*Revolutionizing Learning: User Experience Evaluation of the C#Venture Application Using the User Experience Questionnaire (UEQ)*
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# Revolutionizing Learning: User Experience Evaluation of the C#Venture Application Using the User Experience Questionnaire (UEQ)

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**Abstract**

User Experience (UX) is a crucial element in assessing the effectiveness of educational applications. This study evaluates the UX of the C#Venture application—developed for the introductory programming course at Bandar Darulaman Community College—using the User Experience Questionnaire (UEQ). A total of 54 respondents participated in this study. The study found that the application scored excellently across all UX dimensions, including attractiveness, clarity, efficiency, dependability, stimulation, and novelty. The application's visual appeal and interactive elements successfully increased students' interest and engagement. Its clarity and ease of use ensured accessibility for users with varying technical skills, while high efficiency helped students complete tasks quickly and effectively. The application's reliability and innovation ensured a consistent learning experience. Overall, C#Venture has demonstrated its potential as an effective educational tool that can enhance students' learning experiences and outcomes through gamification. Further research is recommended to assess the long-term impact of this application on academic performance and student motivation, as well as to develop new features for continuous improvement.

**Keywords:** basic programming, user experience evaluation, User Experience Questionnaire (UEQ), attractiveness.

## INTRODUCTION

In today’s digital age, foundational programming skills are indispensable for students in the fields of information technology and engineering (Ahmad & Ibrahim, 2020). These skills are not only crucial at the university level (Medeiros et al., 2019) but are also increasingly being integrated into school curricula (Humble & Mozelius, 2022) and college programs (Li, 2023). The Basic Programming Course, while essential, is renowned for its challenges (Robertson & Doloc-Mihu, 2023) and is often viewed as a daunting and complex subject (Díaz-Lauzurica & Moreno-Salinas, 2019), particularly for students at Bandar Darulaman Community College. This course requires students to grasp abstract concepts and the fundamental structure of computer programming, as well as to apply these basics through simple programs and logical control structures to solve real-world problems.

In today's rapidly evolving educational landscape, traditional teaching methods often struggle to keep pace with the dynamic needs of students (Sudin et al, 2022; Hasbullah et al., 2022), particularly in challenging subjects like programming. The C#Venture application represents a significant shift in the way programming is taught by integrating gamification—a technique that uses game elements to enhance the learning process (Ghafar et al., 2023). The '#' symbol in 'C#' is pronounced as 'sharp' and is used to distinguish this language from older programming languages like C and C++. In this article, the use of 'C#' within the term 'C#Venture' is because the application is developed for the Basic Programming Course. This innovative approach is not just about making learning more engaging; it fundamentally transforms how students interact with and internalise complex programming concepts. By embedding programming tasks within a game-like environment themed around 'The Avengers,' C#Venture turns the often intimidating process of learning to code into an exciting and interactive adventure. Students are no longer passive recipients of information; instead, they actively participate in their learning journey, solving problems, collaborating with teammates, and receiving immediate feedback through the game's challenges and rewards system. This shift from traditional, lecture-based instruction to an immersive, gamified experience is what makes the C#Venture application a revolutionary tool in education. Moreover, the application leverages the familiarity and popularity of the Avengers theme to capture students' interest, making learning more relatable and less daunting. The use of characters, narrative, and competitive elements not only motivates students but also helps to reinforce learning by associating programming concepts with memorable and enjoyable experiences. This innovative approach ensures that students remain engaged and motivated, which is crucial for mastering the foundational skills required in programming. In summary, the C#Venture application revolutionises learning by transforming the traditional educational model into a gamified, student-centred experience. This approach not only enhances engagement and retention but also fosters a deeper understanding of programming concepts, ultimately leading to better educational outcomes. The success of C#Venture serves as a model for future educational tools, showcasing the potential of gamification to revolutionise learning across various disciplines.

This study seeks to delve into the user experience of the C#Venture application using the User Experience Questionnaire (UEQ), concentrating on key aspects such as attractiveness, clarity, efficiency, dependability, stimulation, and novelty. User Experience (UX) is a critical measure of an application's effectiveness in educational settings (Ntoa et al., 2021). The UEQ, with its 26-item framework, is a well-established tool for capturing the subjective experiences of users, providing a comprehensive assessment of the application's impact. By evaluating UX, this study aims to ensure that the C#Venture application not only meets but also exceeds user expectations, thereby enhancing its effectiveness in fostering a deeper understanding and enjoyment of programming among students (Li et al., 2024).

## LITERATURE REVIEW

### C#Venture Application

The C#Venture application was developed to facilitate student learning and increase their interest in programming through a gamification approach themed "The Avengers." This gamification strategy has proven effective in increasing student motivation and understanding of learning content (Chukwu, 2024). In the C#Venture application, students are divided into teams, and each team needs to complete adventure tasks based on the instructions provided in the game. Each player assumes the role of an Avengers team member based on the identity card provided. This is to create fun and increase student interest during the activity. Each identity holder has their tasks, and the team will start the C#Venture adventure by following instructions given through clues and instruction cards included in the application. This game not only tests students' understanding of the course content but also builds team cooperation among players as they work

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together to complete each task instruction given to win the adventure.

The C#Venture innovation, themed "The Avengers," aims to attract students to engage with the game since the film sequel aired during their generation. The main characters in this application include Thor, Captain America, Captain Marvel, Black Widow, Iron Man, and the Quest Master, represented by Nick Fury. The team leader assumes the role of Captain America. Not only are the characters incorporated into the game, but the team names also use the names of the Infinity Stones from the movie, such as Reality, Space, Mind, Power, Time, and Soul Stones. Figure 1 shows the character cards used in the C#Venture application, each depicting a unique role for the participants.


**Figure 1:** Character cards used in the C#Venture application

At the end of the game, each team member must find the Quest Master (QM) to complete the final instruction as a symbolic conclusion to the game. The winner is the team that completes all task instructions first and receives a reward. This game can be played outside the classroom in any suitable place to carry out each task instruction. In the C#Venture application, there is also a Quest Master (QM) who monitors the adventure as it unfolds. Figure 2 shows the game instructions in the C#Venture application.


**Figure 2:** Game instructions in the C#Venture application

The group leader needs to download the Zappar application and a QR code reader. This is because the Zappar application serves as the initial medium for the game, while the QR code reader is used throughout the game adventure. Students will scan the Zappar logo that has been affixed to the kit. After scanning, the group leader will register the group members using a Google Form. Once registration is complete, students will receive instructions to start the first game. Figure 3 shows the group registration process using Google Forms.


**Figure 3:** The group registration form is done using Google Forms

The first game involves assembling a puzzle using the Jigsaw Planet application. The puzzle contains questions related to programming languages, and the answers need to be submitted to the Quest Master (QM) to receive the next clue. If successful, students will be given a clue instructing them to scan the QR code on Thor's card to access the second game. Figure 4 shows that the first game's questions are delivered using the Jigsaw Planet application.


**Figure 4:** The first game's questions are delivered using the Jigsaw Planet application

The second game involves students being given six objective questions that must be answered on an OMR form via the ZipGrade app and then submitted to the Quest Master (QM). The QM will use the ZipGrade app to check the answers. If all the answers are correct, the QM will provide a clue, instructing the students to scan the Black Widow card for the clue to the third game. Figure 5 shows the instruction card for game 2, along with the ZipGrade answer sheet.

The third game tests students' understanding of programming flowchart symbols via a Google Form. The Quest Master (QM) will review the answers and then provide the next clue, instructing students to scan the Iron Man card for the clue to the fourth game. Figure 6 shows the instructions for game 3 using Google Forms.

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**Figure 5:** Instruction card for game 2 using the ZipGrade answer slip

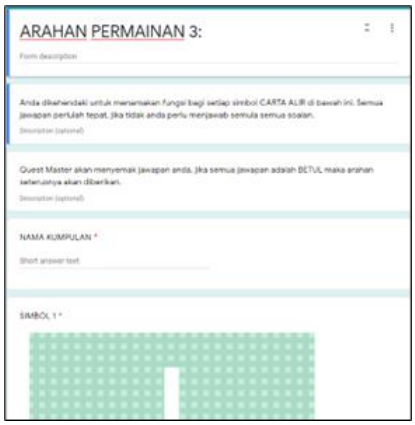


Figure 6: Instructions for game 3 using Google Form

In the fourth game, students will be tested once again on problem-solving through flowcharts. They will be given three questions with six answer choices. Students need to take a photo of the correct answer and send it to the Quest Master (QM) to receive the clue for the fifth game. Figure 7 shows the instructions for game 4 using the included flashcards.


**Figure 7:** Instructions for game 4 using the included flashcards

In the fifth game, students scan the Captain Marvel card and answer true or false questions via the Quiz Maker app. They must answer all questions correctly to receive the next clue from the QM. Figure 8 shows the instructions for Game 5 using Google Docs and the Quiz Maker app. When players meet the Quest Master (QM), they receive the final clue to open the mystery box in the kit and consume the food inside. The first team to complete this task wins the game and earns the reward. To progress through levels, players must answer all questions correctly; incorrect answers require further attempts. Only then will the QM provide the next clue. Figure 9 displays the final challenge and winner's cards, while Figure 10 shows an example of an answer clue card from the QM.

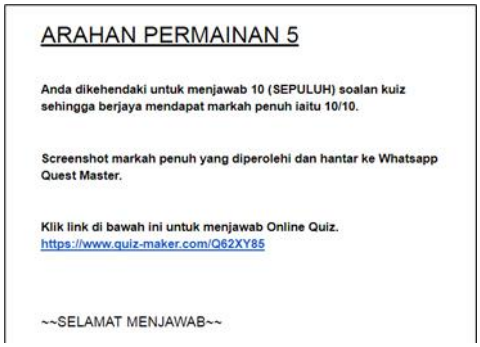


**Figure 8:** Instructions for game 5 using Google Docs and the Quiz Maker application


**Figure 9:** Final challenge card and winner's card


**Figure 10:** Example of answer clue card from QM

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### The Importance of UX in Educational Applications

A good user experience is critical for educational applications, as it can enhance student motivation and engagement. An attractive and interactive design can maintain user interest and ensure they continue to use the application. A systematic literature review conducted by Vieira et al. (2019) showed that heuristic and usable educational games can significantly increase user satisfaction and engagement. Meanwhile, a systematic literature review conducted by Khaldi et al. (2023) indicated that using attractive and interactive visual elements (points, badges, and leaderboards) in educational games can encourage students to be more engaged and motivated to learn. Additionally, Weitl-Harms et al. (2023) showed that a good user experience in educational games can improve student academic performance by increasing engagement and motivation.

### UX Evaluation with UEQ

The User Experience Questionnaire (UEQ) is a tool often used to measure user experience across various dimensions, including attractiveness, clarity, efficiency, dependability, stimulation, and novelty. A study by Somrak et al. (2021) showed that the UEQ could provide a comprehensive assessment of user experience in virtual reality educational games. This evaluation can help application developers understand the strengths and weaknesses of their applications from the user's perspective. A study by Rohandi (2021) also indicated that the UEQ is an effective tool for assessing user experience in educational games, providing valuable feedback that can be used to improve the design and functionality of applications. Furthermore, a study by Nur Hidayat et al. (2024) also showed that using the UEQ in the evaluation of educational games helps identify aspects that need improvement to enhance the overall user experience.

### The Effectiveness of Intuitive Design

An intuitive and easy-to-understand design is crucial to ensure that users with different technical skill levels can use the application easily. A study by Yu et al. (2020) indicated that an intuitive interface could reduce the cognitive load on users and improve learning outcomes. A study by Brown et al. (2019) showed that intuitive design in educational games could increase user satisfaction and make it easier for students to focus on learning content. Another study by Zamri and Tan (2022) emphasized the importance of the user interface (UI) as the point of access where users interact with the application and system.

## METHODOLOGY

This study employs a quantitative method using a questionnaire as the instrument. A total of 54 students enrolled in the Computer Systems and Networking Certificate program at Bandar Darulaman Community College were selected as the sample for this study because all these students had taken the Basic Programming course and had used this learning aid in class. The questionnaire was distributed to students using Google Forms after they finished playing. Various UX measurement tools have been developed, one of which is the User Experience Questionnaire (UEQ) developed by Laugwitz et al. (2008). The UEQ provides a holistic assessment across six main scales: attractiveness, clarity, efficiency, dependability, stimulation, and novelty. Previous studies have shown that the UEQ is effective in identifying the strengths and weaknesses of applications based on user perceptions (Dewi et al., 2020). This study will use the UEQ to evaluate the user experience of the C#Venture application and provide recommendations for further improvement and development. The Malay version of the UEQ questionnaire, adapted from https://www.ueq-online.org/ developed by Schrepp et al. (2014), was used in this study. The questions in the UEQ have a seven-point semantic scale format, with negative and positive statements arranged alternately to test respondent consistency. The rating range is from -3 to +3, where -3 is the most negative

response, 0 indicates a neutral response, and +3 is the most positive response. A positive response is indicated by a score above +1, and a negative response if the score is below -1. To calculate the questionnaire results, a specific tool is used to analyze the responses. The data analysis tool is an Excel file available for download from the official UEQ website. To use it, researchers enter the respondent data on the "Data" tab. Figure 9 shows the items in the UEQ questionnaire.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
|---|---|---|---|---|---|---|---|---|---|
| annoying | ○ | ○ | ○ | ○ | ○ | ○ | ○ | enjoyable | 1 |
| not understandable | ○ | ○ | ○ | ○ | ○ | ○ | ○ | understandable | 2 |
| creative | ○ | ○ | ○ | ○ | ○ | ○ | ○ | dull | 3 |
| easy to learn | ○ | ○ | ○ | ○ | ○ | ○ | ○ | difficult to learn | 4 |
| valuable | ○ | ○ | ○ | ○ | ○ | ○ | ○ | inferior | 5 |
| boring | ○ | ○ | ○ | ○ | ○ | ○ | ○ | exciting | 6 |
| not interesting | ○ | ○ | ○ | ○ | ○ | ○ | ○ | interesting | 7 |
| unpredictable | ○ | ○ | ○ | ○ | ○ | ○ | ○ | predictable | 8 |
| fast | ○ | ○ | ○ | ○ | ○ | ○ | ○ | slow | 9 |
| inventive | ○ | ○ | ○ | ○ | ○ | ○ | ○ | conventional | 10 |
| obstructive | ○ | ○ | ○ | ○ | ○ | ○ | ○ | supportive | 11 |
| good | ○ | ○ | ○ | ○ | ○ | ○ | ○ | bad | 12 |
| complicated | ○ | ○ | ○ | ○ | ○ | ○ | ○ | easy | 13 |
| unlikable | ○ | ○ | ○ | ○ | ○ | ○ | ○ | pleasing | 14 |
| usual | ○ | ○ | ○ | ○ | ○ | ○ | ○ | leading edge | 15 |
| unpleasant | ○ | ○ | ○ | ○ | ○ | ○ | ○ | pleasant | 16 |
| secure | ○ | ○ | ○ | ○ | ○ | ○ | ○ | not secure | 17 |
| motivating | ○ | ○ | ○ | ○ | ○ | ○ | ○ | demotivating | 18 |
| meets expectations | ○ | ○ | ○ | ○ | ○ | ○ | ○ | does not meet expectations | 19 |
| inefficient | ○ | ○ | ○ | ○ | ○ | ○ | ○ | efficient | 20 |
| clear | ○ | ○ | ○ | ○ | ○ | ○ | ○ | confusing | 21 |
| impractical | ○ | ○ | ○ | ○ | ○ | ○ | ○ | practical | 22 |
| organized | ○ | ○ | ○ | ○ | ○ | ○ | ○ | cluttered | 23 |
| attractive | ○ | ○ | ○ | ○ | ○ | ○ | ○ | unattractive | 24 |
| friendly | ○ | ○ | ○ | ○ | ○ | ○ | ○ | unfriendly | 25 |
| conservative | ○ | ○ | ○ | ○ | ○ | ○ | ○ | innovative | 26 |

**Figure 11:** UEQ questionnaire in the English version
(Source: https://www.ueq-online.org/)

## RESULTS

The results from the User Experience Questionnaire (UEQ) for the C#Venture application indicate an outstanding user experience across all measured dimensions. Table 1 displays the UEQ benchmark scores for the C#Venture application, highlighting its performance across different dimensions of user experience.

The application recorded a score of 2.13 for Attractiveness, making it highly attractive and placing it in the top 10% of the best-rated systems. Users found this application visually appealing and interactive, which is essential for capturing and maintaining user interest. Visual appeal and interactive design elements play a significant role in enhancing user satisfaction and engagement, particularly in educational environments where maintaining student interest is critical.

For Clarity, the application scored 2.00, indicating it is clear and intuitive to use. High clarity levels are crucial for educational applications, as they ensure that users with varying technical skills can easily navigate and use the application. Clear and intuitive design reduces cognitive load, allowing users to focus more on the learning content rather than figuring out how to use the application.

An Efficiency score of 2.04 indicates that the application enables users to achieve their goals with minimal effort, showing high operational efficiency. This is vital in educational tools where the primary goal is to facilitate learning efficiently. High efficiency in an application means students can complete tasks quickly, which helps maintain their motivation and reduce frustration from complex processes.

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With a Dependability score of 1.86, the application is reliable and consistent, ensuring users feel in control and confident during their interactions. Dependability in the educational context means that users can trust the application to function correctly and consistently, which is essential for building user trust and ensuring that the learning process is not disrupted by technical issues.

A Stimulation score of 2.08 shows that the application is motivating and engaging. High stimulation is crucial in educational applications to ensure students remain motivated and engaged. By providing an engaging and stimulating environment, this application encourages continuous use and active participation, leading to better learning outcomes.

Finally, a Novelty score of 1.79 indicates that the application is seen as innovative and fresh, giving users a unique experience. Novelty in educational applications is important as it introduces new ways of learning and keeps the content interesting. Innovative features can distinguish the application from traditional learning tools and can appeal to students who might not be interested in conventional educational methods.

Table 2 and Figure 12 show the UX evaluation results, comparing user responses to the application against the excellent benchmark. The UEQ benchmark shows that all six UEQ scales—attractiveness, clarity, efficiency, dependability, stimulation, and novelty—achieved excellent results.

**Table 1:** UEQ Benchmark

| Scale | Mean | Comparison with Benchmark | Interpretation |
|---|---|---|---|
| Attractiveness | 2.13 | Excellent | Within the top 10% of best results |
| Perspicuity | 2.00 | Excellent | Within the top 10% of best results |
| Efficiency | 2.04 | Excellent | Within the top 10% of best results |
| Dependability | 1.86 | Excellent | Within the top 10% of best results |
| Stimulation | 2.08 | Excellent | Within the top 10% of best results |
| Novelty | 1.79 | Excellent | Within the top 10% of best results |

**Table 2:** UEQ Scales (Mean and Variance) in Table Format

| ***UEQ Scales (Mean and Variance)*** | | |
|---|---|---|
| Attractiveness | ↑ 2.133 | 1.13 |
| Perspicuity | ↑ 2.005 | 1.10 |
| Efficiency | ↑ 2.042 | 1.21 |
| Dependability | ↑ 1.856 | 1.03 |
| Stimulation | ↑ 2.083 | 1.13 |
| Novelty | ↑ 1.792 | 1.10 |

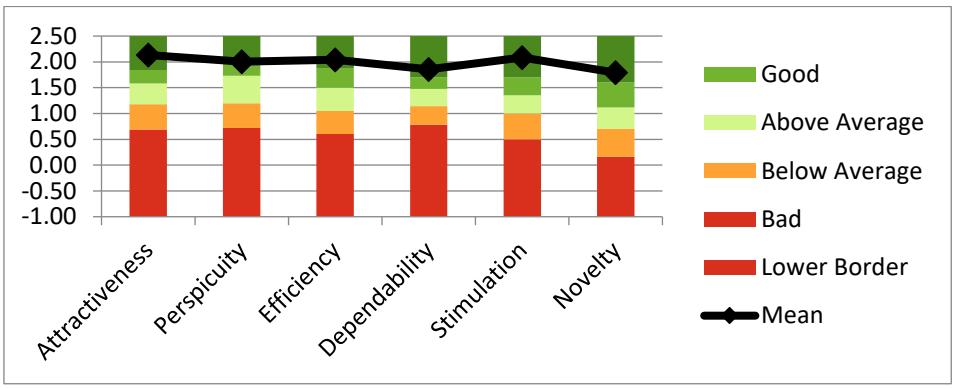


**Figure 12:** UEQ scales (Mean and Variance) in graphical format

## DISCUSSION

The outstanding user experience scores across all UEQ dimensions indicate that the C#Venture application successfully meets and exceeds user expectations in various critical areas of user experience. These findings highlight the application's potential to be an effective educational tool that not only engages users but also enhances their learning experience.

High Attractiveness scores align with research showing that visually appealing educational games can significantly improve user engagement and satisfaction. Visual appeal and interactive elements are crucial for maintaining user interest and promoting continued application use (Vieira et al., 2019). The application's design may incorporate colourful graphics, engaging animations, and interactive elements that make the learning experience more enjoyable and captivating for students (Zamzuri et al, 2024).

Clarity and ease of understanding, indicated by high Clarity scores, are essential for educational tools as they need to be accessible to users with varying technical skills. Studies have shown that intuitive interfaces in educational games improve learning outcomes by reducing the cognitive load (Stiller & Schworm, 2019; Zimmerer et al., 2022). The C#Venture application likely features a well-organized layout, clear instructions, and user-friendly navigation that make it easy for students to understand and use effectively.

High Efficiency, as indicated by the Efficiency scores, suggests that users can complete tasks quickly and effectively, which is essential for maintaining user motivation and minimizing frustration. Efficient educational games have been found to improve learning efficiency and overall user satisfaction (Yu et al., 2020). The application may include streamlined processes, quick access to learning materials, and efficient task management features that help students complete their assignments quickly and with minimal effort.

Reliable and consistent performance, as indicated by the high Dependability scores, is critical for educational applications as it builds user trust and ensures a smooth learning experience. Dependability in educational games supports continuous user engagement and uninterrupted learning (Rohandi, 2021). The C#Venture application may offer a stable and bug-free environment, consistent performance, and reliable access to educational resources, which helps maintain user trust and confidence.

High Stimulation scores reflect the application's ability to engage and motivate users, which is essential for maintaining interest and promoting active learning. Engaging educational games has been shown to enhance learning motivation and retention (Slyman et al., 2022; Zolkipli et al., 2022). The application

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may incorporate gamification elements such as rewards, challenges, and interactive storytelling that make the learning process engaging and motivating for students.

The perception of Novelty indicates that the application offers a fresh and innovative experience, which can enhance user curiosity and interest. Innovative educational games can provide unique learning experiences that may not be offered by traditional methods (Perez et al., 2021). The C#Venture application may introduce new learning methodologies, unique content delivery mechanisms, and creative interactive features that keep the learning experience fresh and exciting for students.

Overall, these findings indicate that C#Venture is highly effective in providing a positive user experience, which is crucial for educational applications aimed at enhancing learning through gamification. High scores across all dimensions highlight the application's potential to engage, motivate, and educate users effectively. This outstanding user experience evaluation suggests that C#Venture can significantly contribute to improving educational outcomes by providing an engaging, efficient, and innovative learning platform.

## CONCLUSION & RECOMMENDATIONS FOR FURTHER RESEARCH

The findings from the User Experience Questionnaire (UEQ) indicate that the C#Venture application provides an outstanding user experience across all measured dimensions. The application scores highly in aspects of attractiveness, clarity, efficiency, dependability, stimulation, and novelty. This indicates that the application is not only attractive and easy to use but also efficient, reliable, and motivating for users. Overall, the C#Venture application successfully meets and exceeds user expectations, making it a highly effective educational tool that can enhance student learning experiences through gamification. The article further underscores the importance of User Experience (UX) in both practice and theory, demonstrating that well-designed UX, incorporating gamification and thematic elements like "The Avengers," can significantly enhance student engagement, motivation, and learning outcomes. It suggests that developers should prioritize visually appealing, interactive, and reliable designs to create seamless and effective learning experiences. The study also validates the role of gamification in education, emphasizing the value of tools like the UEQ in assessing and improving UX, reinforcing the need for a strong focus on UX in the development and evaluation of educational technologies.

The implications of this study are that well-designed educational applications like C#Venture can provide more engaging and effective learning experiences. High scores in attractiveness and stimulation indicate that the application can maintain student interest and motivation, which is crucial for long-term learning. The clarity and efficiency of the application show that it can help students understand and use the application easily, which can improve their learning efficiency. The reliability of the application ensures that users can trust it to function well without interruptions, which is crucial for a smooth learning experience. Additionally, the novelty of the application shows that innovation in educational application design can provide unique and engaging learning experiences that may not be offered by traditional learning methods.

Based on the findings of this study, several recommendations for further research include conducting long-term studies to observe the impact of using the C#Venture application on student academic performance and motivation, as well as demographic analyses to understand how factors such as age, gender, and educational background influence user experience. Additionally, comparative studies with other educational tools could provide insights into the relative strengths and weaknesses of this application. Developing and testing new features, including integrating technologies such as virtual reality and artificial intelligence, as well as conducting qualitative evaluations through in-depth user interviews,

can help improve and enhance the C#Venture application.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

## AUTHOR CONTRIBUTIONS

**Quah Wei Boon**: Conceptualization, Writing- Reviewing and Editing, Supervision. **Noraini Mohd Banua**: Data curation, Writing- Original draft preparation, Reviewing and Editing. **Zulhana Zulkifle**: Data curation, Writing- Original draft preparation. **Nurul Halimatul Asmak Ismail**: Writing- Reviewing and Editing.

## DATA AVAILABILITY STATEMENT

Data is available within the article.

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