# Using Scratch to Increase Students' Achievement and Motivation Toward Solar System

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***Abstract***

The misconception is a conception that is incompatible with the scientific understanding or understanding accepted by the expert in that field. Students often face misconceptions about abstract concepts that they found difficult to be represented in physical forms such as Solar System. ICT such as Scratch application can be used to overcome the misconceptions of Solar System. This study use of Scratch application to increase students' achievement and motivation towards topic Solar System. This action research had applied quantitative approach by using instruments such as pre-test, post-test and questionnaire based on Kemmis and McTaggart model (1988). 30 students from a school at Penang were selected as samples of the research. Science Achievement Test (SAT) was used to identify students' achievement while Motivation Level Questionnaire was used to identify students' motivation towards topic Solar System. Based on deskriptive analaysis, the findings of the research shows that Scratch application can increase students' achievement and motivation towards topic Solar System. The integration Scratch in science have provided positive implications towards science teacher, students and researcher.

***Keywords*** **:** *Achievement; Motivation; Scratch; Solar System*

## I. INTRODUCTION

Malaysia is working to become a developed country, so it needs to develop a society that is focused on science, is forward-thinking, knowledgeable, and progressive. However, Malaysia struggles to perform and gain international acclaim at the primary and secondary levels of education. There have been a lot of worldwide surveys undertaken to gather data on educational performance across nations internationally. [1] had analysed the change in math and science TIMSS scores for the 25 countries that had taken part in TIMSS 2003 and TIMSS 2015. Besides, [3] state that the percentage of students meeting the advanced benchmark has decreased from the initial 5% to now 3%, indicating a declining trend in Malaysian students' science achievement. Malaysia initially participated in the PISA assessment in 2009. Malaysia unfortunately finished in the bottom third of all participating countries in its first attempt [4].

The misconception is a conception that is incompatible with the scientific understanding or understanding accepted by the expert in that field. Students' misconceptions can't be eliminated, but they can be rectified so they don't develop incorrect concepts [6]. Students frequently have misconceptions about astronomical subjects [7]. According to [8], students continue to have misconceptions about the Solar System topic, which makes it one of the challenges to studying. Moreover, misconceptions regarding astronomy issues have been noticed among students at various educational levels in studies on astronomy, which includes these crucial features [9]. According to [10], it was discovered that some students misunderstood the movements of the sun via questions to scientific teachers. Students and future teachers have misconceptions about the causes of night and day, the seasons, the moon's phases, the location of the sun in the sky, and other topics [11]. Misconceptions on students should not be allowed and given must be reduced [12].


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Scratch will be used to teach topic Solar System. Scratch is the world's largest coding community for kids, as well as a coding language with a simple visual interface that allows kids to create digital stories, games, and animations [13]. Scratch encourages the development of computational thinking and problem-solving abilities, inventive teaching and learning, cooperation, self-expression, and equity in computing. Animation and questions about Solar System will be presented to students by using Scratch. Scratch application can be used in both online and physical classroom. In a structured inquiry, the teacher provides the procedures, materials, and input for the student to explore a problem [14]. The purpose of this research is to identify the use of Scratch in increasing Year 3 students' achievement and motivation towards topic Solar System. There are two research questions which are: (1) Do Scratch increase Year 3 students' achievement towards topic Solar System? (2) Do Scratch increase Year 3 students' motivation towards Solar System?

## II. LITERATURE REVIEW

Malaysian students' TIMSS performance suddenly declined from 510 in 2003 to 471 in 2007 and 426 in 2011, whereas Singapore and Japan continued to achieve rising scores [2]. Malaysia's total score was still below the OECD average, placing it 52nd out of 65 participating countries [5]. In PISA 2018, Malaysia scored 438 in science [35]. To solve these problems, ICT can use in teaching and learning in science.

Based on the study of [16], students' knowledge, experiences, and levels of understanding are increased by the use of ICT in teaching and learning, especially in the study of science. Using ICT in CRS lessons raises students' achievements compare to using traditional methods [21]. Moreover, [22] discovered that ICT is much more efficient than traditional teaching methods in this area. ICT was generally more effective than the laboratory training model of teaching for chemistry students [23]. [24] found that, in terms of students' achievement scores in chemistry, the ICT programme is more compelling and effective than the traditional teaching technique. Based on the study of [27], the use of Scratch can overcome the problem of low students' achievement. The use of 3D interactive multimedia 'Scratch' animation that suits the students' learning level makes the teaching of science subjects achieve the objectives. It is obvious that computer programming can enhance problem solving capabilities of learners in all ages, which urges a need for the development of educational programming environment based multimedia activities, especially for young learners [28]. According to [29], after using Scratch programming, all of the teachers unanimously noticed a significant improvement in their students' test scores.

The use of ICT in science education also helps students become more motivated. Based on the research carried out by [15], ICT's rapid expansion has contributed significantly to increasing student motivation. The use of computer-based assessment has motivated respondents to take part in the study [17]. Besides, according to [18], students' performance is improved and their motivation is increased due to ICT. Teaching, learning, and research are all benefited by ICT adoption and application in education [25]. [30] state that this is expected to improve student motivation, as the interactive and multimedia features of software such as Scratch can be utilized to assist students grapple with concepts and ideas in the curriculum.

## III. RESEARCH METHODOLOGY

### *1) Research Design*

This research is action research. This research uses a quantitative approach by using Science Achievement Test (SAT) and Motivation Level Questionnaire (MLQ) as instruments. The model will use in this action research is model Kemmis and McTaggart (1988). Kemmis and McTaggart (1988) characterize class action research as life that requires a cycle of planners to make a reflection [26].

### *2) Study Participant*

The researcher has selected research participants among Year 3 students. The study participants were carefully chosen by the researcher based on their academic achievements in science subjects. Researcher has chosen 15 students from class 3K as treatment group and 15 students from class 3B as control group to participate in this study. Consequently, 30 students in total were chosen to participate in the study.

### *3) Instruments*

The interventions used in this study are Scratch about topic Solar System. The animation and questions about Solar System will show by Scratch application. The instrument used in this research are SAT and MLQ. SAT contain pre-test and post-test and each test contain 15 objective questions. All of the questions are taken out form Primary School Achievement Test (UPSR). MLQ contain pre-questionnaire and post-questionnaire. This questionnaire was used in the research of Wong (2017) and it is validated and trustable. The pre-questionnaire and post-questionnaire have two


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sections, which are general section and science section. General section has 13 questions while science section has 11 questions.

***4) Instruments***

This research was conducted in the school in Penang among 4 days. Before teaching, a 30 minutes pre-test and pre-motivation level questionnaire will give to both treatment and control group. Next, teacher will teach topic solar using Scratch application in treatment group while another teacher will teach topic Solar System by using traditional method in control group. After teaching, a 30 minutes post-test and post-motivation level questionnaire will give to both treatment and control group. Next, the data of pre and post-test were compared to evaluate the effectiveness of using the Scratch application on the topic Solar System in improve students' achievement. Meanwhile, the data of pre and post questionnaire were compared to evaluate the effectiveness of using the Scratch application on the topic Solar System in improve students' motivation.

## IV. RESULT AND DISCUSSION

***1) Achievement***

Based on the data figure 1, the treatment group has higher improvement in achievement than control group. This shows the use of the Scratch application can improve students' achievement towards topic Solar System. According to [29], the increase in students' achievement is due to the use of the Scratch application in teaching and learning. Besides, [24] discovered that, in terms of students' accomplishment scores in chemistry, the ICT programme is more compelling and effective than the traditional teaching strategy. ICT was generally more effective than the laboratory training model of teaching for chemistry students [23]. This is because ICT can help students to learn the conceptual topics easily because students can see it clearly with their eyes as shown in Figure 2. Teachers can use scratch application to make animations in it. As a result, using the Scratch application can help students learn a particular topic better and solve the problems of misconception in science.

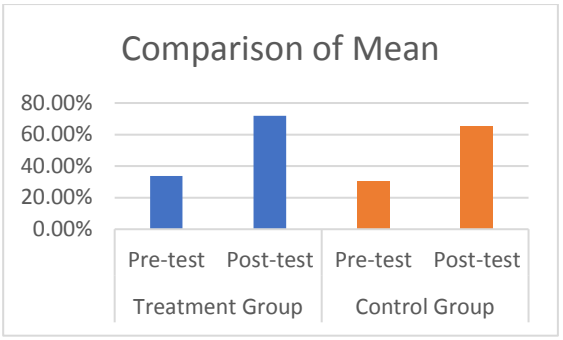


**Figure 1** Comparison of mean of pre-test and post-test


**Figure 2** Animation of Scratch application

The findings of this research shows that students' achievement can be improved by using the Scratch application on the topic Solar System. Integrating ICT into lessons improved student achievement [21]. Thus, the misconception of Solar System can be solved. Based on the study of [27], the use of Scratch can overcome the problem of low students' achievement. The findings are in line with [24], who discovered that ICT has a positive influence on secondary students' accomplishment scores in chemistry. Similar findings were made by [16], who discovered that the use of ICT in teaching and learning raised students' achievement in science disciplines. Besides, [22] concluded that ICT improves student achievement. The user-friendly aspects of Scratch, including its various blocks (such as sound effect blocks, string operator blocks, pen blocks, glide blocks and music blocks), front and sprites make the design of games and animated stories more approachable and interactive [28].

According to constructivism theory Piaget (1953), creating new information based on experience and observation. Constructivism theory is a model for learning that views education as an individual process of "creating" meaning or new information


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based on experience and observation, and it is particularly well suited to the ICT approach [19]. According to [20], ICT allows for the creation of dynamic learning environments for students throughout the continuum from relativist to constructivist styles of education. Thus, students' achievement on the topic Solar System can be improved by using Scratch application and the problem misconception of Solar System can be solved.

***2) Motivation***

Based on Table 1 and Figure 3, treatment group has higher increase in mean score. This shows that Scratch application can increase students' motivation towards Solar System. ICTs, including video, television, and multimedia computer software that combines text, sound, and vibrant moving visuals, can be utilised to deliver difficult and authentic content that will involve student in the learning process. Moreover, some of the respondents' parents expressed the opinion that their children were feeling more motivated than before in such type of class environment as compared to the traditional 45-minute lecture [25]. Their parents believed that this type of teaching was significantly effective than the traditional lesson classroom setting in which the teacher teaches to the class while standing on a platform.

**Table 1** Mean score of questionnaires

| Questionnaire | Groups | Mean Score |
|---|---|---|
| Pre | Treatment | 2.648 |
| | Control | 2.514 |
| Post | Treatment | 2.787 |
| | Control | 2.589 |

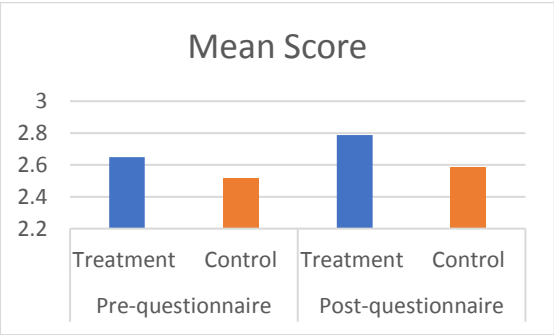


**Figure 3** Comparison of mean score of questionnaires

The findings of this research shows that students' motivation can be improved by using the Scratch application on the topic Solar System. This is expected to improve student motivation, as the interactive and multimedia features of software can be utilized to assist students grapple with concepts and ideas in the curriculum [30]. The ICT is a common instrument for establishing a relevant atmosphere that can boost motivation for learning, encourage new interests, and even have psychological effects on pupils [31]. Besides, according to [18], students' performance is improved and their motivation is increased due to ICT. According to [32], this will make teaching more enjoyable for both teachers and students, who will find their class more interesting and motivated to participate fully. As a result, it has been shown to be able to improve the students' learning achievements and motivation to study [33]. It not only increases the effectiveness and efficiency of education but also makes for a more engaging and difficult lesson that can inspire students' creativity and encourage better learner autonomy [34] and promotes computational thinking skills as problem solving tool [35],[36].

Skinner (1938) state that reinforcement is necessary to maintain the behaviour or the behaviour that has been confirmed. When the student has not achieved learning achievements, the reinforcement programme has an equivalent in virtual settings where there are virtual activities with drill and practise processes that serve as extra stimuli or reinforcements. Scratch application can increase students' motivation to learn. This is because when students answered a question correctly, a sound effect will broadcast to give greeting to students. This is a positive reinforcement and students will more motivated to study topic Solar System. When students' motivation increased, students will more likely to study and keep trying to solve the problem facing when study such as misconception. Therefore, the misconception of Solar System can be solved.

## V. CONCLUSION

The findings of this study shows that Scratch application can increase students' achievement towards topic Solar System. The use of the Scratch application is very effective for students. The application of Scratch is able to help students to understand teaching and learning more clearly and effectively. Besides, based on the findings, Scratch application can increase students' motivation


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towards topic Solar System. The images and animations in Scratch application help increase students' motivation towards science. Therefore, teachers are encouraged to use Scratch application in classroom. However, many teachers don't know what is Scratch and don't know how to use it for coding games and animation. Thus, Ministry of Education Malaysia can collaborate with Institusi Pengajian Tinggi Awam (IPTA) to organise workshop or give briefing to let teachers to learn how to code animation and games by using Scratch application.

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