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International Teaching Aid
Competition 2023

Reconnoitering Innovative Ideas in Postnormal Times

iTAC

2023

iTAC 2023
INTERNATIONAL TEACHING AID COMPETITION
E-PROCEEDINGS

PREFACE

iTAC or International Teaching Aid Competition 2023 was a venue for academicians, researchers, industries, junior and young inventors to showcase their innovative ideas not only in the teaching and learning sphere but also in other numerous disciplines of study. This competition was organised by the Special Interest Group, Public Interest Centre of Excellence (SIG PICE) UiTM Kedah Branch, Malaysia. Its main aim was to promote the production of innovative ideas among academicians, students and also the public at large.

In accordance with the theme "Reconnoitering Innovative Ideas in Post-normal Times", the development of novel ideas from the perspectives of interdisciplinary innovations is more compelling today, especially in the post-covid 19 times. Post-pandemic initiatives are the most relevant in the current world to adapt to new ways of doing things and all these surely require networking and collaboration. Rising to the occasion, iTAC 2023 has managed to attract more than 267 participations for all categories. The staggering number of submissions has proven the relevance of this competition to the academic world and beyond in urging the culture of innovating ideas.

iTAC 2023 committee would like to thank all creative participants for showcasing their innovative ideas with us. As expected in any competition, there will be those who win and those who lose. Congratulations to all the award recipients (Diamond, Gold, Silver and Bronze) for their winning entries. Those who did not make the cut this year can always improve and join us again later.

It is hoped that iTAC 2023 has been a worthy platform for all participating innovators who have shown ingenious efforts in their products and ideas. This compilation of extended abstracts published as iTAC 2023 E-Proceedings contains insights into what current researchers, both experienced and novice, find important and relevant in the post-normal times.

Best regards,

iTAC 2023 Committee
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CT-eKit: COMPUTATIONAL THINKING INTERACTIVE LEARNING

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ABSTRACT

With the spread of digital technologies, the learning trend and student preferences have changed drastically. Many learners now prefer to learn from a variety of online platforms. Students are more engaged with electronic gadgets in this ever-changing digital era. However, the majority of the existing online platforms do not cater to learning in an active environment and limit students' participation, particularly in learning Computational Thinking (CT). Hence, this innovation aims to innovate a CT-eKit, a collective teaching aid that emphasises Inquiry-based learning (IBL), developed to facilitate the learning process on the CT topic. The CT-eKit consists of three main activities: a CT video, a Kahoot CT quiz and a Scratch CT Concepts game to learn the four CT concepts: decompose, pattern, abstraction and algorithm in a fun and interactive environment. A mixed method was employed to investigate the students' learning experience with CT-eKit. This study involved 120 students from the Foundation in Science programme of the University of Technology Sarawak (UTS). Based on the results, CT-eKit is significant to be applied in the foundation computing course for the students as CT-eKit helps the students have a deeper understanding of the course, and they enjoy the fun learning. Policymakers and other stakeholders can incorporate or embed CT into the curricula. In addition, future work could look into the potential to commercialise the idea of CT-eKit as it is also one of the topics in the Malaysian Standard Secondary School Curriculum, Basic Computer Science or *Asas Sains Komputer* in Form 1 syllabus.

Keywords: computational thinking (CT), CT-eKit, interactive learning, gamification, online learning.

INTRODUCTION

In this digital age, interactive learning leveraging digital content is becoming increasingly popular. Digital technologies and information aids are utilised to complement the chalkboard and printed textbook (Shao, 2022). Students are now turning to online resources and platforms

to enrich their learning experience and gain a better understanding. Interactive learning involves engaging learners in various ways, encouraging them to interact with course materials, peers, and educators. Inquiry-Based Learning (IBL) is a teaching approach that focuses on active exploration and investigation by students. This instructional method encourages them to ask questions, gather information and use evidence to develop and test hypotheses to promote critical thinking, problem-solving and independent learning skills. The new learning trend promotes active engagement and includes online teaching methods, such as online quizzes, games, role plays, and case studies using online videos. With the increasing preference for modern technology over traditional teaching aids, educators frequently use web tools, such as Kahoot, Quizizz, Quizlet and others for online learning (Asmawati et al., 2022). Besides, gamification, the application of game design principles to non-game contexts, has gradually attracted the attention and interest of academicians to use it as a popular teaching technique for not only disseminating knowledge but also for fun learning (Sailer & Hommer, 2020). Game-based learning simulates the students' interest with multimedia elements and achievement scoreboards. It provides interactive, immersive and enjoyable learning so that learning is not dull. Games have the potential to be a powerful educational tool to engage learners and motivate them to achieve specific goals effectively (Bezzina et al., 2022). Game-based learning is still a safe bet to increase student motivation regardless of student level (Pagan & Ramirez, 2022).

However, the majority of the existing online platforms do not cater to learning in an active environment and limit students' participation, particularly in learning Computational Thinking (CT). Hence, this innovation aims to innovate a CT-eKit, a collective teaching aid, emphasises on Inquiry-based learning (IBL), developed to facilitate the learning process on the CT topic. The CT-eKit consists of three activities: a CT video, a Kahoot CT quiz and a Scratch CT Concepts game to learn the four CT concepts: decompose, pattern, abstraction and algorithm in a fun and interactive environment. These CT activities enrich the students' learning experience, provide an interactive platform for learning and recap the four established CT concepts by Wing, a pioneer in CT: decompose, pattern, abstraction and algorithm (Wing, 2006).

DESCRIPTION OF THE INNOVATION

The CT-eKit incorporated three activities: a CT video for Inquiry-Based Learning (IBL), a Kahoot CT quiz and a Scratch CT Concepts game to learn the four CT concepts: decompose, pattern, abstraction and algorithm in a fun and interactive environment. The students watched the CT video to explore the CT concepts by applying Inquiry-Based Learning in a team for active exploration and investigation. The students were then required to pick up the main points from the video and draw a mind map in a team of five members. They make connections for the key ideas and map the concepts in a way that improves understanding and retention of information. After that, they paired with another team, lined up and faced one another with their mind map to share and inquire about their understanding of computational thinking. In

this case, the structured IBL approach was adopted whereby the educator acted as the facilitator to direct the learning flows by providing video and questions with instructions. When the students faced the other team, it was a good time for them to engage in IBL, interactive and collaborative learning.

Apart from the IBL activity, a Kahoot quiz on Computational Thinking and Computer Science (CTCS) was created to assess the students' understanding of the concepts. This quiz set consists of twelve questions. Kahoot has a user-friendly design which allows the inclusion of interactive images on an interconnected computer or smartphone, encouraging learning and students' involvement (Voudoukis et al., 2022). In addition, a CT Concepts game was developed to facilitate the teaching and learning process with the questions set based on a case study. Students clicked on the game link to have a quick learn-and-play session. CT Concepts game is a web-based educational game developed using Scratch programming language, which is one of the easiest ways in game development in the visual graphical interface on a block coding platform. CT Concepts game can be played at any time and place using a laptop or smartphone connected to the Internet. CT Concepts game is user-friendly with a graphical user interface and multimedia elements of text, audio and animation. In the storyline, Ben is asking Jack to help him understand CT concepts. Figure 1 shows the screenshot of the first screen of the game.
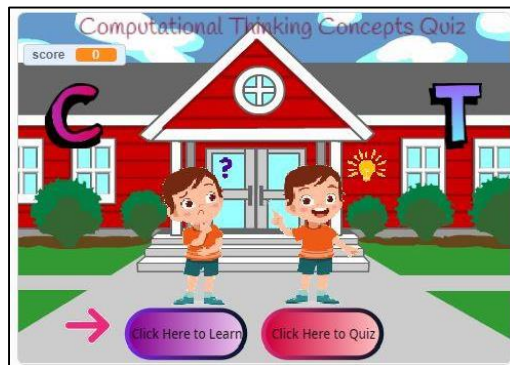

Figure 1. Screenshot of CT Concepts Game First Screen

In the Learn section, the four main CT concepts are explained briefly but precisely. When the users move the cursor over to the wording of the 4 CT concepts, the brief explanation of respective concepts will be shown on the screen as shown in Figure 2 below:

Figure 2. Screenshot of CT Learn Mode

In the Learn section, the users will have a button to go to the Quiz section. The users may proceed to the Quiz section as shown in Figure 3 below:

Figure 3. Screenshot of CT Quiz Mode

In the Quiz section, a simple and real-life case is given by Ben: I want to bake one orange sponge cake and one vanilla sponge cake, but I don't know how to. This case is used to formulate the quiz questions to test on the four main CT concepts, which are decompose, pattern, abstraction or algorithm, as shown in Figure 4 below:

Figure 4. Screenshot of the Sample Question

In this game, the users have to answer seven random questions from the fifteen questions in the question bank. The answers are either decompose, pattern, abstraction or algorithm. The users need to input the answer by keying into the space provided on the screen and clicking the blue tick button for the answer submission. This game will assess if the students have mastered and understand how to apply the CT concepts. The score will increase by one for each correct answer. Otherwise, the game will give feedback on the wrong answer and provide the correct answer, as shown in Figure 5 below:

Figure 5. Screenshot of the Sample Feedback on Wrong Answer

The questions that are answered wrongly by the users will still be in the question bank and might be repeated randomly to enable the students to learn from their previous mistakes. The score gained by the users will be displayed on the screen to show progress. If the users wish to quit the game before answering all the seven random questions prompted, they may click on the end game button, and then the game over screen will appear.

IMPLICATIONS

This study makes a significant contribution to the field of education, especially in Computer Science or Science, Technology, Engineering and Mathematics (STEM) education in terms of the CT framework for teaching and learning activities. As a result, policymakers and other stakeholders can incorporate or embed CT into the curricula. This innovation could benefit educators and students in the teaching and learning process for fun and interactive learning.

CONCLUSION

This paper explores the development of the CT-eKit while disclosing its potential for commercialisation as a part of the Basic Computer Science or Asas Sains Komputer KSSM syllabus in Form 1 and computing courses. This innovation of CT-eKit has the benefits of enhancing the students' knowledge and enriching the students' positive learning experience. This innovative idea hopes to contribute to teaching and learning while benefiting the students, policymakers and stakeholders.

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