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Effectiveness of Role-Play Methods on Performance, Interest, and Motivation in Biology: A Study of Form 4 and 5 Pupils in Public Schools

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Abstract

Teaching techniques and approaches comprise the tools that teachers utilise to enhance student's learning and help them gain skills and knowledge. As part of a teaching strategy called role-playing, students choose roles and act out scenarios to improve their understanding of a subject or enhance their abilities. This approach works especially well to foster critical thinking, interpersonal skills, and active learning. Integrating role-play into a biology classroom can be an effective way to make the subject more engaging and practical for students. The aim of this study is to scrutinise the effectiveness of role play teaching method on students' interest, motivation, and their performance in biology-based topic. This study involved 12 students in a school located in Klang Valley, Shah Alam by using purposive sampling technique. The instruments of the study used are lesson plan, quiz, and questionnaire. The results are obtained through SPSS. The findings of the study showed that there is no significant difference in students' performance after the implementation of role-play. However, there is a significant difference in students' interest as well as motivation after the implementation of role-play teaching method. In addition, the study also found that there is a slight difference in the performance of the low-ability students. Based on the results obtained, it can be concluded that role-play teaching method is an effective teaching method in the 21st century. This study recommends this method to be implemented more in schools not just for biology subjects, but also for all suitable subjects.

Keywords: Biology-Based Topic, Role-Play, Student, Teaching

Introduction

At each stage of the education system, various factors exert an influence on both students and teachers. The teacher's ability to capture students' attention, choose effective pedagogical approaches, and manage the learning process significantly impacts students' academic achievement and motivation. At the secondary level, Biology poses a challenge due to the necessity of memorizing complex terminologies. Thus, fostering success and motivation in learning biology requires a keen awareness of students' attitudes (Daniel, Msambwa, Antony & Wan, 2024).

Research indicates that role-playing enhances students' learning experiences in multiple ways. This technique allows students to explore real-world scenarios, gain practical experience, and test different strategies in a secure environment (Syarul & Sumathi, 2021)

Despite the resumption of operations in the majority of schools after the COVID-19 interruption, education management continues to assess the damage and lessons learned (Bozkurt, Jung, Xiao, Vladimirschi, Schuwer, Egorov & Paskevicius, 2020). Data from Liberia reveals that 43% of pupils in public schools did not return when classes resumed in December 2020. In an article, presents evidence explaining the reasons behind students' drop out or reluctance to return to school (UNICEF,2022). Significant improvements are required in applying learning methods to students to promote achievement through effective strategies and enhance comprehension of the taught. Role play emerges as an approach to encourage student cooperation, and support, and make the classroom more engaging content (González-Pérez, & Ramírez-Montoya, 2022).

The study aims to examine the effectiveness of role-play on the performance, interests, and motivation of Form 4 or 5 pupils in governmental schools. Additionally, it will assess the effectiveness of role-play methods for both higher-ability and regular students, considering both positive and negative effects. The results can contribute to education administration by suggesting role play as a teaching strategy. Subsequent studies should explore various subjects beyond literature to expand the research scope. The following research questions guide the present study:

1. Does the use of role-play methods improve students' performance in biology?
2. Is there an effect on students' interest and motivation before and after implementing role-play methods in biology?
3. Do role-play methods have any effect on different levels of students' ability in class?

Literature Review

Learning Biology

Students studying biology should gain a solid understanding of what biology is and how it is conducted, in addition to learning fundamental concepts. Creating instructional strategies that help students learn and giving them the chance to 'do' biology is crucial (Reiss, 2021). According to a data analysis from research conducted by Çimer (2011), it was mentioned that students think one of the reasons why biology is very difficult to study is the requirement for extensive memorization and the teaching style of biology instructors. Typically, biology teachers choose to use primarily traditional teaching methods (Yaman & Soran, 2000). This emphasizes the need for modern biology teachers to develop effective teaching approaches, including the use of innovative methods such as role-play.

A Good Teaching Method

The key is assisting students in connecting the lesson's material to their personal experiences, which includes using existing knowledge to understand new concepts (Le Pichon, Wattar, Naji, Cha, Jia, & Tariq, 2024). To prevent students from becoming bored in class, teachers must vary their teaching methods. A related study was conducted by Ahmed Awad Amin Mahmoud Raba (Raba, 2009), who was employed in English teaching in Saudi Arabia and Jordan. His research supports and strengthens this theoretical data. In his study, he utilized a 25-item

questionnaire to gauge teachers' opinions on how successful teaching methods result in quick and efficient learning.

Role-Play Method of Teaching

A previous study was conducted to assess the effectiveness of the role-play teaching method, involving 16 students from 4 Enggang 1, SMK Padang Enggang, and a teacher who participated in the study. Students' performance improved after the teaching and learning sessions, and this improvement was sustained before the subsequent teaching and learning sessions. In one instance of the role-play teaching method, a student portrayed the role of a ribosome, the tiniest organelle in a cell measuring 20 nanometers or 20 x 10 -12 meters, and the activity was deemed successful.

Another research study was conducted on the effectiveness of using role-playing techniques with education science students to help them comprehend the notion of 'the process of cell division' by (Wulandari, 2018). The results show that their collaboration in producing a quality play for the audiences and viewers has successfully driven them to meet the learning objectives.

Another significant study was conducted by Azlina and Raj (2021), where Form 4 Biology, Chapter 2 Part 1, focusing on Cell Structure, served as the lesson to implement the role-play method. To gain insights from both parties on biology teaching and learning sessions, group interviews with students were also conducted. The outcomes from the interviews revealed that one student expressed*, 'I think we can remember activities like this even more during exams 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 the size of the protein is too big to diffuse between the lipids.'* This statement highlights the significant impact the role-play method can have on students.

Benefits of Role-Play Method of Teaching

A previous study was conducted to examine the correlation of implementing the role-play method on biology topics. The research took place in April 2017, utilizing a pre-experimental design with descriptive and quantitative methods. It was revealed that students' learning outcomes improved following the post-test, which was administered after the application of the role-playing technique. Due to the role-playing exercises (Steiner, Dray, Ulloa, Garcia, & Ghazoul ,2020), students claimed to have gained a deeper understanding of the process, finding it simpler to remember.

Role-Play Methods of Motivation

A study by Stevens (2015), highlights that role-play can enhance students' critical reading skills, particularly when textual documents are used as preparatory materials. The research noted that students, especially in their first year of university, often struggle to approach texts analytically. For example, first-year history students in the UK tend to rely on textbooks rather than engaging with primary sources, finding the latter "difficult to read," "boring," or unclear regarding their purpose. This preference for textbooks over primary sources reflects a lack of analytical reading skills and a reluctance to take an active role in learning. This finding is supported by Rashid and Qaisar (2017), investigated its effectiveness in skill development through experimental studies, and Krebt (2017), who argued that role-play enables students

to express their opinions, thoughts, and language skills at their level, acting out situations based on their understanding. Role-playing encourages active participation and critical thinking, motivating students to engage with learning materials more deeply.

Method

Research Design

This study employed a two-group pretest/posttest experimental design, using quantitative and methods to analyze the data collected to address the research questions. The analysis involves two subsets: According to (Rogers & Revesz, 2019), pre-experimental design and post-experimental design. The pre-test ensures group compatibility before treatment, while the post-test evaluates immediate effects on the end variable.

Pre-Test

The students will be taking a pre-test before beginning the treatments to determine their level of knowledge of the topic being taught traditionally. The test is a multiple-choice test with 5 questions and 5 short answer questions.

Treatment

During the treatment, the same group of students will be undergoing the treatment where the same topic is carried out but with a role-play method of teaching. The process is, 1. a scenario is prepared by the teacher, 2. the teacher divides the class into groups of mixed ability students, 3. the teacher uses the role-playing method to demonstrate the lesson to the students as intervention for about 20 minutes, 4. the students will follow the instructions to go along with the role-playing and at the same time learning the lesson and 5. teacher gives feedback to the students.

Post-Test

After the treatment, the researcher administered a multiple-choice post-exam to the students. The test had 10 questions, 5 of which were multiple-choice questions and 5 were short answer questions. The post-test test is identical to the pre-test test, but the questions are different. The researcher administered the post-test to determine whether the treatment was effective and whether the post-test result was superior to the pre-test result.

Participant of the Study

The participants involved secondary school (n = 12) science stream (biology) form students. Purposive sampling was applied to select 12 students (7 males and 5 females) from the biology form 4 class. The inclusion criteria were: (1) 16 years of age (2) taking Biology subject (3) signed informed consent (4) participates in pre-test and post-test of the research.

Research Instruments

Quizzes

Quizzes will be administered both before and after implementing the role-play method to assess students' prior knowledge and measure any significant differences in its effectiveness as a teaching method. The quiz, comprising 20 questions (15 multiple-choice and 5 short-answer questions), will focus exclusively on cell division from form 4 Biology. All study participants will complete the quiz.

Questionnaire

According to Fife-Schaw (2020), a questionnaire is defined as a tool where respondents mark objects or provide written answers to express their responses. In this study, the researcher utilizes a questionnaire for effective data collection and organization. The questionnaire comprises exclusively closed-ended inquiries, allowing participants a single response option. With 21 questions, excluding the initial section on demographic backgrounds, it is categorized into four sections: A, B, C, and D. Section A addresses demographic information such as student name, gender, and preferred teaching method. Section B explores students' interests in role-play, while Section C assesses the effectiveness of role-playing. Responses in Sections B and C are rated on a Likert Scale (1 to 5), representing "Strongly Disagree," "Disagree," "Moderate Disagree," "Agree," and "Strongly Agree," respectively. Finally, Section D investigates students' motivation and interest in role-playing.

Teaching Aids

As per Ordu (2021), teachers utilize teaching aids to enhance classroom instruction, captivate students' attention, and foster learning motivation. Teaching aids encompass tools and equipment employed to support in-class learning and stimulate student interest. This study incorporates a control group undergoing traditional teaching methods and an experimental group engaged in role-play teaching, necessitating two types of teaching aids. Traditional teaching relies on textbooks and models for improved comprehension, with model examples provided in the appendix. In contrast, role-play involves the use of flashcards, ropes, and other materials tailored to specific cell division topics, aiming to engage students and observe if there is a significant difference in teaching materials.

Lesson Plan

Lesson plans are crucial tools aiding teachers in navigating the learning process, with students' assimilation, learning, and performance goals forming the plan's foundation (William & Mary School of Education, 2022). The DSKP, also known as the Standards-based Curriculum and Assessment Document, underpins all information within the lesson plan. To ensure the successful implementation of the role-playing method, the researcher develops a lesson plan for a specific subtopic in Biology. Among both teachers and students, lesson planning promotes a sense of control, security, and confidence. Additionally, it contributes to time management, creativity, and strengthens relationships within the teaching team. An illustrative example of a lesson plan will be provided in the appendix section.

Data Gathering Procedures

Table 1

Data Procedures

Pre-test:
The students will be taking a pre-test before beginning the implementation to determine their level of knowledge. The examination consists of a multiple-choice and short answers question. The pre-test is in the form of paper. Students will answer the question in each time frame. Teacher will collect the paper back for further observation. After the pre-test, the students will answer a questionnaire.
Treatment:
The Role Play Method is used to handle the sample. Meetings will be held to administer the treatments. Students will perform the role-playing after briefing and the teacher will teach the topic chosen through this role-play method.
Post-test:
To determine the pupils' understanding, a post-test will be given following the treatment. It is used to evaluate the effects of the interventions and to ascertain whether the Role Play Method was successful in enhancing the motivation, interest, and performance of the pupils. The quiz's questions will be the same format but different questions. After the students have taken the quiz, the students will be answering a questionnaire to evaluate their motivation and interest level after the role-play teaching method is being implemented. The questionnaire will also be paper based. After answering it, teacher will collect the data for further observation.

Data Analysis

Data analysis, as described by (Lester & Lochmiller, 2020) involves a systematic examination and organization of data to enhance comprehension and presentation of findings. The study's data analysis included the following steps: 1. Identifying students' motivation and interests through questionnaire responses. 2. Categorizing student responses. 3. Describing questionnaire findings related to students' motivation and interest in learning biology through role-play. 4. Deriving conclusions from the analysis, which incorporated calculating means and standard deviations using the Statistical Packages for Social Sciences (SPSS) application.

Table 2
Data Analysis

Research Objective	Research Question	Instrument	Analysis
To find whether teaching biology topics using role play methods improve students' performance in biology.	Does using role play methods improve the student's performance in biology?	Quiz	Paired sample T- Test
To study the students' interest and motivation before and after implementing role play methods in a chosen biology topic.	Is there an effect on students' interest and motivation after implementing the role play methods in biology?	Questionnaire	Paired sample T- Test
To analyse the effectiveness of using role play methods on different levels of student's ability in class.	Do role play methods have any effect on different levels of students' ability in class?	Quiz and Questionnaire	Paired sample T-test

Results

Students' Performance After Teaching Biology Topics Using Role-Play Method

The pretest and posttest were used to assess students' performance before and after exposure to the role-play teaching method. Table 1 presents a summary of the descriptive statistics derived from the pretest and posttest results administered to the students, which are relevant to the first research question.

Table 3
Students' performance after teaching biology topics using role-play method

Test	Mean	N	Std. Deviation	Std. Error Mean
Pre-Test	8.67	12	1.670	.482
Post-Test	8.33	12	1.320	.381

Table 3 indicates that the mean scores before and after the implementation of the role-play teaching method were nearly identical. However, the results suggest that students exhibited a better understanding when taught using traditional methods (mean = 8.67, SD = 1.670). Following the introduction of the role-play teaching method, the mean score decreased compared to the pre-test (mean = 8.33, SD = 1.320).

Test of Significant Difference between Students' Pretest and Posttest Mean Score in the Role-Play Teaching Method.

A paired sample T-test was employed to ascertain if a significant difference between the mean scores of the pretest and posttest. Table 2 presents the results of the paired sample T-test.

Table 4

Test of Significant Difference Between Students' Pretest and Posttest Mean Score in the Role-Play Teaching Method

Test	Mean	Std. Deviation	Lower	Upper	t	df	Sig. (2 tailed)
Pre-Test – Post-Test	.333	1.813	-.8.19	1.485	.637	11	.537

Table 4 indicates that the p-value more than the 0.05 level of significance. Thus, it can be concluded that there is no significant difference in students' understanding for all tests before and after the implementation of the role-play teaching method. Consequently, it cannot be said that the role-play method enhances students' understanding of Biology topics.

Effect on Students' Interest and Motivation before and after Implementing the Role Play Methods in Biology

To determine the students' engagement in learning Biology before and after the exposure of Role-Play teaching method, a questionnaire was administered among the students. The engagement score of students in the pre and post-test in each factor was individually analyzed, which corresponds to the second research question.

Table 5

The Pretest and Posttest Mean Score Interest before and after the implementation of role-play teaching method.

	Mean	N	Std. Deviation	Std. Error Mean
Interest before the implementation of role-play teaching method	2.36	12	.579	.167
Interest after the implementation of role-play teaching method	4.30	12	.325	.094

Table 5 shows the Pretest and Posttest mean score interest before and after the implementation of role-play teaching method. The results imply that students can improve their interest towards learning biology after they learned it using role-play teaching method.

Table 6

The Pretest and Posttest Mean Score Motivation before and after the implementation of role-play teaching method.

	Mean	N	Std. Deviation	Std. Error Mean
Motivation before the implementation of role-play teaching method	2.30	12	.450	.130
Motivation after the implementation of role-play teaching method	4.30	12	.325	.094

Table 6 shows the Pretest and Posttest mean score for motivation before and after the implementation of role-play teaching method. The results imply that students can improve their motivation towards learning biology after they learned it using role-play teaching methods.

Test of Significant Difference between Students' Pretest and Posttest Mean Score in the Role-Play Teaching Method

The mean score of each factor in the engagement of pretest and posttest were analysed using the paired sample T-test to determine the significant differences between the questionnaire scores which correspond to the second research question.

Table 7

A paired sample T-test was used to determine whether there was a significant difference between the pretest and posttest mean scores.

Factor	Posttest Mean	Pretest Mean	df	*t*-value	*p*-value	Remark
Interest	4.30	2.36	11	-9.517	.001	Significant
Motivation	4.30	2.30	11	-12.716	.001	Significant

Table 7 shows that the overall computed p-value is less than the 0.05 level of significance. Therefore, there is a significant difference between the student's pretest and posttest mean scores in the two factors of engagement (interest, and motivation) before and after exposure to ther role-play method of teaching. These findings indicate that role-play has a significant effect on improving students' engagement in Biology.

Effectiveness of Using Role-Play Method of Teaching

To determine the effectiveness of learning Biology before and after the exposure of Role-Play teaching method, a questionnaire was administered among the students. The engagement score of students in the pre and post-test in each factor was individually analyzed, which corresponds to the third and last research question.

Table 8

The Pretest and Posttest Mean Score Efficacy before and after the implementation of role-play teaching method.

	Mean	N	Std. Deviation	Std. Error Mean
Effectiveness before the implementation of role-play teaching method	2.54	12	.499	.144
Effectiveness after the implementation of role-play teaching method	4.29	12	.431	.124

Table 8 shows the Pretest and Posttest mean score for the effectiveness before and after the implementation of role-play teaching method. The results imply that learning biology after they learned it using role-play teaching methods is effective.

Table 9
The Pretest and Posttest Mean Score Efficacy before and after the implementation of role-play teaching method on different level of ability.

	Mean	N	Std. Deviation	Std. Error Mean
Pre-Test (High ability))	10.000	4	.000	.000
Post-Test (High ability)	8.750	4	1.323	.661
Pre-Test (Average)	9.000	4	.000	.000
Post-Test (Average)	8.375	4	1.436	.718
Pre-Test (Low ability)	7.000	4	2.000	1.000
Post-Test (Low ability)	7.875	4	1.436	.718

Table 9 shows the Pretest and Posttest mean score for the effectiveness before and after the implementation of role-play teaching method on different level of ability in students. The results imply that the students have little or no interest in the role-play teaching method as they score better in the traditional method of teaching.

Discussion

The first research question concluded that there was no significant difference in understanding before and after the implementation of the role-play teaching method, suggesting limited improvement in students' performance on the chosen topic. Although test scores exhibited minimal variance between the pre-test and post-test, this does not definitively negate the effectiveness of role-playing as a teaching tool. Nonetheless, it is acknowledged that not all classes, students, or contexts may benefit equally from role-playing, and it is not a panacea for educational challenges (Donald, 2017). To contextualize of no differences in pre-test and post-test scores, the researcher considered the complexity of the topic chosen for role-play implementation within the Malaysian biology curriculum, which covers various intricate biological concepts. Research by Salleh et al (2021), about Difficult Topics in Biology from the Viewpoint of Students and Teachers based on KBSM Implementation has found a result perceived by students. The previous researcher, Dikmenli (2009) emphasized the utility of drawings in aiding students' comprehension of complex topics such as cell division, suggesting that visual aids can offer valuable insights into students' learning challenges. This is the process of learning that is developmental, and an instructor can encourage it. This is to justify that the participants were from school in a rural area. The school has just started to embrace technology and changes. The students were all more comfortable with “chalk and talk” method of teaching. However, the researcher who is also a teacher, need to put in a lot of time, patience, and effort to assist students comprehend that there is more to the process.

The second research question reveal a notable difference in students' interest and motivation before and after the application of the role-play teaching method in biology education. This suggests that students' engagement with biology improves following exposure to role-play techniques. Research by Akhtar et al (2022), and Okpala & Okigbo (2021), corroborates this,

demonstrating that students exhibit heightened interest when learning through role-play activities, perceiving them as competitive and engaging. Additionally, role-playing strategies foster motivation and proficiency among learners, promoting active participation, imaginative thinking, and improved retention rates (Keezahatta, 2020). Moreover, such methods enhance students' communication skills, boost self-confidence, and encourage critical thinking, contributing to their overall academic engagement and achievement (Alvarez. 2024). To further enhance biology education, according to (Hadiprayitno et.al, 2019), educators should explore dynamic teaching strategies and classroom management techniques, fostering an environment that stimulates students' interest and motivation in the subject.

The findings pertaining to the third research question indicate a significant difference in effectiveness following the implementation of the role-play teaching method, suggesting that students generally perceive it as an effective approach for learning biology. This is supported by Wulandari (2018) research on the use of role-playing strategies in science education, where students' active engagement with one another during role-playing sessions was observed to enhance the learning process. However, this effectiveness may not be uniformly experienced across students of different learning abilities. While low-ability students demonstrated a slight improvement in post-test scores, there was little to no discernible difference among high-ability and moderate-ability students. This finding aligns with the achievement goal theory, which suggests that high-ability students may exhibit performance-oriented mindsets and may not fully engage in role-playing exercises due to fear of failure or time constraints (Dweck, 1986).

The researcher asked one of the high ability students on their interest towards role-play method of teaching verbally, the student said that *"students frequently face significant workloads and may have distinct time priorities"*. The researcher concludes that it is possible that some intelligent students would rather communicate verbally through writing. Conversely, the social constructivist theory proposed by Vygotsky (1978) supports the notion that role-playing activities can benefit students with weaker academic skills by providing a socially rich environment for collaborative learning. Such activities can be tailored to match students' zone of proximal development, allowing them to practice problem-solving skills in a supportive setting conducive to cognitive growth. In this context, individual performance and traditional grading systems may hold less significance, fostering a more relaxed atmosphere where students feel less pressured. Additionally, low-ability students demonstrated positive engagement during role-playing activities, suggesting its potential as an inclusive and effective teaching approach. The researcher conclude that individual performance and grading may be less important in a role-playing environment. Students who might feel overburdened by traditional academic evaluations may feel less pressure in this more laid-back setting. It can also be seen that the lower ability students show positive feedback and engagement during the role-play activities.

Suggestion for Future Research

Utilizing role-playing techniques can improve both student interest and comprehension, yet it remains underutilized, particularly in rural areas. To address this gap, curriculum developers should provide instructional support, including materials and training, to assist teachers in integrating role-playing into their lessons, with specific attention given to biology teachers. Additionally, there's a need to explore potential disparities in outcomes between urban and

rural students when implementing these techniques. Research by Hou & Li (2022), underscores the influence of personal, familial, and socio-structural factors on students' educational expectations, suggesting the importance of understanding how diverse student backgrounds may influence their response to innovative teaching methods.

Conclusion

In conclusion, the findings demonstrate that the implementation of the role-play teaching method has a positive impact on biology students. While there was no significant difference observed in their understanding of the chapter between the pre-test and post-test, their interest, motivation, and the effectiveness of the role-play implementation yielded positive outcomes. Notably, the benefits of role-play encompass enhanced information retention, practical learning opportunities, active engagement, and the cultivation of critical thinking, cooperation, and communication skills. Moreover, role-playing exercises foster a positive attitude towards learning, particularly in challenging or abstract subjects. Although this study did not reveal significant evidence regarding the effectiveness of the role-play teaching method across different levels of student ability, it remains an enjoyable and beneficial approach overall. Considering these findings, the role-playing method contributes to the creation of a comprehensive, student-centered learning environment. Its capacity to bridge academic concepts with real-world applications underscores its value as a valuable resource for educators seeking to cultivate stimulating and memorable learning experiences. Therefore, its adoption should be encouraged in all educational settings, regardless of socio-economic circumstances.

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