Enhancing Class X Students Proficiency in Biology using Role Play and Games

Yeshi Nidup, Kezang Choden, Yadu Prasad Luitel and Rupashree Gupta

Abstract

This action research explored the use of role play and games to enhance the proficiency of biology of class X A students from one of the schools under Phuentsholing. Students of class X A were chosen from the school; one group of students were used as control group and another group were used as experimental group. Each intervention was used for two weeks and a pre-test were conducted before and post-test were conducted at the end of each interventions. For the games, the mean marks during pre-test were 8.7 and post-test was 10.4 for control group; pre-test 9.9 and post-test 11.8 for experimental group. There is an increase in mean marks by 0.7. For the role play, the mean marks during the pre-test were 10.4 and post-test 11.1 for the control group; pre-test was 10.6 and post-test was 13.6 for the experimental group. The mean marks increased by 3. Through this study, both the interventions were found to be helpful in teaching of biology since both helped to increase in the mean marks during the post-test. Moreover, role play is found to be much better than the games since the increase in mean marks is more when biology is taught using role play.

Keywords: Role Play, Games, Academic performance, Interventions, Mean score

Introduction

Modern education system was institutionalized since 1960s although few schools were established prior to this. Moreover, Science and other disciplines also appear to have been introduced in the schools with English as the medium of instruction during the reign of the third King of Bhutan (1952-1972), (Rinchen, 2014).

Similar to other developing countries, Bhutan also placed great importance in institutionalizing a relevant and challenging science curriculum for all of its school children. Science was considered important as mentioned in the 'Science Curriculum Framework PP-XII' (Department of Curriculum Research and Development, 2011).

Teaching and learning of science in Bhutan had always been a challenge for both the teachers and learners. According to Rinchen (2014),

> Science education in Bhutan continues to face challenges, which includes cultural inappropriateness, lack of qualified science teachers, resource constraints, science being taught in English (i.e., a foreign language), and the lack of progression in science content across different grades (p.22).

The schools had been marred by the shortages of science teachers especially in the higher class. This has also affected the quality of science education in Bhutan. Therefore, the govt had to depend on teachers hired from neighbouring country, India to fill the gap. As we embark into 21st century which is mostly driven by science and technology, quality of education and quality of science education has become an emerging issue and a concern for the Education Ministry.

The performance of science subjects in class X and class XII board examinations for the last five years (2014-2018) showed low average as compared to rest of the subjects (Bhutan Council for School Examination and Assessment report, 2015-2019). This has affected the country immensely in terms of short supply of scientifically sound graduates ready to take up different professions related to science. There were reports of shortages of doctors and nurses in the hospitals. To make up for the gap 15 specialists were recruited from Myanmar in 2011 and BSc nursing program has been launched to address the shortage of nursing staff; there has been critical shortage of nurse in the field of specialized nursing care services (Ministry of Health, 2011). In 2017, there were only 2143 (19%) students enrolled in the field of science out of 11,259 students enrolled in the tertiary institutes (Department of Adult and Higher Education, 2017). All the high-end jobs in the construction sectors were found to be foreigners. If the quality

of science education is not taken care now, it will have repercussion to our socio-economic development and social development. Therefore, it is very important to improve the quality of science education.

The performance of students score in biology was found to be low as compared to other subjects (Tenzin, Johnson, & Ramachandran, 2006, as cited in Rabgay, 2018). Rabgay (2018) also mentioned that the students average scores in class ten biology has not crossed sixty as reported in Pupil Performance Report (2016, 2015 & 2014) by Bhutan Council of School Examination and Assessment (BCSEA).

Lebata and Mudau (2014) identified the quality of biology teacher, the way biology is taught and assessed, learners' discipline, parental support and guidance to children, and physical resources as some of the factors that affected the learning and performance in biology. Besides, the availability of textbooks, laboratory apparatus and other learning resources are identified as factors that contribute significantly to the performance of students in biology; students with positive attitudes towards the subject were noted to have better performance (Dinah, 2013, as cited in Ali, Toriman & Gasim, 2014).

Therefore, use of games and role play as an alternative teaching strategy for improving the proficiency of biology in class ten can be an experimentation, validation and addition of new knowledge on the works of previous researchers.

Objectives of the study

The objective (s) of the study was to:

I) Ascertain if role play and games can be used as teaching strategies to enhance class X student's proficiency in Biology.

II) Help students to improve their proficiency in Biology.

Research Question:

Can I improve Class X Student's Proficiency in Biology using Role Play and Games?

Significance of the study

This action research explored to see if role plays (Games, Simulations, Analogy role play, Experiments) can be used as the interventions for teaching and learning of biology in higher class. Moreover, the findings from this study will help other teachers to apply the similar kind of teaching strategies if it is proven to be effective in their daily classroom teaching of biology for higher classes. It will also make significant contribution in improving the quality of teaching-learning of biology across the schools in Bhutan. Further, it will encourage children to develop keen interest to learn science especially biology and contribute to the overall quality of science education in Bhutan.

Scope and limitations

The study explored whether role play and games can enhance class X students' proficiency in biology. Amongst several types of role play; games and analogy role play were used as an intervention to teach biology for class X students. The participating class for this study was class X A students from one of the schools under Phuentsholing Dungkhag.

Literature Review

The theory behind the use of role-play in science teaching and learning – as with 'active', 'experiential' or 'child-centred' learning – is that children are encouraged to be physically and intellectually involved in their lessons to allow them to both express themselves in a scientific context and develop an understanding of difficult concepts (Taylor, 1987, as cited in Sharry & Jones, 2000). The key to role-play, and the reason why role-play can help to make science relevant to many children, is that it is based upon 'play' (Sharry & Jones, 2000). This play activity is found to be very useful for the development of their knowledge and intelligence (Ginsburg & Opper, 1988). The authors also posit that the desire to play, and therefore to learn, is a fundamental part of human psychology and is a potentially powerful resource residing in the children themselves.

According to Desai, Joshi and Tenali (2016), students tend to mechanically write down the material but rarely reflect on it in a passive learning environment. In this context, Role-playing assigns students to think, argue, write and/or behave as if they were a particular person in a particular situation.

Role Play is considered to be effective and useful. Desai, Joshi and Tenali (2016) mention that role play stimulates students' involvement and enhance the learning environment. It is also mentioned that intensive student participation affords unique learning opportunities to students and enhance their communication skills. Moreover, by encouraging experimentation, role-playing helps students discover divergent viewpoints and overcome stereotype mode of learning the concepts as they examine subjects from multiple perspectives.

What are the advantages of role play in teaching of science? Role paly gives students a feeling of ownership of their education (Danby & Upitis, 1988) as (cited by Sharry & Jones, 2000). It is also known to be effective in teaching moral and ethical issues arising from the curriculum (Colby, 1987). It can also help the children across spectrum of educational needs to understand and interpret their relationship with the world (Cayton, 1989). Role Play is also known to help children conceptualise and increase learning (Lawson, 1993).

According to Chesler and Fox (1966), taking role of others and pretending to feel like, think like, and act like another person, students can act out their true feelings without hesitation and fear. The authors also mention that students can examine and discuss private issues and problems without anxiety. Through role play, students can also imagine and feel about other students or adults world. Role Play also gives an opportunity for understanding oneself and others for the behavioural change. It is also used to demonstrate less personal but pervasive problems between and among people and groups. Role Playing may prove to be an instructional technique particularly useful with non-verbal, acting-out students. Analogies and role plays are found to be helpful to conceptualize abstract ideas and things that are microscopic or too big to observe (Aubusson et al., 2006, as cited in Young, 2020). The students feedback gathered indicated that role play was effective and helpful in learning as mentioned in a study by Young (2020):

> It was really fun way to learn about our topic and I will definitely remember our topic a lot better now than I would had just studied it on my own. It made learning extremely fun and unforgettable. I would love if other modules had a similar aspect to the coursework. (p.6)

Similarly, the feedback from the students on the role play being used for understanding protein synthesis done by Sturges, Maurer and Cole (2009) mentioned.

> I found the activity interesting. The activity was educationally attractive due to the novelty of its style. I would recommend the development and utilization of similar activities for other content areas. The activity was fun and I enjoyed the activity. (p.107)

Howes and Cruz (2009) posit that role playing can be enjoyable and students will have a feeling that they are having fun without realizing how much they learn in doing so. Moreover, Howes and Cruz (2009) recognized the potential of role playing in science education as it leads to authentic learning, develop multiple perspectives, and motivate students to take active participation.

Selvi and Cosan (2018) stated that educational games are considered as an effective alternative teaching method to supporting traditional teaching approaches. Selvi and Cosan (2018) also mentioned that students become keen to learn when learning is made fun and interactive.

It is also found that educational games can be a good teaching approach that helps to teach complex molecular biology (Cardona, Spiegel, Alves, Ducommun, Henricques-Pons & Araujo-Jorge, 2007 as cited in Selvi & Cosan, 2018) and educational games they used enhanced learning of basic biology terms (Olimpo, Davis, Lagman, Parekh & Shields, 2010, as cited in Selvi & Cosan, 2018).

Bhasker (2014) mentioned that games helped the students in understanding of blood grouping to review their previous knowledge and (Osier, 2014) also mentioned that it has significant effect on students' performance of genetic terms. Similarly, Carew (2018) said that game was used as a method for understanding of physiology.

The students were very positive and optimistic about the use of games in teaching biology as mentioned in the study (Selvi & Cosan, 2018). The students expressed

> The games enabled us to understand and learn the topics better. We did not forget what we have learned in the games for a long time. In addition, the games were colourful and clear. It is sad that it happens only for biology course. Playing the games with our peers also enabled us to correct our mistakes. The games were well designed and were at a level that we can understand.
>
> Our interest in the biology course increased with the visual enriched and entertaining games. We learned the topics more easily. We did not get bored in the lesson. Our motivation increased; therefore, all these reflected our exams well. Our relationship with our friends strengthened. I like to see and play the games once again. (p.2023)

After cross examining the benefits and potential of using games and role play in teaching biology, it is understood that role play and games are a good approach to increase the learning of the students. As shown in Figure 1. Role Play can include play, games, simulation, metaphorical role play and analogical role play (Sharry & Jones, 2000; Craciun, 2010). The learning outcome is expected to be more when teaching is done through role plays as they can provide good learning environments for the students (Bhattacharjee & Ghosh, 2013). Gray (2007) described role play such as games, simulations and dramatisations as part of an interrelated set of learning and teaching methodologies, each one with specific characteristics. More specifically, Craciun (2010) mentioned that in science education role play can be viewed as an interaction between play, games, and simulations; and the student that performs an activity with learning outcomes.

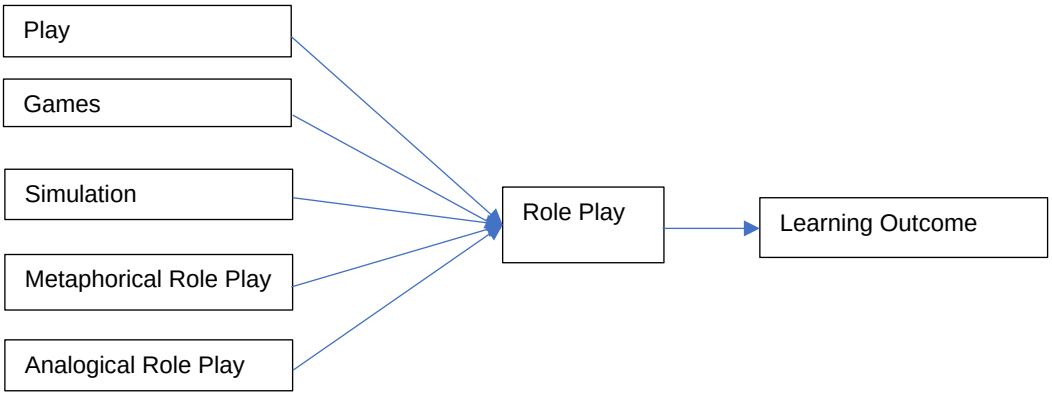

Figure 1*:* Role Play as the Medium of Interactive or Experiential Learning

Table 1*:* Interventions Action Plan

Week	Activity	Group	Remarks
Week 1	Pre-test	Control & Experimental	Researcher analysed the data towards the end of the week
Week 2 & 3	Intervention strategies - Games		
Week 4	Post-test	Control & Experiment	Researcher analysed the data at the end of the intervention
Week 5	Pre-test	Control & Experimental	Researcher analysed the data towards the end of the week
Week 6 & 7	Intervention strategies – Role play		
Week 8	Post-test	Control & Experimental	Researcher analysed the data at the end of the intervention
Week 9 & 10	analysis of Data and report writing		

The Table 1. shows the kind of role plays being used as intervention for this study. For the second week and third week, games such as Crossword puzzle, Bingo and Pair up or Break up were used. For different topics, different games were used as an intervention according to the relevance with the topics to be taught. The result was analysed at the end of week 5 after using the intervention for two weeks. For analogy role play, students were given a set of roles to be played

related to the topics. For instance, students acted as different cell organelles and each student acted as different cell organelles, and described their roles during the role play. The role play intervention was implemented from week 6 and week 7. The data was analysed at the end of week 8 and the report writing was done in week 9 and 10.

Methodology

Action research was considered as research design for this study as deemed appropriate. Amongst several interventions available, games and analogy role play were the two interventions applied at different time intervals. These interventions were evaluated at the end of the implementation period.

For the sample, students from class X A were chosen and used throughout the study. This class was chosen because of the convenience for the researcher as the researcher was teaching biology in that particular class. Convenience sampling was a technique applied for this study.

As an instrument, pre-test and post-test was conducted for both the control group and experimental group for each intervention. The Multiple-Choice Questions (MCQ) were referred from the internet (https://byjus.com/biology/mcqs-on-cell-organelles/) and adopted which were relevant to the topic. The questions were further reviewed by group of science teachers from the school to validate and contextualize according to our use. The control and experimental group were formed randomly from the list of students in the class.

The data was gathered as an ongoing process while implementing the interventions and also while conducting the pre-test and post-test. A descriptive analysis was done for the result of pre-test and post-test conducted at the end of every intervention. The mean, significance level and comparison of the mean marks for both the group (control and experimental) was done for the interpretation of the analysis.

Findings

The data from the pre-test and post-test in both the interventions was compiled and analyzed using excel. The mean score was calculated from the score of 15 students in the control group and 15 students in the experimental group, respectively. This mean score was then used in finding the differences in the mean score of both the control group and experimental group in both the interventions, games and role play.

A simple descriptive analysis was done to describe and interpret the data. Hence, mean marks of both the pre-test and post-test for control and experimental group was calculated and the T- Test was also done to find the significance level in each group.

The findings are all derived from the analysis of the mean score and the significance level testing done for both the interventions and the groups as detailed below.

i) The test result for both the control group and experimental group increased during the post-test in both the interventions. However, the increase was higher in the experimental group than the control group. For the first intervention, games, the mean marks for control group increased by 1.7 and for the experimental group the mean marks increased by 2.8 as reflected in Table 2 and Figure 2. This increase is slightly higher than the control group. This indicates that there was improvement in their performance after the intervention.

Table 2*:* Pre-Test and Post-Test Mean Score of Control and Experimental Group

Test	Control group	Experimental group
Pre-test	8.7	9.4
Post-test	10.4	12.2
Difference in mean marks	1.7	2.8

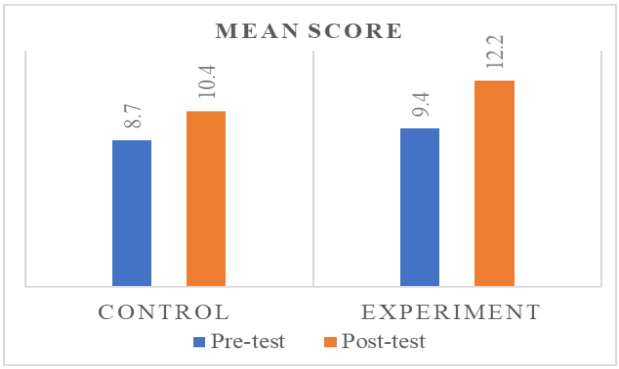

Figure 2*:* Mean Score of Pre-Test and Post-Test for Control and Experimental Group

ii) The test result for the second intervention, i.e about the role play showed better result.

In the control group, there is an increase in mean marks by 0.7 and in the experimental group, there is an increase in mean marks by 3 as revealed in Table 3 and Figure 3. There is significant increase in mean marks.

Table 3: Mean Score of Pre-Test and Post-Test of Control and Experimental Group

Test	Control group	Experiment group
Pre-test	10.4	10.6
Post-test	11.1	13.6
Difference in mean marks	0.7	3

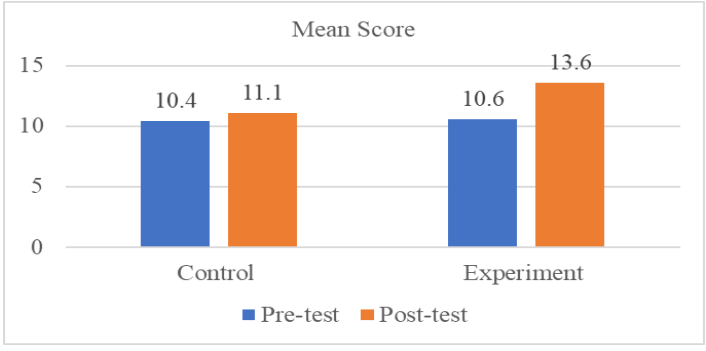

Figure 3*:* Mean Marks of Pre-Test and Post-Test for Control and Experimental group

iii) The mean marks increased in both the control and experimental group when the first intervention (game) was implemented. The P-Value was found to be 0.004 and 0.000 for control and experimental group, respectively as reflected in Table 4. The increase in mean score during post-test was found significant in both the groups.

Table 4*:* T Test for Pre-test and Post-test Result

Group	Control Group	Experimental Group
P.Value	0.004	0.000
Significance	Significant	Significant

iv) The mean marks increased in both the control and experimental group when the second intervention (role play) was implemented. The P-Value was found to be 0.032 and 0.000 for control and experimental group, respectively as reflected in Table 5. The increase in mean score during post-test for experimental group was significant at p-value 0.000 but for control group the increase in mean score during post-test was not significant at p-value 0.322. Thus, the researcher concludes that the role play has helped in improving the mean score of the students.

Table 5*:* T-Test for Pre-test and Post-test result

Group	Control Group	Experimental Group
P.Value	0.322	0.000
Significance	Not significant	Significant

Reflection

The two interventions, games and role play selected for this study was implemented according to the plan and schedule. However, these interventions were implemented only for two weeks; this was found to be short while implementing. The researcher and the participants did not get adequate time to

use these interventions effectively. Moreover, the time gap between the pre-test and post-test was short. There is every possibility that the participants can still remember the questions from the pre-test if the time gap was short. This would consequently impact the mean score.

The interventions were good but some participants did not enjoy especially those participants who are conservative did not like role play. This affected their active participation and it may have also impacted their learning and the test score at the end.

The questions used for the pre-test and post-test was same. It should have been different but the concept and knowledge tested by each question can be kept the same. This would allow the researchers to understand the impact of interventions used and how significant was it for helping the participants to improve their proficiency in learning biology.

Therefore, all these aspects must be given due attention and consider for revision if similar action research is planned by any researchers.

Conclusion

From the two interventions used, it is concluded that both had positive impact in the outcome of the learning of biology since there were increase in the mean marks in both the control and experimental group during the post-test. In particular, role play was found to be slightly better than the games as the increase in mean score during the post-test was greater; the increase was 2.8 for games and 3 for role play, respectively.

However, in the role play, the increase in mean score was not significant for control group but the mean score difference was significant for the experimental group. In general, both the interventions, games and role play, has helped to improve the mean score of the participants.

As a researcher and biology teacher, both the interventions, using games and role play as a teaching strategy was found to be convenient and effective teaching pedagogy that can be applied with any other subjects. It would be of great help in improving the learning of biology for any grade although the study focused on class X.

Through this research, the researcher saw an opportunity for the teachers to shift the teaching pedagogy for biology. But, more in-depth study has to be done to further explore and validate the usefulness and impact of using games and role play in teaching of biology. The duration for the interventions used were very short. Hence, it may not have provided adequate learning opportunities for the learners to really have more impact. Thus, more future study on the similar topic is recommended to validate the findings and also to strengthen the impact of the study.

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About the authors

Yeshi Nidup is currently working as Vice Principal of Phuenthsholing Higher Secondary school. He has Master's degree in development and management from the Philippines. He has six papers published both national and international journals. His interest is in reading, writing poem, research in education, and art.

Kezang Choden is a Physics teacher who is so much passionate of science education and teaching of science. She also has keen interest in research related to teaching and learning.

Yadu Prasad Luitel is a Chemistry teacher who has keen interest in teaching and learning of science. He also has keen interest and curiosity to explore and learn through research.

Rupashree Gupta is an experienced Biology teacher for higher secondary class. It is her interest to explore, learn and enhance professional growth through research.