The design and development of Bijak Seni, a teaching and learning module that incorporates computational thinking skills in visual art education for secondary school

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Abstract

Computational Thinking (CT) is an applicable skill most often set for computer science subjects. However, in this research, the CT skills were introduced in a Visual Art Education classroom. A teaching and learning module called Bijak Seni (Smart Art) was designed and developed based on the ADDIE Model to incorporate elements of CT into the teaching and learning of drawing and painting at the secondary level. The six elements of CT included were Logical Reasoning, Algorithms, Decompose, Pattern Recognition, Abstraction and Evaluation. This module also supported critical thinking and discovery learning among students. It also provided footnotes for teachers and students to help them at every stage of CT. Presented in the form of a sketch and workbook, this module was printed in colour and A3 size. There were also Learning Objectives stated at every level. Students were given ample space to write and scribble for ideas. A survey conducted among Visual Art Education experts, teachers and students showed that the application of CT in the Bijak Seni Module helped students understand the requirements of the tasks in the Visual Art Education exam. 95.9% of students agreed that applying the CT process helped them to improve their drawing and painting skills. The module also helped them to identify important requirements of the questions, break down the complexity of the required tasks, analyse the drawings made, develop ideas to define the key requirements of the questions, and select the best media and method to deliver their drawing and painting, to meet the objectives and requirements of the examination questions. Furthermore, Bijak Seni Module can also be applied in any art classroom at any level to improve the teaching and learning of drawing and painting based on certain given standards or requirements.

Keywords: CT, Visual Art Education, Drawing, Painting

Received: 19 August 2019/ Accepted: 16 September 2019 / Published: 23 October 2019

INTRODUCTION

CT involves solving problems, designing systems, and understanding human behavior (J. M. Wing, 2006). The six elements of CT are Logical Reasoning, Algorithms, Decompose, Pattern Recognition, Abstraction and Evaluation. CT is considered a critical skill for students in the 21st-century learning, along with reading, writing and arithmetic (Computer Science Telecommunications Board, 2010; Malroutu, 2017; Qualls & Sherrell, 2010). It is composed of fundamental concepts in computer science, along with the intellectual skills that are needed for algorithmic thinking, pattern recognition, abstraction, and decomposition (Grover & Pea, 2013; J. M. Wing, 2006, 2008). It helps in processing of thoughts and is used to formulate a problem and find its solution so that the solution can be translated in a form that can be effectively implemented by an information-processing agent (J. Wing, 2011; Bundy, 2007; Taher, Shrestha, Rahman, & Khalid, 2016; Selby & Woollard, 2013).

CT is mentioned as an essential skill for the 21st century, giving learners a different framework for visualizing and analyzing problems (Einhorn, 2011; Kamaruddin & Sulaiman, 2017). Education must undergo a change in paradigm in order for a learner to possess the twenty-first-century learning style and characteristics. Teaching visual art also requires new tools and methods in order to form the competences for young people for life in the 21st century (European Commission, 2009). In Asia and the Pacific Region, the Arts in Education (AiE) approach has been introduced in the teaching and learning that allow students to develop analytical and interactive abilities.

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Computational thinking concepts have been used in other disciplines via problem-solving techniques and that the ability to think computationally is essential to every discipline (Bundy, 2007). The core CT concepts could be embedded in social studies by identifying trends in population data, analysis and deducing general principles from facts, abstraction (Ibrahim & Hassan, 2003). Thus, CT is something that can be central to other disciplines such as Visual Art Education, as it is not limited to computer science, mathematics, and other science disciplines. As CT also involves learning to think about, represent and solve problems that require a combination of human cognitive power and computing capacity (Barr & Stephenson, 2011), it has the potential to foster creativity in the classroom by allowing students to move from consumers of technology to building tools that benefit society (Mishra, Yadav, Group, et al., 2013).

VISUAL ART EDUCATION IN MALAYSIA

Visual Art Education is taught as an academic subject in primary and secondary schools in Malaysia. At the secondary school level, it is a compulsory subject for the lower secondary students (age 13 to 15) and an elective subject at the upper secondary school level (age 16 to 19). It is aimed at giving students the opportunity to cultivate interest, develop personality, awareness and sensitivity towards the arts and the environment values as well as its relevance to other subjects. The use of strategies appropriate to the teaching content is encouraged to nurture students’ interest. The latest curriculum of Visual Art Education includes two main learning areas – Production of Visual Arts (that covers basic art, design, fine arts and visual communication) and History & Visual Art Appreciation.

Art education is a learning tool that can provide education that challenges individual ability to make observations, reasoning, selection, interpretation, and translation of ideas to material or media (Ibrahim & Hassan, 2003). Visual Art Education offered at school encourages students to master various skills based on the National Philosophy of Education so that they are knowledgeable, creative and competitive.

In an increasingly advanced and challenging world, we need to adapt to the current situation. Likewise, for Visual Art Education in Malaysian, the syllabus is now changing and adapting to the needs of modernization and modernity in line with current needs. The purpose is to provide input and the latest useful knowledge to students who can expose themselves to artistic needs in life (Ibrahim & Hassan, 2003). Drawing is also increasingly seen as visual problem solving (Duff & Davies, 2005). By learning the right ways of drawing skills, the student is actually building their path to a way of creativity and able to foster higher-order thinking skills.

THE DESIGN AND DEVELOPMENT OF BIJK SENI

Bijak Seni was designed and developed to enhance student’s critical thinking skills and motivate them to learn visual art. The name Bijak from the Malay language means ‘smart’ and Seni from the Malay language means ‘art’. The name Bijak Seni (Art Smart) was used that holds a positive connotation to build confidence in students to use the module.

Applying the ADDIE Model in Bijak Seni

ADDIE Model was used to design and develop Bijak Seni for its dynamic and flexible guidelines, the most popular for designing instructions, and suits any kind of education. The acronym ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation.

Analysis

In this phase, researchers conducted a brainstorming session to analyze the needs of students like their prior knowledge, interests, and weaknesses. This is to ensure that the development of the teaching and learning module for drawing and painting meets the target user’s requirement.

Design

At this phase, the researcher determines the learning objectives, types of learning activities, and the media for delivery with CT skills in mind.
Development

The prototype of Bijak Seni was developed at this stage. Presented in the form of a sketch and workbook, this module was printed in colour and A3 size. As shown in Figure 1, students were given ample space to write, sketch, and scribble for ideas.

![Sample pages of Bijak Seni](image)

Figure 1. Sample pages of Bijak Seni

Implementation

Bijak Seni was introduced to 67 Form Five students (Age 17). It is mandatory for students to complete all the tasks in the module.

Evaluation

A formative evaluation was carried out at every stage of the design and development phase. This was to ensure that the module meets the requirements and get expert approval in terms of design and content. A summative evaluation was also carried out at the end of the implementation phase to determine the quality of the module in terms of usability. Based on a survey among 67 students who completed the module, 95.9% of students agreed that applying the CT process helped them to improve their drawing and painting skills.

CT Skills in Bijak Seni Module

CT was incorporated into the teaching and learning module to help Visual Art Education teachers in guiding students to find new solutions for problem-solving. In the case of Bijak Seni, the module was to help students
develop critical and creative thinking skills by following the CT stages to complete a drawing and painting task. Figure 2 shows how the elements in CT are incorporated in the module.

![Figure 2. CT in Bijak Seni](image)

**Stage 1: Logical reasoning**

In this stage, students read through the questions/tasks given to them. They need to identify important information from the task given by highlighting the relevant information from the question and listing the required activities to complete the tasks. They have to use logical reasons to identify important information from the question/task. This way, they are able to analyze the logical connection of themes in each task.

**Stage 2: Algorithms**

In this stage, students set formula in order to complete the task, which is, in a way, trying to set a code to solve problems. It focuses on the ability of students to set the steps or a formula code in order to solve the problem from the task systematically. This stage is the most important stage because students will experience formulating their own coding language, as it is known as digital skills (Balanskat & Engelhardt, 2015). A formula (Figure 3) was formulated in this research to help students arrange their flow of thoughts.

![Figure 3. Creating algorithm stage in Bijak Seni](image)
Stage 4. Pattern recognition

At this stage, students need to identify the similarities and differences of things to solve the problems. Students are required to visualize the scene based on the analysis done. At this stage, students need a collection of pictures to guide their visualization. This stage is able to enhance the learning process because students will use social media for personalization, collaboration and changing interaction patterns between and among peers and teachers (Redecker et al., 2011) as the source of pictures can be from the Internet, magazines, books or newspapers as shown in Figure 5.

![Figure 4. Analysis stage in Bijak Seni](image1)

![Figure 5. Pattern recognition stage in Bijak Seni](image2)
Stage 5. Abstraction

At this stage, students develop their ideas through sketches. They are required to focus on the relevant subject matter identified at the analysis stage and during pattern recognition. Every detail in the drawing will be taken into account to make the drawing as realistic as possible. Examples can be seen in Figure 6.

![Figure 6. Abstraction stage in Bijak Seni](image)

Stage 6. Evaluation

At this stage, students combine ideas from pictures at the pattern recognition stage to create a variety of compositions. They produce a few sketches with different compositions and make changes to fulfill the requirements of the tasks. This process allows them to evaluate their drawings in terms of arrangements and look at the subject matter. Figure 7 shows an example of sketches based on two different compositions of ideas.

![Figure 7. Evaluation stage in Bijak Seni](image)

After completing all the stages, students need to complete the final painting using the appropriate colour and media. Figure 8 shows an example of the final artwork.
CONCLUSION

Based on the Malaysian National Philosophy of Education, it is the primary goal of education to develop rational thinkers. It is the aims of the Bijak Seni module to help art students understand the requirements of the tasks in Visual Art Education, namely drawing and painting activities. It is hoped that the application of CT in the module help students to identify important requirements of the tasks, break down the complexity of the required tasks, analyze the drawings made, develop ideas to define the key requirements of the activities, and select the best media and method to deliver their drawing and painting, to meet the objectives and requirements of the given tasks. Thus, enrich teacher’s teaching and encourage students to explore drawing and painting activities without the use or access to technology because CT is a mental activity. Introducing CT in teaching and learning will give good implications to current Visual Art Education in the 21st Century that motivates student learning and increase innovative thinking among visual art education students.

REFERENCES


