

## RESEARCH ARTICLE

## How does the Role-Playing Strategy Affect the Development of Interpretive Skills for Astronomical Phenomena among Fourth-Grade Female Students?

Asma Abd Alrahman Hawamdeh

Queen Rania Teacher Academy, Jordan

[hawamdehasma@yahoo.com](mailto:hawamdehasma@yahoo.com)

Projects and efforts to reform global science education have emphasized the importance of preparing a scientifically educated generation. The science teacher plays an important role in creating learning societies that foster the mental, social, and emotional values of learning science. Therefore, it is the responsibility of the science teacher to develop the skills of students in interpreting scientific phenomena and problem-solving to understand the surrounding world. The research was conducted on three independent study classes in 2018/2019 in Jordan. The data were collected using two worksheets, the interview tool, and a description of the learning process journal. The results showed a positive effect of role-playing on the development of the skill of interpreting the astronomical phenomena of the fourth-grade students when analyzing the results of the students on the worksheet. The strategy of role-playing has a positive role in developing the interpretive skills of the fourth-grade students by deepening the understanding of astronomical phenomena and addressing conceptual misunderstandings to develop interpretation skill.

**Keywords:** teaching science, the role-playing strategy, interpretive skill, astronomical phenomena

♦Received 15 June 2019 ♦ Revised 22 April 2020 ♦ Accepted 20 May 2020

### Introduction

Projects and efforts to reform global science education have focused on preparing a generation of scientifically educated people who can keep pace with rapid scientific and technological developments. The responsibility of science teachers is to build educational societies that reflect the scientific and emotional values of learning science in the social context. Therefore, Science teachers operate to develop students' scientific process skills of interpreting scientific phenomena, solving problems, furthermore understanding the world around them.

Back to the recommendations of Project 2061 (American Association for the Advancement of Science, 1990) and the new generation of science education standards that represents the global

reform map that defines the compass of science education globally, it unanimously emphasized the importance of developing students' interpersonal skills as one skill of complementary science processes that reflect the entrance constructive in the activities of mind and hands-on. Interpretation skill expresses the ability to relate cause to result, to understand the phenomenon or problem at hand (Idiege and Nja and Ugwu, 2017). Based on the researcher's observations, students find it difficult to explain scientific phenomena. The student describes the phenomenon and cannot link the cause to the result, and therefore cannot suggest solutions, make a decision, or make generalizations. Education is a dynamic process (Bondie and Zushoe, 2018) that the teacher continuously shapes through various variables such as student and environment (physical and psychological). When applying science education strategies, the teacher should explore students' abilities, develop learning skills, and focus on achieving meaningful learning for students. This research paper aims to study the impact of the use of the role-playing strategy on development Interpretation of astronomical phenomena for fourth graders.

In this context, the research methodology based on the impact of using the role-playing strategy in the skill of scientific interpretation for 20 fourth-graders students in a public secondary school in Jerash, Jordan. This study took place during the second semester of the academic year 2018/2019. The study also limited to the psychometric properties of the study tools and procedures. The study procedure consisted of planning three educational sessions using the role-playing strategy. To collect the necessary data, the researcher applied various assessment tools as a single worksheet and the semi-formal interview and analyzed their implications in the record describing the learning process. Physical and psychological sources such as papers, colors, and online research are available along with mutual respect.

### Literature Review

While reviewing the educational literature on science education standards, the research focuses on the educational practices that a science teacher must take to provide students with the scientific culture and 21st-century skills. The role-playing strategy is theoretically related to social education models (Osuafor, 2011 and Ladousse, 1987). Osuafor (2011) explained that the role-playing strategy is an activity that represents the understanding (cognitive, psychological) of phenomena in the social context of the students. Therefore, the researcher notes that learning through work and living phenomenon reflects a sensory and rational engagement with the learning experience. Also, procedural representation shows learned habits and scientific thinking skills centered on the learner. Thus defining the strategy of performing role-playing as an educational activity that integrates cognitive skills with the emotional context of social learning in which the learner visualizes the scientific concept and represents it visually.

Many studies point to the importance of role-playing in effective science education. Jarvis et al. (2002) emphasize that role-playing strategy increases the student's understanding and interest in the scientific concept. Other studies also found a positive role of role-playing strategy in emotional development, communication skills, and scientific dialogue. Craciun (2010) noted that

it is a powerful tool in understanding complex scientific concepts. According to the researcher's educational experience, the important characteristics of the role-playing strategy derived from their ability to provide opportunities for concrete learning situations. In which the learner learns scientific concepts and adapts them in his cognitive structure to form strong mental and emotional connections in the two hemispheres of the brain. This strategy also provides students with procedural evidence regarding the importance of conceptual change to alternative or incomplete concepts. Learners can create convincing self-learning and stimulate the thinking process. Perhaps these practices increase students' motivation to learn and understand the world. The characteristics of the aforementioned role-playing strategy are consistent with the educational transition from the senses to the abstraction of fourth-grade students. Also, this strategy allows the teacher to engage shy students and increase their interaction with educational activities. Furthermore, these strategies constitute a development of the skill of scientific interpretation that enables the learner to relate the observations and information obtained logically by linking the cause to the result based on the laws and principles of science and personal sense.

Despite the benefits of this method, Küçüker (2004) believes that one of the most important challenges facing the teacher is a long time in preparation and implementation, but the role-playing strategy focuses on student-centered learning, so it needs the teacher more ability to guide and facilitate learning. The importance of the teacher role is planning the results and adapting them to the needs and capabilities of learners. Since the teacher will plan to develop imagination, awareness, attention, and thinking, the teacher should consider the simplicity of the language used in the texts to adapt it to the language level of learners.

Given the dramatic scientific nature of the role-playing strategy, this strategy consists of three main components: the teacher, the learner, and the educational content (Joyce, Will, and Calhoun, 2009). Jarvis et al. (2002) emphasized that the success of the teacher in achieving the integration of knowledge content with the needs of learners contributes to providing learners with the knowledge and skills necessary to deepen understanding. One of the most prominent advantages of the role-playing strategy is to give learners the confidence to present their ideas (Osuafor, 2011) by fostering debate between student viewers and actors. In this study, the researcher divides students into four groups that they can perform, watch, and change roles among themselves so that everyone can take part in learning. Learners first explore the principles of the scientific phenomenon and then plan its role and manner of presentation in an active social context. The role of the group is to provide information about the phenomenon and hints about how the strategies work, then prepare the performers and viewers to guide them to the points they will observe. Therefore, the teachers plan to work by facilitating the work of the group and individuals in terms of tools and equipment necessary and then represent the role and the work of educational steps to guide the observation of the viewers and then evaluate the main points and give for feedback. Finally, students share experiences and draw generalizations representation of the concepts.

Although the role-playing strategy has two main types: automatic and planned representation (Gray, 2004), the researcher applied for the planned role because of the age of the students. According to the researcher's observations, the cognitive preferences of learners in the sample are mostly visual and individual. Thus, the challenges faced by the researcher are to convert the abstract concept into a real, furthermore change learning style from the individual into a cooperative.

Based on what science education literature has shown, there are indications of the importance of using a role-playing strategy in science education for the primary stage in particular. Therefore, this study examined the effectiveness of a role-playing strategy in developing the skill of scientific interpretation for fourth-graders.

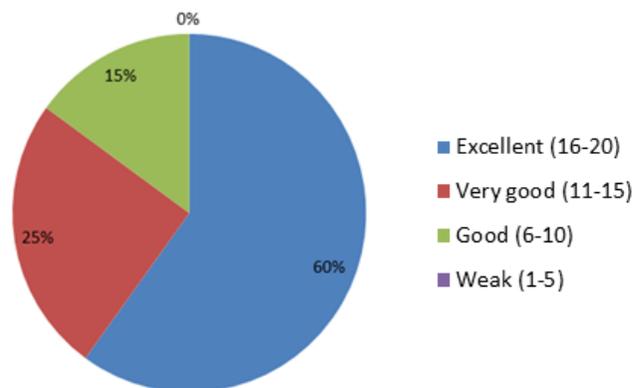
### **Overview of the study process**

This study responded to the spiral path of Jordanian science curricula, so the study chose the sample from the fourth basic class students. The researcher divided the students into two different groups in content and roles. Moreover, the researcher allowed the students to exchange roles. Also, the researcher planned three consecutive class lessons for the concept of the solar eclipse, the lunar eclipse, and the solar system.

After completing the stage of defining the research question and the general framework of the study steps, the principal agreed to the procedures to implement the research plan. Then, the researcher held a training session for teachers that included a brief presentation of the research objectives, tools, and procedures. Furthermore, the researcher took the voluntary official approvals to participate in the research from the study sample. Then the researcher began planning lessons, preparing educational resources, and assessment tools. The researcher determined the educational patterns of the learners by following them closely for three consecutive days and in cooperation with the directed teacher. In the implementation phase of the study, the researcher applied a blueprint for dramatic texts and distributed roles to students according to the plan. Then, the researcher distributed a written and visual guide to enable students to understand the phenomenon and simulate it. Students showed a simulation of the solar eclipse accompanied by a single worksheet that measures understanding and record learning descriptions. Following, the students introduced the lunar eclipse phenomenon, accompanied by another worksheet, and the student completed the learning progress record. Then the students wrote reflections on their learning experience. After completing the research investigation, the researcher interviewed the focus groups. Finally, the researcher tabulated all data and analyzed it to produce learning implications that explain and evaluate the impact of this strategy on learning.

## Results and discussion

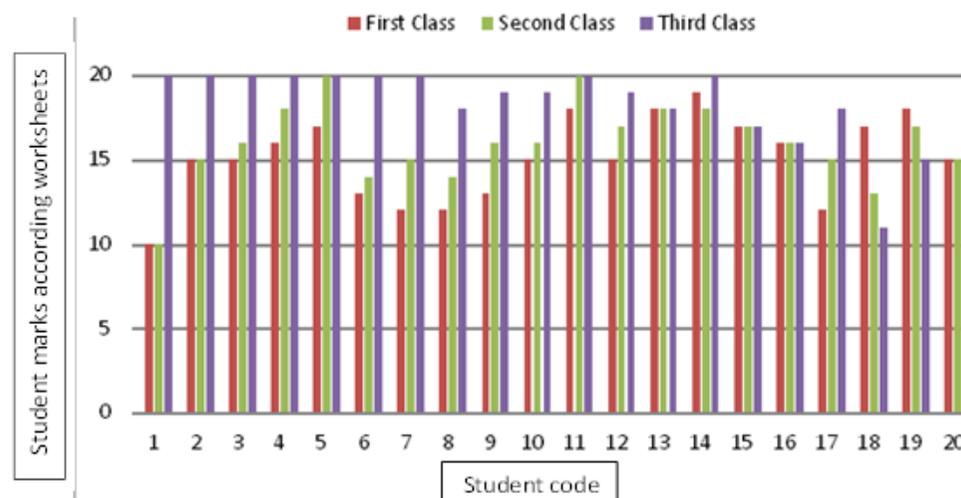
After the researcher implemented the study tools and procedures, analysis of participating fourth-graders' worksheet results, as shown in **Figure 1**, revealed a positive progress which is likely a result of implementing the role-playing strategy on developing the skill of 'interpreting astronomical phenomena.' The positive impact of the role-playing strategy on student learning can be explained due to the fact that it allows the learner to visualize and simulate the phenomenon in hand. The learner can transform the abstract concept into concrete and link the elements of the phenomenon to each other. **Figure 1** shows that 25% of students can explain astronomical phenomena very well. Perhaps this percentage considered satisfactory to achieve educational outcomes if compared with the previous rate of learning. This means that educational outcomes achieved in 60% of students in individual differences. The figure also shows that 15% of students achieved a good level of interpretation of astronomical phenomena, which explained by the inability of female students to express phenomena.



**Figure 1.** Distribution of students' grades on the worksheets

**Figure 2** shows students' results on worksheets over three consecutive lessons, reflecting the level of conceptual growth associated with the skill of interpreting astronomical phenomena that represent the effect of strategy over time. Upon looking into **Figure 2**, the researcher noted a significant structural progression for 14 students, who make up 70% of the sample, and a decrease for two students, which constitutes 10% and consistency in the level of four students, which constitutes 20% of the sample. According to results is drawn from Figure 2, and this is acceptable and theoretically correct because there is no consensus on a specific educational strategy (Bondie and Zusho, 2018). The researcher can infer that the role-playing strategy contributed positively to the development of concepts related to astronomical phenomena satisfactorily and effectively. The researcher assumes that the reason for the lack of response of 10% of the study members is the inadequacy of this strategy for learners with an individual style of learning. Regarding an explanation of the constant level of 20% of female students, the researcher concluded that the

role-playing strategy did not affect the way students learned, and this may be due to the strategy's inability to stimulate curiosity and learn to defend it as required, unlike what Jarvis (2002) concluded.



**Figure 2.** Students' progress over the course of the lessons

The results of the interview analysis were supportive of our conclusion. The results showed that the role-playing strategy enabled students to break the deadlock in sixteen students. Thirteen students can deduce the phenomenon of astronomy. While fifteen students could distinguish between the phenomena, five students found the task difficult, but four students showed a balance in understanding the importance of astronomical phenomena. According to the data from the interview, the study found that the role-playing strategy helped students in developing thinking processes at Bloom levels. The results also show that the strategy affects reducing conceptual misunderstanding. Concerning the challenges encountered via some students throughout implementing the strategy, they don't prefer to work in groups, which negatively affected their ability to represent the phenomenon and identify key elements. The researcher concluded that the role-playing strategy develops communication skills among students because the simulating process of the phenomenon socially requires students to coordinate with each other.

The students showed remarkable awareness of learning during the qualitative analysis of the record of the description of the learning process. They accurately defined the stages of their learning process by discussing their learning role and the proper outcomes. Also, the students become more aware of the cognitive processes and their acting skills in incoherent social contexts that mimic abstraction and convey it to reality in a scientific meaning.

## Conclusion

In summary, the strategy of role-playing has a positive role in developing the interpretive skills of the fourth-grade students by deepening the understanding of astronomical phenomena and addressing conceptual misunderstandings to develop interpretation skill. Also, this strategy helps students to reflect on the awareness of the responsibility of learning and providing elements of pleasure and simulation in learning science.

## References

- American Association for the Advancement of Science. (AAAS). (1990). *Science for All Americans*, New York: Oxford University Press.
- Bondie, R., & Zusho, A. (2018). *Differentiated instruction made practical: Engaging the extremes through classroom routines*. New York, NY; Abingdon, Oxon: Routledge, 1st Edition.
- Craciun, D. (2010). Role-playing as a creative method in science education. *Journal of Science and Arts*, 1 (12), 175-182.
- Gray, L. (2004). *The Use of Role-Play in the Science Lesson: A Study on Discussion and Conflict Resolution*. Paper Presented at the Scottish Educational Research Association Conference, Perth, 25-27 November 2004.
- Idiege, K. and Nja, C. & Ugwu, A. (2017). Development of Science Process Skills among Nigerian Secondary School Science Students and Pupils: An Opinion. *International Journal of Chemistry Education*, 1(2), 013-021.
- Jarvis, L., Odell, K. & Troiano, M. (2002). *Role-Playing As a Teaching Strategy*. Strategies for Application and Presentation, Staff Development and Presentation.
- Joyce, B. and Weil, M. & Calhoun, E. (2009). *Models of Teaching*. PHI Learning Private Limited, 8th Edition.
- Küçükler Tunçer, Y. (2004). *The effect of activities based on role-play on ninth grade students' achievement and attitudes towards simple electric circuits*. (Unpublished master's thesis). Middle East Technical University, Ankara, Turkey.
- Porter-Ladousse, G. (1987). *Role Play London*. Oxford: Oxford University Press.
- Osuafor, A. M. (2011). *Role-play: an effective strategy for teaching and learning of basic science in primary schools*. Retrieved from <https://independent.academia.edu/DrAbigailMOsuafor>

