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“Ocean Rescue: increase diversity in IT through game development”

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Abstract

“Ocean Rescue“ is a video game created by Georgia Gwinnett College (GGC) Information Technology students. We are involved with GGC’s Technology Ambassador’s Program which aims to increase interest and passion in Information Technology programs and technology among middle school, high school, and college students, particularly underrepresented groups. Our goal was to create a game that appeals to students ranging from middle school to college. For that purpose we implemented “Ocean rescue” q multi-player game that is aesthetically reminiscent of Pac-man. It challenges players to collect points, defeat enemies by escaping, and obtain a high score. It also introduces a “Lives” counter and decreases the lives when the player is attacked. This game was designed using Scratch and “Makey Makey”. “Ocean rescue” not only allows players to play the game by using the arrow on the keyboard it also allows them to play with their feet to control the fishes inside the game, using “Makey Makey”. This feature provides fun and engaging ways for students to interact with computer language and understand fundamental programming concepts such as decision structure and loops.

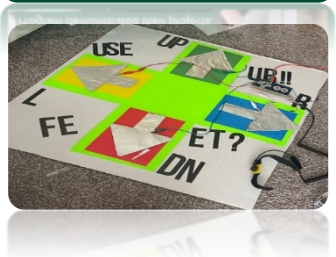
Introduction

TAP stands for Technology Ambassador Program which aims to develop educational technology directed towards non-IT students and students K-12. TAP has so many goals that are so beneficial for students who choose to take this class. To name a few, TAP aims to increase number of underrepresented minorities in IT and help close the gender cap since women make up only 28% of the workforce in technology. In addition, it helps students develop leadership skills, communication, and technical skills through community outreach initiatives.

Being members of TAP has become one of the best experiences in our lives because we were able to learn so many things that we all did not know before in a welcoming environment. In addition, TAP helped us trigger the creativity inside each one of us. We were allowed to pick our own project that we felt comfortable working on and had the chance to see how it turned out. One of the biggest things that got us so motivated in this class is teamwork we were separated in teams of four which had helped us develop our communication and teamwork skills. This class was so unique because we learned a lot from it all while having so much fun throughout the semester.

Methods

Our team created a game named Ocean Rescue which is like Paceman game by using Scratch and Makey Makey. Scratch is an online programming platform that allows the user to do drag and drop basic coding to create their game. However, Makey Makey was the extension that we added to the game to make it more interesting. Makey Makey is a USB device that you can connect to your game and plug it into your computer to make any daily objects used instead of the keyboard keys.



Through our game the goal was to teach, if then statements, forever loop, manipulating variables and iteration with a score counter. We also, incorporated Makey Makey by creating a board that involve four arrows which each arrow represent a direction.

We hosted multiple workshops at IT intro level classes, and we tough the students how to build their own games. After the students created their game, we let them try our game using the Makey Makey board that we made. And that was extremely fun. There also was a pre and post survey for the students to take and to measure the effectiveness of our workshop.

Results and Discussion:

Our goal was to figure out if we can teach coding with drag and drop game development. The game "Ocean Rescue" provided results that confirmed the effectiveness of our workshop in teaching fundamental programming concepts. Figure 1a. proves that our workshop was able to teach certain variables that use "if-else statements" such as creating characters which helped participants to retain knowledge. In Figure 1b, we wanted to test if participants learned what an "loop" is and forty out of fifty-one students was able to correctly answer the question. In the workshop, we taught the participants how to use a "forever loop" to make their characters move. The next question was to test if the participants learned "what determines if the game is over?" and Figure 1c. shows that those forty-nine out of fifty-one participants was able to answer this question correctly. Lastly, we asked our participants about how difficult it was to learn this material and we found that thirty-eight out of fifty-one participants found the material easy to learn as shown in Figure 1d. In summation, we were able to meet our goals within our classes, and our results from the assessments and surveys reflected increased understanding and an increase in general interest in both learning and using new technology.

Figure 1a

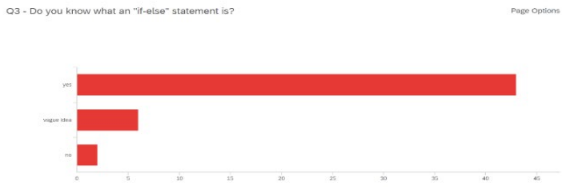


Figure 1b

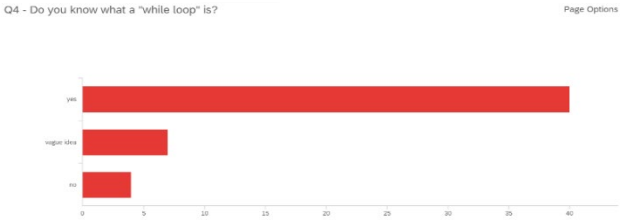


Figure 1c

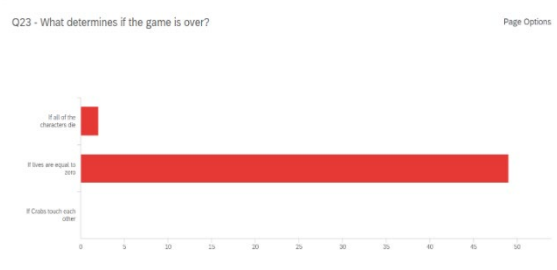
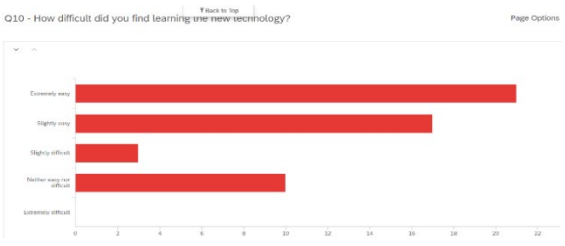


Figure 1d



Acknowledgements

Thanks to the STARS Computing Corps, the Georgia Gwinnett College Technology Ambassador Program committee, and the school of Science and Technology for providing the resources for our team to design this outreach project for all Georgia Gwinnett College students and children of 18 years of age or younger.

Special thanks to Dr. Rahaf Barakat and Dr. Cengiz Gunay who served as our professors and mentors and supported us in our endeavors with our project, and enhanced our teamwork, communication, presentation, and technical skills.

"Boolario: Teaching Logic Statements and Game Development Concepts to Engage Students in IT"

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Abstract

Boolario is a 2D platformer game, in which the player traverses the stage to collect coins that hold the Boolean values of "true" and "false." With Boolario, our team hopes that students will gain a motivation and an appreciation for programming and game development by completing a video game designed in the style of the 1990s game, Mario. Our team developed Boolario as a platform to educate students about frequently used game development and programming concepts in C#.

Introduction

The Technology Ambassador Program (TAP) is a project and research-based course at Georgia Gwinnett College, which aims to provide student-driven technological support for GGC outreach initiatives and introductory STEM courses as well as students to broaden their horizons in IT. TAP is not an exclusive course for Information Technology students; this program welcomes individuals from all backgrounds. Our objective is to train all university students and children at young ages in a hands-on learning experience to teach them about the fundamental IT concepts used in games.

Methods

The completed game, found on our website, serves as a basis for comparison, and the incomplete workshop version provides a platform for students to learn about programming and game development concepts.

Through these workshops, attendees discover that the main character, Boolario, can neither jump high enough to reach elevated platforms, nor land on platforms without falling through. The user's goal is subsequently to attempt to correct these errors by utilizing the Unity interface and modifying code in one of our scripts. Once they create a hitbox using Unity's Box Collider 2D and increase Boolario's jump height by changing the relative y-axis velocity when they press the space key, attendees will be able to complete the level in the game.

Once completed, the students will have the option to play the game using "and" and "or" logical statements. If they choose the "And" mode, they will receive a point if and only if they collect two designated true coins. If students choose the "Or" game mode, the player will collect a point if only they collect one true coin. Collecting a false coin will not regress the score; however, it does function as a limiter to collecting a point. If, while playing, the user touches a spike or falls off the map, the character will die, a game-over screen will display, and their progress in the game will reset.

Results

Seventy-seven percent of students in our workshops did not have any prior programming knowledge; only a total of 23% of students in all three workshops had little or some knowledge in programming.

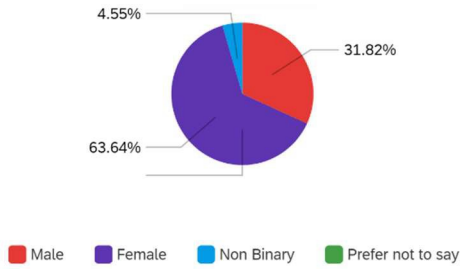

Figure 1: Participation by Gender

After our workshop, we had a significant increase in the number of students who at least understood the programming language used in Unity. We also found an increase in the number of students who believed the answer was HTML; this could be a result of our team not reiterating C# as the correct name of the programming language enough or a result of lack of student participation.

Based on the results, we were overall successful in our ability to teach the desired programming and game development concepts to students. Although we did not have enough participants and experienced issues with discipline in taking the pre and post surveys, we were able to analyze of the effectiveness of our workshop with students from all three workshops. Some possible solutions to this problem would be reinforcing the importance of the pre and post surveys by means of the instructor as well as taking the pre-survey prior to attending the workshop.

Figure 3: Which language is used in Unity? (Pre-survey)

Figure 2: Which language is used in Unity? (Post-survey)

Acknowledgements

Thanks to the STARS Computing Corps, the Georgia Gwinnett College Technology Ambassador Program committee, and the school of Science and Technology for providing the resources for our team to design this outreach project for all Georgia Gwinnett College students and children of 18 years of age or younger.

Special thanks to Dr. Rahaf Barakat and Dr. Cengiz Gunay who served as our professors and mentors throughout the entire development of Boolario, supported us in our endeavors with our project, and enhanced our teamwork, communication, presentation, and technical skills.

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MACK Pages: A Personalized About Me Webpage

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Instructors: Dr. Rahaf Barakat, Dr. Cengiz Gunay

Abstract

Mack Pages is an IT outreach workshop to build a personalized cover page website developed at the Technology Ambassadors Program. We aim to deliver this project to anyone from middle school to college students. Mack Pages allows everyone to have their own "about me" page and have their own QR code for obtaining the website that facilitates creating connections among students. The students who solve the steps and host their website on GitHub, will be given their personal NFC tag that will contain their website. The website will have an API that calls for the quote of the day, giving the students a chance to learn about what APIs are. They will also get the chance to manipulate with HTML/CSS code. The students will be given 5-step blueprint website that they will alter.

Introduction

It is amazing how every single day, in this generation, people use technology one way or the other. However, they believe being backstage in giving these technologies life is very difficult. We aim to educate students of the opportunities of technology and how to move forward. We want students to be confident in learning more about what IT is and expanding their education/careers into it. While working with Technology Ambassador's Program (TAP), our goal is minimizing people's fears of the word "programming". TAP is a class offered by Georgia Gwinnett College to students with any background and emerging interest in IT. With TAP, we are given the opportunity to showcase our goals without any hesitation. The professors and other participating students helped us develop our project. We got exposure on what technology to use, how to address our audience, and what to expect out of our project.

Methods

Mack pages is built with HTML/CSS, JavaScript (API), QR Coding, GitHub, and NFC Reading (https://github.com/TechAmbassadors-GGC/MACK). The HTML/CSS is used for the overall experience of everyone's webpage. We have a section which has an API call to generate "the quote of the day" every time the page is reloaded. GitHub is used to host these web pages. With the Google generated QR Code, the students can share their websites. Also, the NFC chips has the URL of these web pages added on, which allows users to easily share their webpage. Our objective was to teach how to change the title of a webpage, change the background color, add in an image, add in a paragraph, and include emojis.

Keeping all of this in mind, we built our workshops to be as efficient as possible. We were part of TAP Expo, where we had various students come and test our project. We had set

up computers that allowed the students to follow the steps and build their own website. We participated in hosting classroom workshops. We would go in and walk through the project step by step, asking the students pre and post the workshop their inputs. For the Create Symposium, we gathered all the data, and showed the audience the expectations and results of our project.

Results

We gave the students who attended our workshops a pre-survey and post-survey to record data. We tested people on their knowledge of the technologies we were teaching before and after the workshop. When we saw the results, we were pleasantly surprised. In the TAP Expo, the 4 of us were guiding 2 people at a time. Everyone did a great job, and most of them were rewarded NFC chips when they successfully complete the workshop. In our classroom workshops, with our pre-survey, we started with 67 people who took the survey, out of which only 16 people had experience with programming in the past. Since the rest didn't have experience, they had skipped the technology questions completely. With our post surveys, 56 people responded, and this time everyone who participated took the technology questions. With these very different responses, it was difficult to conclude how much we had improved in teaching the technologies. However, we could deduce that around 70-80% of the people who took the survey had gotten the answers.

Discussions and Conclusions

Overall, with the feedback we received, we believe we were able to make our point. To quote one student's feedback, "Nothing, everyone help make this a great and easy experience, I think the presenters should be happy with how engage they had the audience! I really do think I want to take another course in IT programming because of this. Thank You". This shows that we inspired at least one person to come closer to IT. This corresponds to our mission, and one by one we'll get more people closer to IT. Some people who attended the workshops had difficulty keeping with our pace, which makes complete sense, as it is not necessary that everyone is on the same page. We understood from this project that we can't approach every person with the same mindset that whatever we explain they'll understand. It gave us a great insight of the different ways minds work. This was a great experience for us and we really appreciate GGC for giving us the opportunity.

References

Our primary source of showcasing examples was W3Schools. It was the most used component in our project. And, without GitHub pages we would not have been able to show the web pages of the students. Also, we used Quotable.IO for our API calls.

Acknowledgements

We'd like to first thank our Professors, Dr. Barakat and Dr. Gunay for giving us this chance of implementing our project. We'd like to thank TAP for giving us this platform to exhibit our project. Thank you to the School of Science and Technology for creating such great classes for

students like us. And, last but not least, STARS Computing Corp, we cherish your efforts to push us to be better!

How Intersecting Identities Affects Participation in Undergraduate Computer Science Studies

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Sponsor: Dr. Andrea Tartaro, Furman University

Introduction

This research investigates how intersecting identities affect participation rates in undergraduate computer science (CS). Participation rates for women and some racial minorities is low, for example, according to the 2020 Taulbee Survey, 20.6% of bachelor degrees in CS went to individuals identifying as women, 0.1% to individuals identifying as non-binary, 3.1% to individuals who identify as Black or African American, and 8.5% to individuals who identify as Hispanic (Zweban and Bizot 2021). Extensive research in the Computer Science Education community seeks to increase the participation of women in computing, focusing on understanding women's experiences (Pearce et al. 2021). This research builds on that previous work to consider other underrepresented identities and non-binary representation of gender. Applying a sociological lens suggests different social identities intersect to create a unique experience of power and discrimination, called intersectionality, that could influence participation in CS. For example, two black individuals' experiences are not necessarily the same: if one individual is part of the LGBTQIA+ community and the other individuals is straight this could dramatically change the amount and forms of discrimination they face. We conducted a literature review to assess how the Computer Science Education community considers intersecting identities.

Methods

We conducted a literature review using ACM's Transactions on Computing Education Journal (TOCE). This journal contains articles focusing on education and technology. For the literature review, we analyzed articles that included research and analysis on the topics of: race, gender, LGBTQIA+, and social class. We identified articles by reviewing all abstracts for articles published in TOCE (2001 – 2021 June issue) and selected those that mentioned race and ethnicity, social class, LGBTQIA+, gender, or intersectionality in relation to undergraduate CS studies. We developed a codebook that contains different labels for our topics of interest, such as: what kind of institution(s) did the researchers base their participants from, theories on identities, and our identities of interest. These labels were systematically applied to articles, and then analyzed.

Results

Of the articles published in TOCE since 2001, little has been written about the different social identities in our research question (Fig 1). When there were articles that were written about social identities, 82% were about gender. 5 articles discussed race, however, no articles analyzed LGBTQIA+ or social class identities. We found three articles that looked at multiple identity categories, but only two that considered how identities intersect to affect participation We created 6 different intersecting or multiple identity groups for this research study. Out of the 6 total groups, 5 articles only discussed Race/Gender and 1 discussed Gender/LGBTQIA+.

Conclusion

The number of articles that discussed intersecting identities was limited. There was also a limited number of research articles that discussed race, ethnicity, and non-binary gender. Therefore, it is currently not possible to determine how intersecting identities affect participation in computer science. Future research in Computer Science Education should include racial, ethnic and social class groups, consider how different identities intersect to affect participation, and include non-binary representation of gender. The research on gender in the computer science field has looked at gender from a binary point of view. There is an estimated 1 million non-binary adults living in the U.S (Wilson 2021). With this estimated population of non-binary individuals, there should be an adequate number of non-binary individuals that are interested in computer science. Yet, there was no research articles about these individuals and their participations rates. It is important to step away from the traditional binary approach to gender and move towards inclusive research that many social sciences are adopting. Broadening the identities we study, including race, ethnicity, and social class, will bring diversity into the computer science field. Diversity in any field helps to create new ideas and bring different perspectives. In particular with computer science, making sure that we have a diverse group of individuals creating technology and writing algorithms for our systems will help ensure that the technological world is accessible for everyone, not a certain group of people.

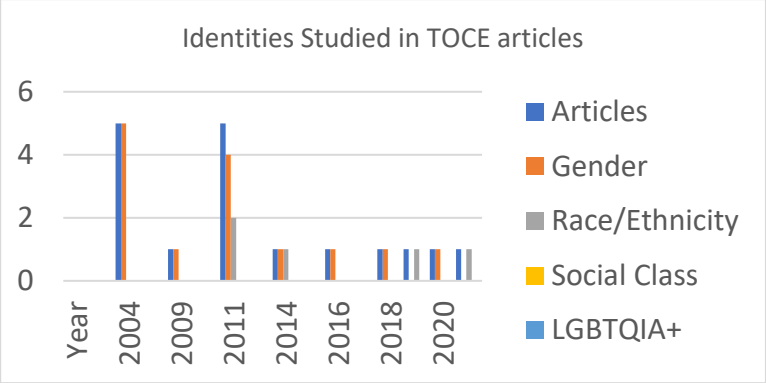

Fig.1: This chart shows the number of articles addressing social identities of interest.

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Evaluating Interactive Visualizations in Dual RNA Sequencing

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Introduction

Traditional RNA sequencing allows researchers to see how genes are expressed differently during an infection but it is limited to one organism's transcriptome. Dual RNA sequencing allows us to look at both organisms' transcripts at the same time. With this new process, researchers can now observe genes expressed by a host and the pathogen infecting it and this in turn can create new medicines. While dual-RNA sequencing is not as well developed as single RNA sequencing, there is no doubt that it is becoming essential to the development of drugs. However, this technology is not as accessible as it could be: systems are difficult to install and most require programming background that bioinformaticians do not have. In an effort to create a user-friendly and accessible application for dual-RNA sequencing, in our previous work, we created ViBE DRSapp.

ViBe DRSapp is an application that facilitates the analysis and visualization of dual-RNA sequencing data. Using the R programming language, ViBe DRSapp executes the processes for RNA sequencing analysis, makes interactive plots, and creates a web framework for displaying results. ViBeDRSapp is a prototype dual-RNA sequencing application and therefore has not gone through usability and validity testing. Our research aims to improve the ViBe DRSapp prototype by: (1) Identifying best practices for evaluating bioinformatics tools; and (2) Developing ViBe-DRS app so it is both accessible to bioinformatics researchers and a powerful tool for dual-RNA seq analysis.

Background

In order to gain an understanding of the RNA sequencing, we first took a short course on transcriptomics and RNA seq. After this we conducted a literature review on evaluating bioinformatics tools. From this literature review we identified several challenges with bioinformatics tools. First, researchers have trouble accessing bioinformatics tools because they are difficult to download and install (Bartlet et al. 2012). In order to use these tools, researchers have to download multiple applications, including text editors and IDEs. Bartlett et al. (2012) found that researchers found tools that were hard to download particularly off-putting. This was further supported by our own experience with ViBe DRSapp, which requires downloading libraries, packages, and other software.

Going hand in hand with researchers having trouble accessing the tools, is them not being able to use them or understand how to use them. Many bioinformatics apps are not usable because they require programming knowledge and lack documentation. With dual-RNA sequencing technology being so new, there is also the issue that many researchers are new to applying the technique. This is complicated by the fact that novice and expert bioinformaticians have different needs. While help and documentation was important for novices, ease of access was most important for experts (Bartlett and Kloda 2011, Homa et al. 2004).

Surprisingly, usability testing is rarely done for bioinformatics tools. However, traditional approaches to usability testing, including usability studies with users (asking participants to run through the process of using the application and think aloud) and heuristic evaluations (using

Nielsen's 10 usability heuristics (Nielsen, Jakob 1994, 2020) as a blueprint to evaluating the application) can be applied to these tools (Mirel and Wright 2009, Mirel 2007). The biggest issue with testing not being done on these tools is that tools that aren't properly developed and tested can cause significant issues in life science research.

Morrison-Smith et al. (2015) argues that Bioinformatics tools have become essential to life science research. However, the tools are lacking in help documentation, error messages, and other features that are essential to make the tools easy to use for researchers. These untested applications have caused some researchers to change their research questions in order to fit the limitations of the tools and their ability to use and understand them (Morrison-Smith 2015). The inability to answer certain questions can be a serious handicap when it comes to advances in life science research, so testing newly developed tools is essential to making sure that these new advances can be made.

Methods

We developed a usability protocol that we ran with three people of different skill levels with respect to RNA sequencing. Our first study was conducted with someone who had no knowledge of RNA sequencing, the second was with an undergraduate researcher who knew a little about RNA sequencing, and the third was with a professional in the biology/immunology field. The usability studies took place over Zoom and all meetings were recorded for future reference. After the observation study we interviewed the participants to gather additional feedback. We then analyzed the feedback from our participants in order to further improve our application. Finally, we conducted an heuristic evaluation to find violations of Nielsen's 10 usability heuristics within the application. After our testing, we have been working to draft and implement that changes we need to make from the feedback we received and conclusions we made.

Conclusions

Using our background information and user feedback we have determined 5 main things we want to focus on in terms of improving the app. (1) We want the ViBe DRSapp to be an easy to download application. We have considered packaging the application as one download or making a web interface. (2) We want to make the ViBe DRSapp as user-friendly as possible. This is our main focus and we have been working on implementing changes. These changes include adding help documentation explaining how to use the application, what the visuals (heatmaps, violin plots, etc) mean, definitions for terminology (normalization methods, grouping variable, etc.), and a video that runs through using the ViBe DRSapp. (3) We want to make sure that the ViBe DRSapp is compatible with different devices. (4)We want people of different skill levels to able to use the ViBe-DRSapp without needing prior programming knowledge or previous experience with dual RNA sequencing tools. (5) We want ViBe-DRSapp to be a fully functioning application that produces the correct output and visualizations through future validity testing. After we have made the necessary changes to ViBe-DRSapp, we hope that it can be useful tool for bioinformaticians to further their research, without having to worry about the potential setbacks of using an untested tool or having prior programming knowledge.

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