INVESTIGATING COMPUTATIONAL THINKING AMONG PRIMARY SCHOOL STUDENTS IN TERENGGANU USING VISUAL PROGRAMMING

OSMANULLRAZI BIN ABDULLAH

MASTER OF SCIENCE

UNIVERSITI MALAYSIA PAHANG

SUPERVISOR'S DECLARATION

We hereby declare that We have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

____
(Supervisor's Signature)

Full Name : Assoc. Prof. Ts. Dr. Adzhar bin Kamaludin

Position : Dean, Faculty of Computing

Date : 09 August 2022

____
(Co-supervisor's Signature)

Full Name : Dr. Nur Shamsiah binti Abdul Rahman

Position : Senior Lecturer

Date : 09 August 2022

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

(Student's Signature)

Full Name : Osmanullrazi bin Abdullah

ID Number : MCI19001

Date : 09 August 2020

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ABSTRAK

Kemahiran Pemikiran Komputasional (CT) boleh ditakrifkan sebagai keupayaan untuk menjalankan proses pemikiran yang menggunakan konsep sains komputer untuk menyelesaikan masalah. Ia telah dianggap sebagai salah satu kemahiran penting dalam abad ke-21 dan mendapat perhatian yang besar di seluruh dunia. Kajian terkini menunjukkan bahawa pengaturcaraan visual adalah salah satu alat yang berkesan untuk membangunkan kemahiran CT. Kompetensi kemahiran pemikiran komputasional adalah satu indikasi dalam aspek kemahiran pemikiran komputasional. Beberapa negara telah memperkenalkan CT ke dalam kurikulum dan Malaysia telah mengambil langkah berani untuk memperkenalkannya pada 2017 dengan mengintegrasikannya ke dalam kurikulum. Kajian CT telah dijalankan ke atas pengajian tinggi, sekolah menengah dan kalangan guru di Malaysia, namun demikian masih terdapat kekurangan kajian dan jurang yang besar terutamanya kajian yang melibatkan pelajar sekolah rendah dalam konteks pengaturcaraan visual. Bagi mengisi jurang ini, kajian ini bertujuan untuk menyiasat kecekapan pelajar terhadap kemahiran CT dalam kalangan pelajar sekolah rendah di Malaysia menggunakan pengaturcaraan visual melalui penciptaan artifak pengiraan seperti animasi dan permainan. Kajian ini mengguna pakai rangka kerja Brennan dan Resnick (2012) dalam mereka bentuk eksperimen dan penilaian kecekapan kemahiran CT. Pendekatan kuantitatif digunakan untuk mengukur kemahiran CT pelajar tentang Kawalan Aliran, Abstraksi, Paralelisme, Penguraian, Penyegerakan, Interaktiviti Pengguna dan Logik daripada artifak pengiraan mereka. Ia juga membandingkan kecekapan kemahiran CT dalam dua genre projek berbeza iaitu animasi dan permainan serta perbandingan antara jantina. Selain kaedah kuantitatif, kaedah kualitatif temu bual separa berstruktur berdasarkan projek yang dipilih telah dijalankan selepas pelajar menyelesaikan projek mereka untuk mengenal pasti kekuatan dan kesukaran yang mereka hadapi semasa penciptaan projek. Eksperimen dua jam seminggu selama lapan minggu telah dijalankan melalui mata pelajaran Teknologi Maklumat dan Komunikasi. Peserta adalah pelajar berumur 12 tahun (darjah 6) dari dua buah sekolah di Terengganu. Eksperimen ini dibahagikan kepada tiga fasa iaitu, pengenalan algoritma dan antara muka Scratch, penciptaan animasi dan permainan dan pada fasa terakhir, peserta dibenarkan memilih sama ada untuk membangunkan animasi atau permainan sebagai projek akhir mereka. Dapatan kajian ini mendedahkan bahawa walaupun kompetensi kemahiran CT peserta dalam fasa animasi berada pada tahap Asas, terdapat peningkatan kecekapan kemahiran CT ke tahap Membangun dalam fasa permainan. Kajian juga menunjukkan genre projek mempengaruhi pelajar untuk menggunakan kemahiran CT yang berbeza dan tidak terdapat perbezaan yang signifikan terhadap kecekapan kemahiran CT antara jantina. Temu bual telah menghasilkan bahawa motivasi, perasaan positif, dan pemahaman mereka terhadap pernyataan logik (Logik) adalah kekuatan pelajar manakala penyahpepijatan, pembolehubah dan pengendali adalah kemahiran yang paling sukar untuk dilaksanakan. Kajian ini menyumbang kepada pemahaman dan memberikan beberapa pandangan tentang bagaimana pelajar Sekolah Rendah Malaysia telah memperoleh kecekapan kemahiran CT menggunakan pengaturcaraan visual melalui penciptaan artifak pengiraan. Hasil kajian ini diharapkan dapat membantu para pendidik dan pembangun kurikulum dalam merancang dan mereka bentuk strategi dan bahan pembelajaran untuk pembangunan CT khususnya kepada pelajar sekolah rendah.

ABSTRACT

Computational Thinking (CT) skills can be defined as the ability to carry out the thought process which utilize the concepts of computer science to solve the problems. It has been regarded as one of the important skills in the 21st century and received considerable attention worldwide. Recent studies have shown that visual programming is one of the efficient tools to develop CT skills. The measurement of CT skills is indicated by CT skills competency. Several countries have introduced CT into the curriculum and Malaysia has taken a bold step to introduce it in 2017 by integrating it into the curriculum. Despite some CT studies have been conducted on the higher education, secondary schools and among the teachers in Malaysia, there is still a lack of studies especially among the primary school students within the context of visual programming. There is still a large gap in term of the investigation of student's CT skills competency in this aspect. To fill this gap, this study aims to investigate student's competency on CT skills amongst primary school students in Malaysia using visual programming through the creation of computational artifacts such as animation and games. This study adopted a framework of Brennan and Resnick (2012) in designing the experiment and the assessment of CT skills competency. Quantitative approach was used to measure student's CT skills of Flow Control, Abstraction, Parallelism, Decomposition, Synchronization, User Interactivity and Logic from their computational artifacts. It also compares the CT skills competency in two different project genres namely animation and games as well as the comparison between the genders. In addition to quantitative methods, a qualitative method of semi-structured interview based on the selected project was conducted after the students completed their projects to identify the strengths and difficulties, they had faced during the project creation. This study had implemented a two-hours per week experiment for eight weeks which had been conducted through the subject of Information Technology and Communication. Participants were 12-year-old students (standard 6) from two schools in Terengganu. The experiment was divided into three phases namely, the introduction of algorithm and Scratch interface, the creation of animation and games and in the final phase, participants were allowed to choose either to develop animation or games as their final project. The findings of this study reveal that although the participants' CT skills competency in the animation phase is in the Basic level, there is improvement of CT skills competency to the Developing level in the game phase. Study also shows project genre influence students to use different CT skills and there was no significant difference on CT skills competency between the genders. The interview has yielded that motivation, positive feelings, and their understanding of logical statement (Logic) are the student's strengths while debugging, variables and operators are the most difficult skills to implement. This study contributes to the understanding and provides some insights of how Malaysian Primary Schools students have acquired CT skills competency using visual programming through the creation of computational artifacts. The results of this study could hopefully assist the educators and curriculum developers in planning and designing the learning strategies and materials for CT development especially to the primary school students.

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