Development of Interactive Software for Implementing the Science Process Skills in Science Primary School

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Abstract
This study aims to develop interactive software for implementing the science process skills among primary pupils. Objectives of this study to developed interactive software in the sub title of "Rusting" and examines the usability of interactive software in the process of teaching and learning and its ability to apply science process skills among pupils. ADDIE instructional design model was used as a guideline of developing the interactive software. At the analysis level, 10 experts were interviewed for get their opinian on the topics that are difficult to run experiments in the science year 4 syllabus. Level of design, researchers have identified the theories related to the cognitivism, constructivism and contextual. Level of development, researchers have developed an interactive software using Macromedia Flash. Level of implementation, 10 experts who were interviewed have tried to use the interactive software in their schools. Level of evaluation, 10 experts will fill the same checklist to specify whether this interactive software can apply science process skills or not. The data analysis found, interactive software that has been developed is able to apply the science process skills amongst primary school pupils. In future, hopefully there are a lot of interactive software can be developed to help teaching and facilitation in schools, science process skills among pupils. Interactive software definitely makes learning of Science more interesting.
Keyword: Development, Implenting, Interactive Software, Science Process Skills, Primary School

Introduction
Education in Malaysia now has been through a period of very significantly change. Malaysia Education Blueprint (MEB 2013-2025) 7th underlined that the information and communication technology (ICT) should be used to improve the quality of teaching and facilitation (PdPc) in Malaysia. Accordingly, this study was conducted to develop a software-based interactive multimedia applications to help improve science process skills among primary school pupils.

Advances in science and technology have helped in the education system in Malaysia. The Government's to develop the nation in line with the progress of science and technology has led to some changes in the education system in Malaysia. The existence of the gate Corridor (MSC), information technology has been demanding concept of education towards the development of the country.

Over the decades, technology has become a part of teaching and learning. This type of technology and its importance to the process of teaching and learning has faced a wave of change every day. In Malaysia, the field of science and technology is one that gets high attention. Instead, this field is also considered as one of the important for maintaining economic development, improve the quality of life and national security (National Science Policy).

Efforts to cultivate educational technology is already started unofficially in early 1945 (Norazilawati, 2013). This shows that technology in education has long been established in our educational system and it goes hand in hand with current technologies. We can see several subjects in primary schools have been using resources based on ICT in teaching and learning activities. Therefore, teachers should also have at least a little skill in providing the resources based on ICT to be offered to their pupils.

Science subject is suitable in combination with ICT element. As a result, in 2011 the Primary School Standard Curriculum (KSSR) have been introduced and science primary school are exchanged and known as subjects World of Science and Technology. In this KSSR, primary school science curriculum has been incorporated ICT syllabus in which demanding science teachers to teach ICT in the teaching of science in primary schools.

Problem Statement

A research by Yusmainor (2010) clearly shows science teachers still tended and bound with teaching methods, teacher-centered learning, without trying to emphasize the integration of cognitive, affective and psychomotor students. Many of the teachers are still using traditional methods in the teaching-learning science (Soleh, 2007). Teachers still use the white board and many lectures, where students bribed by words without understanding (Rose Amnah et al., 2010). In other words, pupils are not given the opportunity to be actively involved in designing practical activities that will be done. They do practical activities simply by following the procedures established by the book as a guide to confirm a theory or explain a concept (Yeam, 2007). Practical work is done only to nurture the manipulative skills of students, as suggested by most reference books available in the market (Rezba, 2013). Supposedly, students are given the opportunity to build a hypothesis, designing, carrying out and predict the results of an experiment they did (Lay, 1999). With this, the practical work that can be done to encourage students to think critically and creatively, and affirms the theory or concepts, as well as to cultivate their interest (Yeam, 2007). Teachers should provide opportunities for pupils to develop and explore their own learning through experience.

In the era of globalization and high-tech society becomes more complex, like learning elements should use interactive software oriented elements such as cognitivism, constructivism and contextual emphasized in teaching. Pupils have to learn not just the facts but the science process skills in order to improve their thinking skills and analytics more successful in solving a problem (Norazilawati, 2016). Science process skills not only act as a support for science activities in the classroom, but it plays an important role in proving a

theory. Through this approach, students have the opportunity to combine scientific knowledge, processes and thinking skills to understand a concept. A research by Rose Amnah et al., (2010) find science process skill is higher in terms of intellectual as compared to the mastery of facts and principles of science. When the pupils has mastered the science process skills, they can find answers and develop an idea or concept itself of any phenomenon in science.

Learning science in the laboratory are usually exposed to the use of various tools and hazardous chemicals (Toth, Ludvico & Morrow, 2012). Additionally, the initial setup should be done to provide equipment, apparatus and materials to do the experiment. The process of conducting experiments usually involve costs in terms of time, equipment and experiment materials if a repeat experiment of failure to obtain proper results (Li-Chiou & Tao, 2012). The problem with control classrooms and laboratory conditions were not perfect cause school teacher less unning the experiment activity instead of just running the demonstration only (Alexiou et al., 2004). As a result, pupils not involved with the science process skills which experiment skills because hands-on activities does not apply.

Through the use of virtual lab software, pupils can perform experiments like in real laboratory (Dillenbourg, 2007). Approach learning through virtual laboratory emphasizes the use of contextual teaching approach, simulation, visual and audio with the concept of two-way in period can produce more creative and critical student (Tatli & Ayas, 2013). In addition, experiments can be carried out repeatedly and learning materials can be presented in the form of text, pictures, animation and based on the actual scenario (Singh, 2012). Pupils can perform experiments in the rate of their own. Pupils will be in a virtual world and can change the position and orientation of the object. Pupils also can move and put objects and can interact with the objects Ramasundaram, Grunwald, Mangeot, Comerford & Bliss, 2005). Learning to use the virtual laboratory makes pupils more fun in their learning, because they can determine the rate of learning as well as determine their learning time in self. This will solve the problem of shortage of computers for the needs of all pupils, teachers also face the problem of choosing quality multimedia courseware to fulfill the objective needs of teaching and learning in the classroom.

Therefore, a study to develop virtual laboratory based on the concept of interactive software should be carried out. It aims to determine the extent to which the software has been developed fulfilling the objectives and criteria of science process skills.

Research Objective
The objective of this study is:

1) Develop an interactive software for the sub-heading "Rusting"
2) Review the usability of interactive software for teaching and facilitating (PdPc) and the application of science process skills among pupils

Research Methodology
Interactive software development consists of five phases based on the model of ADDIE :

i) At the level of Analysis, 10 experts were interviewed to get their views on the topics that are difficult to run experiments in the science syllabus years 4 .
ii) At the level of Design, researchers have identified theories learning related cognitivism, constructivism and contextual.

iii)   At the level of Development, researchers have developed an interactive software using Macromedia Flash.

iv)   At the level of Implimentation, 10 experts were interviewed have tried to use the interactive software in their schools.

v)   The evaluation phase, 10 experts will fill the same checklist to specify whether this interactive software can apply science process skills or checklist to evaluate the application of science process skills using interactive software.

Findings
Content Interactive Software
The screen display is entered starting with an interactive software pupils can choose icons Click Here to enter the interactive software or the X icon to exit the interactive software as found in Figure 1.

Figure 1 The main display screen interactive software

The next screen is the pupils have to click Experiment to continue the experiment titled Rusting as in Figure 2.

Figure 2   Experiments: entitled "Rusting"

Think of the next display will go out. This display is a question of thinking skills that aims to inspire the mind so that pupils are excited to carry out the experiment. Pupils will click the Run Experiment to carry out the experiment as shown in Figure 3.

Figure 3   Question Thinking skills

The next screen will show the experiment, in which the apparatus diagram and instructions will appear. Pupils are required to read the instructions and click on the icon of the apparatus. If pupils do not understand the instructions, pupils can click on the icon again. In this view there is also a light bulb icon, if pupils clicks light bulb icon, info science would seem to provide additional information regarding the scientific theory related to the experiment. If pupils are

unable to continue the experiment, they can click the menu icon to return to the main menu. Screen experiment as in Figure 4 (a-e).

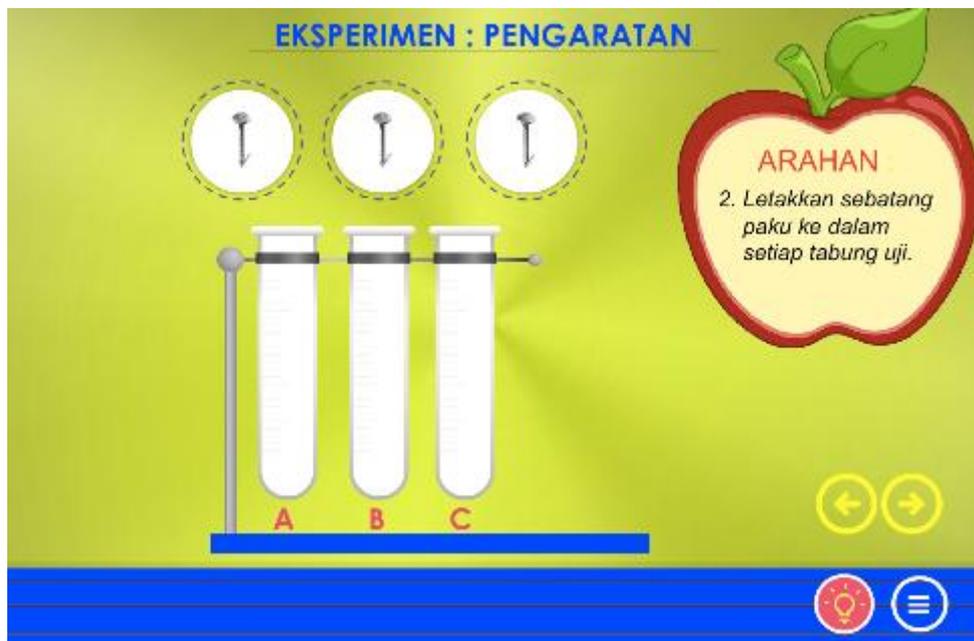**Figure 4 (a)**   Experimental Display: Instructions 1

Figure 4 (b)   Experimental Display: Instructions 2

Figure 4 (c)　　　Experimental Display: Instructions 3

Figure 4 (d)　　　Experimental Display: Instructions 4

Figure 4 (e)   Experimental Display: Instructions 5

After pupils follow all instructions displayed on the screen, pupils will get an answer on the questions trigger ideas at the beginning of the experiment. By clicking Icons?, screen will display answers as shown in figure 5 .

Figure 5 Answer questions trigger ideas

Pupils are encouraged to get the info by clicking on the icon science bulbs and displays as shown in Figure 6 will appear.

Figure 6 Science Info

If pupils want to repeat the experiment, pupils can click the Back icon. If the pupils already understand, pupils can test the level of understanding and their science process skills by clicking the Book icon (IQ). Display Quiz Test Mind questions will look like Figure 7.
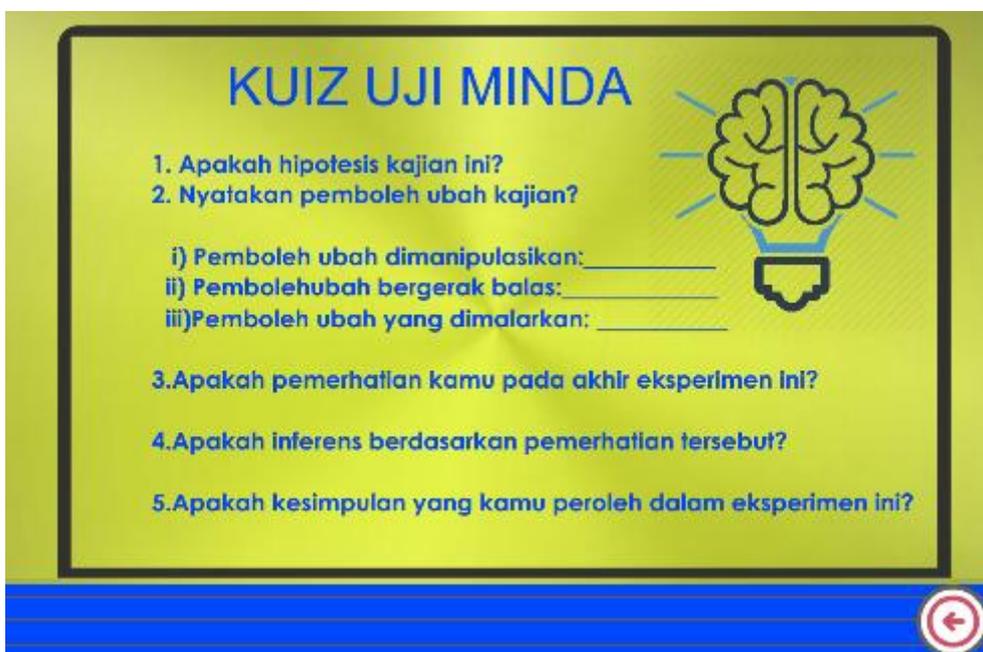

Figure 7   Quiz Test Mind (Question Science Process Skills)

Validity and Usability of Interactive Software

Validity of interactive software is done through the analysis checklist. A total of 10 respondents were filling out the checklist provided. It consists of outstanding science teachers

from different schools and has over 10 years experience. Each item in the checklist is built based on the evaluation of the curriculum, pedagogy, technical and cosmetic. Respondents also need to fill out evaluation forms Science Process Skill to determine whether an interactive software can be used to test science process skills pupils after they try this software to pupils. In addition, respondents were also asked to provide comments and suggestions to improve the interactive software.

Table 1

Table analysis checklist (curriculum aspect)

No.	Items (Curriculum)	Mean
1	This interactive software-based science subjects for the title of Rusting	0.60
2	The interactive software provides accurate information regarding the experiments conducted.	0.70
3	This interactive software-focused science process skills.	0.8
4	This interactive software encourages creative and critical thinking.	0.60
5	This interactive software is related to the actual experience of pupils.	0.70
6	This interactive software using the right language and clear.	0.70
7	This interactive software is in accordance with the corresponding sequence (simple to complex).	0.70
8	This interactive software help pupils understand concepts science easily and quickly.	0.80
9	This interactive software encourages pupils to experiment by themselves repeatedly.	0.80
10	The material in this interactive software can be integrated with other PdPc materials (example: textbooks).	0.70

Table 1 shows the analysis checklists based curriculum. All respondents agreed that this interactive software to provide accurate information regarding exsperiment and it focuses on science skills. They also agree that this interactive software using the right language and clear, help pupils understand scientific concepts easily and quickly, and encourage pupils to create experiments for self repeatedly. Overall interactive software suitable of the science curriculum subjects.

Table 2
Table analysis checklist (pedagogy aspect)

No.	Items (Pedagogy)	Mean
1	Interactive software to apply the theory of teaching and learning that are appropriate.	0.70
2	This interactive software using appropriate teaching approach to the topic.	0.70
3	This interactive software can be used pupils without the help of other materials.	0.80
4	This interactive software suitable for beginning teaching.	0.60
5	This interactive software suitable for middle teaching.	0.60
6	This interactive software is suitable for use at the end of the lesson.	0.70
7	This interactive software suitable for training activities.	0.80
8	Interactive software is suitable for rehabilitation activities.	0.80
9	This interactive software suitable for enrichment activities.	0.80
10	This interactive software suitable for strengthening activities.	0.80
11	Perisian interaktif ini boleh digunakan untuk ujian formatif.	0.80
12	The interactive software can be used as support material PdPc.	0.80
13	Interactive software is suitable for weak students, moderate and excellent.	0.60
14	This interactive software contains various basic science process skills.	0.70
15	This interactive software takes the various elements of pupils learning styles.	0.70
16	This interactive software takes the elements multiple intelligences.	0.80
17	The interactive software can maintain pupils attention on the content of the software to complete.	0.80
18	This interactive software contains aspects of learning assessment that helps increase pupils understanding.	0.80
19	This interactive software allows pupils to apply the knowledge acquired into new situations.	0.70
20	The use of this interactive software helps pupils make a self reflection of its understanding.	0.80

Table 2 shows the analysis checklists based pedagogy. All respondents agreed that this interactive software to apply the theory of teaching and learning that are appropriate and can be used by pupils without the help of other materials. All respondents agree that the software is suitable for interactive training, recovery, enrichment, reinforcement, and formative tests and may also be used as support material PdPc. Respondents also agreed that the interactive software takes into various elements of the multiple intelligences can maintain pupils attention on the content of the software to complete. Interactive software also contains aspects of learning assessment that helps increase pupils understanding as well as to helps

pupils make a self reflection to test their understanding. Overall, respondents agree that interactive software accurate the pedagogical aspects in delivering knowledge in science subjects.

Table 3
Table analysis checklist (technical aspect)

Num	Items (Technical)	Mean
1	Instructions screen interactive software easy to understand.	0.80
2	Interactive software is easy to use without the help of others.	0.70
3	Interactive software has clear audio.	0.80
4	Interactive multimedia software has multimedia attractive elements.	0.90
5	Interactive Software have multimedia elements that are relevant.	0.70

Table 3 shows the analysis checklist based on technical aspects. Overall, all respondents agree that the instructions on the screen interactive software easy to understand, easy to use without the help of others, have clear audio and elements multimedia relevant.

Table 4 Table analysis checklist (cosmetic aspect)

Bil	Items (Cosmetic)	Mean
1	Screen display (layout) is an interesting interactive software.	0.70
2	Presentation of the contents of the interactive software on the screen is interesting.	0.60
3	Font size interactive software is easy to read.	0.70
4	Form letter interactive software is in appropriate with the level of pupils.	0.60
5	Objects interactive software that use is clear and interesting.	0.70
6	Objects shown interactive software helps in the process of teaching and learning.	0.70
7	Objects shown interactive software is suitable for the experiment content.	0.80
8	Music used in the interactive software is interesting.	0.60
9	The graphics shown in the interactive software is clear and satisfactory.	0.80
10	Interactive software has a smooth animation.	0.70
11	Interactive software has a fun interactive elements.	0.80
12	The entire interactive software is interesting.	0.80

Table 4 shows the analysis checklists based on the cosmetic aspect. All respondents agree that objects used interactive software is clear and interesting, helps the process of PdPc and fulfill experimental content. Respondents also agreed that the graphics shown in the

interactive software is clear and satisfying and have a fun interactive elements. Overall, for the cosmetic aspect respondents in agree the interactive software is interesting

Table 5
Science Process Skills Checklist

Science Process Skills	Details	Mean
Observing	Using the senses of sight, hearing, touch, taste or smell to gather information about objects and phenomena	0.70
Classify	Using observations to separate and collect the object or phenomenon based on the same features.	0.40
Measuring using number	Making quantitative observations using numbers or tools with standardized units or standardized tool as a reference unit	0.30
Make inferences	Concluded initial a reasonable which may be true or not true to explain an event or observation.	0.70
Forecasting	Create expectations about about an event based on observation and past experience or by data.	0.60
Communicate	Receive, select, organize and present information or ideas in writing, orally, tables, graphs, diagrams or models.	0.40
Using the relationship of space and time	Describing changes in parameters such as location, direction, shape, size, volume, weight and mass of with time.	0.40
Interpret data	Giving rational explanations about an object, event or pattern derived from collected data.	0.60
Definition in operation	Provide interpretation of a concept by stating things done and have been observed.	0.60
Controlling variables	Identify the manipulated variable, the variable and responding variable in forecasting. In an investigation of the manipulated variable to observe its relationship with the responding variable. At the same time other variables is forecasting.	0.70
Make hypothesis	Making a general statement about the relationship between variables that are thought right to explain a matters or event. These statements can be tested to determine its authenticity.	0.70
Experiment	Plan and carry out an investigation to test a hypothesis, collect data, interpret the data to get a summary from the investigation.	0.80

Table 5 shows the results of analysis checklists based on elements of science process skills that can be an implementation to pupils through experiments carried out using interactive

software. This interactive software can apply science process skills to observe, makes inference, predict, interpret the data, define operational, control variables, create a hypothesis and experiment. Overall, respondents confirm that this interactive software can be implemented 8 of the 12 elements of the science process skills.

In conclusion, the results of the analysis checklists, the majority of respondents agree that interactive software fulfill aspect of the curriculum, pedagogy, technical and cosmetic. Respondents also give a high score mean to 8 science process skills elements that can be applied through interactive software. Among the elements that can be applied is observing skills, making inference, predict, interpret the data, define operational, control variables, create a hypothesis and experiment. At the review, all of the respondents gave positive comments and views. They agreed that the development of interactive software is good, accurate, easy to understand and can be used in science subjects. According to one respondent, interactive software is very steady and can help students conduct experiments and apply the science process skills. The interactive software also allows pupils to be more creative, courageous and ready use the software in learning of science although learning independently. In addition, the interactive software is software 3 in one. pupils that have an interactive software can run virtual experiments, understand scientific concepts and facts of science and test their science process skills. Respondents say that this interactive software should be developed to run as many experiments as possible in accordance science syllabus that can be used as a reference mastery major science process skills by all pupils.

Conclusion
This study has produced an interactive software for title Rusting in the syllabus for primary school science subjects. This interactive software was built using the approach of cognitivism, constructivism and contextual based ADDIE model. The findings are based on analysis of the checklist by 10 respondents. The finding shows interactive software produced fulfill aspect of curriculum, pedagogy, technical and cosmetic as well as be able to implement elements of science process skills which skills to observe, makes inference, predict, interpret the data, define operational, control variables, create a hypothesis and experiment. Respondents also noted that interactive software also can be used as independent learning by pupils and suitable use as a teaching aids outside or in the classroom.

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