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# INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES



## The Application of 'Role Play' in Teaching Stem Subjects

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### Abstract

The purpose of this paper is to examine the problems faced by students of the Science Stream focusing on one of the subjects in STEM, Biology. This study was implemented during "Program Perintis Guru 2" on January 2019 to February 2019. The study was carried out a total of 16 students of 4 Enggang 1, SMK Padang Enggang and a teacher was involved in this study. Initial reviews were conducted through verbal quizzes on teaching and learning sessions as well as subject teacher interviews. The results show that students faced difficulties in understanding and remembering topics because they were unable to imagine the shape or process of a cell. The students were exposed to theatre games during an hour of teaching and learning sessions and the study was conducted for 4 weeks. The results indicated that the application of 'role play' in teaching stem subjects through verbal quizzes at the end of teaching and learning sessions and before the next teaching and learning sessions, showed an increase in performance amongst students.

### Introduction

The areas of STEM provides an opportunity for students to conquer 21st century skills including inquiry, dialogue, creativity, and critical thinking by learning (MOE, 2013) that uses Science, Technology, Engineering and Mathematics as access points. Malaysia is facing some challenges in education from globalisation, liberalisation and information and communication technologies development in the 21<sup>st</sup> century. Revolution Industry 4.0 aims for 90% of world population to own smart phones and have access to internet by 2025 and beyond (World Economic Forum, 2015). Thus, it is common that most students have access, know how to access and own their own smart electronic devices to socialize and get information but although this is so, the level of education is below the standard of achievement. The Ministry of Education aims to provide all Malaysian citizens with equal access to education that from highly-skilled, knowledgeable, and united Malaysians. STEM is introduced in order to fulfil the blueprint whereby students are trained in problem-solving, embrace collaboration, take thoughtful risk, engage in experiential learning and work through the creative process. The

researchers would like to apply a part of theatre games known as role play in aiding in STEM subjects to help students in the learning process. Role play can be the eye opener for students, as well as spark student's interest in STEM subjects.

According to Benjamin Cuff (2017), students nowadays are not interested in science based subjects as the percentage of students who are in science stream keeps declining each and every year, not just in Malaysia but nationwide. In 2018 STPM, there were only 4,566 students who took science subjects compared to the year before whereby there were 5,475 students (Chin, 2019). According to Mazslee Malik (2019) only 44% of Malaysian students were in science streams in 2018 compared to 48% in 2012. The interest in choosing science stream amongst Malaysian students is decreasing each year as according to Bambang Sumintono (2015) science subjects are difficult, resulting in poor performance of the subjects.

Students are not interested in STEM subjects because they lack motivation. Students claim that they do not understand the process and structure of the subjects' syllabus because it's difficult for them (A. Benjamin Etobro & O. Emmanuel Fabinu, 2017) as they cannot deduce the process and structure of the subject. In the case of Biology, it can be tricky as it consists of small particles, cells or cells' organelles and each of them carry different characteristics functions and there is a lot of content to be considered in biology. Action and consideration in education is needed (Hadiprayitno, Muhlis & Kusmiyati, 2019) as in the year 2020 science stream subject or STEM subject will be an elective subject (MOE, 2013). Thus, to increase the percentage of students choosing STEM subject to keep the Fourth Industrial Revolution in track, technique 'role play' in theatre should be applied in teaching and learning session. Role play provides an enjoyable learning environment if applied correctly and brain chemical transmitters react to the comfort level and influence information transmission and storage in brain (Willis, 2007). The research was aimed at to identify and overcome the problems faced by students of Science Stream concerning STEM subjects. The researchers were also looking into determining the effectiveness of role play in teaching STEM subjects focusing on Form 4 Biology. The research was also conducted to motivate students to choose Biology as a STEM subject. The researchers looked into what is role play and how it can be applied in teaching and learning sessions.

### **Literature Review**

STEM or Science, Technology, Engineering and Mathematics areas are one of the new implementation in education system (Gossart, 2019)(Trachta, 2018), to produce graduates who acquire moral and knowledgeable characteristics that consist of spirituality, leadership skills, national identity, language proficiency, thinking skills and knowledge (Jamaludin, 2018). According to Bambang Sumintono (2015) science subject is difficult and STEM are basically pure science subjects. STEM subjects consist of a lot of concepts, topics and facts that students have to learn and remember, making it hard for the students to study (Cimer, 2004)(Zeidan, 2010)(Cimer, 2012). Furthermore, Education Minister Dr Maszlee Malik mentioned that despite STEM-related positions being among the top emerging jobs, the number of Malaysians students in STEM stream dropped by 4% in 2018 compared to 2012 ("Interest in science continues to drop", 2019) this would be a problem for the industry in achieving IR 4.0. Facing the fourth industrial revolution, supports in STEM amongst the youth is the way to lead changes in challenging work landscape (Trisha, 2019).

Currently Malaysian education system had been exposed and promoted to STEM but it is not enough for making fourth industry revolution into reality and according to Dr Maszlee Malik STEAM will be a better approach towards it (Ibrahim, 2019). Thus, in the year 2020 there are

no more science stream, STEM subjects will be an elective subject as well as arts (MOE,2013), students can plan and choose the subjects as they wish. According to Professor Datuk Dr Ahmad Ibrahim (2019) inculcating future citizens with the skills encapsulated under STEM, which incorporates the arts and reading, is a better bet in making a success of the United Nations Sustainable Development Goals, SDGs. In order to nurture STEM subjects amongst students, teaching and learning techniques should be upgraded (Rajaendram, 2018)(Cimer, 2012). The teaching and learning environment should not only be active but deeply engaging for students where they have the potential to lead the activity and this is exactly what role play activities does in class (Smith, 2015) (Rashid & Qaisar, 2017). The Cambridge Dictionary 2019 states that role play is pretending to be someone else, especially as part of learning new skills. The act of imitating the character and behaviour of someone who is different from yourself as a training exercise derives a great deal of enjoyment and satisfaction (Francis, 2002). Role play is a product of 'play', 'games' and 'simulation' not just tied to drama performance (McSharry & Jones, 2000) more as exercise and effective in reaching learning outcomes in three major learning domains: affective, cognitive, and behavioral (Hidayati & Pardjono, 2018).

Role play can be divided into three types: fully scripted role play, semi-scripted role play and non-scripted role play (Krebt, 2017). Role play give an enjoyable situation, promotes interaction in the classroom and increases motivation (Ladousse, 1995) if applied correctly and brain chemical transmitters react to the comfort level and influence information transmission and storage in brain (Willis, 2007). Role play will involve a lot of psychomotor movement and it give effect like exercise (McSharry & Jones, 2000) exercises give endorphins, a happy hormone. Happy is emotion, emotions can influence memories (Öhman & Mineka, 2001) so doing role play make it easy for students to remember (Gray, 2016). Role play is one of the strategies to reduce stress and build a positive emotional environment, so students can learn more efficiently at higher levels of cognition (Willis, 2007) (Gray, 2016).

Besides, the application of theatre touch in education will entrenched in students long-term memories (Christopher & Simms, 2017)and Zacharoula Smyrniou et al. (2017) also agree with this statement said the combination of verbal expression, body movements and emotional involvement helps in creation of cognitive shapes. Furthermore, applying role play in education leads to longer learning process that indirectly promote not just critical thinking dispositions but also problem-solving skills, decision-making skills, communication skills, team building, and leadership skills (Rashid & Qaisar, 2017) (Hidayati & Pardjono, 2018) (Krebt, 2017) because the students will think and discuss among them to plan what are the suitable way to deliver the topics they got. According to Christopher Davidson and Simms (2017) theatre touch in teaching also can grow enthusiasm about STEM field thus, automatically words will spread and motivates other students to choose Biology one of STEM subject in school.

... The role of the teacher is to create a climate of freedom and trust among the participants, while it is important to have defined the duration of the game from the beginning (Erturk, 2015),

According to Erturk (2015), role-playing games are an active method that can be used by the teacher in the context of distance education. The goal of learning design is to help create educational settings and sessions that are learner and activity centered. Authentic learning activities can better engage learners. Role playing is an interesting example of an active learning and teaching strategy. It can incorporate drama, simulations, games, and demonstrations of real life cases related to any topic. This strategy has been applied recently

(from 2013 through 2015) in a New Zealand tertiary institution, in a systems analysis and design course within the computing and information technology bachelor's degree programme. Learning design plans were prepared with the expectation that role play activities would contribute positively to this course.

### **Methodology**

In this study, the researcher used qualitative methods to collect the data. The data collected are non-numerical data and interpretation of interviews and observations. During this study a Biology teacher and few form 4 students had been interviewed informally. These respondents are from Sekolah Menengah Kebangsaan Padang Enggang, Kota Bharu, Kelantan.

### **Observation**

Observation of the teaching techniques on subject teachers and student behaviours during the teaching and learning sessions conducted on 16 students of Form 4 Enggang 1. Two observations of the teaching and learning sessions during the same week had been done. The lesson that was carried out was Form 4 Biology, Chapter 2 Part1 – Cell Structure.

### **Interviews**

Interview sessions of the Biology Teacher were first conducted to identify the level of student acceptance in his teaching and learning session. Group interviews with students were also conducted to seek clarification from both parties on biology teaching and learning sessions. The interviews were conducted pre and post. Pre interview were conducted once before the implementation of role play and post interviews were conducted after the teaching and learning session that applied role play.

### **Data Analysis**

#### **Open-Ended Question in Informal Pre-Interview Session**

In this session, interviewed of the respondents were conducted

Respondent 1

Question: How was the students' performance in class during teaching and learning session?

Answer: They were quite slow in learning. They keep saying they understand everything I teach but when I ask questions they cannot answer it. Some of them can but most of them have no idea what they had learnt so I have to teach in a slower mode that usual.

Question: Can you define slower mode?

Answer: I cannot finish what I planned to teach in my Lesson Plan as I need to follow the students' understanding, if they cannot understand I have to explain to them in other way to make they understand. There are some PAK21, 21<sup>st</sup> Century Learning Activities but it is only written in the Lesson Plan but I do not usually follow it because it is time consuming and the students cannot adapt very well with PAK21.

Question: So students have problems in understanding the content or memorising it?

Answer: Since the students have problems in understanding, thus they will have problems in memorising the content. I often ask students before and after teaching and learning session but most of them just sit in silence, some try to answer but they provide the wrong answer. There are certain students that provide the correct answer but it is always the same student.

Respondent 2, 3 and 4

Question: How was the teacher's performance during class? How was the teaching and learning session in class?

Answer:

Respondent 2: It was quite boring.

Respondent 3 and 4: yes.

Respondent 4: He uses "Chalk and Talk" so it bores us.

Respondent 3: Mr S is sporting while teaching but somehow we lose interest during the class .

Respondent 2: Yes. So do I. I feel the same. Sometimes I even sleep in class.

Question: Are the STEM subjects difficult for you?

Answer:

Respondent 2, 3 and 4: Yes

Respondent 3: It is really difficult.

Respondent 2: Especially Biology. It is difficult for most of us compared to Chemistry and Physics.

Respondent 4: I wanted to change to go to take up accounts but this school does not offer any account subject. I'm good at mathematics so I am able to perform in Physics.



Question: Have you ever heard of 21<sup>st</sup> Century Learning Activities, PAK21?

Answer:

Respondent 2, 3 and 4: No.

Question: Have you ever heard of role play before?

Answer:

Respondent 2, 3 and 4: No

Question: Has your teacher ever done activities in class that involves discussion between your classmates in pairs or in a group? Or has your teacher asked you to do group work and present it in class?

Answer:

Respondent 2, 3 and 4: Ohh that.

Respondent 3: We used to do that activities but not so much.

Respondent 4: So that is what we called PAK21 now I remember.

Respondent 2: But our teacher does not do the activity often, I don't know why.

Respondent 3: He has done it twice. I was basically sharing our ideas with a partner but we were not able to carry out the activity as we did not understand what was taught.

### Open-Ended Question in Informal Post-Interview Session

In this session, interviews of the respondents were conducted

Respondent 2, 3 and 4

Question: How was the teacher's performance during class? How was the teaching and learning session in class?

Answer:

Respondent 2, 3 and 4: Good.

Respondent 2: It was better than before.

Respondent 4: Yes. I never been in such a happening class.

Respondent 3: The learning was made easy.

Respondent 2 and 4: Yes teacher, exactly.

Respondent 2: I have never done this before so I felt shy but it was awesome.

Question: Is the STEM subject hard for you?

Answer:

Respondent 2, 3 and 4: Yes, but not really.

Respondent 3: If it was executed correctly it is not as hard as it seems. It is only hard because we don't know the easy way to understand the lesson.

Respondent 2: I never thought we can take the role of organelles, I mean I have never acted before and was shy but the teacher's encouragement helped.

Respondent 4: Yes. I never thought learning Biology can be so adventurous.

Question: Have you ever heard of 21<sup>st</sup> Century Learning Activities, PAK21?

Answer:

Respondent 2, 3 and 4: Yes.

Question: Have you ever heard of role play before?

Answer:

Respondent 2, 3 and 4: Yes.

Respondent 4: We did it in class today.

Question: What do you think of role play?

Answer:

Respondent 2, 3 and 4: Great.

Respondent 3: We enjoy doing all the activities.

Respondent 4: At first I was confused when the teacher told us about it. I thought it was acting with script.

Respondent 2: Yes, I also thought so.

Respondent 4: I don't know how to act.

Respondent 3: But when the teacher explained it then I can understand that we do not have to act but there are a lot of roles that we play. That is why my group and I decided to do puppet. It was easier for us to talk behind the table.

Respondent 2: I agree with you.

Question: So do you think role play helps you in learning if it is applied to all STEM subjects?

Answer:

Respondent 3: I don't know about maths but for other STEM subjects, it definitely helps in understanding the content effectively.

Respondent 2: I am sure teachers will figure out how to apply this role play in maths respondent 3.

Respondent 4: Yes I agree with respondent 2 just like this subject, teacher made it applicable to role play with Fluid Mosaic Model and the rest of the chapter like osmosis in few versions of role play.

Respondent 3: So far Biology, Chemistry and Physics needs to apply theatre games like this to help us get energetic in class or else we will get sleepy and for sure we will sleep.

Respondent 2: Besides, I think we can remember activities like this even more during exam because I still remember how the guy that acted as protein walked like a pregnant lady with his bag in front but he could not enter the phospholipid bilayer because of the size of protein is too big to diffuse between the lipids.

Respondent 4: Yes. I remember it also. We also used almost all of our senses.

Question: Since you find this activity helpful, do you think it would motivate students to choose STEM subjects?

Answer:

Respondent 2: Definitely.

Respondent 3: I will spread the word. I heard from my seniors that STEM is difficult.



Respondent 4: Exactly. That is one of the reason I wanted to change to account stream.

Question: How about now? Do you still want to change to account stream?

Answer:

Respondent 4: Not anymore because I like science stream now.

Respondent 2: I like science stream.

Respondent 3: Agreed.

### **Observation**

Form the observation during the teaching and learning session of the subject teacher, students are always quiet when asked questions. Students do not seem to know and do not remember what they just learned. The “Chalk and Talk” technique used by the subject teacher did not attract the students. Teacher also often asks students to copy a table containing a syllabus that has been summarized as a note. This table is helpful for students to refer to, however, students cannot fully understand what is being learned. During the teaching and learning session using role play, the students enjoyed themselves and were energetic in class. The students were also able to relate to the learning objectives of each syllabus.

### **Discussion**

Based on the observation of teaching and learning session before applying the role play technique, students are less interested in learning especially the male students. They only hear and copy notes, but the look on their faces indicate disinterest. Role play involves psychomotor, so pupils will move around indirectly and will not feel sleepy, so students can concentrate. In addition, this activity can help students understand better the diffusion process and functions of the molecules involved as students need to study the characters before role playing. Based on the observations after the study was conducted on the target group, students were more focused during each teaching and learning session. The Learning outcomes of each topic or subtopic were asked after each session to ensure that the techniques applied are effective. Besides, students can easily explain each process as they engaged in each process through role play. Positive responses were received from students and teachers of the subject. Students had better understanding and claimed how easy it is to remember the process because of the role play activities. Students were able to imagine each process and integrate it with everyday life. Students also showed an understanding of the process when some of them were able to state the continuation of the process although it is not included in their syllabus.

### **Conclusion**

Role-play is a pedagogy used in a wide variety of contexts and content areas. The guidelines for the role-play are usually modelled on realistic criteria, so the students can get as close to the real thing as possible. Research on role-play’s effectiveness and best practices exist as far back as the 1970s; recently, however, role-play has been touted as a better-suited tool for the needs of today’s college student than more traditional teaching methods. Role-play has been shown to be effective in reaching learning outcomes in three major learning domains: affective, cognitive, and behavioural. By making students take on the role of another person,

they practice empathy and perspective taking. It can lead to more self-reflection and awareness on the part of the student.

This pedagogical tool has been used in various fields. Numerous studies have reported that role-play has positive effects for students' learning; for example, the method provided the opportunity to get a deeper understanding of an issue and stimulated further interest in the subject. Aspegren's literature review on how medical student best learning communication skills revealed that an experiential training produced much better results than a simple one-way instruction. The use of role-playing has been shown to be better preparation for teachers and construction managers. Not only increasing student engagement, it also increases their knowledge retention.

The role-playing pedagogy succeeded to improve student learning achievement in the learning models. The students' response to the implementation of role-playing was that it was easy to understand and to be applied in the learning process. It has flexibility for implemented in school. It accelerated the student's understanding of learning materials, it trained the students' independence and responsibility as an agent of learning, it trained awareness to others and it trained the students as a prospective teacher. Thus through this branch one can explore the variety of points of views while sharpening their movement and mind by travelling to any location even microscopic region in this case. One of the student pretended to be a ribosome, the smallest organelle in a cell with the size of 20 nanometre or 20 x 10<sup>-12</sup> meter and was able to play the part successfully.

This study enhances the relationship between role play and that of STEM subjects giving importance to the subject of Biology. The study has shown that theatre precisely role play can involve a student to participate and understand a subject that is deemed difficult. The study is significant as it integrates other related concepts such as developing students' ability to comprehend a lesson in a fun way. As such it adds to the existing knowledge that 21st century teaching and learning require theatre games to evoke interest in the subject learned, namely Biology.

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