BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

APPLICATION OF PRAGMATIC PRINCIPLES TO TEACHING AND LEARNING OF MATHEMATICS AT "O" LEVEL IN THREE SCHOOLS IN MAVIRIRA CLUSTER IN CHEGUTU DISTRICT MASHONALAND WEST PROVINCE

BY

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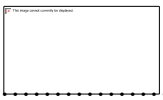

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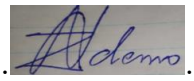
Signature …  ……Date ……/……/……..

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DEDICATION

This research project is dedicated to my loving family, whose unwavering support and encouragement have been the driving force behind my academic pursuits. To my partner, Choruma Rejoyce, your patience and understanding have allowed me to pursue my dreams. And to my children Wayne, Ryan, and Dylan your curiosity and enthusiasm inspire me to make a positive impact on the world.

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ABREVIATIONS AND ACRONYMS

BODMAS: BRACKETS OF DIVISION MULTIPLICATION ADDITION AND SUBTRACTION

BOMDAS: BRACKETS OF MULTIPLICATION DIVISION ADDITION AND SUBTRACTION

ABSTRACT

The purpose of this research was to find the application of pragmatic principles to teaching and learning of mathematics at "o" level in three secondary schools in Mavi Rira Cluster of Chegutu District. The adopted a descriptive survey research design. The researcher used both purposive and random sampling. A total of 40 students and 12 teachers were used as the sample for the study. Questionnaires, observations, and interviews were utilized in gathering data from the respondents. The collected data was presented using tables, bar graphs and pie charts. The research revealed that, there is need for teachers to involve the use of real-life examples, teaching should be from simple to complex, varying teaching methods and be able to use each method effectively. Recommendations set were that teachers should get in-service training on how teachers should have in service training programs to familiarize themselves with various

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CHAPTER ONE: INTRODUCTION

1.0 INTRODUCTION

The research aims to assess the application of the pragmatic principles in solving mathematical problems at O' level in three schools found in Chegutu District. Therefore, this study will seek to investigate how mathematics teachers in Mavirira cluster of Chegutu District can use practical approaches that enhance the teaching and learning of mathematics. Furthermore, practical approach is a philosophical tradition that considers words and thought as tools and instruments for prediction, problem solving and action, and rejects the idea that the functions of thoughts is to describe, represent or mirror reality. This implies that teachers should teach mathematics using real life experiences. However, this chapter gives a general overview of the whole study. This incorporates the background to the study, statement of the problem, aim of the study, research objectives as well as research questions. As the chapter progresses the researcher examines: the importance of the study to various stakeholders, the research delimitations, challenges encountered during the undertaking of this study, definition of key terms and the chapter summary.

1.1 BACKGROUND TO THE STUDY

The teaching and learning of mathematics at 'O' level is a challenge in which teachers must devise various approaches if the learners are to reap positive outcomes out of the teaching and learning situation. Enerst (2014) fields of philosopher of various dimensions and approaches can be implemented to try and inculcate varied mathematical skills in learners at various levels of education ladder and one such school of philosopher is pragmatism. Philosophically, mathematics teachers are encouraged to use methods that are child-centered and practical-based, such as the experimentation and the project methods of teaching.

Sleeper (2017), the pragmatic approach to mathematics teaching places high premium value on activity this is because philosophically their belief is that their ideas are born out of activities .Thus in teaching mathematics teachers should ensure that learners are immersed in mathematical activities at "o" level such activities would include in probability , playing cards, dice, and coins. Alexander (2017) shows that learners who engage in activities perform exceptionally well and take time to forget concepts learnt. This means that hands-on activities

consolidate concepts and promote recalling capabilities in learners by forming mental images.

Pragmatists also encourage use of project method in teaching such topics like geometry construction, whereby learners carry out their task individually under the supervision of the teacher. In line with the above studies show real life problem on geometric construction such as constructing a 90-degree angle which is a concept which is used by builders when building rectangular houses, such that students will correlate mathematical knowledge with real life problems. Thus, the researcher will investigate whether teachers in Mavirira cluster Chegutu District are teaching mathematical concepts using real life problems which evoke learners' critical thinking.

Pragmatists do believe in predetermined truth. Singh (2017) asserts that truth always changes according to time, place, and situation. Hence a certain thing which was true to a person yesterday need not to be the same for him today or will remain the same tomorrow. The research has shown that teachers must be ready to change in his act of teaching and should use the appropriate method which suits the current situation and should use current textbooks which suits current syllabus .Teachers should constantly look for information as mathematical subject content may change with time, for instance, the acronym BODMAS used to apply when teaching laws of precedence, but nowadays it has changed to BOMDAS and BODMAS is no longer applicable (Frankenstein, 2019) .

Moreover, when teaching mathematics almost close to 100% have resorted to the use of the calculator version hence teachers should move with time and move from non- calculator version. Also, teachers should use flexible teaching methods, for instance, when teaching transformations, the teacher can use the experimental method whereby they would graphically perform the transformations needed or can use the matrix method whereby they would use certain matrices to perform the transformations (Marcone, 2015). Thus, the researcher would want to investigate whether teachers in Chegutu District are using pragmatic methods to teach mathematics, are they using flexible methods of teaching as to give learners the leeway to understand the concepts.

1.2 STATEMENT OF THE PROBLEM

During the researcher stint at a secondary school as a mathematics teacher, he made several observations related to mathematics teaching. I noted that each school approached the teaching and learning of mathematics from a different philosophical angle as guided by the nature of resources, types of methodologies used by teachers and the nature of the mathematics curriculum designed by policy makers and curriculum developers. He also observed that most mathematics teachers in the cluster near to his school had no teacher education and hence tended to approach the teaching and learning of mathematics from diverse viewpoints. I also noticed that apart from limited pedagogical acuity by teachers, there was also rampant reluctance by the same to periodically allude to policy documents and circulars to remain acquainted with pragmatic trends to the teaching and learning of mathematics. Again, some of the tenets envisioned by the pragmatic philosophy are not feasible under the current economic environment in Zimbabwe and this motivated the researcher to ascertain the efficacy of implementing the pragmatic approach to the teaching and learning of mathematics to "o" level learners at the case study schools.

1.3 RESEARCH OBJECTIVES

The study will address the following objectives:

To relate the Zimbabwe policy documents to the pragmatic philosophy of teaching mathematics at 'O' level

To establish the relationship between the pragmatism philosophy and the teaching of mathematics at 'O' level.

To propose techniques that can be implemented to improve the use of pragmatic approaches in the teaching and learning of mathematics 'O' level.

1.4 RESEARCH QUESTIONS

The researcher attempts to answer the following research questions:

What is the relationship between the pragmatic school of philosophy and the teaching and learning of mathematics at 'O' level?

How do Zimbabwe Policy relate with the pragmatic approaches to the teaching and learning of mathematics at 'O' level?

Which techniques can be implemented to enable mathematics teachers effectively implement the pragmatic philosophy in the teaching and learning of mathematics at 'O' level?

1.5 SIGNIFICANCE OF THE STUDY

The researcher has many hopes that this study would greatly benefit teachers, learners, and policy makers. The literature to be consulted by researcher hopes that the findings to be unpacked and the recommendations to be proposed are going to be instrumental in enlightening mathematics teachers on how they should implement the pragmatic approaches in the effective teaching and learning of mathematics. Since there are many philosophical schools of thought that can be employed in teaching and learning of mathematics to 'O' level learners, the researcher hopes that this study may help teachers to prefer pragmatic approaches ahead of other schools of thought, basing on their effectiveness in the classroom. The researcher expects this study to give policy makers and curriculum developers a clear guideline of how to match the existing scenario with the current national policy documents and the documented pragmatic practices. This means that the Zimbabwean policy documents relating to mathematics teaching may eventually strike a relationship with the properly laid down pragmatic principles.

Also, the researcher hopes that the learners may set to benefit from this study. The Zimbabwean situation expects all school leavers to be in possession of at least five ordinary levels, and one of the core subjects is mathematics. The successful completion of this study will end up improving pass rates in schools, particularly in Mathematics. This entails that the inclusion of pragmatic approaches in policy documents in the classroom may eventually help learners to attain their maximum potential in Mathematics. The researcher also hopes that this study shall be a yardstick for future research that are to be carried out to ascertain the feasibility of pragmatic approaches in the teaching and learning of mathematics.

1.6 STUDY DELIMITATIONS

This study is carried out in Chegutu District, found in Mashonaland West Province. A total of three schools in Mavirira Cluster were used in this study and the schools include: Mucheri secondary School, Royal secondary school, and World harvest secondary schools. Statistics obtained from the District Inspector's office indicate that Chegutu District has a total of 53 secondary schools and whose enrolment hovers over 20 000 learner and 1300 teachers. Of the three schools, both are rural day schools which enroll learners from all parts of the country. The researcher worked with 52 participants, among them 40 learners, and 12 teachers. The major aim of carrying out this study was to establish the efficacy of using the pragmatic

approaches in the teaching and learning of Mathematics at 'O' level. The study was done and completed in 2024.

1.8 LIMITATIONS OF THE STUDY

The study was carried out in 2024 and hence the collection of data from respondents was a mammoth task. The researcher wanted to use face-to-face data collection methods such as interviews and forced him to adopt online techniques of data collection. They were also detrimental to the effective data collection techniques, such that the researcher faced challenges to adequately get in touch with the research participants. Again, the researcher was keen to carry out this study with infant learners but the limited resources at his disposal and the available time were an inhibition factor. To enable generalizability of the findings obtained from this study, the researcher chose the sample with care to include all sex groups in the teacher and learner samples.

The researcher was also stationed away from Bindura University of Science Education (BUSE) hence it was an uphill battle to periodically get in touch with the tutor for corrections and guidelines to smoothly progress with the study. To avert this challenge, the researcher resorted to online means of communication and sending documents to the tutor for marking. Again, the researcher maximized the little time that students came for block release and made constant discussions with the tutor to cover up for the distance barrier.

1.9 DEFINITION OF TERMS

Pragmatism – a school of philosophy in which the theory and practice of education is based on two main principles, that education should have a social function and that education should provide real-life experience to the child.

Principles- are basic ideas or rules that explains or controls how something works or chain of reasoning .

Mathematics – the science that deals with the origin, everyday use and abstract nature of numbers that encompasses algebra and geometry.

1.10 SUMMARY

This chapter provided the problem and its setting in which the background to the study, the problem statement, research objectives as well as research questions were discussed. Furthermore, it emerged that the study is instrumental to teachers, learners, other researchers as well as policy makers and curriculum developers. It was highlighted that the study was carried out in Mavirira Cluster of Chegutu District, Mashonaland West Province on a population of 52 participants. The study was carried out using online methods of data collection were implemented to reduce transport cost and time consuming the teacher have exam classes to attend to. The researcher finally gave the definition of key terms to cap the chapter.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

This section examines the contributions of early researchers and other educational thinkers whose pragmatic ideas are still invaluable in today's teaching and learning, particularly of mathematics. The relationship between the pragmatic philosophy and mathematics teaching, the stance of Zimbabwe's education policy versus pragmatic principles as well as techniques that can be implemented to improve the use of pragmatic practices in the teaching and learning of mathematics shall be discussed in this chapter.

2.2 THE RELATIONS BETWEEN THE PRAGMATISM PHILOSOPHY AND THE TEACHING OF MATHEMATICS

Many people are pragmatic by doing what works, and when something does not work, one is compelled to ask questions as to how to make it work. Beginning from the 1940s, Reginald Revans started developing the action learning concept, a problem-solving method characterized by taking an action and reflecting on the results, as an educational pedagogy for business development and problem-solving (Wilson, 2003). Since that time, action learning has come to describe a variety of forms it can take and contexts it can be observed. In the context of achieving high quality of teaching, the target of action learning is the teaching of the individual teacher (Marcone, 2015). In the general context of improving professional performance, Welchman, (2018).argues that action learning starts with an inquiry into a real problem so that regardless of whether the problem is tactical or strategic, the process of learning is strategic. Action learning in mathematics education can be defined as learning through student individual work on a real problem followed by reflection on this work. In most cases, this work is supported by a more knowledgeable other.

In mathematics education, action learning, the genesis of which is in the early childhood experience, has natural levels of maturity (Mitias and Alexander, 2019). This means that, before we become concerned with the day-to-day responsibilities attached to adulthood, we can freely consider action learning in a game form. The key to success is ability to solve problems and research finds that curiosity be characterized in terms of excitement about peculiar observations and unexpected phenomena (Boisvert, 2018). In addition, "What children

will be curious about depends in large part on the nature of the world about them and their previous experience'' (Sarama, & Clements, 2009). Students at all educational levels seek concreteness, are naturally curious about the real world, and enjoy benefits of action learning, especially when they use it repeatedly in mathematics education. In the post-secondary mathematics curriculum for non-mathematics majors, the problems should have applicability. Interestingly, we seem to return to "gaming" when we deal with pure theory, since we might seek an abstract solution for the sake of solution itself.

Max Wertheimer, one of the founders of Gestalt psychology, argued that for many children, "it makes a big difference whether or not there is some real sense in putting the problem at all". He gave an example of a 10-year-old boy who was not successful in her studies at school. In particular, he was unable to solve simple problems requiring the use of basic arithmetic. However, when given a problem which grew out of a concrete situation with which he was familiar and the solution of which "was required by the situation, he encountered no unusual difficulty, frequently showing excellent sense" (Bohac, 2016: 34). Put another way, the best strategy to develop students' interest in subject matter is to focus teaching on topics that are within their basin of attraction. Interest can be also used to develop motivation in education as it "refers to pattern of choice among alternatives patterns that demonstrate some stability over time and that do not appear to result from external pressures" (Welchman, 2018).

Reflection is also as important as action and being able to reflect on action carried out constitutes the so-called internal control when individuals think of themselves as being responsible for their own behaviour, something that is different from external control when seeing others or circumstances being the primary motivation for an individual behaviour (Boisvert, 2018). Three basic questions commonly begin the action learning process in addressing a real problem, and these are: what should be happening, what is stopping us from doing it, and what can we do? Action learning, often referred to in academia as action research has been traditionally used for teaching Mathematics and the social sciences (Sleeper, 2019), conducting scientific research (Popper, 2014).and teacher development (Ernest, 2014). In mathematics education, action learning, as a teaching method, has been adopted as pedagogy oriented on self-solving real problems followed up by reflection (Dilworth, 2019; Ozmon and Craver, 2018).

Again, learning is the primary goal, even though the problem-solving is real and important. Learning is facilitated by breaking out well-established mind-sets, thereby presenting a somewhat unfamiliar setting for the problem. We now have the technology-assisted, action learning pedagogy for teaching mathematics through real-world problems, guided by STEM instructors and community professionals, employing a project component (Sleeper, 2019). Digital technology is seen at least within the requisite typology of the manuscripts. It may go further, of course, and include an essential utility (e.g., a numerical integrator, a spreadsheet, or specialized software). Finally, action learning, with origins in Mathematics education provides an effective and clear approach to mathematics education. This approach was developed out of different, and, as mentioned above, sometimes controversial, active learning techniques which are ubiquitous among mathematics educators across a variety of constructivist-oriented, student-centred teaching contexts (Frankenstein, 2019; Mitias and Alexander, 2019).

William (2017) has established that action learning is a positive pedagogical feature throughout all grade levels. One may argue that since many people are lifelong learners, some of us may employ action learning beyond Ordinary level. Our motivation to action learning mathematics can give young students a taste of the interesting things known of mathematics. The underlying concepts can be quite sophisticated, and students may return to the ideas and take them further as they gather experience (Singh, 2017). Examples of action learning are presented in the subsections below by instruction level. These examples are given with an emphasis on the goal of concreteness, which in turn motivates the learners. Employing a project component makes the "1 + 2" Mathematics Umbrella model available at the tertiary level (Ozmon and Craver, 2018; Mitias and Alexander, 2019).

At the secondary school level, mathematical concepts can be motivated through the appropriately designed hands-on activities supported by manipulative materials (Segal, 2018). Such activities must integrate rich mathematical ideas with familiar physical tools. As was mentioned above, an important aspect of action learning is its orientation towards gaming. A pedagogical characteristic of a game in the context of tool-supported mathematics learning is one's "thinking outside the box," something that in the presence of a teacher as a "more knowledgeable other" opens a window to students future learning. Nonetheless, the absence of support can be observed, as Vidler (2018; 208) puts it, "when a child stares longer at an asymmetrical rather than a symmetrical figure", recognizing intuitively, through perceptual curiosity, that stability of a figure depends on its position. Perceptual curiosity combined with

creative thinking often transcends activities designed for one level and merges into the study of more advanced ideas at a higher cognitive level (Bohac, 2016; Marcone, 2015).

Humans are creative when they are motivated, and one may be more creative following general, formative concretizations of ideas. It is important to recognize student creativity early. Educators see creativity as "one of the essential 21st century skills vital to individual and organizational success" (Dilworth, 2019: 45). Teachers' ability to recognize creativity of their students that may be hidden behind their immature classroom performance is critical for successful teaching and learning. If students' hidden creativity is not acknowledged and supported by a teacher, it would most likely remain dormant if not vanish (Kitta, 2014).

Mathematics language is abstract with greater abstraction at higher levels. Traditionally, university mathematics for non-mathematics majors is taught by distancing it from reality with no connection to students' professional interests. In this setting, quite several soon-to-be professionals do not see the importance of mathematics in their prospective fields (Singh, 2017) Furthermore, abstractness in teaching often results in the problem of communication. As noted in Mitias and Alexander (2019). in connection with teaching engineering mathematics, there may be discordance between terminology and ideas used by a lecturer mathematician and their interpretation by the students.

As a result of being too theoretical, mathematics education at the university level becomes ineffective: non-mathematics majors study the subject matter "because they have to." An alternative approach to mathematics education is based on the well-known and pragmatic notion of "learning by doing" (Bohac, 2016) which makes it possible a meaningful interplay of pure and applied ideas. This approach has great potential to bring experiential learning to calculate basic course sequence in the tertiary mathematics curriculum. In education, pragmatism is an approach to learning and teaching that focuses on keeping things practical. Its key theorist is John Dewey, and it has four principles: unity, interest, experience, and integration. Pragmatic teachers use active project-based learning strategies in the classroom and focus on topics relevant to students' lives Dilworth, (2019).

2.3 ZIMBABWE POLICY DOCUMENTS IN RELATION TO THE PRAGMATIC PHILOSOPHY OF TEACHING MATHEMATICS

In the Zimbabwean context, the primary and secondary school curricula are shaped by documents crafted by policy makers, and from some documents implemented to be prepared in the school by teachers. Some of the policy documents are used in teaching and learning of mathematics as per pragmatic guidelines include statutory instruments, national syllabi, The Curriculum Framework document as well as The Education Acts. According to Ozmon and Craver (2018), pragmatism hinges on the practicality of the content to be given to learners, as well as the child-centred teaching methodologies that should accompany the content to be taught. Similarly, Dokora (2015) avers that it should be the prerogative of policy makers to ensure that whatever policy documents they coin should be discussed by all the revenant stakeholders in the education system before they find their way into the classroom.

In a related finding, Frankenstein (2019) acknowledges that policy documents like the national syllabi should contain aims, objectives to be achieved, methods of teaching to be used, media that may be roped in as well as any other necessary tactics that can be implemented in a successful teaching and learning episode. This entails that national policy documents work as a guide of how teachers should incorporate a wide range of philosophical guidelines, as they spell out: aims to be reached, related objectives to be achieved as well as the methodologies and accompanying activities that are instrumental in enabling the achievement of all the range of activities ensconced in the national syllabi (Dokora, 2015). Also recommended by the national documents is the need develop local documents at school level to help the teacher with organizational attributes, for example: schemes of work, lesson plans as well as inventories and progress records.

2.4 TECHNIQUES OF IMPROVING USE OF PRAGMATISM PHILOSOPHY IN MATHEMATICS TEACHING

2.4.1 Sending teachers to workshops and seminar

According to Sleeper (2019), most Mathematics teachers are not acquainted with pragmatic principles and hence there is need for teachers to be sent for workshops and seminars to familiarize them with various philosophical ideas, among them, the pragmatic principles. This entails that despite that that the most teachers have undergone teacher training programmes, there are knowledge gaps regarding application of pragmatic principles in teaching and learning. Similarly, William (2017) acknowledges that the best approach of enlightening

educators on the application of pragmatic principles is to regularly hold workshops and seminars, particularly on relevance of philosophical tenets in teaching and learning of Mathematics.

2.4.2 Availing resources to teachers

Frankenstein (2019), there is widespread discontent among classroom practitioners on the availability of resources in schools. Bohac, (2016). avers that without adequate resources at the teacher's disposal, it would be an uphill battle to apply pragmatic principles in mathematics teaching and learning. Resources such as textbooks, instructional media, as well as ICTs are instrumental in enhancing the teachers' efforts to promote implementation of pragmatic principles in teaching and learning of Mathematics. For example, the availability of geometrical instruments as well as models of geometrical shapes promotes hands-on experience of learners with mathematical concepts. Similarly, Dilworth (2019) declares that for teachers and learners to be able to apply pragmatic principles, they should have adequate ICT gadgets to promote higher levels of motivation as well as exposure to mathematical problems.

2.4.3 Availing literature related to pragmatic tenets

With ever-changing societies, Alexander (2019) advises that there is need by the responsible authorities to avail adequate literature to educators so that they can apply some of the pragmatic principles in mathematics teaching and learning. Also, Marcone (2015) posits that it's not only availing of adequate literature to teachers that will help them to apply requisite skills that are consistent with pragmatic principles, but responsible authorities should make this literature accessible to the intended users. Some of the literature expected to be available to teachers to apply pragmatic principles include textbooks, journals and circulars periodically prepared in improving teaching and learning of Mathematics. There is need for school to procure adequate and appropriate literature that will promote the application of pragmatic principles in teaching and learning of mathematics (Bohac, 2016).

2.4.4 Sending teachers for exchange programmes

They should also be exposed to varied exchange programmes as well as teaching and learning situations that promote usage of pragmatic principles in teaching and learning of mathematics. Mitias and Alexander (2019), the application of pragmatic principles in teaching and learning of mathematics calls for teachers to engage in exchange programmes with teachers from

renowned schools to acquire requisite skills. An exchange programme for teachers means educators move around schools and exchange classes with experienced or non-experienced personnel to develop requisite skills (Segal, 2018). Exchange programmes are beneficial they promote sharing of skills as well as development of permanent dispositions, particularly in application of pragmatic principles in Mathematics teaching and learning.

2.4.5 Encouraging use of field trips

One of the ways through which teachers in mathematics can be encouraged to apply pragmatic skills is the partaking of field trips so that learners are exposed to hands-on experience (Singh, 2017). Since hands-on experience is one of the tenets of pragmatism, taking part in field trips exposes learners to real world experiences, which helps to consolidate the concepts learnt. For example, mathematics teachers may plan a field trip to a supermarket to teach consumer arithmetic or money problems. This will not only help to consolidate concepts learnt in money problems but will motivate learners to put concerted efforts in schoolwork with the aim to get employment as salesman or any other office they emulate, in a process called role modelling (Dokora, 2015). This means that field trips are a motivating to learners as they encourage learning by doing at the same time exposing learners to real world experiences.

2.4.6 Availing policy documents to teachers

Bohac (2016) acknowledges that in a pragmatic curriculum, what is to be learnt should not only be practical and experimental, but the content should be something agreed upon by all the interested stakeholders. This implies that since all the content to be learnt and the guiding principles to be followed are contained in policy documents, these should be adequately available to teachers, learners, and members of the parent community to enable them to acknowledge if it is feasible to study such content. Zimbabwean context, Dokora (2015) attests that the policy documents to be available to classroom practitioners before they get into the classroom include: national syllabi, the Education Act, curriculum framework, statutory instruments and any other recommended literature pertaining to all what should be followed in the teaching and learning of Mathematics in the secondary school curriculum.

2.4.7 Supervision of teachers during lesson delivery

In another assertion by Boisvert (2018), there is also need for relevant authorities in the Ministry of Primary and Secondary Education constantly visit schools and supervise all educators and establish adherence to philosophical principles when delivering mathematics

lessons. This entails that school heads or even heads of departments constantly supervise practising teachers to ascertain if they are acquainted with philosophical principles like pragmatism. Though Mitias and Alexander (2017) opine that the concerned supervisors may also be unfamiliar with requisite pragmatic skills to look for when assessing those under their jurisdiction, Sleeper (2019) says that constant supervision helps educators to be innovative and creative, consequently employing varying approaches to teaching and learning of mathematics that include: learning by doing, use of real life examples, employing of experimentation and the project method, as well as using past experiences to construct new knowledge.

2.5 SUMMARY

This chapter assessed the literature pertaining to utilization of pragmatic principles in the teaching and learning of mathematics in the secondary school. The researcher examined the relationship between pragmatism and mathematics teaching, the Zimbabwean policy documents in relation to the pragmatic philosophy as well as the techniques that can be implemented to encourage educators to use pragmatic principles in teaching and learning.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.0 INTRODUCTION

The chapter shows the research methodology and design which the researcher adopted. The advantages and disadvantages of the research design and methodology are to be discussed as well. The chapter also examines the target population, the sample and the sampling technique, the merits, and setbacks of the research instruments to be used to collect data which are questionnaires, observations, and structured interviews for this study. The data collection procedure, ethical issues, and summary seal this chapter.

3.1. RESEARCH DESIGN

Best and Kahn (2013) defines a research design as a program to guide the researcher in collecting, analyzing, and interpreting observed facts. The researcher is to adopt a descriptive survey research design which is effective in obtaining cultural behaviors in the social context of populations. Descriptive survey will make use of three essential instruments these are structured interview, the self-administered questionnaire and non-participatory observation, which can be used together in a method called triangulation. Since the questions are standardized, the descriptive survey has an advantage of producing precise results (Punch, 2019). The weakness of descriptive survey research design in that data collected using this method are susceptible to distortion through bias. He might pick only information which supports his research hypothesis and ignore other parts of the data. This might lead to bias and error (Creswell, 2014). He must avoid bias by pre-testing research tools before unveiling them to respondents.

3.2 DATA COLLECTION INSTRUMENTS

The researcher is going to use these instruments in gathering data for the research. According to Borg and Gall (2014), research instruments are tools used in the collection of data in the conduct of a research. Three instruments to be used namely: questionnaires, direct observations, and interviews. The questionnaires shall be administered to the 12 teachers and conduct oral face-to-face interviews with the 40 learners scheduled for seven days on three groups (Mucheri secondary school 13 learners, World harvest secondary school 14 learners, Royal secondary school, 13 learners). The researcher will conduct the interviews with the three

groups and interviews would need more time. Above all, the researcher shall also observe mathematics lessons during the teaching and learning of mathematics at the sampled school and record invaluable data for analysis.

3.3 QUESTIONNAIRES

Best & Kahn (2013) define a questionnaire as a document containing questions designed to find information appropriate for data analysis. Questionnaires are easy to analyze and are familiar to most people, for nearly everyone had some experience in completing them (Popper, 2014; Creswell, 2014). Again, the authors above contend that questionnaires do not generally make people apprehensive. This will help the researcher because most of the participants will be interested in completing questionnaires. Moreover, since names of respondents are not excluded from the questionnaires, this gives the participants maximum liberty to freely express themselves (Best & Khan, 2013).

The researcher chose questionnaires because they maintain uniformity in questioning, and have no middleman bias (Popper, 2014). This implies that the researcher's own opinions do not influence the respondents to answer questions in a certain manner. Questionnaires are also chosen because they can be used to conform to the level of respondents.

The researcher will choose the closed, as well as the open-ended questionnaire, they are considered easy to answer, by allowing respondents to show their feelings. Best and Khan (2013), also acknowledge that using questionnaires, researchers can accumulate large amounts from a large population within a short period of time. Moreover, Leedy (2015) acknowledges that with questionnaires, information can be collected from people who are thousands of miles away, and whom the researcher may never see. Popper (2014) argues that unlike interviews, questionnaires are easy to plan, construct and administer, and since they bear no names or any other identification, there is a high chance for respondents to freely express their feelings and emotions.

Leedy (2019) also posits that questionnaires tend to eye blinker the respondents and direct them on those aspects the researcher requires, thus avoiding all other irrelevant data. This means that there is no likelihood that respondents would proffer unwanted information, since there are guidelines to be strictly followed.

Questionnaires do not probe respondents when they give interesting, ambiguous, or unfinished answers, and they are not an ideal method of gathering data when dealing with illiterate

respondents (Popper, 2014). This means that in other instances, respondents may give vague responses, especially with open-ended items, making it difficult for the researcher to analyze such data. Moreover, they are also wholly unsuitable to the illiterate, and there are chances that some of the respondents may withhold information by either retaining the questionnaires or by destroying them. The problems cited above are not yet encountered by the researcher because the questionnaires will be administered to literate respondents, and the researcher will do a pilot study to pre-test the questionnaires to remove ambiguity and reduce bias tendencies.

3.4 OBSERVATIONS

In addition to the questionnaires on mathematics learners, the researcher will also physically observe the respondents, the teachers, and pupils, and took down necessary information for appropriate analysis. He will mostly observe application of pragmatic approaches by teachers in the teaching and learning of mathematics. Best & Kahn (2013), define an observation as a systematic data collection approach, in which researchers use their senses to examine people in natural settings. This entails that when using observations as data collection tools, researcher can use at least one sense at a time.

Wandelt (2019) believes that observations are advantageous since they provide direct access to the participants under study. The researcher will physically see the subjects and record what he wants unlike relying on reports or responses from asking people. Where people may need to falsify data, direct observations guard against this drawback. Further to that, Leedy (2015) also contends that with observations, there is a greater provision for a permanent record. He argues that much of the physical behavior which is of high interest to the researcher is highly transient. The fact that all observation entails some form of recording means that it provides a permanent record of such events or behavior, thus permitting prospective analysis or future comparisons to be done easily.

Leedy (2015) agrees that direct observation is time consuming and is highly susceptible to bias from the observer. This means that the observer may be tempted to record events that did not take place, and this may consequently undermine the validity and reliability of such observed data. Observer effect is also another potential weakness of observations, where the presence of the observer may influence the behavior of those participants under observation (Popper, 2014). Thus, strict care shall be taken for participants be observed hid their actual behaviors during observation.

3.5 STRUCTURED INTERVIEWS

Creswell (2014) defines an interview as a process which involves collecting data through direct verbal interaction between individuals. Like any other research tools, interviews have got advantages and disadvantages. The author above contends that interviews are suitable when one intends to solicit for information, even from illiterate respondents, as the wording of interview items can be modified to suit the level of interviewees. Moreover, with interviews, participants cannot falsify data such as age, sex, and race (Creswell, 2014).

Again, interviews help to build relations between the researcher and the respondents, as there is a greater need to confide in each other, especially when dealing with sensitive information (Alexander, 2019). This implies that apart from allowing researchers an immense opportunity for screening, inter-personal relations between the interviewer and interviewees improve tremendously. The researcher preferred information about personal feelings, opinions, and perceptions. Thus, another advantage of oral interviews is that they allow for soliciting of sensitive information from respondents (Phillips & Pugh, 2016), and the respondents' own words are recorded, and ambiguities can be clarified. Interviews are not influenced by others in the groups (Best & Khan, 2013). Again, the researcher will record firsthand information directly from the participants, for example, their emotions.

Probes should be neutral, and the interviewer must allow sufficient time for the respondents to answer questions and should stop anticipating and cuing potential answers (Creswell, 2014). Again, with interviews, at times respondents may feel uneasy and adopt avoidance tactics if the questioning is too long, sensitive, or deep. To mitigate this disadvantage, the interviewer will build trust and rapport with respondents, thus, making it possible to obtain information that the participants would probably not reveal by any other data collection method.

3.5.1 POPULATION

Best and Kahn (2013:13), define a population as, ''any group of individuals that have one or more characteristics in common, and that are of interest to the researcher.'' The above authors explain that the population may be of a particular individual type. Thus, a population in research is the target group from which one intends to find information, values, and attitudes. Fraenkel Wallen (2021), defined population as a group of individuals from which a sample is drawn. The researcher is to investigate the application of pragmatic approaches in the teaching and learning of Mathematics in Chegutu District, Mashonaland West Province. The target

population from the three schools involved 40 mathematics learners and 12 mathematics teachers.

3.5.2 SAMPLE

Samples consists of individuals selected from a larger group of people called the population. Fraenkel & Wallen (2016) defines sample as a sub-group of a population in a research study on which information is obtained. For this research, the sample consisted of 40 ordinary Level Mathematics learners and 12 Mathematics teachers taken from the 3 sampled schools. The 40 learners consisted of 23 boys and 17 girls to find the true reflection of ideas from all sex groups and the teacher population comprise of 8 males and 4 females.

3.5.3 SAMPLING PROCEDURE

The researcher used purposive and random sampling. Borg and Gall (2014), a purposeful sample includes several cases at defined points of variation with respect to the phenomenon being studied. The researcher drew conclusions from mathematics learners in Mavirira cluster, located in Chegutu District, Mashonaland West Province. MacMillan and Schumacher (2015), defines purposive sampling as a strategy to choose small groups or individuals likely to be acknowledgeable and informative interest. Creswell (2014) also submits that purposive sampling entails selecting participants for a study basing on certain characteristics in this study the fact of being an ordinary level mathematics student. The researcher also employs simple random sampling to choose respondents for this study. The 40 learners were chosen randomly from all Ordinary level mathematics learners to avoid bias. According to Creswell (2014), a small sample drawn from a large target population saves the time and expense than studying the entire population. Similarly, Borg and Gall (2019) view random sampling as precisely a process of selecting cases, the selection of each individual from a population that provides every sample of a given size an equal probability of being selected.

Best and Kahn (2013) avers that in a simple random sample, the individuals are chosen in such a way that each has an equal chance of being selected and each choice is independent from any other choice. The researcher uses random sampling because it permits to apply inferential statistics to the data. It implies that random sampling is a systematic process of selecting a few individuals for study in a way that the selected individuals would equally represent the larger group, making it easier to arrive at generalizations for the whole group (Creswell, 2014).

To get the required sample of 40 learners, the researcher placed odd numbers, written on pieces of card, and placed in a hat mixed with even numbers. He then asked the participants to pick a number randomly and those who pick odd numbers will be disqualified, while those who pick even numbers will be eligible to be used in the study. The researcher felt that simple random sampling is the best method to use since no possible chances' respondents felt disadvantaged during the selection process. From the three schools the teachers to be used in this study should be also purposefully selected.

3.5.4 DATA COLLECTION PROCEDURES

The researcher use questionnaires, observations and oral interviews as means of data collection. The questionnaires are to be constructed basing on the main problem and sub-research questions. Questionnaires are to be prepared for learners; an interview schedule are to be prepared for teachers and an observation guide is also to be prepared for teachers and pupils. The researcher will distribute the questionnaires to the pupils and make follow ups to the questionnaires.

On interviews, the researcher will arrange time with the interviewees during their spare time. The researcher will use a mobile phone to record the interviews done with the teachers. The responses are collected and recorded for future use in data analysis. The researcher explains to respondents that the results are strictly for research purposes only and therefore they should have maximum liberty to proffer their responses. Above all, the researcher will also observe and record the ways in which pragmatic principles are applied in teaching and learning of mathematics in Mavirira luster

3.5.5 DATA PRESENTATION AND ANALYSIS PROCEDURES

The data collected is to be presented on statistical tables such as: frequency tables, tally tables, bar chart as well as pie chart. The data presentation tables are advantageous in that they will make the collected data comparable and amendable for analysis at the same time retaining original findings. Moreover, the data presentation tables used compacted the data and made it easier for the researcher to draw inferences on it. Thereafter, the presented data was analyzed and interpreted in relation to the research questions of the study. This means that the researcher will relate the gathered data with findings from earlier researchers to ascertain similarities and differences.

3.5.6 ETHICAL CONSIDERATIONS

Proper permission is to be sought from all relevant authorities before the researcher kicked off his study. Bindura University of Science Education, the Ministry of Primary and Secondary Education, as well as the heads of the sampled schools, all granted permission to the researcher to carry out this study. This study prioritizes the following ethical considerations: inform consent, voluntary participation, as well as anonymity and confidentiality.

Both confidentiality and anonymity are to be seriously considered in this study. Bell (2019) submits that the researcher needs not to tell or insinuate which responses come from participants. Thus, on the questionnaire that was availed to learners, there was no space for them to write names, credentials, or any identification features. The researcher also maintained high confidentiality, by assuring respondents that their responses were solely to be applied in research and the educational domain. This gave the respondents vast freedom to expound their feelings and before partaking of this study, the researcher notified respondents that participation was entirely voluntary, and there were no reprisals to those participants who were reluctant to continue participating in the study halfway. This means that, participation in this study was not by coercive force, as individuals did it on their own volition. This gave the respondents a greater opportunity to express their feelings, as they participated with free will. Finally, informed consent refers to the revelation of the purpose, aims, as well as the study objectives to the participants by the researcher (Phillips & Pugh, 2019). The participants of this study signed a consent form, explaining all the details pertaining to the relevance of the study to various stakeholders. This inevitably enabled the participants to feel valued, and to proffer authentic and credible information.

3.5.7 SUMMARY

This chapter outlined the theoretical foundations for the practical conduct of the study. It considered the research paradigm, the research design, the population, and sample, as well as the sampling techniques and procedures. It also looked at the strengths and weaknesses of the data collection instruments, as well as the ways to avert the latter. The data collection procedures and ethical issues were also examined at the closing sections of the chapter.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

In this chapter, the researcher represents findings on the application of pragmatic principles in teaching and learning of mathematics. This chapter focus on the responses obtained from the questionnaires given, observations and the interviews conducted. Tables, graph, and pie chart were used as data presentation technique. The findings of this research answered the research questions in chapter one.

4.2 QUANTITATIVE DATA ANALYSIS

4.2.1 TEACHERS DEMOGRAPHIC DATA

The researcher sought to establish the gender of the respondents. The figure 4.1 shows an even distribution of respondents of male (67%) and females (33%) of the sampled teachers.

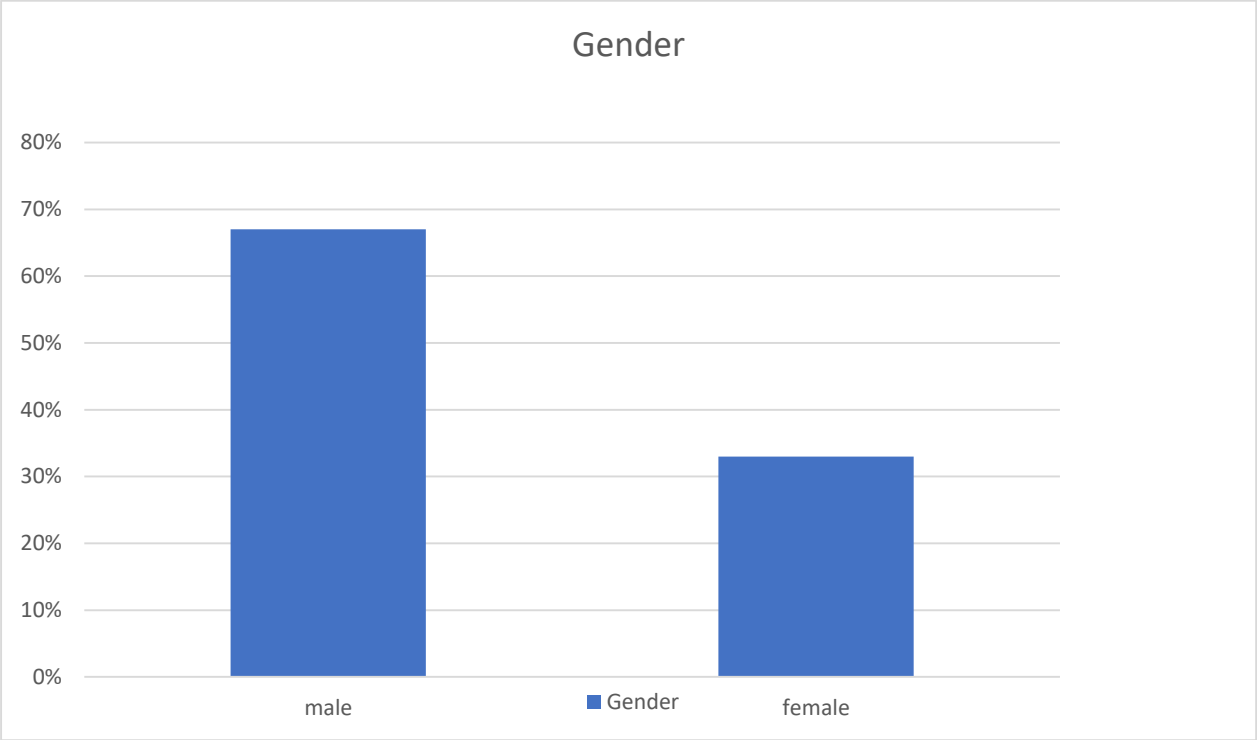

Figure 4.1 Gender of the respondents

4.2.2 TEACHER'S AGE

Table 4.1 Teachers age

Age	Number
Between 20-30 Years	1
Between 30- 40 Years	6
Between 40 - 50 Years	3
Above 50 Years	2

From the table above, one teacher is between 20-30 years, six teachers are between 30-40 years of age, three are between 40-50 years and two teachers are above 50 years.

4.2.3 TEACHERS' QUALIFICATIONS.

Table 4.2 Teacher's qualifications.

Educational qualification	Number of teachers
Certificate in Education	1
Diploma in Education	6
First Degree	3
Master's Degree	2

From the data obtained, the study showed that most of the mathematics teachers are diploma holders from teacher's colleges. Darling-Hammond (2000) averts that professional qualification is otherwise called teaching knowledge. It shows whether the teacher is professionally trained or not, which could be revealed through the professional certificate a teacher is holding. The data in table 4.2 is shown in the pie chart below.

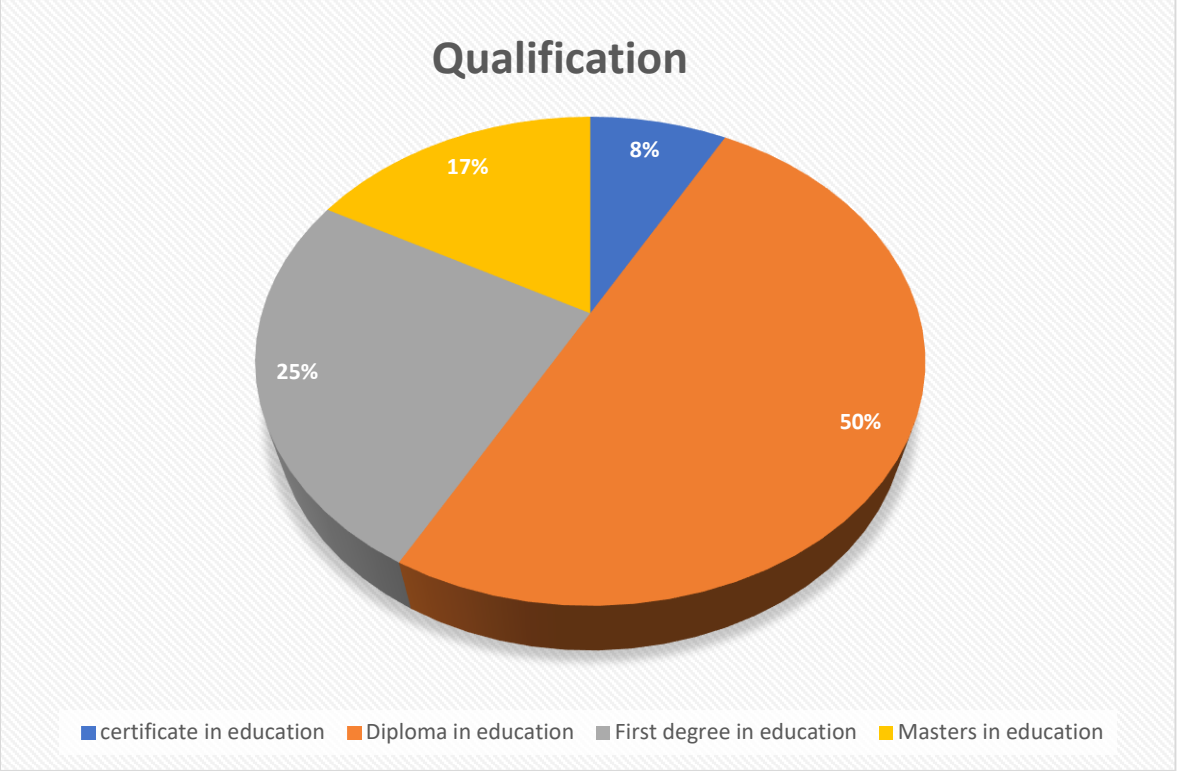

Figure 4.2 Teachers' qualifications

The figure 4.2 above shows that 50% of the teachers obtained Diploma in education, 8% of the teachers have certificate in education, then 17% of the teachers have master's in education and finally 25% of the teachers have first degree in education. This implies that most of the teachers are from the teacher's colleges holding Diploma in education.

4.2.4 TEACHERS WORKING EXPERIENCE.

Table 4.3 Teacher's working experience.

Working Experience	Number of teachers
Less Than Five Years	2
Between 5 and 10 Years	4
Between 10 and 15 Years	4
Above 15 Years	2

From the table above, two teachers are less than five years of working experience. Four teachers are between 5 and 10 years of working experience, four teachers are between 10-15 years and two teachers have 15 years and above of working experience.

4.2.5 TEACHERS APPLICATION OF THE PRAGMATISM PHILOSOPHY TO THE TEACHING AND LEARNING OF MATHEMATICS AT 'O' LEVEL.

Table 4.4 Teachers application of the pragmatism philosophy to the teaching and learning of mathematics at "o" level

Possible pragmatic teaching approach	SA	A	U	D	SD
Teaching using real world examples	9	3	0	0	0
Teaching from the known to the unknown	8	4	0	0	0
Using the project method	7	5	0	0	0
Using experimentation method	5	2	0	3	2
Motivating learners before lesson	10	2	0	0	0
Employing the learning by doing approach	12	0	0	0	0

From the table above, 75 % of the teachers strongly agreed on the use of real-world examples. The rest which is 25% agreed on the use of real-world example. Real world examples promote discovery learning. The sense of perception of concrete things acquires much meaning through discovery learning which promotes motivation and cultivating natural curiosity among pupils. Using real-world examples such as loci, plane shapes, solid shapes among others. 67% of the teachers strongly agreed on teaching from the known to the unknown and 33% agree on the teaching from known to unknown. The teachers seem to be aware of the Bloom Taxonomy theory which stresses teaching from simple to complex. 58% strongly agreed on using the project method, whilst 42 % strongly agreed on using experimentation method. The teachers showed to be lacking the teaching Technique and strategies of applying such teaching methods. The usefulness of teaching method depends on the content, instructional objectives, environment teachers and learner's style. Effective teacher must know how to use each method effectively. They must understand the advantages and disadvantage of each method (Mitias and Alexander, 2019). This helps the teacher to overcome the short comes that are enhanced with those methods. Teacher must use alternative number of methods to meet the demand of every student in the class (Boisvert, 2018).

83% of the teachers strongly agreed on motivating learners before the lesson. 100% of the teachers strongly agreed on employing the learning by doing approach. This shows that these teachers allow the student to become source of what is to be learned. Student gets opportunity

to interact with the teacher, content, and student themselves. From these ideas is where the trench of knowledge is dug to make a big and wide canal of knowledge" (Singh, 2017).

4.2.6 POLICY DOCUMENTS THAT TEACHERS SHOW LEARNERS DURING THE TEACHING AND LEARNING OF MATHEMATICS.

Table 4.5 Policy documents that teachers show learners during the teaching and learning of mathematics.

Policy document	SA	A	U	D	SD
School-based syllabus	0	6	0	4	2
National syllabus	7	4	0	0	1
Scheme of work	0	0	0	4	8
Circulars	4	1	0	3	4
Examination Analysis document	0	0	0	9	3
Education Act document	0	0	0	5	7

50% of the teachers disagreed on showing policy documents to their learners. However, 50% agreed on showing school-based syllabus, 58% strongly agreed,33% agree on showing the national syllabus and 8% strongly disagree on showing national syllabus to learners. No teacher who showed that they show schemes of work to learners and 33% strongly agreed showing educational circulars and 8% agree showing learners circulars then the rest disagree. Dokora (2015) avers that it should be the prerogative of policy makers to ensure that whatever policy documents they coin should be discussed by all the revenant stakeholders in the education system before they find their way into the classroom.

4.2.7 STRATEGIES THAT CAN BE USED TO IMPROVE IMPLEMENTATION OF PRAGMATIC PRINCIPLES IN TEACHING AND LEARNING OF MATHEMATICS

Table 4.6 Strategies that can be used to improve implementation of pragmatic principles in teaching and learning of mathematics.

Possible strategy to improve use of pragmatic principles in teaching and learning of mathematics	SA	A	U	D	SD
Sending teachers to workshops and seminars	12	0	0	0	0
Availing resources to teachers	12	0	0	0	0
Availing literature related to pragmatic tenets	12	0	0	0	0
Sending teacher for exchange programs	12	0	0	0	0
Encouraging use of field trips	12	0	0	0	0
Availing policy documents to teachers	9	2	0	1	0
Supervision of teachers during lesson delivery	12	0	0	0	0

From the table above all the teachers strongly agreed on attending workshops, seminars, and exchange programs, provided with adequate resources, literature related to pragmatic tenets, funds for field trips and supervision. Resources play an important role in education system and they are real agents of change to assist in the implementation and of innovations in mathematics education. Textbooks provide teachers and pupils with whatever understanding they may have of the subject. Singh (2017) asserts that, one of the ways through which teachers in mathematics can be encouraged to apply pragmatic skills is the partaking of field trips so that learners are exposed to hands-on experience. Since hands-on experience is one of the tenets of pragmatism, taking part in field trips exposes learners to real world experiences, which helps to consolidate the concepts learnt. 75% of the teachers strongly agreed, 17% agree and 8% disagree on the provision of educational policy documents that can assist in the teaching and learning of mathematics. Sleeper (2019) who avers that educator should be innovative and creative, consequently employing varying approaches to teaching and learning of mathematics.

4.3 QUALITATIVE DATA ANALYSIS

4.3.1 LEARNERS INTERVIEWS

4.3.1.2 Relationship between the pragmatism philosophy and the teaching of mathematics

Table 4.7 Relationship between the pragmatism philosophy and the teaching of mathematics

Question	boys		Girls	
	Yes	No	Yes	No
Do your teachers use real world examples during teaching and learning of mathematics at "o" level?	14	9	8	9
Does your mathematics teacher teach from the familiar example to the complex ones?	15	8	10	7
Are you given project work to research on in mathematics?	20	3	15	2
Does your mathematics teacher use experimentation method?	14	9	7	10
Does your mathematics teacher motivate you before and during the lesson?	20	3	11	6
Are you given hands-on tasks to work on by your mathematics teacher?	18	5	15	2

From table 4.1 most of the pupils (55%) reviewed that the mathematical concepts were linked to real life examples and 45% reviewed that the concepts were not linked to real life examples. The pupils could establish the relationship of mathematical concepts with real life events for example the use of loci in construction. This showed that, the teachers were or are using real life example which makes the learning of mathematics easy. The sense of perception of concrete things acquires much meaning through discovery learning which promotes motivation and cultivating natural curiosity among pupils using real-world examples such as plane shapes, solid shapes, loci among others. Teachers can experience and explore themselves to a wide range of discoveries rather than emphasizing on chalkboard only. The use of field trips can also enable pupils to discover or learn more concepts in a sequential manner from simple to complex. Using real-world examples, teachers can easily deliver lessons and pupils can easily

grasp concepts since real world examples enable concepts to be delivered from simple to complex. Teachers must teach with real world examples to engage them in an exploration of their learning environment.

As shown above, most of the teachers were or are using real life examples in the teaching of mathematics, during the interviews with the pupils, 63% confirmed that, teaching of mathematics involve teaching from the familiar example to the complex since there was real life examples in the teaching and learning process. However, 37% confirmed that, some of the teachers didn't demonstrate from familiar examples to the complex ones. The teacher should make concepts educationally simple so that pupils easily assimilate by presenting concepts from simple to complex by this, the child eventually sees that the immediate goals could lead along a path going on the desired direction. Teachers should drill a firm understanding of subordinate mathematical concepts into pupils before they integrate these concepts into more complex ideas. Teaches should follow the Bloom Taxonomy theory which stresses teaching from simple to complex.

From interview conducted with the pupils, 88% acknowledged receiving projects work to research on in mathematics. These are mainly in the form of continuous assessment learning area activity (CALA). These learning activities or assessment requires learners to perform, demonstrate their knowledge, understanding and proficiency. Adeleye (2017) who found that, the project-learning is the best method of encouraging group learning. The method has the advantage of allowing the children to display their free initiative and native intelligence in solving problems. More importantly, it is the major ground for the development of social and co-operative living, and of organized social intelligence. Ozmon and Craver (2018); Mitias and Alexander, (2019) are in support that, employing a project component makes the "1 + 2" Mathematics Umbrella model available at the tertiary level. The CALA components in mathematics use direct measures of skills in which students perform psychomotor, affective, and cognitively demanding tasks from which quality of constructed response is scored. The activities requires that learners use critical thinking and written communication skills. Dilworth (2019) is in support that, action learning starts with an inquiry into a real problem so that regardless of whether the problem is tactical or strategic, the process of learning is strategic. Action learning in mathematics education is defined as learning through student individual work on a real problem followed by reflection on this work.

78% of the pupils reviewed that motivation was done by their teachers. Motivation is to lead people so that they want to do the correct thing and keep doing the right things which should be the key activity of teachers. It's a prerequisite for successful mathematics teachers to concern themselves with applying motivational principles to create and maintain a motivating environment, since most pupils perceive mathematics as abstract in its nature. Once a motivating climate is created, pupils can be driven towards success.

From the interviews, pupils 53% confirmed the use of use experimentation method and 83% of the pupils admitted the use of hands-on tasks to work on by their mathematics teachers. Experimentation method is the most assured method that causes assimilation of content. The practical allows pupils to be hands on and minds on engaged. For example, during probability lessons pupils can experiment on outcomes or during volume (capacity) lessons pupils can experiment on calculations of volume through experiments without the use of formulas. This motivates pupils and removes boredom by providing a break from only listening to the teacher and writing notes.

There is no active learning taking place without the use of adequate resources. Sleeper (2017) who avers that educator should be innovative and creative, consequently employ various approaches to teaching and learning of mathematics that include: learning by doing, use of real-life examples, employing of experimentation and the project method, as well as using past experiences to construct new knowledge.

4.3.1.2 RELATION OF THE ZIMBABWE POLICY DOCUMENTS TO THE PRAGMATIC PHILOSOPHY OF TEACHING MATHEMATICS.

Table 4.8 Relation of the Zimbabwe policy documents to the pragmatic philosophy of teaching mathematics

Question	Boys		Girls	
	Yes	No	Yes	No
Does your teacher show you the school-based syllabus before beginning of the "o" level course?	0	23	4	13
Does your teacher show you the national syllabus before beginning of the "o" level course?	5	18	5	12
Does your teacher show you mathematics circulars from the Ministry of Primary and Secondary Education on teaching and learning of Mathematics?	7	16	5	12
Does your Mathematics teacher show you the school's results analysis documents showing pass rates in mathematics?	10	13	4	13
Does your teacher show you schemes of work to show what is to be done in a specified timeframe?	10	13	2	15

From the table above, 10% of the pupils confirmed that their teachers showed them the school-based syllabus before beginning of the "o" level courses. 25% agreed that their teacher showed them the national syllabus before beginning of the "o" level courses. 30% admitted that teacher showed them mathematics circulars from the Ministry of Primary and Secondary Education on teaching and learning of Mathematics. 35% student confirmed that, teachers showed them the school's result analysis documents showing pass rates in mathematics. 30% agreed that teachers showed them schemes of work to show what was to be done in a specified timeframe. These findings proved that mathematics teachers are not showing their pupils educational policy documents that are used in teaching and learning of mathematics as per pragmatic guidelines. These findings are coherent with Craver (2018), pragmatism hinges on the practicality of the content to be given to learners, as well as the child-centred teaching methodologies that should accompany the content to be taught. Similarly, it should be the prerogative of policy makers to ensure that whatever policy documents they coin should be

discussed by all the revenant stakeholders in the education system before they find their way into the classroom (Dokora, 2015).

4.3.1.3 TECHNIQUES THAT CAN BE IMPLEMENTED TO IMPROVE THE USE OF PRAGMATIC APPROACHES IN THE TEACHING AND LEARNING OF MATHEMATICS

Table 4.9 techniques that can be implemented to improve the use of pragmatic approaches in the teaching and learning of mathematics

Question	Boys		Girls	
	Yes	No	Yes	No
Does the school have adequate resources to enhance the effective teaching and learning of "o" level mathematics concepts?	9	14	11	6
Do you attend field trips to facilitate the effective teaching and learning of mathematics?	0	23	0	17
Do teachers encourage to use the experimentation teaching method?	22	1	15	2
Do teachers encourage to use the project method of teaching and learning?	20	3	17	0
Does mathematics teachers acquire pedagogical skills related to the pragmatic philosophy?	16	7	13	4

From the table 4.9, 50% reviewed that they have adequate resources to enhance effective teaching and learning. For example, textbooks play an important role in the teaching and learning of mathematics. Salender (2000) investigated that, resources play an important role in education system and could be real agents of change to assist in the implementation and innovations in mathematics education. Textbooks provide teachers and pupils with whatever understanding they may have of the subject. Dewey (2013) is in support that, without adequate resources at the teacher's disposal, it would be an uphill battle to apply pragmatic principles in mathematics teaching and learning. Resources such as textbooks, instructional media, as well as ICTs are instrumental in employing the teachers' efforts to promote implementation of pragmatic principles in teaching and learning of mathematics. Similarly, teachers and learners

to be able to apply pragmatic principles, they should have adequate ICT gadgets to promote higher levels of motivation as well as exposure to mathematical problems (Dilworth, 2019).

From the table, 100% of the pupils showed that they do not attend field trips. The purpose of field trip is usually to provide students with experiences outside their everyday activities. The main aim of this activity is to observe the subject in its natural state and collect samples. Field trips are also used to produce civilized young men and women who appreciate culture and the arts. Field trips provide the following benefits as confirmed from the interviews with the pupils; reinforcement of what the teacher has been instructing in class about a subject and help students understand the topic better, engagement on project based learning, socialization, exposure particularly to students who are less fortunate and don't have the opportunity to travel, curiosity to learn more about the subjects on which the trip focused and retention of memories that Educational trips create, for instance episodic memories, that helps children retain information for longer periods. For tactile learners, educational trips offer an uncommon opportunity to perform hands-on learning. These findings are consistent with the findings of Singh (2017) who asserts that, one of the ways through which teachers in mathematics can be encouraged to apply pragmatic skills is the partaking of field trips so that learners are exposed to hands-on experience. Since hands-on experience is one of the tenets of pragmatism, taking part in field trips exposes learners to real world experiences, which helps to consolidate the concepts learnt. For example, mathematics teachers may plan a field trip to a supermarket to teach consumer arithmetic or money problems.

93% of the pupils agreed to have their teachers encouraged to use the experimentation teaching method. 93% agreed to have their teachers encouraged to use the project method of teaching and learning. 68% of the pupils also confirmed to have their teachers encouraged to acquire pedagogical skills related to the pragmatic philosophy. Sleeper (2017) who postulates that educators should be innovative and creative, consequently employing varying approaches to teaching and learning of mathematics that include: learning by doing, use of real-life examples, employing of experimentation and the project method, as well as using past experiences to construct new knowledge. However, Mitias and Alexander (2019) opine that the concerned supervisors may also be unfamiliar with requisite pragmatic skills to look for when assessing those under their jurisdiction.

4.3.2 OBSERVATIONS

4.3.2.1 RELATIONSHIP BETWEEN THE PRAGMATISM PHILOSOPHY AND THE TEACHING OF MATHEMATICS

Table 4.10 observation on relationship between the pragmatism philosophy and the teaching of mathematics.

Observations made	Yes	%	No	%
Teachers use real world examples during teaching and learning of mathematics	12	100	0	0
Mathematics teachers teach from the familiar concepts to abstract ones	12	100	0	0
Teachers give learners project work to research on in mathematics	12	100	0	0
Teachers use the experimentation method of teaching mathematics concepts	7	58	5	42
Mathematics teachers motivate learners before and during the lesson	12	100	0	0
Mathematics teachers give learners individual, pair, or group hands-on tasks to work on during mathematics lessons	12	100	0	0

As shown above, 100% of the teachers were or are using real world examples in the teaching of mathematics. The teaching of mathematics involve teaching from the familiar example to the complex since there is no lacking real-life example in the teaching and learning process. Real world examples promote discovery learning. The sense of perception of concrete things acquires much meaning through discovery learning which promotes motivation by cultivating natural curiosity among pupils. Using real-world examples such as plane shapes, solid shapes, loci among others, teachers can experience and explore themselves to a wide range of discoveries rather than emphasizing on chalkboard only.

100% of the teachers showed that they were teaching mathematics from familiar concepts to abstract ones and the rest were not teaching from familiar to abstract. The teacher should make concepts educationally simple so that pupils easily assimilate by presenting concepts from simple to complex by this, the child eventually sees that the immediate goals could lead along

a path on the desired direction. Therefore, teachers should drill a firm understanding of subordinate mathematical concepts into pupils before they integrate these concepts into more complex ideas. Teaches should follow the Bloom Taxonomy theory which stresses teaching from simple to complex. In other words, teaching should be from known to unknown.

From the observations 100% of the teachers give learners project work to research on in mathematics. These are mainly in the form of continuous assessment learning area activity (CALA). These learning activities or assessment requires learners to perform, demonstrate their knowledge, understanding and proficiency. Adeleye (2017) who found that, the project-learning is the best method of encouraging group learning. The method has the advantage of allowing the children to display their free initiative and native intelligence in solving problems.

From the findings 42% of the teachers were not using the experimentation method of teaching mathematics concepts and 58% of the teachers showed that they used experimentation method. Experimentation method is the most assured method that causes assimilation of content. The practical allows pupils to be hands on and minds on engaged experiments without the use of formulas. Schools should provide strong security on science laboratory or rooms to store the apparatus. 100% of the mathematics teachers showed to be good motivators of their learners before and during the lessons. This helps the pupils to have the courage in mathematical problem solving and the eager to improve their critical thinking skills. Singh, (2017) who asserts that, through examples of action learning with an emphasis on the goal of concreteness, motivates the learners. 100% of the teachers showed to be giving their learners individual, pairs, or group hands-on tasks to work on during mathematics lessons. This proved that most of the lessons were learner centered, where the pupils were regarded as active recipients of information.

4.3.2.2 ZIMBABWE POLICY DOCUMENTS TO THE PRAGMATIC PHILOSOPHY OF TEACHING MATHEMATICS

Table 4.11 Zimbabwe policy documents to the pragmatic philosophy of teaching mathematics

Observations made	Yes	%	No	%
Learners are given the school-based syllabus before beginning of the "o" level course	6	50	6	50
Learners are given the national syllabus before beginning of the "o" level course	11	92	1	8
Learners are shown mathematics circulars from the Ministry of Primary and Secondary Education on teaching and learning of Mathematics	5	42	7	58
Learners access the school's results analysis documents showing pass rates in mathematics.	0	0	12	100
Learners are shown schemes of work to show what is to be done in a specified timeframe.	0	0	12	100

From the observations made, 50%were showed school-based syllabus and the other 50% didn't show the school-based syllabus to learners. 92% indicated that they show learners the national syllabus and 8% didn't show national syllabus to learners. 100% on schemes of work, examination analysis and educational policy documents were not availed to the pupils. 42% indicated that they show circulars to pupils and 58% didn't show circulars to the learners. This proves most learners do not know the sequence of their learning activities. Therefore, pupils find it difficult to plan for their work in relation to what the teacher will deliver. As well pupils can also find it difficult to research ahead to fully conceptualise the concepts when they are presented to the class. Dokora (2015) who averts that it should be the prerogative of policy makers to ensure that whatever policy documents they coin should be discussed by all the revenant stakeholders in the education system before they find their way into the classroom.

4.3.2.3. TECHNIQUES THAT CAN BE IMPLEMENTED TO IMPROVE THE USE OF PRAGMATIC APPROACHES IN THE TEACHING AND LEARNING OF MATHEMATICS

Table 4.12 Techniques that can be implemented to improve the use of pragmatic approaches in the teaching and learning of mathematics

Observations made	Yes	%	No	%
Teachers have adequate literature pertaining to pragmatism	12	100	0	0
Teachers have adequate resources to apply pragmatic principles in teaching and learning of Mathematics concepts	12	100	0	0
Teachers have pedagogical skills to apply the experimental method in teaching and learning of mathematics	12	100	0	0
Do teachers have adequate policy documents to give to learners?	11	92	1	8
Are teachers sent to seminars and workshops to improve methodologies in teaching and learning of Mathematics?	12	100	0	0

From the table above, 100% of the teachers proved to have adequate literature pertaining to pragmatism, since the researcher observed them utilizing hands on task that were more pupil centered. 100% of the teachers showed to be lacking teaching and learning resources such as textbooks, teaching aids like solid shapes (dices, similar objects). However, one teacher observed proved to have improvised in terms of teaching aids like similar objects like 500g and 1kg cardboard boxes of washing powder surf, geoboards, dice, playing cards, cylindrical containers and many other aids that were observed. 100% of the teachers proved to have pedagogical skills to apply the experimental method in teaching and learning of mathematics. The rest of the teachers devoted to demonstrations and illustrations mostly using given formula from the textbook. 92% of the teachers proved to have adequate policy documents to give to learners, even though they did not avail them to the pupils. 100% of the teachers were sent to seminars and workshops to improve methodologies in teaching and learning of mathematics. The workshop two teachers attended was concerned with the compressed syllabus. The rest of

the teachers were not in positions of attending seminars and workshop, probably due to administrative issues. Singh (2017) who asserts that, one of the ways through which teachers in mathematics can be encouraged to apply pragmatic skills is the partaking of field trips so that learners are exposed to hands-on experience.

4.4 DISCUSSION

From the teachers' questionnaires it was reviewed that, most of the teachers strongly agreed on attending workshops, seminars, and exchange programs, to be provided with adequate resources, literature related to pragmatic tenets, funds for field trips and supervision. Salender (2000) who investigated that, resources play an important role in education system and could be real agents of change to assist in the implementation and of innovations in mathematics education.

Most of the teachers disagreed on showing policy documents to their learners. A few agreed on showing school-based syllabus, national syllabus, schemes of work and educational circulars. However, it should be the prerogative of policy makers to ensure that whatever policy documents they coin should be discussed by all the revenant stakeholders in the education system before they find their way into the classroom (Dokora, 2015).

Most teachers strongly agreed on motivating learners before the lesson, employing the learning by doing approach. This shows that these teachers allow the student to become source of what is to be learned. Student gets opportunity to interact with a teacher, content, and student themselves. From this information- is where the trench of knowledge is dug to make a big and wide canal of knowledge.

From the interviews conducted with the pupils, most of the pupils reviewed that the mathematical concepts were not linked to real life examples. The pupils could not establish the relationship of mathematical concepts with real life events. 88% of the pupils acknowledged receiving projects work to research on in mathematics. These are mainly in the form of continuous assessment learning area activity (CALA). These learning activities or assessment requires learners to perform, demonstrate their knowledge, understanding and proficiency.

Pupils also reviewed lack of motivation from their teachers. Motivation lead people so that they want to do the correct thing and keep doing the right things which should be the key activity of teachers. 58% confirmed the use of experimentation method and 83% of the pupils admitted

the use of hands-on tasks to work on by their mathematics teachers. Experimentation method is the most assured method that causes assimilation of content. The practical allows pupils to be hands on and minds on engaged. For example, during probability lessons pupils can experiment on outcomes or during volume (capacity) lessons pupils can experiment on calculations of volume through experiments without the use of formulas.

Most pupils reviewed that they do not have adequate resources to enhance effective teaching and learning. For example, textbooks play an important role in the teaching in the teaching and learning of mathematics. 100% of the pupils showed that they do not attend field trips. The purpose of field trip is usually to provide students with experiences outside their everyday activities. The main aim of this activity is to observe the subject in its natural state and collect samples.

From the observations carried out, 100% of the teachers were or are using real world examples in the teaching of mathematics. The teaching of mathematics involve teaching from the familiar examples to complex since there was no lacking real-life example in the teaching and learning process. 100% of the teachers showed that they were teaching mathematics from familiar concepts to abstract ones. The teacher should make concepts educationally simple so that pupils easily assimilate by presenting concepts from simple to complex by this, the child eventually sees that the immediate goals could lead along a path on the desired direction.

The observations also showed that, 100% of the teachers give learners project work to research on in mathematics. These are mainly in the form of continuous assessment learning area activity (CALA). 58% of the teachers were using the experimentation method of teaching mathematics concepts and 42% were not using the experimentation method. Experimentation method is the most assured method that causes assimilation of content. The practical allows pupils to be hands on and minds on engaged experiments without the use of formulas.

As well, 100% of the mathematics teachers showed to be good motivators of their learners before and during the lessons. This helps the pupils to have the courage in mathematical problem solving and eager to improve their critical thinking skills. From the observations made, no educational policy documents were availed to the pupils. This proves most learners do not know the sequence of their learning activities. Therefore, pupils find it difficult to plan for their work in relation to what the teacher will deliver. As well pupils can also find it difficult to research ahead to fully understand the concepts when they are presented to the class.

4.5 THE RELATIONSHIP BETWEEN THE PRAGMATIC SCHOOL OF PHILOSOPHY AND THE TEACHING AND LEARNING OF MATHEMATICS AT "O" LEVEL

4.5.1 Using real world examples

The teaching of mathematics must involve the use of real-life examples such as plane shapes, solid shape, loci in construction among others; teachers can experience and explore themselves to a wide range of discoveries rather than emphasizing on chalkboard only.

4.5.2 Teaching from simple to complex

The teachers should make concepts educationally simple so that pupils can easily assimilate by presenting concepts from simple to complex by this, the child eventually sees that the immediate goal could lead along a path going on the desired direction. The concepts should be arranged in a sequential manner.

4.5.3 Varying teaching methods

Teachers must vary teaching methods and be able to use each method effective. They must understand the advantages and disadvantage of each method. This helps the teacher to overcome the short comes that are associated with those methods. Teacher must use another number of methods to meet the demand of every student in the class.

4.5.4 Hands on activities

Teachers should employ the learning by doing approach. They should allow the student to become source of is to be learned. Student should get the opportunity to interact with the content themselves, carrying out the classroom activities with the teacher acting as a facilitator.

4.6 Zimbabwe Policy relation with the pragmatic approaches to the teaching and learning of mathematics at "o" level

4.6.1 Availing educational documents to pupils

The practicality of the content should be given to learners, as well as the child-centred teaching methodologies that should accompany the content to be taught. This assist pupils to know the sequence of their learning activities. Therefore, pupils will plan for their classroom work in relation to what the teacher will deliver.

4.7 TECHNIQUES THAT CAN BE IMPLEMENTED TO ENABLE MATHEMATICS TEACHERS EFFECTIVELY IMPLEMENT THE PRAGMATIC PHILOSOPHY IN THE TEACHING AND LEARNING OF MATHEMATICS AT "O" LEVEL.

4.7.1 Sending teachers to workshops and seminar

Teachers should be sent to workshops and seminars to familiarize them with various ideas, among them, the pragmatic approaches to cover the gaps regarding application of pragmatic principles in teaching and learning of mathematics.

4.7.2 Availing resources to teachers

There should be adequate resources at the teacher's disposal enable a smooth application of pragmatic principles in mathematics teaching and learning. Resources such as textbooks, instructional media, as well as ICTs are instrumental tools in enhancing the teachers' efforts to promote implementation of pragmatic principles in teaching and learning of mathematics.

4.7.3 Availing literature related to pragmatic tenets

The responsible authorities to avail adequate literature to educators so that they will be able to apply some of the pragmatic principles in mathematics teaching and learning.

4.7.4 Sending teacher for exchange programmes

Teachers should also be exposed to varied exchange programmes as well as teaching and learning situations that promote application of pragmatic principles in teaching and learning of mathematics.

4.8 SUMMARY

This chapter was to present, analyse and interpret data from questionnaires, observations and interviews from the data collected at the schools. The researcher has presented the findings and discussed the relationship between the pragmatic principal, the relation of Zimbabwe Policy with the pragmatic approaches and the techniques that can be implemented to enable mathematics teachers to effectively implement the pragmatic philosophy in the teaching and learning of mathematics at "o" level. Bar graph, pie chart and tables were used to present data for easy interpretation. This data was grouped according to the quantitative and qualitative data to make it possible to interpret the given data. The next chapter focus on summary, conclusions, and recommendations.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter summarize the findings of the study. It will discuss the implications of these findings for infusion of pragmatic principles to deliver mathematical concepts. Suggestions for further research in this area will also be discussed.

5.2 SUMMARY

The major purpose of the study was investigating the relationship between the pragmatic school of philosophy, the relation of Zimbabwe Policy with the pragmatic approaches and the techniques that can be implemented to enable mathematics teachers effectively implement the pragmatic principle in the teaching and learning of mathematics at "o" level. Pragmatists also put more emphasis on the use of flexible teaching methods since they believe that minds of different students are different in the teaching and learning of mathematics. More emphasis was given on the discovery and enquiry method which emphasize on learning by doing. Pragmatic approach to mathematics teaching places high value on activity because their belief is that their ideas are born out of activities .Thus in teaching mathematics teachers should ensure that learners are involved in mathematical activities at "o" level.

The researcher assumed that this study would improve the teaching and learning processes hence found it worthy to undertake the study. It is very important to know the relationship between the pragmatic principles, the relation of Zimbabwe Policy with the pragmatic approaches and the techniques that can be implemented to enable mathematics teachers effectively implement the pragmatic philosophy in the teaching and learning of mathematics at "o" level. This helps the teachers to come up with the correct and effective way of delivering mathematical concepts hence improve pupils learning and understanding.

The researcher adopted a descriptive survey research design. A sample of 40 students was selected from Ordinary level students at three schools in Chegutu district. The researcher collected data using questionnaires, observations, and interview for triangulation purpose. The researcher used three instruments namely: questionnaires, direct observations, and interviews. The researcher administered questionnaires to the 12 teachers and conducted oral face-to-face

interviews with the 40 learners scheduled for seven days on three groups (Royal secondary school, 13 learners, World harvest secondary school , 14 learners, Mucheri secondary school, 13 learners). The researcher conducted the interviews with the three groups since he felt that they were a large group and interviews would need more time. Above all, the researcher also observed mathematics lessons during the teaching and learning of mathematics at the sampled school and recorded invaluable data for analysis.

With regards to research question one, there is need for teachers to involve the use of real-life examples such as plane shapes, solid shapes, loci among others. Teaching should be from simple to complex by this, the child eventually sees that immediate goals could lead along a path on the desired direction. The concepts should be arranged in a sequential manner. Teachers must vary teaching methods and be able to use each method effectively. They must understand the advantages and disadvantage of each method. Teachers should enhance the learning by doing approach. They should allow the student to become source of what is to be learned. Student should get opportunity to interact with the content themselves, carrying out the classroom activities with the teacher acting as a facilitator.

With regards to research question two, the practicality of the content should be given to learners, the child-centred teaching methodologies that should accompany the content to be taught. This helps pupils to know the sequence of their learning activities. Therefore, pupils will plan for their classroom work in relation to what the teacher will deliver.

Regarding research question three, teachers should have in service training programs. Teachers should be sent to workshops and seminars to familiarize them with various philosophical ideas, among them, the pragmatic principles to cover the gaps regarding application of pragmatic principles in teaching and learning of mathematics. School should provide adequate resources to the teachers to enable a smooth application of pragmatic principles in mathematics teaching and learning. There is need by the responsible authorities to provide adequate literature to educators so that they will be able to apply some of the pragmatic principles in mathematics teaching and learning. Teachers should also be exposed to varied exchange programmes as well as teaching and learning situations that promote application of pragmatic principles in teaching and learning of mathematics.

5.3 RECOMMENDATIONS

This study found out that application of pragmatic principles to deliver mathematical concepts may improve if:

Teachers use a variety of teaching methods that allows pupils to think for themselves, practically being involved in their learning activities with teachers acting as facilitators.

With regards to research question one (What is the relationship between the pragmatic school of philosophy and the teaching and learning of mathematics at "o" level?),

Teachers to involve the use of real-life examples such as plane shapes, solid shapes, loci among others. Teachers can experience and explore themselves to a wide range of discoveries rather than relying on chalkboard only.

Educators should teach from simple to complex by this, the child eventually sees that the immediate goals could lead along a path on the desired direction. The concepts should be arranged in a sequential manner.

There is need to vary teaching methods. Teachers must vary teaching methods and be able to use each method effectively. They must understand the advantages and disadvantage of each method. This helps the teacher to overcome the short comes that are associated with those methods. Teacher must use alternative number of methods to meet the demand of every student in the class.

Teachers should employ the learning by doing approach. They should allow the student to become source of what is to be learned. Student should get the opportunity to interact with the content themselves, carrying out the classroom activities with the teacher acting as a facilitator.

With regards to research question two (How do Zimbabwe Policy relate with the pragmatic approaches to the teaching and learning of mathematics at "o" level?), educators should avail educational documents to pupils. This helps pupils to know the sequence of their learning activities. Therefore, pupils will plan for their classroom work in relation to what the teacher will deliver.

Regards to research question three (Which techniques can be implemented to enable mathematics teachers effectively implement the pragmatic philosophy in the teaching and learning of mathematics at "o" level?).

Provision of in-service training programs where teachers are sent to workshops and seminars to enhance them with various philosophical ideas, among them, the pragmatic principles to cover the gaps regarding application of pragmatic principles in teaching and learning of mathematics.

Teachers are given adequate resources to enable a smooth application of pragmatic principles in mathematics teaching and learning. Resources such as textbooks, instructional media, as well as ICTs are instrumental tools in enhancing the teachers' efforts to promote implementation of pragmatic principles in teaching and learning of mathematics.

Providing literature related to pragmatic tenets to educators so that they will be able to apply some of the pragmatic principles in mathematics teaching and learning.

Teacher should be sent for exchange programmes so that they can be exposed to a variety of teaching and learning situations that promote usage of pragmatic principles in teaching and learning of mathematics.

5.4 Summary

This chapter, a summary of the findings of the study has been presented. The implications of the study in the present context have been discussed. Suggestions for further research in the area have been provided. The major finding of the research was that teachers should use a variety of teaching methods that allows pupils to think for themselves, practically being involved in their learning activities with teachers acting as facilitators. In-service training for teachers is mainly recommended for proper implication of pragmatic principles.

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APPENDICES

Appendix 1: Questionnaire for teachers

Section A: Introduction

I am Madondo Richard a student from Bindura University of Science Education and am currently doing my degree program (HBSciEdMt). These questionnaires aim to gather insights into Application of pragmatism to deliver mathematical concepts at 'O' level in five schools in Chegutu District in Mashonaland west province. Please be assured that your responses will remain confidential and will only be used for research purposes.

Section A: Demographic Data Tick where applicable [ ]

1. **Sex:** Male [ ] Female [ ]
2. **Age:** Between 20 and 30 Years [ ]

   Between 30 and 40 Years [ ]

   Between 40 and 50 Years [ ]

   Above 50 Years [ ]

3. **Highest Educational Qualifications**

Certificate in Education [ ]

Diploma in Education [ ]

First Degree [ ]

Master's Degree [ ]

Other:(Specify)……
……

4. **Working Experience**

Less Than Five Years [ ]

Between 5 and 10 Years [ ]

Between 10 and 15 Years [ ]

Above 15 Years [ ]

Section B: Research Questions

Key: SA- strongly agree, A- agree, U- undecided, D- disagree, SD- strongly disagree

5. How do you apply the pragmatism philosophy to the teaching and learning of mathematics at 'O' level?

Possible pragmatic teaching approach	**SA**	**A**	**U**	**D**	**SD**
a) Teaching using real world examples					
b) Teaching from the known to the unknown					
c) Using the project method					
d) Using experimentation method					
e) Motivating learners before lesson					
f) Employing the learning by doing approach					

Other(specify)……
……

6. Which of the following policy documents do you show your learners during the teaching and learning of mathematics?

Policy document	**SA**	**A**	**U**	**D**	**SD**
a) School-based syllabus					
b) National syllabus					
c) Scheme of work					
d) Circulars					
e) Examination Analysis document					

f) Education Act document					

Other(specify)……
……

7. What strategies can be used to improve implementation of pragmatic principles in teaching and learning of Mathematics at ‘o’ level?

Possible strategy to improve use of pragmatism in teaching and learning of mathematics	**SA**	**A**	**U**	**D**	**SD**
a) Sending teachers to workshops and seminars					
b) Availing resources to teachers					
c) Availing literature related to pragmatic tenets					
d) Sending teacher for exchange programs					
e) Encouraging use of field trips					
f) Availing policy documents to teachers					
g) Supervision of teachers during lesson delivery					

Other (specify)

……
……..

Appendix 2: Interview Guide for Learners

The researcher to conduct face to face oral interviews with 'o' level learners to ascertain the extent to which pragmatic principles are being applied during mathematics lessons.

OBJECTIVE 1: To establish the relationship between the pragmatism and the teaching of mathematics at 'O' level?

Tick where applicable [ ]

1. Do your teachers use real world examples during teaching and learning of mathematics?

YES [ ] NO [ ]

2. Does your mathematics teacher teach from the familiar example to the complex ones?

YES [ ] NO [ ]

3. Are you given project work to research on in mathematics?

YES [ ] NO [ ]

4. Does your mathematics teacher use experimentation method?

YES [ ] NO [ ]

5. Does your mathematics teacher motivate you before and during the lesson?

YES [ ] NO [ ]

6. Are you given hands-on tasks to work on by your mathematics teacher?

YES [ ] NO [ ]

OBJECTIVE 2:

To relate the Zimbabwe policy documents to the pragmatic philosophy of teaching mathematics at 'O' level.

2.1 Does your teacher show you the school-based syllabus before beginning of 'o' level course?

YES [ ] NO [ ]

2.2 Does your teacher show you the ‘o’ level national syllabus before beginning of the course?

YES [ ] NO [ ]

2.3 Does your teacher show you mathematics circulars from the Ministry of Primary and Secondary Education on teaching and learning of Mathematics?

YES [ ] NO [ ]

2.4 Does your Mathematics teacher show you the school’s results analysis documents showing pass rates in mathematics?

YES [ ] NO [ ]

2.5 Does your teacher show you schemes of work to show what is to be done in a specified timeframe?

YES [ ] NO [ ]

OBJECTIVE 3:

To propose techniques that can be implemented to improve the use of pragmatic approaches in the teaching and learning of mathematics at ‘O’ level

3.1 Does the school have adequate resources to enhance the effective teaching and learning of ‘o’ level mathematics concepts?

YES [ ] NO [ ]

3.2 Dou you attend field trips to facilitate the effective learning of mathematics?

YES [ ] NO [ ]

3.3 Do you use the experimentation learning method?

YES [ ] NO [ ]

3.4 Do teachers encourage you to use the project method of learning?

YES [ ] NO [ ]

Appendix 3: Observation Guide

The researcher used an observation guide to examine the ways teachers managed their mathematics classes.

OBJECTIVE 1:

To establish the relationship between the pragmatism philosophy and the teaching of mathematics at 'o' level?

The researcher will observe if:

Tick where applicable [ ]

1. Teachers use real world examples during teaching and learning of mathematics at 'o' level

   YES [ ] NO [ ]

2. Mathematics teachers teach from the familiar concepts to abstract ones

   YES [ ] NO [ ]

3. Teachers give learners project work to research on in mathematics

   YES [ ] NO [ ]

4. Teachers use the experimentation method of teaching mathematics concepts

   YES [ ] NO [ ]

5. Mathematics teachers motivate learners before and during the lesson

   YES [ ] NO [ ]

6. Mathematics teachers give learners individual, pairs, or group hands-on tasks to work on during mathematics lessons

   YES [ ] NO [ ]

7. Teachers acquire pedagogical skills related to the pragmatic approach

   YES [ ] NO [ ]

OBJECTIVE 2:

To relate the Zimbabwe policy documents to the pragmatic approach of teaching mathematics at 'o' level.

The researcher will observe if:

2.1 Learners are given the school-based syllabus before beginning of the 'o' level course

YES [ ] NO [ ]

2.2 Learners are given the national syllabus before beginning of the 'o' level course

YES [ ] NO [ ]

2.3 Learners are shown mathematics circulars from the Ministry of Primary and Secondary Education on teaching and learning of Mathematics

YES [ ] NO [ ]

2.4 Learners access the school's results analysis documents showing pass rates in mathematics

YES [ ] NO [ ]

2.5 Learners are shown schemes of work to show what is to be done in a specified timeframe

YES [ ] NO [ ]

OBJECTIVE 3:

To propose techniques that can be implemented to improve the use of pragmatic approaches in the teaching and learning of mathematics at 'o' level

The researcher will observe if:

3.1 Teachers have adequate literature pertaining to pragmatism

YES [ ] NO [ ]

3.2 Teachers have adequate resources to apply pragmatic approaches in teaching and learning of Mathematics concepts

YES [ ] NO [ ]

3.3 Teachers have pedagogical skills to apply the experimental method in teaching and learning of mathematics

YES [ ] NO [ ]

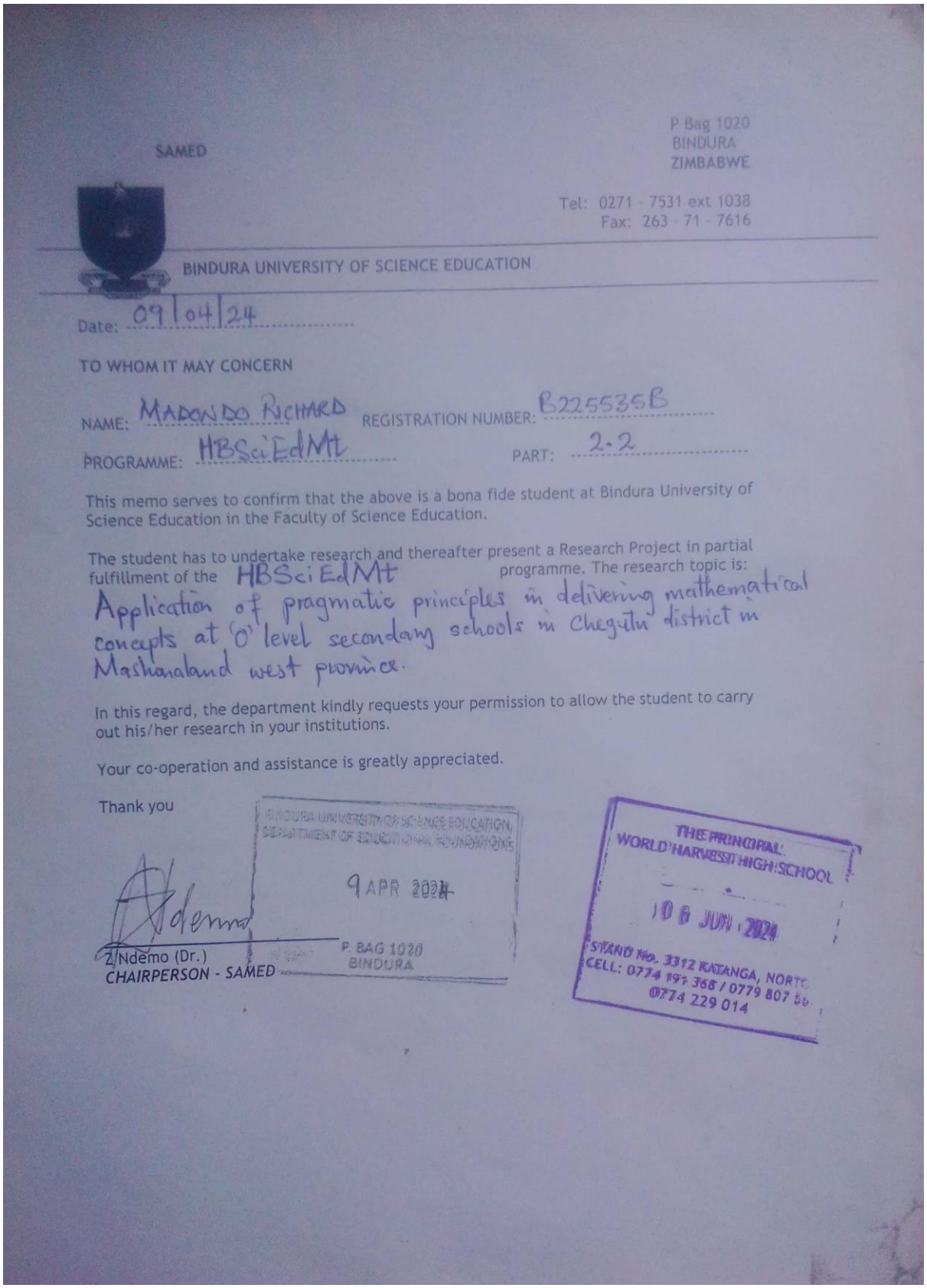
3.4 Do teachers have adequate policy documents to give to learners?

YES [ ] NO [ ]

3.5 Are teachers sent to seminars and workshops to improve methodologies in teaching and learning of Mathematics?

YES [ ] NO [ ]

Appendix 4: Application letter to carry out research



SAMED

P Bag 1020
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ZIMBABWE

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

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 09/04/24

TO WHOM IT MAY CONCERN

NAME: MADONDO RICHARD REGISTRATION NUMBER: B225535B

PROGRAMME: HBSciEdMt 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 HBSciEdMt programme. The research topic is:
Application of pragmatic principles in delivering mathematical concepts at 'O' level secondary schools in Chegutu district in Mashonaland west province.

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

Z Ndemo (Dr.)
CHAIRPERSON - SAMED

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

THE PRINCIPAL
WORLD HARVEST HIGH SCHOOL
10 JUN 2024
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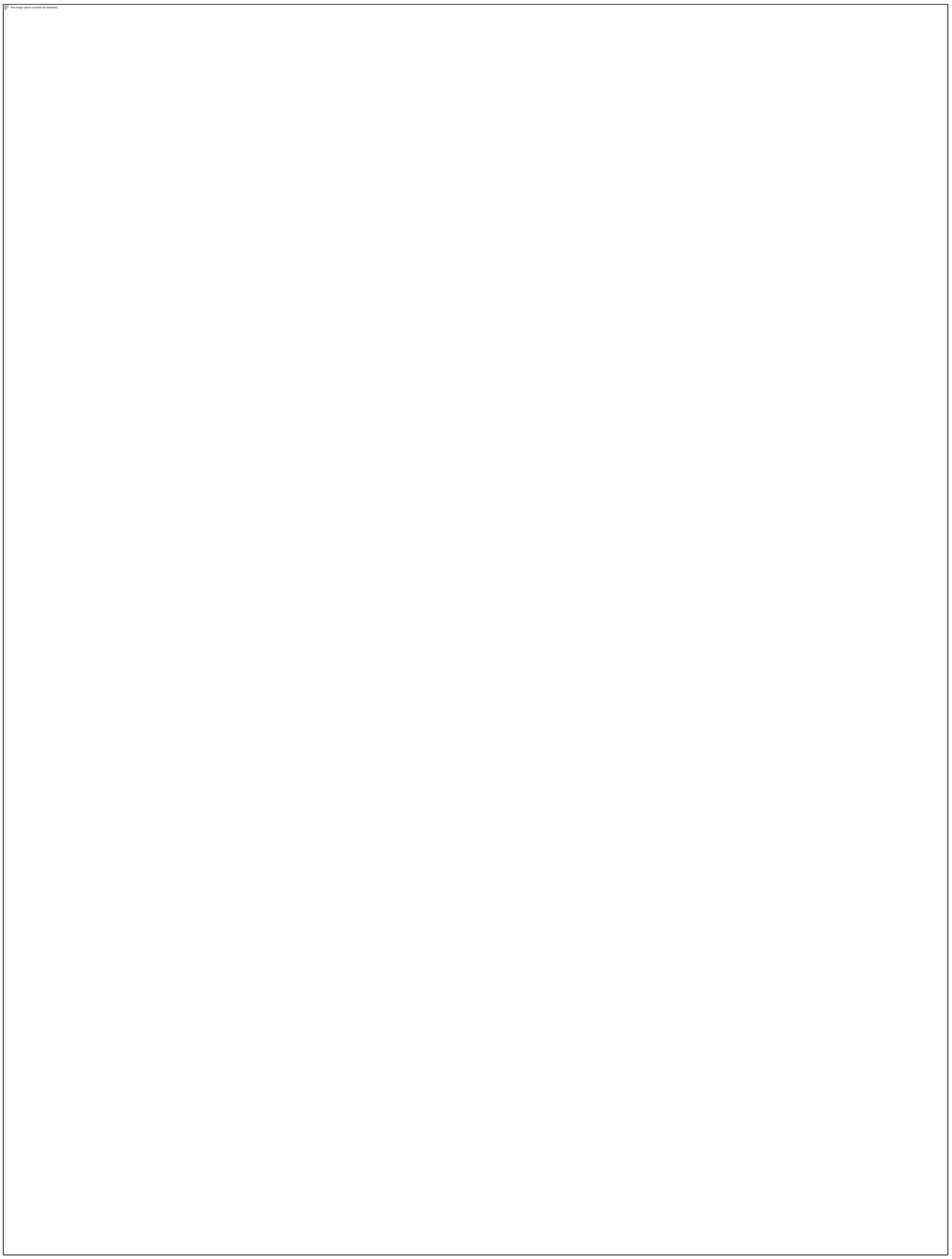
CELL: 0774 197 368 / 0779 807 58
0774 229 014

Appendix : Permission to carry out research



Appendix 6: Permission to carry out research