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Research paper

The Making of Science Smart i-THINK: Science Expert Teachers' Evaluation

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Abstract

Science Smart i-Think is an interactive pedagogical tool that was created to facilitate the learning of science among 30 year five rural primary pupils, specifically on the topic Earth, Moon and Sun. The application was intended to enhance higher order thinking skills (HOTS) based on ADDIE model, advanced organizer and mastery learning. It incorporates the following eight thinking maps: circle map, bubble map, double bubble map, tree map, brace map, flow map, multi-flow map and bridge map. Reviewers provided favourable responses on various features in the application (e.g. animation, user-friendliness) that make learning interesting and effective.

Keywords: *Science, i-THINK, Thinking Maps, Problem Solving*

1. Introduction

i-Think program aims to enhance and enculture thinking skills among pupils to become future innovators. The program was first introduced in 2013 (Curriculum Development Centre, Ministry of Education, 2012) [1]. Teachers and pupils are expected to apply thinking tools in teaching and learning and engage in higher-order thinking skills (HOTS) related activities. According to the Curriculum Development Centre (2012) there are eight i-THINK maps to be introduced to pupils: circle map (defining in context), bubble map (describing qualities), double bubble map (comparing & contrasting), tree map (classifying), brace map (whole–parts relationship), flow map (sequencing), multi–flow map (analysing cause & effect), and bridge map (relating factor).

2. Problem Statements

Malaysia's achievements as reported in the Trends in International Mathematics and Science Study (TIMSS) is worrying. Malaysia's TIMSS science scores increased in 2003, but has since declined to below average until 2011. Similarly, Malaysia's scores for science in Program for International Student Assessment (PISA) too had declined from 2009 to 2012. In 2009, for example, out of 74 participating countries, Malaysia only managed to secure the 57th position in Mathematics, 55th in Science and 52nd in Understanding. The declining trends had affected the country's position in the international ranking, which has often been used as an indicator of the quality of the education system. Recognising the importance of achievement in TIMSS and PISA, the education authority has set as a key performance indicator, in the Malaysian Education Development Plan (2013-2025), for Malaysia to at least score average at TIMSS in 2015 and be in the top one-third position by 2025. In addition to the ranking reports, needs assessment reports carried out by consulting bodies, Kestrel Education (UK) and 21 Century Schools (USA), presented on 2 November 2011, found that higher-order thinking among teachers and students in Malaysia is very low (Curriculum Development Centre Ministry of Education Malaysia, 2012). The current study, therefore, was intended to develop interactive applications to promote thinking skills in learning primary school science subject.

Learning through Thinking Maps

The practice of using thinking maps in classroom teaching and learning can be very important in realising the goals of the curriculum. The use of thinking maps can systematically facilitate pupils' understanding of the subject matter. According to Buzan (2003), people easily remember and store information in the long term memory when they are visually appealing, whether in the form of texts or images [2]. Further, attractive visuals can facilitate understanding and lead to improved recall of stored information. To facilitate understanding, attract interests and activate both sides of the brain, learning through thinking maps as introduced by David Hyerle (2009) is one method of learning which can be applied in certain subject matters, especially in science [3]. As found in Aida Tukiran (2004), the use of concept maps can improve pupils' attitude towards learning. Further, the effectiveness of thinking maps has been internationally recognized as an effective advance organizers for learning science. Additionally, the use of thinking map has been reported to improve HOTS and, learners' mastery of subject content (Rohaida Zamri Yusof, 2015) [4]. Nonetheless, Mohd Mahzan Awang Mohd, Abdul Razaq Ahmad & Mohd Muhaimi Abdul Rahman (2014) found that some learners lack the neccessary skills to construct thinking maps and therefore, need teachers' guidance to build them [5]. The researchers remarked that teachers could further enhance learners ability to build creative advance organizers with the aid of the latest technology. In accordance with the problems raised and suggestions set out in past studies, the present researchers have engaged in building and testing Science Smart i-Think (SSiT) interactive application which involves eight thinking maps to facilitate the learning of primary five topic on Earth, Moon and Sun. It is hoped that teachers can be encouraged to enculture thinking activities among primary pupils through the use of i-Think thinking map that stimulates thinking.

Research Questions

1. What are the mean score for the science expert teachers' evaluation of SSiT?
2. What are the science expert teachers views about SSiT?

3. Research Methodology

This paper reports the results of a preliminary study assessing SSiT which was conducted for the purpose of improving future use of the application. The study employed descriptive analysis of quantitative and qualitative data. The process of evaluating SSiT was conducted simultaneously in a place agreed by all the experts, following Field (2013) suggestions [6]. The evaluation process lasted for half a day from 9.00 am to 1.00 pm. Meanwhile, qualitative semi-structured interviews were carried out to obtain the science expert teachers views on SSiT. Semi-structured interview was employed because it allows for flexible responses and allows the participants to explain in detail their views on the application [7]. Each interview session lasted between 15 to 20 minutes and was videotaped. Data analysis process was carried out in three stages namely transcription, data reduction and coding [7].

The Participants

A total of four science expert teachers who have experiences of teaching primary school science for more than 10 years were selected to participate in the evaluation of the SSiT and the interview sessions.

Instrument

To obtain quantitative data, SSiT assessment questionnaire adapted from Danakorn (2011) was used [8]. The questionnaire has high reliability with alpha of .87. Scores for each response were based on four-point Likert scale, ranging from 1 to 4 (Refer to Table 1). Assessors evaluated the application based on its design and user-friendliness. The instrument was divided into five sections: Part A- Profile of expert teachers, Part B- Information Presentation, Part C- Interaction Design, Part D- Presentation Design, Part E- the items for this section were intended to obtain feedback from teachers regarding their understanding of the learning activities based on eight thinking map in the SSiT.

Table 1: Item scale for SSiT Assessment Questionnaire

Item	Scale
Very Good	4
Good	3
Not Good	2
Very Bad	1

The interview protocol was developed by the researchers. There were five interview questions designed to obtain science expert teachers views about SSiT.

Mean Rating Score of Science Expert Teachers Evaluation of SSiT

Table 2 shows four categories of assessment (i) information design, (ii) interaction design, (iii) presentation design, and (iv) users' understanding of the thinking map activities. The results of the teachers' evaluation revealed the mean value for all items to be between 3.25 to 4.00. This indicates that all items are evaluated as good and very good.

Table 2: Science expert teachers score

No.	Items	Mean	SD
	INFORMATION DESIGN		
1.	SSiT content		
	Easy to understand	3.75	.50
	Not too difficult	3.50	1.00
	According to syllabus (DSKP)	4.00	.00
	Layout	3.75	.50
2	Language is easily understood	3.75	.50
3	Build an understanding of the thinking map	3.75	.50
4	Content relates to students' existing knowledge	3.75	.50
	INTERACTION DESIGN		
5	Doesn't stray	3.75	.50
6	Contains instructions	3.75	.50
7	Navigation is clearly represented	3.75	.50
8	Desired sections easily reachable	3.25	.96
9	Free control of sequences	3.75	.50
10	Can give the correct response	3.50	.58
11	Easy to use	3.75	.50
12	Button functions are easily identifiable	3.75	.50
13	Consistent navigation system	4.00	.00
	PRESENTATION DESIGN		
14	Interesting design	4.00	.00
15	User friendly	3.25	.50
16	Balanced in terms of the composition of the elements	3.75	.50
17	**Graphics**		
	Attractive	4.00	.00
	Clearly represent the intended objects	4.00	.00
	Consistent	4.00	.00
18	**Font**		
	Clear	3.75	.50
	Easy to read	3.75	.50
19	**Colour**		
	Suitable	3.75	.50
	Attractive	3.75	.50
	Consistent	4.00	.00
20	**Audio**		
	In accordance with the function displayed	3.75	.50
	Does not disturb focus on content	3.50	1.00
	Sound-action correspondence	3.25	.95
21	**Animation**		
	Interesting	4.00	.00
	clear	3.75	.50

	Available controls to start and stop	3.75	.50
22	**Button**		
	Attractive	3.75	.50
	Easy to understand	3.75	.50
	Consistent	3.75	.50
	In accordance with the monitor display size	4.00	.00
	User understanding related to SSiT		
23	Circle map (defining in context)	3.75	.50
24	Bubble map (describing qualities)	3.75	.50
25	Double bubble map (comparing & contrasting)	3.75	.50
26	Tree map (classifying)	3.75	.50
27	Brace map(whole – parts relationship)	3.75	.50
28	Flow map (sequencing)	3.75	.50
29	Multi – flow map (analyzing cause & effect)	3.50	.58
30	Bridge map (relating factor)	3.50	.58

N=4

Science Expert Teachers' Views on SSiT

a) SSiT stimulates HOTS through interesting composition, colour and sound

Three expert science teachers agree that SSiT is able to stimulate higher order thinking skills. It is a very good application that helps pupils to learn and remember science easily. Even the composition, colour and sound used in the application attract the pupils' attention as illustrated below.

Teacher 1: SSiT is excellent, pupils can easily learn and remember the displayed content.
Teacher 2: SSiT is an interesting application, the colour, sound and arrangement can attract pupils to science.
Teacher 4: Very good. The pupils apply higher order thinking skills for each type of thinking map displayed.

b) SSiT trains pupils to be aware and careful while the teacher facilitates

The science expert teachers believe SSiT trains the pupils to be rigorous and careful as they are required to type their answers in the available space using correct spellings and in accordance with the format specified in the instructions provided. Further, the teachers agree that SSiT succeeded in reinstating teachers as facilitators, thus reducing the amount of teacher centered-ness as commonly found in traditional teachings.

Teacher 2: SSiT trains pupils to be careful in giving the right answers and to be alert of all contents that are displayed.
Teacher 3: The pupils needed guidance only at the start of using the application, but soon all pupils continued to learn independently without depending too much on the teacher. In fact, they can continue to use the application without teacher's help.

c) SSiT contains interesting animation, is learner-friendly and easy to use

All teachers interviewed agreed that SSiT has many advantages: the application helps pupils to identify and give correct answers easily through automatic scoring, inculcates interest in learning science, improves the pupils' mastery of science, and attracts pupils to use thinking maps in learning.

Teacher 1: SSiT provides attractive animation and is very appropriate to pupils.
Teacher 2: The application is very learner friendly and easy to use.
Teacher 3: This application successfully trains pupils to learn by using the thinking maps that are introduced in i-THINK program.

d) Pupils can identify the answers easily and accurately.

SSiT stimulates concentration and motivates pupils through mastery learning approach

Teacher 1: SSiT is an interactive applications which attracts pupils to learn. Pupils were excited to continue learning.
Teacher 2: Pupils can continue to identify and correct the answers by making repeated readings on the notes provided through mastery learning.
Teacher 3: Automatic scoring helps motivate pupils to keep trying until successful through mastery learning approach.

4. Discussion and Conclusion

Education is a fundamental contributor to raising the living standards in Malaysia. Education is meant to prepare future generations with 21st century capabilities in science and technology. Thinking map is one of the learning strategies known as advance organizers (Ausubel, 1978), and when combined with technology can incite learning [9]. Based on the mean score of expert teachers' evaluation of SSiT, the results of this study reveal that the teachers receive well the application for use in the learning of science among primary school pupils. Qualitative feedback through interviews with four teachers showed positive responses because this application could potentially stimulate higher order thinking skills. This is consistent with the educational goals as outlined by the Ministry of Education.

The combination of five multimedia elements such as texts, graphics, audio, video and animations make learning science more interesting and stimulate students' interest to learn science. Even the use of thinking maps can generate higher order thinking skills and attract students to science and technology.

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