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EFFECTIVENESS OF ROLE-PLAYING GAMES IN INCREASING LEARNER ENGAGEMENT WITH PHOTOSYNTHESIS CONCEPTS AT NYUNI GOVERNMENT HIGH SCHOOL

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DECLARATION FORM

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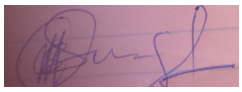
Signature:  **Date: 20/07/2024**

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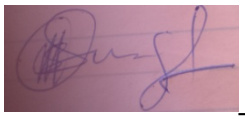

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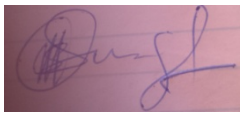
Signed  Date 20/07/2024

DEDICATION

This research is dedicated to my late parents who should have witnessed this work and perseverance.

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Firstly I would like to give glory and honour to the almighty God for his grace and mercies which guided, protected and helped me during my research project. I also extend my sincere gratitude to my supervisor, Doctor Dziva for being and understanding supervisor, and for sacrificing her time and for being patient with me during the course of this research. Without her inspiring supervision, I would not have been able to complete this study. My final gratitude goes to my wife for helping me both financially and socio-emotionally during my research.

ABSTRACT

This study was carried out in 2024 at Nyuni Government High School found in Mwenezi District of Masvingo Province, on a population of forty-five participants; among them forty students and five teachers. The purpose of carrying out this study was to explore the effectiveness of using role-playing games in improving learner engagement on Ordinary level learners during teaching and learning of photosynthesis concepts. The sample of forty-five participants was selected randomly from the case study school. All the participants highlighted: lack of adequate funding and technical assistance, lack of knowledge, over-enrolment, inadequate manpower resources, teachers' lack of interest, and insufficient time by both teachers and pupils, as contributory to failure by teachers to integrate role-playing games in improving learner engagement during teaching and learning of photosynthesis concepts. Again, it was also noted that: provision of technical assistance or training to teachers by school authorities, trimming classes to standard teacher-pupil ratios, safeguarding existing infrastructure, availing play materials to learners, as well as consistent procurement of play materials by schools and the parent community, would help to alleviate the challenges mentioned above. In light of the above findings, the researcher suggested that school authorities should also offer refresher training, workshops, and seminars to both teachers and learners, as a way to improve their capabilities in using role-playing games to improve learner engagement when teaching photosynthesis concepts.

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CHAPTER ONE

THE PROBLEM AND ITS SETTING

1:0 Introduction

The chapter's primary goal is to present the research problem's conceptual and contextual dimensions. This is accomplished by giving an outline of the study's history, problem statement, objectives, and research questions to be addressed. In addition, the chapter discusses the study's boundaries and assumptions as well as the importance of the research to educators, students, administrators, and policy makers. Additionally, the researcher looks at the constraints that undermined the study's conclusions as well as potential fixes. Ultimately, this chapter's contents are sealed with definitions for important terminology.

1.1 Background to the Study

The historical background of role-playing games dates back to time immemorial. According to Gwarinda (2015), role-playing games were invented as early as the period humans first existed on this planet. This assertion implies that role-playing games are as old as the first human race to have survived on earth. In an African setting, Gibb (2019) observes that role-playing games evolved naturally as the human race sought entertainment, physical prowess and skills for survival. Thus, the invention of role-playing games was first construed as essential for purposes of play and recreation.

With the passage of time, Vankus (2018) submits that role-playing games invented rules that means participants had to now compete and see who was better than others. The inception of rules brought orderliness and the discovery of role-playing games as vital in other facets of life like numeracy mastery (Dokora, 2015). The outlook of role-playing games played in the developed world and the underdeveloped world had sharp contrasts, with the former being quick to enforce written guidelines, while the latter relied on mutual understanding (Brown, 2019). However, in both instances role-playing games later found their way in the classroom, particularly to inculcate numerous educational skills, among them those in the biological domains.

When teaching Biology to secondary school learners, the concept of role-playing games serves a fundamental role, and most learners prefer to learn in a conducive environment in which role-playing games constitute a greater percentage of their learning time (Panskepp, 2018). A good number of learning institutions for secondary school learners are awash with

outdoor activities, for learners to acquire a variety of skills through role-playing games. Most learners in the secondary school have poor concentration spans (Fisher, 2017), compelling the majority of teachers to resort to game activities as a form of consistently capturing their attention. It is notable that in most learners, learning occurs unconsciously, and those teaching methods that directly engage the learners often reap more positive results (Donaldson, 2018). Classroom practitioners are urged to plan adequately for game activities that promote effective learning in learners, and while role-playing games seem to benefit learners socially and physically, the researcher intends to explore their impact on promoting concept development in the topic 'Photosynthesis' in Biology.

Both teachers and parents have numerous collective tasks to perform as means to facilitate playing of role-playing games by secondary school learners. With supportive adults, adequate game space, and an assortment of game materials, learners stand the best chance of becoming healthy, happy and productive members of society (Fisher, 2017). According to Shutton and Smith (2017), role-playing games increase brain development and growth, establish neural connections and improve the intelligent quotient. This means that game playing improves the learner's ability to perceive others' emotional state, as well as to adapt to the ever-changing circumstances.

Other influential education thinkers posit that role-playing games are most frequently used during adolescents' periods of rapid brain development and growth (Brown, 2019; Peter, 2020). This entails that the Ordinary level stage is the most suitable one for roping in role-playing games to improve learners' brain functioning. Notwithstanding these findings, nothing much is being mentioned on the contribution of role-playing games in inculcating biological proficiency in Form four learners, particularly in teaching and learning of Photosynthesis. Thus, this study seeks to ascertain the effectiveness of role-playing games, their benefits in Biology teaching, likely challenges encountered when using role-playing games in teaching and learning of Biology as well as possible ways to avert the identified challenges.

To a greater extent, the role-playing games approach is seen to produce immediate benefits in learners, such as general body fitness, as well as long-term benefits such as moral uprightness (Panskepp, 2018; Hannes, 2018). This assertion means that, as learners engage in playing role-playing games, they also derive numerous indirect benefits like fitness of the heart and mind, and at the same time they learn some invaluable life skills like obedience, punctuality,

logical reasoning, respect, cooperation, or teamwork- attributes that will be of great use in the child's future life if nurtured accordingly.

Shutton and Smith (2017) also advocate that through using role-playing games, learners develop skills they will need to apply as adults. This means that role-playing games induce in learners some behaviors that become engraved permanently. In the same vein, Azaar (2017) submits that playing role-playing games also facilitates aerobic conditioning and fine tuning of motor skills in learners. Azaar (2017) adds that children who successfully learn to play role-playing games with others attain emotional intelligence, an attribute that will enable them to control their emotions, as well as to understand and appreciate emotions of other learners.

The researcher noted that in spite of the vast research that has been carried out on the use of role-playing games to promote teaching and learning of other life attributes, little has been found out on the effectiveness of using role-playing games to specifically prop up biological skills in Form 3 learners. From the history of role-playing games mentioned above, the use of role-playing games has been confined to physical, emotional and social domains, at the expense of their usefulness in the cognitive domains. Moreover, most research that has been carried out was done with primary school learners, a situation that left secondary school learners, particularly those in Form 3, out of the equation (Moyo, 2016). It is against this background that the researcher was motivated to carry out this study to explore the effectiveness of role-playing games in teaching and learning of Photosynthesis at Form 3 level at Nyuni Government High School. The extent to which teachers rope in role-playing games in teaching and learning of Biology, the benefits both teachers and learners derive from use of role-playing games, challenges they encounter as well as intervention strategies to alleviate these challenges, shall be investigated.

1.2 Statement of the Problem

Since biology is such a complicated subject, the secondary school curriculum suggests using a variety of teaching and learning strategies, including role-playing games, drama, experimentation, and storytelling. Each of these approaches has an impact on the progression of form four students from one level to the next. The researcher has observed that role-playing games have traditionally been used to target the social and physical development of Nyuni Government secondary school students, ignoring the possibility that these games may also be crucial in helping students learn the abilities necessary for photosynthesis topics. The

researcher believes that role-playing games are an essential tool for teaching Form 3 students basic biology skills and guided discovery, but that their primary purpose in the classroom has been to amuse students and make the sessions more engaging. The majority of educators, including the researcher, are not entirely aware of the advantages that role-playing games offer for teaching biology to Form 3 students because some of these advantages are obtained indirectly and are highly challenging to quantify. The researcher's desire to find out how much Form 3 students at Nyuni Government High School are engaged in role-playing games has been sparked by this background.

1.3 Research objectives

The study wishes to satisfy the following objectives:

1.3.1 To explore the benefits of role-playing games in promoting learner engagement in teaching and learning of Photosynthesis topics to Form 3 learners.

1.3.2 To determine challenges which hamper the effective use of role-playing games in promoting learner engagement in teaching and learning of Photosynthesis to Form 3 learners.

1.3.3 To identify factors that should be considered for the effective use of role-playing games in improving learner engagement when teaching Photosynthesis to Form 3 learners.

1.4 Research Questions

The researcher will answer the following research questions:

1.4.1 How do role-playing games promote learner engagement during the teaching and learning of Photosynthesis concepts at Form 3 level?

1.4.2 What challenges do teachers face when using role-playing games to improve learner engagement in the teaching the concepts of Photosynthesis to Form 3 learners?

1.4.3 What strategies can improve implementation of role-playing games to promote learner engagement when facilitating instruction of Photosynthesis to Form 3 learners?

1.5 Significance of the Study

1.6.1. Learners –.This study may offer insights into ways that games can make the learning of Photosynthesis more engaging and memorable, potentially improving their understanding of this complex biological process. Additionally, the games may contribute to the development of important skills like collaboration and problem-solving

1.6.2 Educators – The expansion of the knowledge base regarding the use of role-playing games in facilitating cognitive development on Form 3 learners will help teachers to build on the existing skills and improve the use of role-playing games in teaching and learning of Biology. Teachers may also be acquainted with varied equipment that can be used in playing biological role-playing games, using the data to be gathered in this study as evidence.

1.6.3 Curriculum developers – As technocrats and designers of curricula for schools, officials from the Curriculum Development and Technical Services (CDTS) may also find this study useful to them, as it shall provide guidelines on how role-playing games can be incorporated effectively in the Biology Ordinary level curriculum to facilitate the proper acquisition of skills in the topic Photosynthesis.

1.6.4 School heads – This study may highlight the specific needs and requirements for successfully implementing game-based learning in the Biology classroom. This can help school heads make informed decisions about resource allocation, professional development opportunities, and the creation of supportive learning environments.

1.7 Assumptions of study

The study is premised on the following assumptions:

- Secondary school teachers are aware of the general benefits of role-playing games in other facets of development, e.g. physical and cognitive, but not in teaching Biology topics.
- The participants used in this study are credible to produce bias free and reliable data.
- The participants will be cooperative and willing to freely participate in the study

1.8 Limitations

The time frame within which this study is to be completed is one of the challenges that scuttled this study. The study was carried out while the researcher was very busy on the constraints of the hectic Teacher Capacity Development program, and as a result the researcher did not have ample time to periodically observe and interview a large group of participants. This forced the researcher to focus on a small group of participants. The researcher also worked during weekends, after school hours, and during the school holidays to perfect this study and avert time scarcities. Moreover, the inadequate financial support base deprived the researcher to fully implement all the necessary procedures, as money was vital to fund periodic visits to observe lessons and also to mobilize resources. Thus, finance

constraints compromised the quality of the study. The researcher complemented the extra financial demands by using his salary proceeds and assistance from relatives.

1.9 Delimitation

This study will be done in Masvingo Province. It will be done at Nyuni High School found in Mwenezi District. While this limits the direct application of findings to other regions of Zimbabwe, it provides in-depth insights into the challenges and possibilities of game-based Biology instruction within this specific context. Nyuni High School was selected as the research site due to its representativeness of rural secondary schools in the region and the researcher's established relationship with the school community. It is important to recognize that school-specific factors, such as teacher experience and available resources, may influence the findings. This study investigates the Ordinary level (Form 3) as this stage is a critical juncture in developing foundational Biology concepts. Further research may be needed to understand the suitability of game-based approaches for younger or more advanced learners.

1.10 Definition of Key Terms

- **Game** – A structured activity, usually with rules and goals, designed for both entertainment and the development of specific skills and knowledge within an educational context
- **Photosynthesis** – the process by which green plants use sunlight to synthesize nutrients from carbon dioxide and water.
- **Teaching and learning** – The process of facilitating knowledge acquisition, skill development, and conceptual understanding in learners

1.11Organization of the study

This study is organized in five sections.

Chapter one is the elementary chapter, which highlights the general overview of the whole study. The general outline entailed; a brief history of the problem, the merits of the study to different groups of people, research questions and related objectives, assumptions, and research boundaries. Also highlighted in the first chapter is: the organizational structure of the study, as well as the conceptual analysis of key terms related to the study.

In **Chapter two,** the literature on the issue of how role-playing games might improve student engagement when teaching Ordinary level Photosynthesis concepts is compiled from other

well-known writers and websites. The benefits of adopting role-playing games to increase student involvement and the difficulties that teachers and students face while implementing these activities in Ordinary Level Photosynthesis topics, will be investigated in this chapter. Chapter two will also examine potential intervention tactics that biology teachers and students at Ordinary Level can employ to try to enhance student engagement though the use of role-playing games in their classes.

The third chapter involves the methods and techniques which the researcher adopted to enable him to effectively gather evidence for the study. These include the research methodology and design, population and sample size, sampling techniques, and the nature of research tools that were used to gather data. The merits and shortcomings of each of the research instruments to be used in this study will also highlighted in this chapter, together with the detailed procedure of collecting, presenting, analyzing and interpreting the findings. The researcher will work with one school, and with a total population of 55 participants, among them 50 learners and 5 teachers.

Chapter four mainly focuses on how the gathered data is presented on various statistical tables to deduce meaning out of them. Most statistical graphs to be used by the researcher to present data include frequency distribution tables, pie charts, bar charts, as well as tally tables. Thereafter, the data will be analyzed and interpreted with reference to the study's research questions and objectives. **Chapter five** seals the study by giving the detailed summary of the whole study, findings and the conclusions drawn basing on the findings, recommendations proposed from the findings, as well as other research questions generated by the study.

1.12 Chapter Summary

The researcher outlined the study's background, problem statement, research questions, objectives, significance of the investigation, and study limits in this introductory chapter. In addition, the researcher looked over the study's underlying assumptions and the definitions of important words. The focus now shifts to the literature review in the following chapter.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter discussed findings of other educational thinkers on the effectiveness of using role-playing games in encouraging leaner engagement on Form 3 learners when teaching Photosynthesis topics. These aspects encompass: the merits of using role-playing games in enhancing learner engagement and the problems of the role-playing games approach when teaching Photosynthesis. Above all, the researcher scrutinized the strategies that are of instrumental consideration when implementing role-playing games to foster Photosynthesis skills on Form 3 learners.

2.1 The Conceptual Framework

This study's main objective was to ascertain the efficacy of using the role-playing games approach to enhance learner engagement with Photosynthesis topics at Ordinary level. The main goal was accomplished by looking at a variety of factors, including the advantages of using role-playing games to increase student engagement when teaching topics related to photosynthesis, the difficulties that teachers and students face when using role-playing games to enhance student engagement when teaching topics related to photosynthesis, and any strategies that teachers could implement to improve the use of role-playing games in the teaching and learning of photosynthesis topics. In order to solve the topic under investigation, the researcher collaborated with Form 3 students, since most of the aspects under investigation were found at that level.

The researcher was inspired to participate in this study after realising that Form 3 Science teachers were not utilising modern teaching and learning techniques when instructing their students on Photosynthesis topics. According to Woolfolk (2020), the majority of teachers prefer to use traditional teaching and learning methods that were used by their teachers, at the expense of current approaches which are not only learner-centered, but also promote high levels of motivation and interest among learners. Thus, the researcher wanted to ascertain how role-playing games can be instrumental in improving learner engagement during the teaching and learning of Photosynthesis topics at Ordinary level, particularly with learners in Form 3.

2:2 The Theoretical Framework

This study was modeled along the cognitive theory of insightful learning. Insightful learning is the brainchild of a German Psychologist, Wolfgang Kohler in the 1920s. The teaching and learning method emerged following experiments with apes or chimpanzees. Insightful learning is one of the cognitive learning methods based on a sudden realization of a problem, and consequently sudden finding of a solution to the identified problem. According to Wragg (2019), insightful learning entails a sudden understanding of a problem that implies the solution. This means that with insightful learning, there is no trial and error in finding a solution to a given problem. Martinez (2015) also avers that there is also no continuous practice, when insightful learning is used to find solutions to a problem. The researcher contends that insightful learning opposes all other learning theories which stipulate that effective acquisition of skills in learners occurs as a result of repetitive attempts.

Insightful learning resembles the ‘eureka’ or ‘aha’ moment in problem solving. Martinez (2020) submits that insightful learning is one of the most indispensable teaching and learning approaches in the teaching and learning of Photosynthesis topics at secondary school level, as both creativity and out-of-the-box thinking play pivotal roles. Insightful learning happens regularly in our lives, and often leads to inventions and innovations (Gibson, 2018). At one point in time, everyone has experienced some insightful learning, mostly when the dawning of a problem coincided with the dawning of a solution. For example, in using role-playing games to teach Photosynthesis topics, learners have to display creativity, and find solutions to their problems within moments that happen simultaneously with the realization of a problem. This entails that role-playing games are a favorable teaching and learning method that encourages insightful learning.

The teaching and learning of Photosynthesis topics requires a great deal of insightful learning. In most cases, learners learn new skills or concepts through observation, while in other instances, learning emanates from experience through personal interactions with the environment, and this is what Kohler (2019) termed insightful learning. The use of insightful learning in the teaching and learning of Photosynthesis topics is indispensable, since most of the skills to be acquired are self-discovered, and hence require meticulous observation and perfect execution if instructional objectives are to be achieved. The researcher has often witnessed numerous incidences where learners appeared confused by a problem, but quickly found the solution thereafter through use of role-playing games. Thus, in the teaching and

learning of Photosynthesis topics at secondary school level, there is immense use of insightful learning, to which this study modeled its structure.

2.3 Promotion of learner engagement during the teaching and learning of photosynthesis concepts at form 3 level.

When planned and executed properly, role-playing games induce a lot of pupil–pupil, as well as teacher-pupil interaction, which in turn promotes vast learner engagement with Photosynthesis topics. Gibson (2018:61) notes that, 'role-playing games involve much active participation on the part of the pupils', which is a fundamental tool for effective learning. The same author adds that, the method acts as a 'motivating factor as the teacher finally gives a feedback of the ideas exhibited by different students.' The fact that role-playing games enable the teacher to give some feedback about the performances of learners, mostly their strengths and weaknesses, implies that the pupils feel encouraged to offer more contributions in the future as their contributions would be valued (Goldstein, 2017). This study seeks to ascertain if use of role-playing games in Photosynthesis topics teaching and learning at Form 3 level stimulates motivation and consequently enhances learner engagement.

In addition, Fontana (2015) recommends the use of role-playing games in teaching and learning of Photosynthesis topics as they build up pupil's confidence to participate in class. This contention rests on the fact that, when students develop confidence in small group interaction during game play, they can then begin to take part in activities that involve the whole class. The same author further calls for the use of words like "how" and "why" to phrase discussion questions, as they arouse interest in pupils and fully engage them, since if a student gives an opinion, others would also want to give their own views.

Correspondingly, role-playing games also nurture leadership skills in those pupils bestowed with leadership positions. This is in line with the ideas of Marland (2015), who confesses that role-playing games nurture leadership skills in pupils for subsequent use in life. The same author adds that those pupils who work under the tutelage of a leader learn the spirit of respecting authority at a tender age. In the same context, role-playing games implant attitudes of team work and togetherness. This means that pupils exposed to role-playing games also learn other behaviors passively and unconsciously, e.g. punctuality, leadership, respect, co-operation and team work.

Similarly, Mwamwenda (2016) concurs with the use of varied forms of language and gestures in role-playing games as they greatly assist the pupils' language development. Though the above techniques can be used in any teaching and learning approach, their inclusion in role-playing game tasks vastly improves children's language and expressive skills, as they are probed to expound their feelings and responses in detail. These language skills will inevitably be useful to the pupils in mastering numerous academic skills. Castle (2018) also claims that resources may be easy to distribute in class if pupils are organized in groups during role-playing game activities. This idea means that, even when classes are large, the role-playing games approach enables the teacher to plan ahead on how to ration the available resources, for example, text books, furniture, work cards, writing material or play equipment. Jackson (2016) also sums up other benefits of the role-playing games approach as: improvement of class management skills, discipline control measures, as well as achieving high pass rates in general.

Russel (2019) contends that with the role-playing games approach, meaningful and helpful remedial work can be done immediately, making necessary corrections and lessening mistakes. This means that, unlike with other teaching methods, where cases of remediation are diagnosed at the end of some given written work, with role-playing games, the diagnosis for remediation can be done there, consequently having few or no mistakes at the end.

When role-playing games are used in teaching and learning of Photosynthesis concepts, it is also noted that learners fully concentrate (Woofolk, 2015). Unless not feeling well, role-playing games enable all secondary school learners to fully concentrate, and for long. In addition to that, Jackson (2016: 142) construes role-playing games as an 'important method in the area of attitude development and modification.' This implies that, where the role-playing games approach is in use, pupils` attitudes towards the teacher and the subject are altered and directed towards a positive end. Thus, pupils having negative attitudes towards a subject may change for the better, as they will be exposed to vast engagement and great learning opportunities (Rwambiwa, 2018).

Once more, Fisher (2017) asserts that playing role-playing games requires players to adhere to rules or a set of guidelines, which gives them the opportunity to practise subservient behaviour. This means that students can participate in a variety of role-playing games even when the teacher is not there, usually adhering to rules to keep the games engaging. The aforementioned views are supported by Donaldson (2018), who notes that students' capacity

to adhere to rules in role-playing games might have implications for their social lives and also instils in them a tendency to follow directions, such as while taking an exam.

The role-playing games that are chosen for Form 3 students help them quickly understand the facts of photosynthesis and expose them to a variety of other skills that are essential in daily life. Azaar (2017) lists the following abilities that students gain by using role-playing games: the ability to solve problems quickly, the ability to be on time, the ability to obey, and general social interaction. In line with this, Donaldson (2018) contends that role-playing games help students understand the value of competition in fostering social mobility. This is accomplished by rewarding and recognising students who demonstrate excellence in specific activities, or by giving awards to the top performers.

Moreover, Sprinthall (2018) postulates that the role-playing games teaching and learning method promotes socialization, and different reasoning degrees are experienced, as they lead to creativity after problem solving skills are exhibited. Thus, by so doing, new skills are stimulated and pupils learn to reason divergently, as well as to respect others' contributions. In the same vein, Bridge (2020) agrees that where role-playing games are used, pupils have the opportunity to express their emotions and creative skills, which evokes more meaningful thinking in learners. Proper administration of game activities may lessen both the teacher's talking time as well as the marking load (Mwamwenda, (2016). This implies that, those educators who employ role-playing games in teaching and learning of Photosynthesis topics talk less, as their talking may be restricted to the issuing of instructions, guidelines and giving of the feedback or summary, and the work contributed by various groups can be critiqued by others (Gwarinda, 2016). This consequently gives the teacher amble time to plan some meaningful activities for the pupils, at the same time giving learners independence to do their own activities (Woofolk, 2010).

In addition to the aforementioned educational advantages, role-playing games serve a crucial role in fostering a sense of group cohesion, solidarity, and collaboration, particularly in the context of team games (Goldstein, 2017). All role-playing games are supposed to foster a sense of group cohesion, team trust, team satisfaction, and team dedication in achieving a common objective because the majority of them are designed to be competitive, whether played alone, in pairs, or in groups. Geraldine (2016) suggests that in order to ensure a balance in engagement, the teacher should occasionally let the students handle the entire procedure.

To a greater extent, role-playing games are a teaching and learning approach that immensely involves learners. According to the opinions of Geraldine (2016), the use of role-playing games physically involves the learners, and accords them ample chances to actively participate, and resultantly consolidating concepts learnt. This means that role-playing games allow learners to have hands-on experience and physically interact with teaching and learning materials during the lesson.

Though role-playing games are difficult to effectively implement in the teaching and learning of Photosynthesis concepts, prominent psychologists opine that the use of role-playing games in learner engagement enables acquisition of skills in an interesting and fun way (Mwamwenda, 2016). The researcher feels that those concepts learnt through fun and enjoyment are retained for longer periods and are easily recalled during examination times. Moreover, the fun and joyful aspect of the role-playing games approach helps teachers to easily control learners, since they will all be motivated to participate in the activities. In another finding by Marland (2015), the use of computer role-playing games when teaching and learning Photosynthesis concepts is another fun way of achieving instructional objectives. The researcher believes that though computers may be scarce at the case study school, the use of computer role-playing games is encouraged as learners get engaged in a more motivated manner.

Furthermore, Woofolk (2015) acknowledges that role-playing games enable a wide range of activities to be carried out, including use of: visual media, question and answer activities, demonstration or group work. This assertion implies that, amidst role-playing games, educators may use other invaluable techniques, for example, teaching and learning aids, as well as other teaching strategies, to make the learning situation more engaging. However, Dudey (2016) maintains that, the discovery method is adversely affected when role-playing games are used in teaching and learning, and thus, calling for their minimal or average use. The above author argues that discovery learning results from individual learning which may not be manifest when role-playing games are used in teaching and learning.

2.4 Challenges faced by teachers when using role-playing games to improve learner engagement in teaching the concepts of Photosynthesis to Form 3 learners.

The use of role-playing games in teaching and learning of Photosynthesis topics requires teachers who are time conscious because they are time consuming in nature. According to Goldstein (2017), role-playing games have been rarely used to facilitate teaching and learning

in many subject areas because they require a lot of time to be fully effective. A lot of time is required to put learners in order, to issue instructions or guidelines, to allow adequate game time, as well as to give feedback – highlighting strengths and weaknesses (Geraldine, 2016). Moreover, a lot of time is required for the teacher to move around various groups to ensure that the role-playing games are being done in accordance with laid out guidelines that will promote effective learning.

In a finding by Mwamwenda (2016), all teaching methods should be used bearing in mind that there is presence of different abilities among learners. This implies that the role-playing games approach cannot be universally applied to any kind of learner, as the results may not be always forthcoming. According to the sentiments by Rhodes (2020), the use of role-playing games in teaching and learning of Photosynthesis topics disadvantages other learners who are elusive, and interested in using individualized learning. Similarly, Kebritch (2015) laments that fast learners who quickly grasp concepts through insightful learning may also feel disadvantaged when role-playing games are being used in teaching and learning of Photosynthesis topics, since they may prefer other challenging ways of teaching and learning.

Again, Whitehead, (2015) notes that some of the pupils may not take part and the outspoken of the peer group often influences the course of the role-play activities. This means that, where role-playing games are organized without taking cognizance of individual differences, the outspoken learners may dominate the on-goings of the game activities (Gibson, 2018). Again, those Science teachers implementing the role-playing games teaching and learning strategy should ensure that groups do not consist of too friendly pupils or members, as the greater majority may not take part.

Gibson (2018) further argues that it requires adequate control to ensure that learners remain engaged and the game activities remain relevant to the objectives. Thus, if not properly monitored, some pupils may take the time for the role-playing games to do their personal chores. This is most likely when groups comprise peers or close friends. Thus, to attain desirable goals, the teacher should use sociometry to construct groups that comprise members who will devote their time to display of relevant activities (Sprinthall, 2018).

In another finding by Fisher (2017), role-playing games do not suit all topics in a learning area. Though this finding is not specifically referring to the use of role-playing games in Photosynthesis concepts, it is worthwhile to note that the use of role-playing games does not apply to all the topics in Science, particularly Photosynthesis topics. This implies that

teachers have to use their discretion when selecting the most appropriate method. Correspondingly, Mapepa (2019) contends that the large pool of teaching and learning methods requires a professional teacher to select the best one suiting the nature of content to be imparted to learners.

Goldstein (2017) acknowledges that role-playing games and group work are much alike, though the former may be done individually. The author above contends that role-playing games can affect the level at which learners use discovery learning to understand factual information. This implies that since role-playing games involve many people, there is likelihood that those learners who want to work individually and discover some of the concepts by themselves are adversely affected. Nonetheless, the researcher believes that insightful learning can result from the use of role-playing games in teaching and learning.

Whitehead (2015) also opines that role-playing games are rarely used by many teachers in the teaching and learning situation due to their need for adequate time. Nevertheless, the researcher feels that if proper planning is put in place, role-playing games can be a method to use regularly, since it has numerous benefits for teachers and pupils. Again, some teachers perceive role-playing games as a technique they can use to find time to rest and leave everything done by the pupils (Goldstein, 2017). This has often resulted in poor results from the role-playing games method, forcing other teacher and pupils to view it as undesirable. This calls for teachers to be physically available to monitor game activities.

The prevalence of large classes in Zimbabwean secondary schools cannot be averted if teachers resort to the use of role-playing games in teaching and learning (Marland, 2015).The role-playing games that teachers use to help students learn Photosynthesis topics are not the same as the role-playing games that are typically played on sports fields, where teams are made up of numerous individuals. This indicates that some educative role-playing games are meant to be used with small groups of students and are specifically made for teaching and learning about photosynthesis.

2.5 Strategies which can improve role-playing games to promote learner engagement when facilitating instruction of photosynthesis concepts to form 3 learners.

Garry (2020) declares that all effective learner engagement does not take place via a single teaching and learning approach. He submits that effective teaching and learning involves a mixture of various teaching methods at the teacher's disposal. This implies that the role-

playing games approach could be as equally effective as any other teaching method. Gwarinda (2016) cites the lecture method as another approach which can be paired with role-playing games. Gwarinda submits that the lecture method of instruction enables teachers to go over topics quickly and to collect as well as to summarize pupils' results on concept discussed, especially through role-playing games.

Unlike other teaching and learning approaches where teachers can give learners some activities to do while the teacher relaxes, with the role-playing games approach, teachers have to be ever-alert, lest the role-playing games may degenerate into situations beyond control (Rwambiwa, 2018). This means that when role-playing games are being used to facilitate teaching and learning of Photosynthesis topics, there are great chances that if not monitored, accidents or injuries may occur and the lesson objectives may not be achieved. Similarly, Garry (2015) notes that if learners are not strictly monitored during role-playing games, some of them may not participate, or those older ones may disturb the smooth running of game activities.

Like any other teaching and learning method, the use of role-playing games in teaching and learning of Photosynthesis topics also requires adequate planning to ensure the games being used commensurate with the objectives to be achieved (Gwarinda, 2016). This implies that the teachers should plan the activities that learners will partake of before unveiling them to the class. In the same vein, Gibson (2018) avers that teachers should do some rehearsals to ensure that the role-playing games to be used are relevant to the concepts being taught. This will resultantly enable the teacher not to only engage learners fully, but also to avoid dishing out inconsequential subject matter.

The secondary school level requires that teachers should use role-playing games that are not only complicated, but which are also familiar to the learners (Marland, 2015). This entails that the teacher should start with those role-playing games which learners have used either at home or with peers. This will generate a lot of interest as the learners will be working with something they are familiar with. In the same vein, Wheldall and Glynn (2019) acknowledge that the teacher should also accord the learners maximum liberty to be innovative and invent their role-playing games that are relevant to the concept in question.

The use of role-playing games should be done as a motivating factor, and hence the teacher is urged to use varied forms of role-playing games to induce massive interest and consequently get rid of boredom (Rwambiwa, 2018). This means that teachers should avoid use of similar

role-playing games each time they are teaching Photosynthesis topics as this may end up killing the learners' enthusiasm. Echoing the same sentiments is Mapepa (2019), who submits that not only should role-playing games be varied, but they should also be stimulating and interesting so that they motivate the learners to have interest in acquisition of intended skills. The use of stimulating role-playing games is also the brainchild of Gwarinda (2016), who advises teachers to make sure that they select their role-playing games with discretion to avoid generating boredom in learners.

Marland (2015) suggests that the teacher's discretion is also indispensable when selecting an approach to employ in the classroom. This implies that, the type of lesson to be taught and the nature of pupils, determine the teaching method to use. Some Photosynthesis topics may be taught better using the role-playing games approach than any other method or the lecture method. This is seen to affect the outcomes of this study, as other Photosynthesis topics could be taught more successfully when using other teaching and learning approaches like the drama, lecture method, or any other approach (Rwambiwa, 2018).

The possible inclusion of teaching and learning aids when using the role-playing games teaching and learning approach makes it a very desirable tactic when teaching Photosynthesis topics, since some of its concepts are complex and should be consolidated by visual aids (Gwarinda, 2016). Wheldall and Glynn (2019), also accept that, visual aids play a pivotal role in aiding the pupils to comprehend numerous concepts in many lessons, Photosynthesis topics included. According to these writers, progressive educators realised that integrating media into all lessons may lead to more desirable outcomes, whereas classical teachers still saw media use as cumbersome. The use of media in teaching and learning of Photosynthesis topics using role-playing games needs a discrete teacher, who is also innovative and creative if the lessons are to be stimulating and animated.

In the same line of opinion, Wheldall and Glynn (2019) propound further that teaching and learning aids effectively engage learners as they stimulate interest, by creating a conducive environment which guides pupils to discover knowledge on their own. When role-playing games are adopted to teach Photosynthesis topics, educators should decorate their lessons and classes with various forms of media to create inquisitive minds in the pupils. Any of the stages of the role-playing games approach requires the educators' discretion to arouse interest in pupils. Similarly, Gulliford (2019) agrees that, teaching and learning aids create images in pupil's minds, and force them to explore more about the topic in question. The first stage of

the role-playing games approach is the most ideal to incorporate media, and then pupils can be guided to build knowledge on the aids used.

Cementing the same idea, Mapepa (2019) offers that visual aids, in the form of concrete objects, permit effective acquisition and retention of learnt concepts. The above author agrees that with the role-playing games approach, the pupils' skills can also be displayed in the class to motivate them, and encourage other pupils to be creative and sharpen game skills. Wragg s (2019) also advocates for the inclusion of visual aids in all lessons, Photosynthesis topics included, since they allow some learning to take place via multiple senses. He argues that, during role-playing games usage, audio –visual aids are such a necessity to pupils, as they learn through seeing and hearing.

Gibson (2018) also puts forward influential ideas about teaching and learning aids in all lessons where role playing games are used, when he ascertains that they define facts and concepts precisely, and are seen as a means of simplifying abstract concepts for easy comprehension by the pupils. Nonetheless, Gibson (2003) warns that when using role-playing games in teaching and learning, visual aids need proper choice, lest they may mislead pupils, especially if they are not properly selected. Gibson (2003) advices educators to seriously plan for the visual aids they intend to use before they use them in lessons so that they would attain the intended goals.

2:6 Conclusion

The aim of this chapter was to draw attention to relevant ideas that previous educationists had contributed regarding the use of role-playing games to promote learner engagement among Form 3 learners. Among the topics covered were the advantages of role-playing games in promoting learner engagement as well as the obstacles that prevent Form 3 learners from using role-playing games to teach Photosynthesis concepts. Lastly, the researcher analysed strategies that should be adopted in order for Form 3 learners to effectively use role-playing games to engage. The following section, Chapter 3, examines the methodologies that the researcher used to collect data for this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The methods used by the researcher to collect the data for this study were examined in this chapter. Examined also were the target population, sample, sampling process, research instruments, and study design. The benefits and drawbacks of the research methodology and tools employed in this study were also looked at by the researcher. Lastly, the researcher looked at the plans for data collection, processing, and interpretation in addition to ethical issues.

3.1 Research Design

One of the study designs within the pragmatic research paradigm, the convergent parallel research design, was chosen by the researcher for this study. According to Johnson and Onwuegbuzie (2019), the convergent parallel research design combines quantitative and qualitative approaches at the same time. The researcher preferred the convergent parallel study design because it allowed him to use statistical graphs for data presentation, analysis, and interpretation, in addition to narrations. Once more, the convergent parallel research method was chosen by the researcher because it worked best when study tools including evaluation tests, interviews, and observations were used simultaneously (David and Sutton, 2019).This means that the convergent parallel research design was chosen because it enabled the researcher to combine several research methodologies to collect data in a triangulated manner. Additionally, this design was preferred as it required that the researcher's methods for presenting, analyzing, and interpreting data were both quantitative and qualitative.

3.2 Population, sample and sampling procedure

All the science teachers at the case study school as well as the ordinary level science students made up the research's population. There were up to 400 participants in the whole population; therefore, the researcher worked with a limited sample because the population was too large. According to Polit and Hungler (2018), sampling is the area of statistical practice that deals with the selection of individual observations with the goal of providing some information about a population of interest, particularly for statistical inferences.

In order to select respondents for a study, the researcher employed concurrent mixed methods sampling, which comprises using simple random sample approaches as well as stratified procedures. This entailed classifying the target population into strata or groups that are comparatively homogeneous in terms of one or more attributes (Leedy, 2019). There were just two strata: those of science teachers and those of science students at Ordinary level. In order to determine the necessary number of participants in each stratum, the researcher first divided the participants into two groups and then used systematic random selection. In order to determine the necessary samples for each stratum, the researcher employed computer codes during random sampling. The researcher worked with a sample size of forty-five participants, among these: 40 Ordinary level Science learners and 5 Science teachers. All the members of the research sample were selected from Nyuni Government High School.

3:3 Data Collection Methods

Three study instruments were used by the researcher, i.e. direct observations, oral interviews, and evaluation tests. Because the study employed a convergent parallel research design, the researcher gathered quantitative and qualitative data simultaneously. The quantitative data was gathered through evaluation tests, and the qualitative data was gathered through interviews and observations. As a result, while the five science teachers were being interviewed, the Ordinary level students were given the evaluation tests. To determine the degree to which they employ role-playing games as a teaching and learning tool for Photosynthesis topics, participant observations were also conducted with each participant. Below is a breakdown of each of the three research methods that were used.

3.4.1 Observations

For accurate analysis, the researcher saw and recorded videos of the respondents, who were science teachers and students at Ordinary level. Punch (2015) defines an observation as a methodical approach of collecting data in which researchers use all of their senses to watch people in natural settings. Observations are a useful research method with advantages and disadvantages. Braun and Clarke (2019) argue that observations are beneficial because they provide researchers with direct access to the persons under study. The researcher was able to personally see the Science teachers and Ordinary level pupils instead of depending solely on reports from individuals. Once more, direct observations prevented circumstances in which people would have to falsify information, particularly with regard to age or sex.

Additionally, Dalar (2018) asserts that observations offer a greater chance for a permanent record and that because the majority of the physical behaviour the researcher was interested in was transient, documenting was required to preserve data for later use. However, Dalar (2018) asserts that observer bias is a significant risk when using observation and that direct observation is a time-consuming process. This puts the validity and dependability of the data gathered at jeopardy since the observer might be persuaded to describe events that never happened. The observer effect, which happens when the observer's presence affects the behaviour of those being observed, is another possible drawback of observations (Dalar, 2018). Because of this, tremendous effort was taken to make sure that people who were being monitored would not conceal their true nature from viewers. Consequently, the researcher employed the technique of participatory observation, whereby he watched the subjects covertly (Creswell, 2019). This allowed them to display the required qualities as freely as possible.

3.4.2 Evaluation tests

An evaluation test is defined as a systematic assessment of a learner's knowledge, skills or attitudes to determine their level of understanding; proficiency or achievement at the end of a lesson, week or course (Dalar, 2018). Similarly, Mpofu (2021) avers that a test consists of tasks that are used to enable the systematic observation and recording of behaviour that are selected to represent an individual's knowledge levels. In this study, two tests were given to 40 learners; a pre-test for diagnostic purposes, and a post-test for evaluation of performance after learner engagement through role-playing games.

According to Borg and Gall (2018), test are used to determine whether learning has taken place or not by assessing the extent of knowledge retention. Similarly, Creswell (2019) acknowledges that evaluation tests in research help to identify areas of improvement, pinpoint learners' weaknesses, develops critical thinking and provides feedback. This entails that in the context of this study, testing aided to inform students, parents or guardians and teachers about progress and growth. In a similar assertion, Punch (2015) submits that tests help teachers to adjust instruction so that it meets student needs and improve teaching methods. This merit of evaluation tests is instrumental in this study, since the researcher intends to use tests to determine the extent of learner engagement when teaching photosynthesis to Form 3 learners.

However, testing for research purposes may have shortcomings of bringing about stress and anxiety, which may both be detrimental to the finesse of the study findings. This means that whenever students are promised that they will write a test, they develop tension due to the fear of failure. Again, Popper (2019) contends that testing is susceptible to bias whether in questioning or the cultural context. Thus, tests may not accommodate different learning styles or abilities, and evaluate teachers and schools rather than support student learning. To get rid of the above shortcomings associated with testing, the researcher concentrated on a single topic, i.e. Photosynthesis, and was very meticulous in question choice.

3.4.3 Interviews

Creswell (2019) defines an interview as a process of obtaining knowledge through open communication between two or more individuals. Because questions may be tailored to the interviewees' level of understanding, interviews are suitable for obtaining information from even illiterate respondents. Moreover, since there was a greater need for confiding with participants, especially when handling sensitive information, interviews also helped the researcher and participants to build relationships (Popper, 2019). This indicates that interpersonal relationships between the interviewer and respondents significantly improved in addition to offering researchers excellent screening chances.

Again, since the researcher valued the respondents' personal sentiments, opinions, and perspectives, oral interviews allowed for the capture of sensitive material from respondents as well as the recording of the respondents' own words and the clarification of any possible misunderstandings, (Oyedele, 2015). Likewise, Punch (2015) concurs with the authors above, stating that any double-barreled questions in an oral face-to-face interview are immediately explained, improving the quality of the data collected. Once more, during interviews, participants were able to provide justifications for their answers, thus the researcher did not need to press interviewees to defend their opinions.Relatedly, and another benefit of interviews was that interviewees were not influenced by other group members (Popper, 2019). Here, the researcher obtained first-hand information from the subjects, including their feelings and other behaviors.

Conversely, oral interviews had the drawbacks of being time-consuming, subjective, and biased - especially when dealing with huge populations. As a result, the interviewer used neutral questions and allowed the respondents ample time to react without predicting or hinting at potential answers (Punch, 2015). In the context of interviews; lengthy, delicate, or

in-depth questions may make respondents uncomfortable and cause them to employ avoidance strategies. To guard against the shortcomings, the researcher pre-tested the instruments before revealing them to the respondents. Once more, the interviewer built rapport and trust with the participants, who finally led to them disclosing information that they would not have shared through any other method of data collecting. Furthermore, respondents cannot be guaranteed anonymity during interviews, according to Borg & Gall (2019). The researcher planned face-to-face oral interviews with the study sample over the course of a week, recording the interviewees' responses for future use as a source.

3.5 Data Presentation, Analysis and Interpretation

The researcher presented the data gathered from evaluation tests using statistical techniques such frequency distribution tables, pie charts, and bar graphs. In addition, the researcher collected qualitative data through oral interviews and observations. The sub-research questions served as the foundation for creating the observation checklists and interview schedules. The responses were gathered and documented for later use in data analysis, and the researcher utilized a cell phone to record the interviews. Respondents were informed by the researcher that the findings were solely intended for study reasons and hence they ought to exhibit as much freedom as possible to respond.

3.6 Ethical Considerations

From the start of the study until its conclusion, the researcher gave priority to a good number of ethical issues. According to Leedy (2019), research ethics are guidelines for moral conduct among researchers. Because this study included participants from a variety of socioeconomic backgrounds, the researcher demonstrated a high standard of morality. The following ethical factors were taken into account in this study: informed consent, voluntary involvement, anonymity, and secrecy. Before beginning this investigation, the researcher obtained consent from all those involved. He got approval from the administrators of Bindura University of Science Education, the Masvingo Provincial Education Director, the head of Nyuni High School, and the teachers and students who took part in the research. This suggests that participants were given the option to participate in the study or not, rather than being forced to do so. Additionally, names of respondents were not printed on interview schedules to allow for high degrees of anonymity and confidentiality, and interviewees were given the utmost assurance that their contributions would only be used in this study. This gave them maximum liberty to expound their feelings.

3.7 Summary

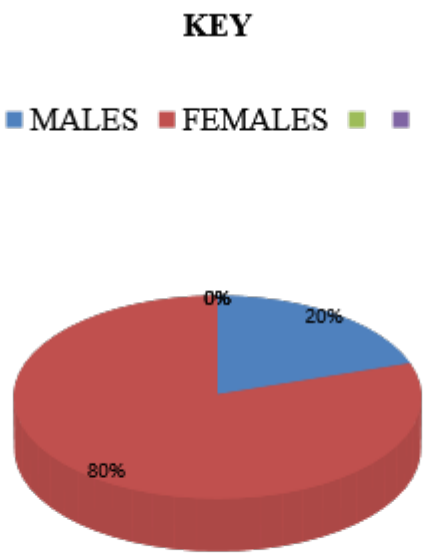
This chapter made references to the techniques the researcher used to collect the study's data. In order to collect data, the researcher used a convergent parallel study design that included evaluation tests, structured interviews, and observations. The researcher defended the decision to choose a convergent parallel study design and described how he overcame some of its drawbacks in the same chapter. Additionally, the researcher emphasized the benefits and limitations of the research instruments that were employed. Specifically, the researcher examined the advantages and disadvantages of structured interviews, observations, and evaluation tests, and explained how he mitigated the disadvantages of each of these research instruments. Once more, the researcher discussed moral concerns and the standards by which the research results were presented and interpreted. The data that the researcher collected is presented, examined, and interpreted in Chapter 4.

CHAPTER 4
DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 Introduction

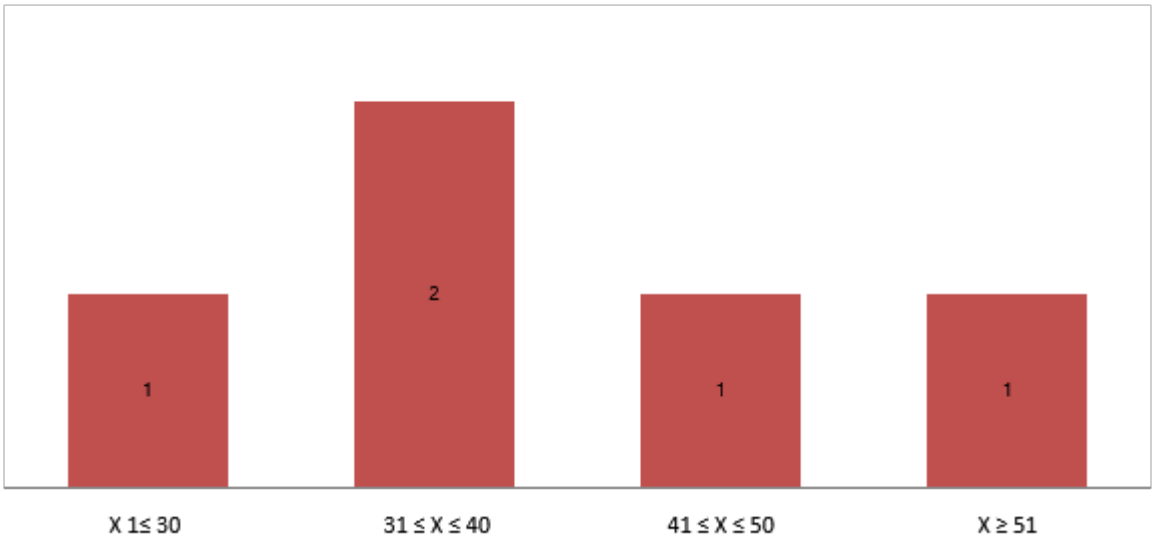
The main purpose of this chapter was to display the evidence that the researcher gathered from teachers and learners. The data was presented on statistical tables such as frequency distribution tables, pie charts and bar graphs. Thereafter, the data was analyzed and interpreted with reference to the demands of research objectives, i.e. with reference to the Literature Review in Chapter 2. This implies that the researcher ascertained correlations or distinctions between gathered data against the findings of other earlier researchers.

4.1 Teacher's Demographic Data: Pie Chart Showing Teachers' Sex (n=5)



The pie chart above is reflective that the researcher worked with 5 teachers, among them one male (20%), and four females (80%). The inclusion of both sexes in the study served to address gender equity, and to solicit for views regarding the efficacy of employing role-playing games to enhance learner engagement in teaching photosynthesis concepts from all sex groups.

4.2 Bar Graph Showing Teachers' Ages



From the bar chart above, it is manifest that of the respondents, one teacher (20%) was less than or equal to 30 years, two teachers (40%) were between 31 and 40 years inclusive, one teacher (20%) was between 41 and 50 years and one teacher (20%) was greater than or equal to 51 years of age. The data indicates that the researcher's population of educators included those new in the system as well as seasoned teachers who have seen a lot regarding the use of role-playing games to improve learner engagement in teaching and learning of photosynthesis skills. This implies that the perceptions collected by the researcher depicted views from the rank and file of Ordinary level teachers. The use of teachers who are fresh from college, as well as those who are seasoned, enabled the researcher to collect authentic data from respondents.

Table 4.1 Showing Teachers' Highest Educational Qualifications

Educational Qualification	Frequency	Percentage
Certificate in Education	0	0%
Diploma in Education	2	40%
First Degree in Education	2	40%
Other (specify)	1	20%
Total	5	100%

As regards teachers' educational qualifications, it is noticeable on the frequency table above that of the teachers used in the study, no teachers (0%), had a Certificate in Education, two teachers (40%), had Diplomas in Education, two teachers (40%), had a first Degree in Education, while one teacher (20%), had a Masters' Degree in Education. Again, the researcher considered teachers with varying qualifications, to ascertain their perceptions on the effectiveness of using role-playing games to facilitate teaching of photosynthesis concepts and to improve learner engagement among Ordinary level learners.

In addition, the researcher contends that the above results indicate that most secondary school teachers in Zimbabwe are properly qualified to man their classes, and the majority of them are pursuing further studies to improve their professional growth. The use of properly qualified teachers in the study also helped the researcher in that, almost all these teachers were well-versed in contemporary teaching approaches like role-playing games, that can be used to attain various benefits in learners, among them: acquisition of cognitive and physical skills, development of proper socialization patterns as well as inculcation of numerous photosynthesis concepts.

Table 4.2 Showing Teachers' Teaching Experience

Teaching Experience (years)	Frequency	Percentage
$x < 5$	2	40%
$5 \leq x \leq 10$	1	20%
$11 \leq x < 15$	1	20%
≥ 15	1	20%
TOTAL	5	100%

The frequency table above also reflects that of the teacher respondents, two of them (40%) had less than or equal to 5 years of working experience, one teacher (20%) had between 5 and 10 years of teaching experience inclusive, one teacher (20%), had between 11 and 1 5 years inclusive, and one other teacher (20%), had greater than 15 years of teaching in the secondary school, particularly at Ordinary level. This data was ideally useful to the researcher as it reflected that he worked with teachers who were still fresh from college, as well as those teachers with vast teaching experience and who are established in the system.

The above results are also indicative that the researcher had the chance to solicit for data from both teachers who have fresh information about contemporary teaching and learning methods like role-playing games, which can be used to prop up desirable biological attributes in learners; and from seasoned educators who have been in the education system for long, and have seen the benefits of role-playing games, as well as other related correct techniques to be employed in partnership with them in teaching and learning of photosynthesis concepts to reap more positive results.

Table 4.3 Analysis of Teachers' perceptions of benefits of role-playing games in teaching and learning of photosynthesis concepts to Ordinary level learners

Possible contribution of role-playing games in teaching and learning of photosynthesis concepts	SA	A	D	SD
- They enable sharing of skills	20%	80%	-	-
- They encourage following of rules and instructions	100%	-	-	-
- They build confidence and self-esteem	20%	80%	-	-
- They build social relationships required in group work	100%	-	-	-
- Role-playing games inculcate leadership skills	100%	-	-	-
- Role-playing games promote respect for others' views	40%	60%	-	-
- New friends are met through playing role-playing games	20%	60%	20%	-
- Role-playing games fight stress and other social problems	20%	80%	-	-
- Role-playing games encourage group solidarity when problem solving	100%	-	-	-

Though there were varied perceptions from teachers as regards the contributions of role-playing games in facilitating Ordinary level learners' development of biological acuity, particularly in photosynthesis topics, it was evident from the tabled results above that almost all the five teachers agreed that role-playing games contributed in many ways to the development of learners' biological skills. All the five teachers (100%) conceded that role-playing games encourage group solidarity, encourage adherence to rules or instructions, build social relationships, and are an indispensable tool that can be employed by teachers who want to nurture leadership skills in Ordinary level learners. Though the attributes mentioned above are difficult to ascertain, it is worthwhile to note that teachers are aware that role-playing

games are instrumental when one intends to inculcate desirable social attributes that help to improve learner engagement during the teaching and learning of photosynthesis concepts in Ordinary level learners.

The assertions of the teachers are akin to the contributions of Goldstein (2017), who opines that through the use of role-playing games in teaching and learning, learners amass skills of togetherness, team work and group cohesion – qualities which are requisite in their everyday life in a number of situations involving manipulation of biological problems. In addition, Fisher (2017) also supports the sentiments shown by the teachers above when he submits that learners who are consistently exposed to role-playing games learn the essence of following guidelines in their approach to problem solving, which may help them to distinguish what is bad from what is right. In the same vein, Goldstein (2017) emphasizes the need to incorporate role-playing games in teaching and learning to encourage formation of social relations that encourage a group approach in tackling biological problems. Though not directly related to Biology learning, the use of role-playing games to prop up leadership skills is hailed by Carolle (2016) and Geraldine (2016), whose contentions are that learners accorded with leadership roles in team role-playing games nurture leadership skills that can be used in prospective professions.

Though not agreeing strongly, 80% of the teachers condescended that role-playing games promote sharing of skills, build confidence and self-esteem, and are a viable way to fight stress and its related disorders. The sentiments of these teachers are that, role-playing games can be used for interactive processes that allow sharing of skills in photosynthesis learning; and learners amass a lot of confidence that would be useful in solving biological algorithms. These findings are identical to the sentiments opined by Azaar (2017) and Hannes (2018), who posit that role-playing games are useful to learners as they give them the chance to interact and build confidence, respectively. Another 80% of the teachers also acceded that role-playing games can be used to brush aside thoughts of stressful events, thus, consolidating the findings of Peter (2020), who emphasized the use of role-playing games to fight stress and its related effects. Finally, while 60% of the respondents offered that role-playing games promote respect and meeting of new people, one teacher (20%) averred that meeting new people was insignificant in photosynthesis teaching and learning

Table 4.4 Showing challenges met when using role-playing games to enhance learner engagement when teaching photosynthesis skills.

Possible challenge encountered when using role-playing games approach in teaching photosynthesis skills	SA	A	D	SD
- Inadequate time	100%	-	-	-
- Shortage of play facilities	-	20 %	80%	-
- Qualified manpower shortages	-	-	100%	-
- Role-playing games may evoke past sad memories	-	-	100%	-
- Role-playing games induce boredom if repeated	100%	-	-	-
- Learners shun practical subjects for academic ones	-	-	100%	-
- Lack of technical support	100%	-	-	-

Information shown on the frequency distribution table above is indicative that teachers strongly agreed that: role-playing games use to improve learner engagement in teaching and learning of photosynthesis topics requires a lot of time (80%), role-playing games are monotonous if not varied (80%) and schools are not giving adequate technical support to teachers and learners to enable the effective use of role-playing games in teaching and learning of photosynthesis concepts. These sentiments resemble the ideas propounded by Pellis and Pellis (2020), who aver that if adequate time is not slotted for role-playing games on the master time table, their use may be heavily compromised.

Moreover, Panskepp (2018) contends that the use of similar role-playing games each day should be avoided, lest the learners may become uninterested and have negative attitudes towards them. This finding calls for educators to be creative, and even assign learners to design role-playing games of their choice in a bid to induce interest and motivation in learners through variety of role-playing games. Similarly, Moyo (2016) laments on the lack of technical support by schools, which consequently restricts teachers and learners to shun the role-playing games approach in teaching and learning of photosynthesis concepts.

In addition, the statistical apparatus above also reflect that the teachers disagreed that: there were no play facilities at the case study school (80%), role-playing games use induces past memories (80%), and that there are inadequate qualified Ordinary level teachers at the case

study school (60%). This implies that teachers were contended with the state of outdoor infrastructure at the case study school and they also felt that the school had adequate manpower resources to man Ordinary level learners. These sentiments go against the findings of Donaldson (2018) and Dokora (2015), who aver that lack of outdoor play facilities and qualified Secondary school teachers respectively contributed to the minimal use of role-playing games in teaching and learning of biological skills. Teachers further opposed the assertions of Aishabi (2017), when they acknowledged that if correctly selected and used in teaching and learning, role-playing games may not induce past unpleasant memories to the learners. Though teachers refuted that there were some moments they included some game aspects that provoked past sad events, the researcher realized that it was a common mistake among teachers to sometimes include games with personal reflections in their teaching and learning episodes.

Table 4.5 Showing factors considered when using role-playing games to improve learner engagement during teaching and learning of photosynthesis concepts

Possible factor to be considered when using role-playing games	SA	A	D	SD
- Schools should improve play facilities	80%	20%	-	-
- Schools should supply adequate resources	80%	20%	-	-
- Ministry should train more Secondary teachers	-	20%	80%	-
- There should be awareness campaigns on importance of role-playing games in promoting photosynthesis concepts	-	-	100%	-
- Teachers should vary role-playing games to reduce tedium	100%	-	-	-
- Role-playing games should include music to generate interest	80%	20%	-	-
- Teachers should improvise if resources are in short supply	-	40%	60%	-

From the Likert Table and Bar chart above, it can be observed that teacher respondents strongly agreed that for role-playing games to be effectively used, schools should provide facilities and resources (80%), role-playing games should be varied (100%), and music should be roped in as a stimulus (80%). This implies that the majority of teachers heaped the burden of resource supply on the school, and encouraged variation of role-playing games and use of music to keep learners concentrating on desired tasks. The teachers' contentions go in tandem with the revelations of Geraldine (2016) and Moyo (2016), who respectively urge teachers to play a pivotal role in ensuring that role-playing games used in teaching and

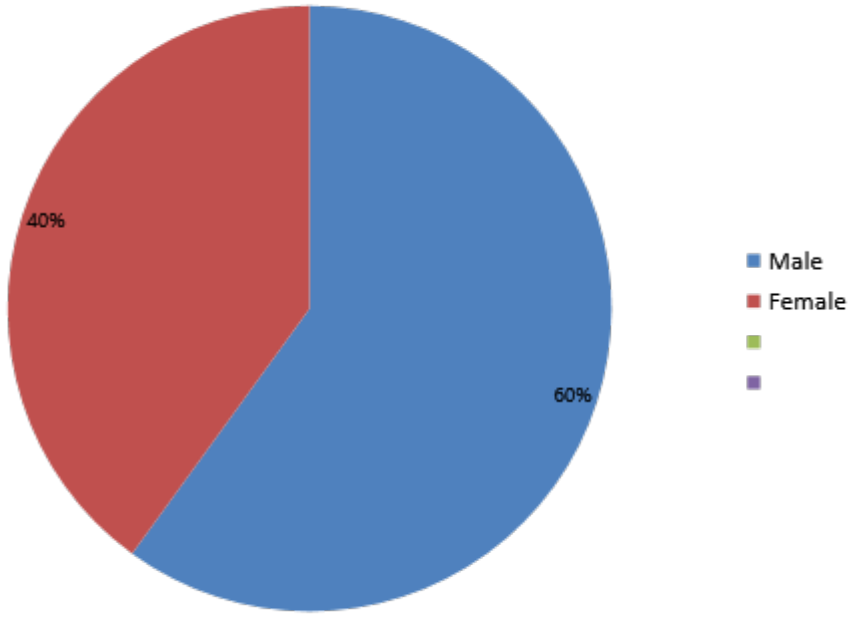
learning of biological knowledge are diversified, and there is incorporation of ice breakers to liven the game situation. Nonetheless, the researcher is of the opinion that where ice breakers are to be used, they should not over ride the acquisition of desired concepts during the teaching and learning episode.

Correspondingly, Moyo (2016) also encourages schools to play an instrumental role in ensuring that facilities used in the school for play activities are adequate to the learners, and resources are available to be used in partnership with those facilities. Interestingly though, teachers refuted the suggestion to improvise resources (60%), have more Ordinary level teachers churned out of colleges (80%) and to have refresher training on awareness of the use of role-playing games in teaching and learning (100%). The teachers highlighted that they were aware of the significance of role-playing games in developing learners' biological knowledge, there were enough secondary school teachers across the entire nation, and that there was no need to use sub-standard improvised resources when schools were capacitated to procure suitable play facilities for learners.

The teachers' sentiments are however in opposition to the ideas of Moyo (2016) and Fisher (2017), who respectively proclaim that there is need for more teachers in secondary schools for facilitating use of role-playing games and there is need to constantly acquaint practicing teachers with contemporary skills of incorporating role-playing games in teaching social attributes to learners. The current Zimbabwean situation was different to that of yesteryears when there were massive shortages of Biology teachers due to limited numbers churned out by colleges and universities each year. Rather, in Zimbabwe, colleges and other tertiary institutions were meeting the growing demand for science teachers, and the main challenge lied with the employer, who faced challenges of deploying all qualified teachers to schools in short supply of science teachers.

Above all, Bailey (2017) and Ginsburg (2017) are also in disagreement with the teachers' sentiments, as they posit that teachers should have the capacity to improvise play materials where resources may be in short supply. Basically the findings saw the need by teachers not to stand back and fold their hands where resources were scarce, but to make initiatives to avail them by any possible means, improvisation included.

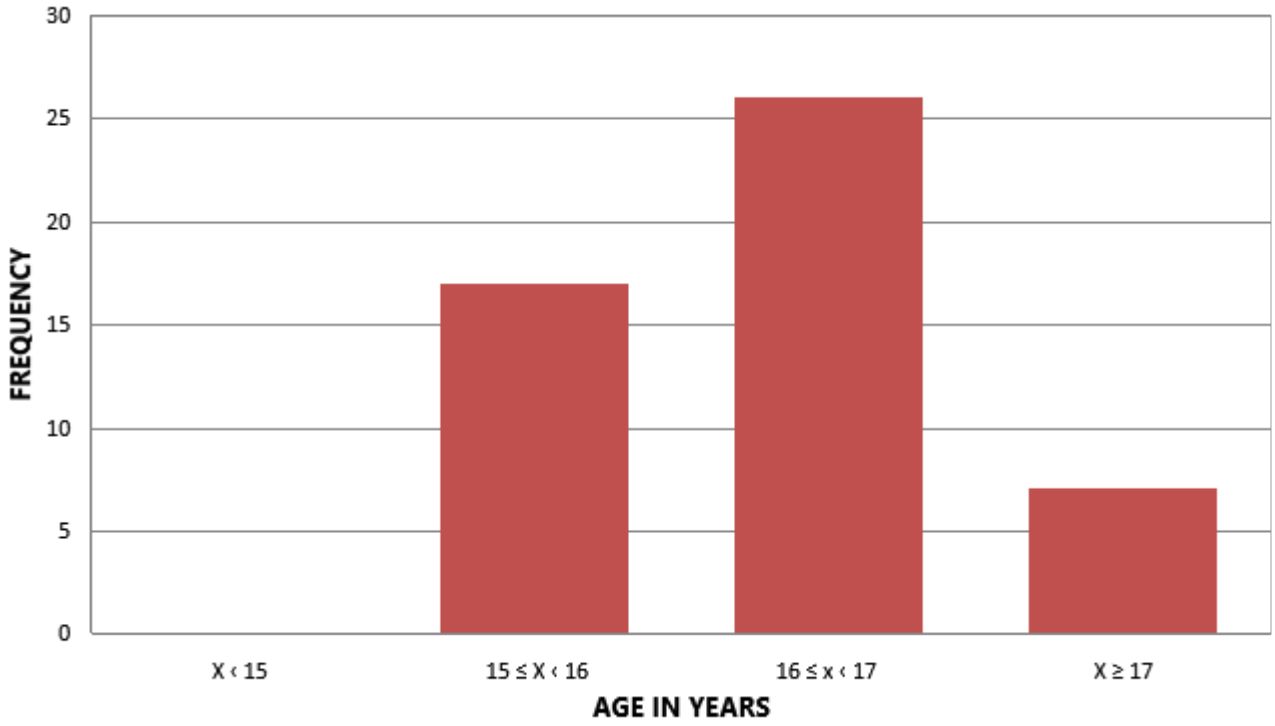
4.3 Learners' demographic data: Pie Chart showing Analysis of learners' sex (n=40)



From the pie chart above, it is evident that the researcher used 60% males and 40% female learners. This entails that of the 40 learners, 24 were boys and 16 were girls. The use of both females and males in this study served to address gender balance. Thus, the researcher collected perceptions of all the sexes towards the use of role-playing games in the teaching and learning of Biology to Ordinary level learners, particularly to reap positive results such as the acquisition of proper photosynthesis attributes.

Again, the researcher preferred the use of both male and female learners so as to be able to find out the extent to which each of the sex groups would be helped more than the other to attain photosynthesis skills after exposure to role-playing games. Thus, the researcher intended to find out if role-playing games impacted equally on both boys and girls as regards their use in inculcating biological skills.

Fig. 4.4 Bar Graph Showing Ages of Learners (n=40)



From the bar chart above, it is manifest that of the respondents, no learners (0%) were less than 15 years old, seventeen learners (34%) were between 15 and 16 years old inclusive of the lower limit, twenty-six learners (52%) were between 16 and 17 years old and seven learners (14%) were greater than 17 years of age. This data shows that the greatest percentage (52%) of Ordinary level learners was in the age range of 16 to 17 years old (inclusive of lower limit and exclusive of upper limit), followed by 34% who were between 15 and 16 years old, also inclusive of lower limit and exclusive of upper limit. The data also reflects that no percentage of learners (0%) at Ordinary level was less than 15 years of age and another small figure of only seven learners (14%) were over 17 years old. This overall means that the average Ordinary level learner was between 16 and 17 years old.

4.5.0 Analysis of Results from Observations

4.5.1 Availability of play facilities at case study school.

From the observations he made on the school regarding the availability of play facilities at the case study school, the researcher noted that the school had done a lot to support Ordinary level learners in terms of play materials. There were all sorts of play materials in the school, particularly in Biology laboratories. The presence of all these play materials showed that there were great efforts by the school to ensure that Ordinary level learners were fully engaged in play activities, like the Plant Cell Factory, Water Cycle Wizards, Ecosystems Engineers or the Sunlight Squad. The researcher could also see the learners taking turns to do their play activities, and sometimes doing so in pairs or groups, which all indicated that there were signs of togetherness, relationship formation, as well as great socialization. The ideas that role-playing games promote social attributes like respect for others and togetherness are a brainchild of Pellegrin (2017) and Goldstein (2017), who all emphasized the consistent use of role-playing games with learners for photosynthesis awareness.

4.5.2 Nature of play activities done by learners at case study school

The researcher also noted that the learners were heavily engaged in activities that were mostly collaborative in nature. This implies that most of the activities which Ordinary level learners got involved in were pair or team role-playing games, in which there was a lot of interaction between the participants. Some of the activities included the Leafy Lab, the Root Riot and the Photosynthesis Factory Line. In all these activities, the learners were highly exposed to sharing, problem-solving and direct interaction, which all facilitated the growth of required photosynthesis attributes. These observations are akin to the sentiments of Azaar (2017), who acknowledges that most team role-playing games partaken of by secondary school learners are interactive in nature, and enable the learners to solve problems as a group.

4.5.3 Amount of time given to role-play activities on the timetable

In the majority of classes observed by the researcher, very limited time was accorded for Biology – the learning area which was expected to allow learners to experience the use of role-playing games for photosynthesis concepts. Although teachers went out of their ways to ensure that learners have adequate play time outside the class, it appeared like the time was

not slotted on the master time table. The researcher also noted that most Ordinary level learners knocked off at four o'clock, a scenario that left them with ample time to have play activities after school. The sentiments of Peter (2020) and Pellis and Pellis (2020) hold water when equated with this observation, as he posited that time imbalances are some of the hindrances that may scuttle the teacher's efforts to rope in role-playing games in teaching and learning of photosynthesis knowledge. The researcher however noted that, some of the learners continued with play activities even after normal school, an indication that they were propping up biological skills in learners.

4.5.4 Teachers' organizational skills during play activities

During most role-play activities done during working hours, the researcher noted that all the learners worked under the supervision of an older person, mostly their teacher. Since there was a lot of sharing facilities involved, the researcher construed the supervision as necessary to avoid conflicts, or even cases of bullying and intimidation by older learners. The researcher however noted that outside school hours, learners played some of the activities on their own, a situation that bred self-restraint behavior, tolerance and respect for each other. Though the researcher felt that working alone for some of the learners was detrimental, for activities that posed no danger, this promoted social attributes like: independence, respect, tolerance and group solidarity. Moyo (2016) claims that learners should be closely monitored during play activities to avoid accidents.

4.5.5 Learners' interest in play activities

There were great indications that Ordinary level learners enjoyed all the time they were out on out-door play activities, as witnessed by the beehive of activity that characterized situation. All the learners were heavily involved in the game activities, and even those sluggish learners were quite mobile. This observation is a reflection of the ideas of Azaar (2017), who contends that role-playing games are a viable approach that can be used to improve the learners' concentration span during lesson time. The researcher noted that, except for those not feeling well, everyone was heavily involved. The researcher also noted that the level of interest was increased as the learners had a lot of choices of role-playing games to choose from, and implements to use in some of the role-playing games that were available. Geraldine (2016), Panskepp (2018) and Moyo (2016) all support the need to vary game activities to avoid boredom and to generate a lot of interest in learners.

4.5.6 Learner-facility ratio during play activities

The researcher noted that when learners came for play activities as single classes, the available facilities were quite adequate for them, but when multiple classes were released for play activities, the facilities were in short supply. This implies that the facilities at the school were adequate for use in teaching and learning of biological knowledge. During lesson time, the researcher noted that some of the facilities were not even occupied, and learners had a wide pool to select play activities of their own choice. Thus, the learner-facility ratio was very bearable, considering that at no point in time were the facilities wholly occupied. This is against the findings of Donaldson (2018) and Dokora (2015), whose studies established that there were inadequate facilities in many schools to encourage the use of role-playing games to promote development of photosynthesis skills in learners. Thus, learners had the liberty to make use of the facilities even during their spare time after school hours.

4.5.7 Signs of social interaction among learners

Of all the teaching and learning approaches ever observed by the researcher, role-playing games were the best way to promote social interaction among learners. Though the group work teaching and learning approach was also useful to promote social interaction among learners, it was noticeable that role-playing games were more useful in promoting development of photosynthesis attributes in a freer way, since learners would acquire the biological skills indirectly. The researcher noted that the social interaction experienced by learners during role-playing games was done through fun and enjoyment, compared to the social interaction experienced in a strictly controlled group work environment. According to Azaar (2017), role-playing games can be used to induce social interactions among learners, some of which will culminate into behaviors like: confidence, respect, tolerance, cooperation and group solidarity - which were all instrumental in inculcating photosynthesis concepts.

4.5.8 Challenges evident during play activities

During play activities, the researcher noted that there were a lot of challenges encountered, though some of them could have been avoided if corrective measures were taken before the use of role-playing games in teaching and learning of biological skills. The first noticeable

challenge was that of inadequate time. The researcher observed that, in most cases, learners left the play activities without will, as their concentration span would not have been exhausted. It was also noticeable that when the teacher is not around to monitor the activities, some of the learners would be heavily disruptive, and disallow all learners to participate in the activities of their interest. This observation goes hand in glove with the assertions of Moyo (2016), who postulates that when game activities are not strictly monitored, some of the learners may not take part in the activities. Other challenges noted include the acute shortage of implements and aging of some of the facilities.

4.6.0 ANALYSIS OF DATA FROM EVALUATION TESTS

TABLE 4.6.1 DATA FROM EVALUATION TESTS

No	NAME	SEX	PRE-TEST SCORE	POST-TEST SCORE
1.	A1	F	63	77
2.	A2	M	76	87
3.	A3	F	88	93
4.	A4	F	85	83
5.	A5	F	74	80
6.	B1	F	91	97
7.	B2	F	88	93
8.	B3	F	94	97
9.	B4	F	92	97
10.	B5	F	87	90
11.	C1	M	87	90
12.	C2	M	75	83
13.	C3	M	85	83
14.	C4	F	88	93
15.	C5	M	89	97
16.	D1	M	85	83
17.	D2	F	67	57
18.	D3	M	76	87
19.	D4	F	87	90

20.	D5	F	96	97
21.	E1	M	92	97
22.	E2	M	85	83
23.	E3	M	75	83
24.	E4	F	89	97
25.	E5	F	78	93
26.	F1	M	82	73
27.	F2	F	74	80
28.	F3	F	87	90
29.	F4	F	95	100
30.	F5	M	89	97
31.	G1	F	87	90
32.	G2	M	83	77
33.	G3	F	93	100
34.	G4	M	83	77
35.	G5	F	89	97
36.	H1	F	89	97
37.	H2	F	81	70
38.	H3	M	85	83
39.	H4	F	87	90
40.	H5	F	88	93

The data in Table indicates that the above evaluation tests were written by 40 learners and marks were expressed as a percentage. The data also shows that there were 15 boys and 25 girls who wrote the evaluation tests. This data indicates that the researcher collected results from both female and male respondents. In order to deduce understanding out of the data, the researcher grouped and tabulated the data in the table below:

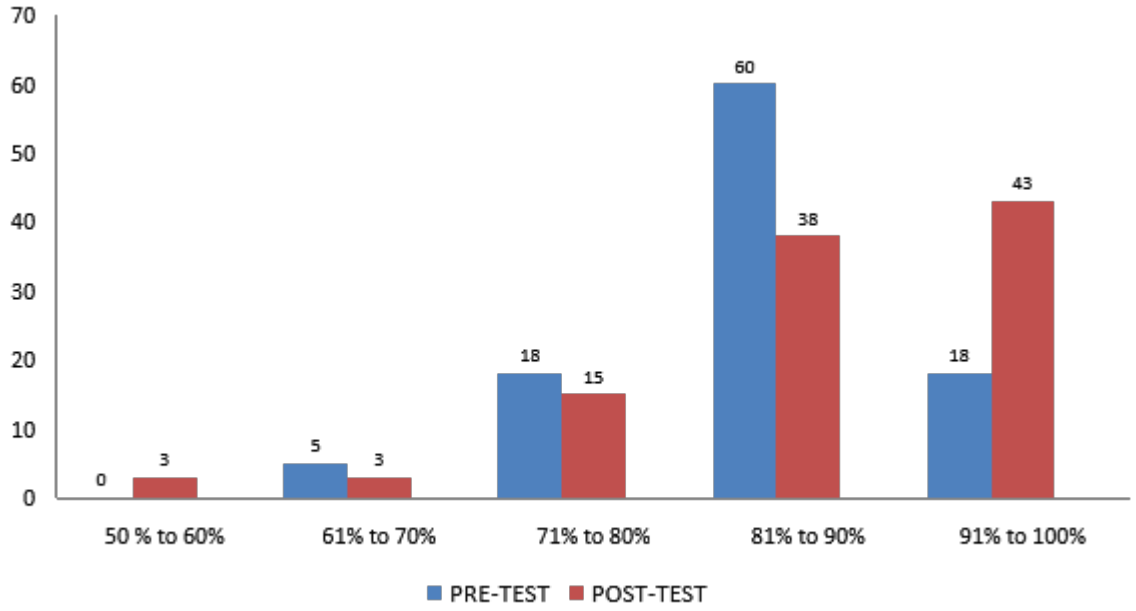
TABLE 4.6.2 SHOWING GROUPED DATA FROM EVALUATION TESTS

CLASS WIDTH	**FREQUENCY**		**PERCENTAGE**	
	PRE-TEST	**POST-TEST**	**PRE-TEST**	**POST-TEST**

$0 \leq x \leq 50$	**0**	**0**	**0%**	**0%**
$51 \leq x \leq 60$	**0**	**1**	**0%**	**2.5%**
$61 \leq x \leq 70$	**2**	**1**	**5%**	**2.5%**
$71 \leq x \leq 80$	**7**	**6**	**17.5%**	**15%**
$81 \leq x \leq 90$	**24**	**15**	**60%**	**37.5%**
$91 \leq x \leq 100$	**7**	**17**	**17.5%**	**42.5%**

The data tabulated in Table 4.5.2 indicates that there was no learner who obtained a mark below 50%. The data also shows that one student (2.5%) obtained a mark between 51% and 60%, another student (2.5%) obtained a mark between 61% and 70%, six students (15%) obtained a mark between 71% and 80%, fifteen students (37.5%) obtained a mark between 81% and 90%, and 17 students (42.5%) obtained a mark between 91% and 100%. The resealts indicate that the modal class is 91% to 100%, an indication that evaluation tests in Linear Programming were well done by the majority of learners. The same data also showed that the lowest mark was between 51% and 60%, an indication that there were cases of backwardness in the class. The researcher presented the same data using the bar graph below.

FIGURE 4.6.3 SHOWING MARKS OF STUDENTS ON EVALUATION TESTS



From the bar graph in Figure 4.5.3, it is noticeable that the data does not follow a normal distribution as it is skewed to the right. This data is reflective that the majority of the students

obtained very high marks in the evaluation tests they were given on photosynthesis. From the data in Figure 4.5.3, it can also be deduced that there were 100% pass rates in both tests, and the pass rates had quality results. This indicates that evaluation tests which are prepared and adminstered effectively, particularly after teaching the topic on which they were prepared using role playing games, have the opportunity to score higher grades. This finding is akin to the ideas opined by Peter (2020), who established that role playing games have the advantage that they improve learners' performances and they also have the potential to diagnose learners' weaknesses. The researcher also observed that despite the effectiveness of role-playing games in improving performance, there were some cases of giftedness amongst the sampled students, as so,e of them scored 100% in the post-test.

The same results also reveal that though passesd by all students, the diagnostic test had lower marks thazn the post-test, whose scores were reminiscent of the usefulness of role-playing games in improving learner engagement, and consequently improving performance. For the record, 43% of the students got above 90% in the post-test as compared to 18% who obtained similar grades in the pre-test. These results qre reflective that there was massive improvement of learners' performance after exposure to role-pmayong games as co,pared to their performance before exposure. These findings resemble the sentiments of Pellis and Pellis (2020), who posited that role-playing games encouraged adherence to prescribed rules, which fostered a culture to follow instructions in learners. Following of rules and guidelines in role-playing games was seen as instrumental in equipping learners with exam tactics, especially a step-by-step approach envisaged for Biology problems.

4.6.4 Summary

This chapter presented the researcher's findings on pie charts, bar charts and frequency distribution tables. Thereafter the presented data was analyzed and interpreted with the overall intention to answer the research questions. The researcher also analyzed data collected through observations, and consequently noted similarities and differences that existed between the gathered data and that of earlier findings. The gathered data revealed the significance of role-playing games in facilitating development of biological knowledge, the challenges encountered by teachers when using role-playing games in teaching and learning, as well as the techniques that can be adopted by parents, guardians, teachers and learners to improve the use of role-playing games in facilitating the photosynthesis skills of Ordinary level learners.

CHAPTER FIVE

SUMMARY, FINDINGS AND RECOMMENDATIONS

5.0 Introduction

This chapter summarizes the whole study, findings from the study, recommendations proposed based on the findings of the study, as well as some research questions generated by the study.

5.1 Summary of the Study

This study was carried out in 2024 at Nyuni Government High School found in Mwenezi District of Masvingo Province, on a population of fifty-five participants; among them fifty students and five teachers. The purpose of carrying out this study was to ascertain the effectiveness of using role-playing games in facilitating the teaching and learning of photosynthesis concepts on Ordinary level learners. The sample of fifty-five participants was selected randomly from the case study school.

Related literature examined the uses of role-playing games in teaching and learning of photosynthesis skills, challenges met when using role-playing games in teaching and learning of photosynthesis concepts, as well as techniques that can be adopted to make the integration of role-playing games in teaching and learning of photosynthesis concepts viable. From the related literature, it was established that role-playing games were essential for provision of a competitive environment on learners, encouraged learners to adhere to prescribed rules, equipped learners with exam tactics and also promoted the spirit of group solidarity among learners. Moreover, all the sources consulted highlighted: lack of adequate funding and technical assistance, lack of knowledge, over-enrolment, inadequate manpower resources, teachers' lack of interest, and insufficient time by both teachers and pupils, as contributory to failure by teachers to integrate role-playing games in the inculcation of photosynthesis concepts. Again, it was also noted that: provision of technical assistance or training to teachers by school authorities, trimming classes to standard teacher-pupil ratios, safeguarding existing infrastructure, availing play materials to learners, as well as consistent procurement

of play materials by schools and the parent community, would help to alleviate the challenges mentioned above.

To gather data for this study, the researcher adopted a descriptive survey approach, whose design was both quantitative and qualitative in nature. The mixed method and the descriptive survey approach were mostly preferred by the researcher as they offered the greatest opportunity to collect valid and reliable data. The research methodologies adopted also enabled the researcher to use questionnaires and an observation guide to collect data for this study. Merits and demerits of each of the above research tools were also given, as well as how the research instruments were used to collect data for the study. Randomization was used to select the target sample of participants.

The data which was collected from questionnaires and observations was presented in Chapter 4 using statistical itinerary such as pie charts, bar charts, as well as frequency distribution tables. All the statistical graphs used were selected by the researcher as they allowed him to easily identify the modal appearance, i.e. the highest frequency on the collected data. Moreover, apart from keeping originally collected results, the statistical tables used by the researcher also enabled him to present the findings in a compact form, hence making it amenable for analysis. The presented data was then analyzed and interpreted, with the chief aim to satisfy the research objectives. The researcher did not encounter any problems in collecting data for this study, save for costs to surf through the internet, as well as costs to type and print research instruments.

5.2 Findings and Conclusions

Information gathered by the researcher indicated that role-playing games were indeed useful in facilitating teaching and learning of photosynthesis concepts to Ordinary level learners. The following benefits were realized through the use of role-playing games in teaching and learning of photosynthesis concepts:

- Role-playing games enable effective teaching and learning of photosynthesis skills through their provision of a competitive environment on Ordinary level learners.
- Role-playing games encouraged adherence to prescribed rules, which fostered a culture to follow instructions in learners. Following of rules and guidelines in role-playing games was seen as instrumental in equipping learners with exam tactics, especially a step-by-step approach envisaged for Biology problems.

- The ability by learners to play certain role-playing games efficiently built some confidence and self-esteem in them, attributes that were necessary in effective acquisition of photosynthesis concepts or other facets of life.
- Role-playing games also promote the spirit of group solidarity, which is manifest in learners who desire to work collectively to achieve group objectives. Thus attributes like cooperation, togetherness and team spirit were developed through exposing learners to different forms of role-playing games.

5.3 Recommendations

In light of the above findings, the researcher would like to offer the following recommendations:

- ❖ Schools should erect adequate play infrastructure for Ordinary level learners and also avail a wide range of role-play materials for them, as a way to promote proper teaching of photosynthesis concepts.
- ❖ School authorities should also offer refresher training, workshops, and seminars to both teachers and learners, as a way to improve their capabilities in using the role-playing games approach to facilitate acquisition of skills in Biology concepts, like photosynthesis topics.
- ❖ School administrators should keep class sizes relatively small, using standardized teacher-pupil ratios, to enable effective rationing of various forms of role-play implements during teaching and learning using the role-playing games approach.
- ❖ Teachers should be very good improvisers, and should vary the nature of role-playing games they use in their teaching and learning of Biology concepts like photosynthesis topics so as to avoid monotony on Ordinary level learners, whose concentration spans are a major cause for concern.
- ❖ School administrators should avail adequate play time for Ordinary level learners as a way to inculcate proper biological attributes in them.
- ❖ Ordinary level learners should be strictly monitored when partaking of various role-playing games, since the most vocal or outspoken may override the entire process, and consequently deny other learners from developing proper biological skills through the use of role-playing games.
- ❖ Apart from training more secondary school teachers, the Ministry of Secondary and Secondary Education should raise awareness campaigns on

importance of role-playing games in developing photosynthesis literacy in learners.

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APPENDICES

APPENDIX A: INTERVIEW GUIDE FOR TEACHERS

My name is Simango Trymore, a student at Bindura University of Science Education (BUSE) studying for a Bachelor of Science Honors Degree in Science Education. I am carrying out a study to establish the influence of role-playing games in enhancing learner engagement in teaching and learning of Photosynthesis topics at Ordinary level in Mwenezi district, Masvingo province. Please assist me with information on questions below. The information that you provide will be used for academic purposes only.

Section A: Teachers' Demographics

1. Sex: Male [ ] Female [ ]
2. Age: Below 30 Years [ ]

Between 30 and 40 Years [ ]

Between 40 and 50 Years [ ]

Above 50 Years [ ]

3. Educational Qualifications

Certificate in Education [ ]

Diploma in Education [ ]

First Degree [ ]

Master's Degree [ ]

Other (specify)

……..……

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4. Working Experience

Less Than Five Years [ ]

Between 5 and 10 Years [ ]

Between 10 and 15 Years [ ]

Above 15 Years [ ]

Section C: Research Questions

1. **Research Question** 1-How do role-playing games promote learner engagement during the teaching and learning of Photosynthesis concepts at Form 3 level?

Possible contribution of games in improving learner engagement	**SA**	**A**	**D**	**SD**
- **They enable sharing of skills**				
- **They encourage following of rules and instructions**				
- **They build confidence and self-esteem**				
- **They build social relationships required in group work**				
- **Games are greatly learner centered**				
- **Games promote respect for others' views**				
- **Games enable variation of learning activities**				
- **Games encourage group solidarity when problem solving**				

Key: SA–Strongly Agree; A-Agree; U–Undecided; D– Disagree; SD – Strongly Disagree

OTHER (SPECIFY)

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2. **Research Question** 2 - What challenges do teachers face when using role-playing games to improve learner engagement in the teaching the concepts of Photosynthesis to Form 3 learners?

Possible challenge encountered when using role-playing games	**SA**	**A**	**D**	**SD**

- **Inadequate time**				
- **Games don't suit all types of learners**				
- **Some learners may not take part if not monitored**				
- **Games negatively affect discovery learning**				
- **Games induce boredom if repeated**				
- **They don't suit large classes prevalent in most schools**				
- **Lack of technical support from school administrators**				

Key: SA – Strongly Agree; A- Agree; U – Undecided; D – Disagree; SD – Strongly Disagree

OTHER (SPECIFY)

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3. **Research Question** 3 - What strategies can improve implementation of role-playing games to promote learner engagement when facilitating instruction of Photosynthesis to Form 3 learners?

Possible strategies to improve implementation of role-playing using games	**SA**	**A**	**D**	**SD**
- **Games should be inter-twined with other teaching methods**				
- **Schools should supply adequate resources**				
- **Learners should be strictly monitored**				
- **There should be more literature on importance of role-playing**				

games in promoting Biology skills				
- **Teachers should vary games to reduce tedium**				
- **Teachers should adequately plan and prepare before using games**				
- **Teachers should improvise where resources are in short supply**				
- **Teachers should use familiar role-playing activities**				
- **Teachers should use teaching aids to make games more enjoyable**				

Key: SA –Strongly Agree; A-Agree; U–Undecided; D–Disagree; SD – Strongly Disagree

OTHER (SPECIFY)

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APPENDIX B: OBSERVATION GUIDE FOR PARTICIPANTS

The researcher will observe and record the following:

1. Availability of Science role-playing facilities at case study school.

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2. Amount of time given to Science on the timetable

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3. Teachers' organizational skills during role-playing activities

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4. Learners' interest during role-playing activities

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5. Learner-facility ratio during role-playing activities

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6. Signs of learner engagement when using role-playing games

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7. Challenges evident during playing activities

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7.3 APPENDIX C: EVALUATION TESTS

Pre -test

Instruction: Answer all questions in section A and B

Section A

1. Which of the following are conditions necessary for photosynthesis?

A. Carbon dioxide, light, Water, chlorophyll

B. water, light, oxygen

C. Carbon dioxide, chlorophyll, water

D. oxygen, temperature, water

2. Which of the following is an adaptation of a leaf adapted for photosynthesis?

A. Network of veins to transport water.

B. presents of roots to absorb water.

C. Small surface area.

D. Thick cuticle

3. Which colour shows the positive results for starch test?

A. yellow

B. brown

C. blue black

D. red

4. Products of photosynthesis includes which of the following?

A. nitrogen and oxygen. B. hydrogen and oxygen

C. Glucose and oxygen. D. phosphorous and carbon dioxide

5. In factors that affects the rate of photosynthesis which of the following is excluded?

A. water B. light

C. carbon dioxide D. oxygen

6. Photosynthesis takes place in which part of the palisade cell?

A). cell membrane B). Vacuole

C). mitochondrion D).chloroplasts.

7. What is the source of carbon dioxide which plants need for photosynthesis?

A. Air B. Ammonia

C. Sunlight D. Starch

8. Why is the leaf first boiled when testing a leaf for starch?

A. To de-starch the leaf. B. To soften it.

C. To remove color. D. To kill it

Section B

9a).Photosynthesis produce oxygen as a by -product yes or no? (1)

b). Write down the equation for photosynthesis. (2)

c). Photosynthesis is important, Explain why? (3)

d). Describe the fate of the organic end products of photosynthesis? (2)

10a). State what the danger is involved in the testing a leaf for starch and how it may be overcome. (2)

b) Explain three adaptations of leaves for photosynthesis. (2)

Marking guide

Section A

1A

2 A

3 C

4 C

5 D

6 D

7 A

8 D

Section B

9a) Yes

b) Carbon dioxide + water chlorophyll/sunlight carbohydrates + oxygen

c) -it provides oxygen needed for respiration

-reduces effect of global warming

- maintains a natural balance of carbon dioxide and oxygen in the atmosphere

d) -used to supply energy

- used to make other sugars such as sucrose and fructose

- used to make other organic substances such as cellulose

- Oxygen is used in respiration

10a). Alcohol is highly inflammable. To overcome the danger, switch off the burner before using alcohol.

b). thin -allows inner tissues to lie close to the surface, reducing the distance carbon dioxide must diffuse to reach the chloroplasts in palisade cell

veins – form its transport system

Broad leaves - for absorption of more sun light

Presents of air space between mesophyll cells - for free gaseous exchange

Numerous chloroplasts - to trap more sun light

Form 3: Post test

Instruction: Answer all question in all sections

Section A

1. Which of the following is not a factor that affects the rate of photosynthesis?

A. Light B. carbon dioxide

C. Oxygen D. Water

2. When testing a leaf for starch, why is the leaf first boiled?

A. to dissolve the starch. B. To remove micro- organisms.

C. To decolorise it. D. To stop chemical reaction in the leaf

3**.** Where do plants get the carbon dioxide needed for photosynthesis?

A. Water B. The air

C. The sun D. Glucose

4. In which part of the palisade cell does photosynthesis take place?

A). Cell sap. B). Nucleus.

C) . Chloroplast. D). Mitochondrion.

5. Which of the following are products of photosynthesis?

A. Carbon dioxide and oxygen. B. glucose and carbon dioxide

C. Oxygen and glucose. C. Nitrogen and glucose

Section B

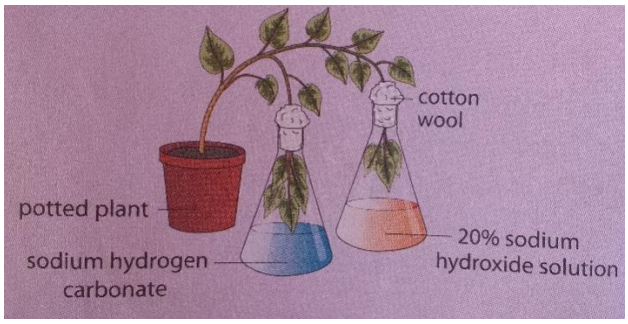
Instructions:

- Tick the appropriate box

- Answer all questions

6. Network of veins to transport water is one of the leaf adaptations for photosynthesis yes ☐ or no ☐

7. In an experiment to investigate if carbon dioxide is necessary for photosynthesis, Sodium hydroxide solution is used.



a) This chemical release carbon dioxide true ☐ or false ☐

b) Sodium hydrogen carbonate solution is also used. This chemical absorbs carbon dioxide True ☐ or False ☐

8. Energy conversions that takes place during photosynthesis is Light to chemical. True ☐ or False ☐

9. Sunlight is not a factor that affects the rate of photosynthesis True ☐ or False ☐

10. Starch is soluble True ☐ or False ☐

11. Describe how you would test a leaf for starch. (4)

Post-test: Marking guide

Section A

1 C

2 D

3 B

4 C

5 C

Section B

6) Yes

7a) False

7b) False

8.) True

9) False

10a). False

b) - put the leaf in hot water to kill it.

-boil the leaf in alcohol to remove chlorophyll

-wash the leaf in hot water to soften it

-put the leaf on a white tile and use a dropper to add iodine solution.

-if starch is present blue black is observed

7.4 APPENDIX D:

NYUNI GOVERNMENT SECONDARY SCHOOL

ALL COMMUNICATIONS SHOULD BE ADDRESSED TO:
THE HEAD
NYUNI GOVERNMENT SECONDARY SCHOOL
PO BOX 73 TRIANGLE
Cell. 0773003757
amohlungwani@gmail.com

The Chairperson SAMED

Bindura University of Science and Technology

P Bag 1020

Bindura

Zimbabwe

Dear sir/madam

RE: PERMISSION TO CARRY OUT RESEARCH AT NYUNI GVT SECONDARY SCHOOL: SIMANGO T: STUDENT REG NO: B225543B: PART: 2, 2

The above subject matter refers.

I write to confirm that the above mentioned student has been granted permission to carry out his research at this institution.

Yours faithfully

Hlungwani A (Head)

THE HEAD
NYUNI GVT SEC SCHOOL
29 MAY 2024
P.O. BOX 73 TRIANGLE
SIGNATURE.....

7.5 APPENDIX E:

SAMED

P Bag 1020
BINDURA
ZIMBABWE

Tel: 0271 - 7531 ext 1038
Fax: 263 - 71 - 7616

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 12 MAY 2024

TO WHOM IT MAY CONCERN

NAME: SIMANGO T REGISTRATION NUMBER: B2255H3B

PROGRAMME: HBScEdBz PART: 2:2

This memo serves to confirm that the above is a bona fide student at Bindura University of Science Education in the Faculty of Science Education.

The student has to undertake research and thereafter present a Research Project in partial fulfillment of the HBScEdBz programme. The research topic is:

THE EFFECTIVENESS OF ROLE-PLAYING GAMES IN INCREASING LEARNER ENGAGEMENT WITH PHOTOSYNTESIS TOPIC AT NJUNDI GOVERNMENT SECONDARY SCHOOL.

In this regard, the department kindly requests your permission to allow the student to carry out his/her research in your institutions.

Your co-operation and assistance is greatly appreciated.

Thank you

BINDURA UNIVERSITY OF SCIENCE EDUCATION
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
9 APR 2024
P BAG 1020
BINDURA

Z Ndemo (Dr.)
CHAIRPERSON - SAMED