging students in the learning process with game-based learning: The fundamental concepts. International Journal of Technology in Education (IJTE), 4(3), 542-552. https://doi.org/10.46328/ijte.169
2. Dekhane, S., Xu, X., Napier, N., Barakat, R., Gunay, C., & Nagel, K. (2018). Technology focused service-learning course to increase confidence and persistence in computing. Journal of Computing Sciences in Colleges, 34(2), 147-153. https://dl.acm.org/doi/10.5555/3282588.3282609
3. "Unity Real-Time Development Platform: 3D, 2D, VR & AR Engine." Unity, https://unity.com/. Accessed 23 Sept. 2024.
4. Wisc-Online. "Hexadecimal Bee Game." Wisc-Online Arcade, www.wisc-online.com/arcade/games/computer-science/foundational-it-skills/2169/hexadecimal-bee-game.