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Exploring the Art of Pedagogy in Teaching Linear Programming to Support Novice Performance at Munkuye Secondary School in Nkeyema District: A Hermeneutics Phenomenological Perspective

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ABSTRACT

The study aimed to explore the art of pedagogy in teaching linear programming to support novice performance. The study was qualitative in nature and hermeneutic phenomenological design guided the study. The study had 16 participants who were selected through homogenous purposive sampling. Data was produced through semi-structured interviews and focus group discussion schedules. Then generated data was thematically analysed. Findings of the study were that Comprehensive Pedagogy has been essential to secondary school students' academic achievement and advancement. Comprehensive pedagogy is typically demonstrated by the teaching strategies used to improve learning and the resources used in the teaching/learning process. However, most teachers were not employing appropriate methods in teaching linear programming hence poor pupils performance. Freeman *et al.* (2014) supports the use of group work in the teaching/learning process since it encourages students' social inclusion. Make use of interactive techniques such as problem-solving workshops, case studies, and group discussions. Participation is encouraged and newcomers can apply LP ideas realistically with the aid of interactive learning. On approaches to problem-solving, offer constructive criticism. Beginners should apply LP techniques with plenty of possibilities to practice on a regular basis.

INTRODUCTION

The purpose of this study is to critically explore the art of pedagogy in teaching linear programming to support novice performance at Munkuye secondary school in Nkeyema District using hermeneutics phenomenology approach. I assert that the adequate information of LP as part of the pedagogical frame work significantly contributes to improved learner performance. This study offers appropriate pedagogic strategies employed in teaching L.P based on available educational references. Teaching methods and concepts are based on both artistic and scientific principles. In order to stimulate learning environment, teachers employ art. Therefore, the study of instruction and how pupils are taught material is known as pedagogy. The creation aids in the knowledge acquisition of students. Howard (2021) applied the idea that pedagogy is similar to learning and teaching as an artistic endeavor.

To put it simply, pedagogy is how educators teach linear programming theoretically and practically (Howard Gardner, 2021). In discourse, the term "pedagogy" has come to refer to instructional practices alone (Pritchard & Woollard, 2010). Teaching, then, is the process of learning by experimentation and many approaches. Since science and art are fields that are always changing, the term "pedagogy in education" is now used frequently.

The Value of Pedagogy in Instruction

Pedagogy has the capacity to fundamentally change the rules in the sphere of education. The tools and high-level efforts needed to give pupils the fortitude to face the future can be found in a variety of pedagogies. One benefit of pedagogy learning is that it enhances education and boosts student performance, which benefits both teachers and learners.

Students find it difficult to comprehend the ideas of linear programming. To help in idea explanation, the instructor may use a strategy that considers the student's developmental stage. Moreover, in the event that the initial pedagogy fails, a teacher may try a second one (Shumba, 1988).

Context

The Greek terms "agogos" (leader) and "paidos" (child) are the origin of the English word "pedagogy." Thus, pedagogy is the study of instruction and how students are taught stuff. It facilitates students' acquisition of knowledge. The notion that pedagogy is comparable to learning and teaching as an artistic endeavor was put into practice by Howard (2021).

Both artistic and scientific elements serve as the foundation for teaching concepts and processes. Teachers use art to inspire pupils in an engaging learning environment. Children pick up a variety of language and critical thinking abilities in school. Teaching is an art, it instructs students and teachers must use the right tools and strategies.

Peyser (2006) defines pedagogy as the art or science of teaching and educational techniques. Teachers' philosophies influence pedagogy. To assist students

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learn more effectively and develop higher-order thinking skills, well-thought-out pedagogy is required. The term "instrumental knowledge of pedagogy" is used to lead to scientific study.

Pedagogy has the capacity to fundamentally change the rules in the sphere of education. One benefit of pedagogy learning is that it enhances education and boosts student performance, which benefits both teachers and learners. A student-centered approach can raise the standard of instruction. It is possible for students to take full responsibility for their education. Moreover, according to Pedaste *et al.* (2015), pupils can grasp complex academic ideas at their individual speed.

Statement of the Problem

Mathematical educators have put a lot of effort into identifying the primary causes of secondary school pupils' poor linear programming ability. Substandard rates of success in linear programming remain a concern despite all these admirable attempts. Pedagogy help students improve their linear programming skills. We do not, however, know if students' actual experiences with linear programming were consistent with educational instruction. This formed the foundation for the current study's hypothesis.

Purpose of the Study

The study's goal was to explore the art of pedagogy in Munkuye Secondary School's linear programming instruction in order to enhance novice performance.

Research Objectives

The research objectives are:

i. Explore Exploring the art of pedagogy in teaching linear programming to support novice performance.

ii. Describe appropriate pedagogic strategies to employ in teaching L.P to support novice performance.

Significant of the Study

More study data may be able to assist instructors in refining their methods for teaching linear programming. The study's findings may be useful in developing inclusive education policy for educational institutions and the ministry of education. The study is significant for educators, students, and the country at large since it has the potential to improve comprehension and boost academic accomplishment. Since economists and businesses add value to the nation, the data in this study might also be useful to them in their daily business dealings.

METHODOLOGY

Research Design

The study explored students' lived experiences with their academic performance in linear programming using a hermeneutic phenomenology design. The study was qualitative in character, using methodologies and techniques of qualitative research under the given approach. This is due to its strict adherence to specific methods, like data analysis techniques and sample protocols (Mulenga, 2015).

Additionally qualitative in nature, the study sought to evaluate people's statements in order to look for supporting information, validate interpretations, and gauge the data's internal consistency (White, 2018). Furthermore, the research was qualitative in nature as it sought to offer a comprehensive comprehension of the low mathematics performance among senior secondary school students in a specific district (Harrison, *et al.*, 2017). Thus, examine participant perspectives regarding the causes of low math learner performance.

Research Site

The current study was conducted at Munkuye secondary school in Nkeyema district of western province of Zambia.

Target Population, Sample Size and Sampling Procedure

Study Population

The target population of the study was grade twelve pupils who were at Munkuye secondary school in 2023.

Sample Size

The study had 16 participants comprising 9 females and 7 males.

Sampling Procedure

The researcher used a homogenous purposive sample technique to choose study participants who could provide in-depth knowledge about the issue. According to Denzin and Lincoln (2017), this meant that participants in purposive sampling were selected based on their familiarity with the requested information.

Put differently, purposive sampling allows the researcher to use their judgment to choose the best volunteers to meet the study's goals and provide answers to the research questions. According to Makondo & Makondo (2020), the purpose was to choose participants who will enable the researcher to gain phenomenon, rather than extrapolating findings to a broader population.

Research Instrument, Data Generation and Analysis Procedure

Research Instruments

The instruments utilized to collect data from participants were semi-structured interview guides and focus group discussion guides, which encourage interaction and dialogue with the participants (Wahyumi, 2012). The study findings are more credible when a range of techniques are used, as multiple points of view are used to collaborate and triangulate the facts.

In-depth Interviews

Extensive interviews were conducted with the intended audience. One-on-one interviews with participants were conducted while the researcher took notes. To obtain

insightful information on the research issue, in-depth interviews were employed. The use of this instrument has several benefits. Among benefits are the following: in-depth interviews improved secrecy and privacy; participants had the opportunity to ask questions when they were unclear and the researcher had the opportunity to clarify; and the researcher was able to gather a wealth of insightful information.

Focus Group Discussions
Participants in the focus group talks were divided into groups of five. Focus group talks promote dialogue and mutual understanding, particularly when tackling challenging topics. It makes it possible to examine both the parallels and contrasts in experiences and ways of thinking (Lewis, 2010). This promotes shared perspectives and comprehension.
According to Moyle (2013), focus group conversations also have the advantage of allowing the researcher to listen to the participants, which empowers them in and of itself. In order to allow participants to go into further detail about topics that came up in the one-on-one conversations, the researcher played a moderate role. The instruments utilized to collect data from participants encouraged communication and interaction with the participants (Wahyumi, 2012).

Data Analysis
Given that the study was entirely qualitative, themes were developed by grouping participant ideas that were comparable (Mufalo and Kabeta, 2019). The generated data was therefore subjected to a thematic analysis.

Ethical Considerations
In order to maintain their anonymity, the participants gave the researcher their consent. All participants were also given the assurance that the information collected would be handled strictly, with the utmost confidentiality, and used only for that reason. This was made possible by adhering to the ethical standards put forth by Kimmel (2014), which include obtaining ethical clearance, getting participants' agreement, ensuring their anonymity, and assigning them pseudonyms. As previously mentioned, Kimmel's (2014) highlighted ethical norms were fully taken into account.

Study Findings and Discussion
The study revealed that pupils' performance in linear programming was poor due to the methods teachers use. The revelations were established after sixteen (16) participants were interviewed to describe appropriate pedagogic strategies to employ in teaching L.P to support novice performance. As a result, eight (8) students claimed that linear programming was taught incorrectly, five (5) thought it was taught fairly, and three (3) said it was taught properly. This indicates that the pedagogic strategies used in teaching L.P to support novice performance in linear programming were not appropriate.

An engaged, immersive, self-paced learning environment is facilitated by the use of pedagogy in instruction. However, it is only feasible when a progressive learning environment is constructed using the fundamentals of pedagogy. Teachers can engage students' interests and establish a forward-thinking learning environment through the use of pedagogy. By employing several instructional techniques, educators can assist learners in progressing at their own rate. However, in order to fully utilize pedagogy in the classroom, educators must employ creative approaches.
It is cardinal to indicate that appropriate pedagogic strategies in teaching L.P can support novice performance in linear programming. This is because high quality teaching rests on teachers pedagogic. Teachers should understanding the subjects they are teaching by knowing the structure and sequencing of concepts, developing factual knowledge essential to each subject and guiding their pupils into the different ways of knowing. It is also clear that when there is lack of appropriate pedagogy in teaching, pupil's examination results are at risk. By using Step-by-Step Problem Solving, LP issues can be divided into more manageable phases. Starting with simple examples and gradually introduce complexity (Taha, 2016).Thus, the issue of appropriate pedagogy by the teacher benefit the pupil and can enhance good performance, especially linear programming. Consistent with these statements Fletcher, (2018) issue that students have when learning linear programming teachers who lack creativity and understanding in the techniques they employ, results in subpar exam performance.
Teachers' pedagogy was the theme that emerged during the discussions with participants.
Nama indicated in transcribed verbatim:
"Teachers who had appropriate pedagogy explained to pupils well and pupils got the concept without difficulties. The teacher who taught suitably made pupils to have an interest in the topic thereby inspiring the pupils to work extremely hard (Nama, 10 .11. 2023).
According to Mwambazi et al. (2022), learner involvement is essential to solving the issue of subpar academic performance in linear programming. Active participation is the appropriate approach instead of seeing them as just passengers (Wang et al., 2015).
Similar opinions were expressed by Mono, who claimed that meaningful learning is possible when pedagogy is prioritized.
"Where children understand the explanation of the topic, pupils tend to do better because they have understood and this produces a real desire for learning that should be at the heart of any school's provision and needs proper teaching methods (Mono,10 .11, 2023).
All the Sixteen (16) participants revealed that Learner-centred teaching was the best teaching methodology that foster learning and enhance performance (Mtitu, 2014). Pupils who focus on what they are taught tend to do better and score more marks. This can only be done if teachers increase their efficiency and effectiveness in teaching.

Wize commented that:

"I did not understand linear programming concept because I could understand the way the teacher was explaining the topic. I just learn because I had to. It did not understand the topic; I had a lot of challenges in trying to understand. This was because my teacher failed to teach to help me understand" (Wize, 18.11. 2023).

By encouraging students to think critically and pay attention during lessons, student-centered techniques improve successful teaching. This method works well in the 21st-century learning environment, which demands more creative and interesting pedagogical approaches that improve conceptual retention, are learner-centered, and support better learning for students in the present (Mtitu,2014).

Yet Mungo stated that:

"I did not understand anything in linear programming because the teacher was struggling in teaching the topic. I recall the teacher telling the class that don't waste time answering any question on linear programming. This was so because, teachers lacked appropriate teaching approach (Mungo, 25.11. 2023).

Ansah *et al*. (2020) discovered that subject-matter expertise of teachers has a major impact in their study. Another theme that emerged was pupils' confidence.

Taze commented that:

"Pupils lost confidence in teachers because they appeared to have no content. They were failing to help us understand questions better and apply the concept correctly as they were unable of employing a variety of strategies to retain high performance and good mark" (Taze, 22 .11, 2023).

The above assertion collaborates with Watson (2016) who said that an effective teacher ought to have Facts and skills. The skillset comprised computing and numerical abilities; conceptual structures, which were intricately, linked knowledge bases; and general strategies, which are protocols that direct the selection of skills.

Further, Yote stated that:

"I had difficulties in following what my teacher was teaching as the lessons were not Interactive hence failing to understand the concepts. There was no student participation through discussions and problem-solving exercises. Majority of the pupils in class listened to teacher talking (Yote, 17.11. 2023).

Similar observations were made by SMASSE (2018), who noted that some math teachers continued to teach through lectures and that students were given tightly constructed sentences that they had to learn by heart and repeat back to the teacher when asked.

Another theme that emerged from the findings was, Pedagogy for Teaching in the Classroom was not suitable. Further, Masisi stated that:

"I had difficulties in understanding what my teacher was trying to teach as most of learners were lost in the process. The lesson was boring to follow. I left the class without getting anything. Majority of the pupils in class listened to teacher talking (Masisi, 19.11. 2023).

These have an impact on students since they will be less adept at addressing problems (Kamatchi & Stanly 2021). All the Sixteen (16) participants revealed that Pedagogy for teaching and learning in the classroom involves teacher centred, an approach most teachers used to facilitate learning. Using the effective pedagogical strategies in the classroom, teacher can assist students in achieving the learning objectives. By employing this tactic, students can collaborate, think, pair, and share-leveraging their combined knowledge and abilities to complete learning objectives (Puteri, 2018).

Teaching linear programming can be approached in various ways to ensure students understand the concepts effectively. This can only be done if teachers increase their efficiency and effectiveness in teaching.

Sima stated that:

"I did not understand anything. This was as a result of efficiency and effective teaching by my teacher. Some pupils showed greater enthusiasm as they value the topic more and studied hard in order to deepen their knowledge" (Sima, 30.11. 2023).

The aforementioned results are consistent with the assertion made by (Gunduz, 2015) that learners who actively participate in the process generate their own meaning and understanding of the subject matter. Students should actively build their knowledge and comprehension from their experiences. Instructors should facilitate learning by encouraging exploration, problem-solving, and hands-on activities (Vygotsky, 1978).

Appropriate Pedagogic Strategies to Employ in Teaching L.P to Support Novice Performance
A 2014 study by Njoroge on teaching strategies in secondary schools states that there has long been debate about the most effective ways to teach and understand math and science. The teaching approach and style were the main topics of discussion. One specific method that made some students hate the subject was instruction, which keeps them from enjoying their lessons and from benefiting from learning what they know on their own.

Moreover, the teacher-centered techniques of instruction that are commonly used are not innovative or enthusiastic to help students acquire the skills and knowledge that they need. Thus, linear programming performance in secondary schools is deficient (Shikuku, 2015).

Linear programming may not be a challenging topic if teachers can employ workable method that can provide meaningful learning opportunities for pupils to develop understanding of the topic through discovery. Teaching linear programming (LP) effectively to novices requires employing pedagogic strategies that are clear, engaging, and practical.

Conceptual Clarity Through Visual Aids
Teachers should use visual aids, such as graphs, charts, and diagrams, to explain the fundamental concepts of LP. Visual representations can enhance understanding and retention (Hillier & Lieberman, 2014).

Conceptual clarity through visual aids enhances performance across various fields, including education, business, and communication. It can contribute to improved performance as it improves Comprehension and Retention. Visual aids help in simplifying complex concepts, and remember (Mayer and Anderson 1992).

Facilitates learning and Understanding
Visual aids, such as diagrams, charts, and info graphics, facilitate active learning. According to Sundararrajan (2012), they captivate students by exhibiting material in a more charming and comprehensible.

Increased Engagement
Visual aids capture attention and maintain engagement. In educational contexts, research by Schwartz *et al.* (2009) highlights that visual aids stimulate interest and help maintain focus during learning.

Encourage Critical Thinking
Encourage novices to be creative when approaching LP problems. Foster a problem-solving mind-set that involves exploring multiple solution paths. The effectiveness of these strategies may vary based on the learners' backgrounds, interests, and prior knowledge. It's essential to adapt and refine these strategies based on the specific needs of the novice learners (Hillier & Lieberman, 2014).

Constructivism
Certainly! Pedagogy for teaching involves various strategies, approaches, and methods that educators use to facilitate effective learning.
Constructivism theory places a strong emphasis on how students actively create their knowledge and understanding from their experiences. Educators facilitate learning by encouraging exploration, problem-solving, and hands-on activities (Vygotsky, 1978). Learners create their own meaning from the material, (Gunduz, 2015). Active participation is the appropriate approach instead of seeing them as just passengers (Wang *et al.*, 2015).
In a similar vein, a social constructivist perspective on education sees teamwork as a novel approach to teaching and learning for both instructors and students (Roya *et al.*, 2015). According to social constructivist theory, social input has cognitive development. It highlights how knowledge is jointly produced and formed (Eggen & Kauchak, 2013).

Collaborative Learning
This approach involves students working together in groups to achieve learning goals. It fosters teamwork, communication skills, and peer learning (Bruffee, 1999). Multiple learners work together, like in small group instruction, and they all contribute and help each other learn (Laal & Laal, 2012). Groups of students collaborate to solve problems, finish tasks, or produce products as part of the educational strategy known as collaborative

learning (Laal & Laal, 2012). This kind of collaboration among learners provides valuable opportunities for individual learners especially those who may be lacking to learn to improve their quality of knowledge which in turn is likely to impact positively on the academic performance (Smith & Johnson, 2018).

Inquiry Based Learning
Inquiry-Based Learning investigates, and seeks answers. It promotes critical thinking, problem-solving, and curiosity (National Research Council, 2000). Students address real-world problems, like in project-based learning, by asking questions and doing further research (Tsafe, 2013). According to Ball (2003) a teacher possessing strong mathematical pedagogical topic expertise can simplify mathematical concepts into less formal, abstract forms, making them understandable to pupils with varying cognitive abilities. By doing this, curiosity is piqued, causing students to appreciate the material that is being provided to them. Additionally, because they are drawn in by the presentation, this may cause an attitude shift.
Hurrel (2013) further argued that in order for society to demand effective learning, quality instruction is both necessary and unavoidable. Lee *et al.* (2019) assert that teachers possess outstanding pedagogical topic knowledge if they are able to instruct the lessons effectively. It is required of teachers to exhibit their understanding of this subject.
Constant and frequent feedback and remediation from the professors is also crucial. Math performance is inevitably improved when students receive feedback and remediation. Remediation helps students make up any inadequacies so they can compete on an equal footing with other students. Instructors that employ interactive techniques get their students to participate actively. It has been demonstrated that project work, group projects, and discovery approaches are successful ways to teach and learn mathematics. When humor is used as a teaching approach, students perform better because the instruction is engaging and pleasant (Ngussa and Mbuta, 2017).
In contrast, Kolb (2014) discovered that students who were taught a problem-solving technique outperformed those who were taught a standard approach in linear programming. Students were introduced to autonomous problem-solving strategies with the teacher serving as a facilitator. Learner-centered teaching is what this sounds a lot like (Mtitu, 2017). Similarly, a study on creativity and problem-solving skills among higher secondary students was carried out by Kumar, M. (2020). The study's conclusions showed that higher secondary pupils have a high degree of problem-solving proficiency.
In 2021, Sathishkumar & Prema conducted a study titled "Problem Solving Ability and Academic Achievement on Mathematics among IX Standard Students". According to the study's findings, girls and kids from rural regions were better at addressing problems. It was also found that students in government schools have lower problem-solving skills. These previously mentioned research show

that an individual's capacity for problem-solving varies depending on their upbringing. The ability of teenagers at different times to solve problems is resolute by the facilities that are available to them. Offering of various pedagogical theories and methods that educators can utilize in their teaching practices. Pedagogy evolves, and new research continually contributes to refining these approaches.

Nonetheless, studies reveal that guided discovery, exposition, question-and-answer sessions, and group projects are the most often employed instructional strategies.

CONCLUSION

Incorrect delivery strategies for the lesson are the cause of students' subpar performance. Poor results are a result of most students not participating in the lesson's delivery. Consequently, educators must meet the needs of each student and ensure that none are left behind. It is important to promote group collaboration in adaptable thought processes and applications.

Ajogbeje and Alonge (2012) assert that teacher competency is essential, stating that educators must exhibit proficiency in all subject areas' pedagogical content understanding. In agreement with Ajogbeje and Alonge, Lee *et al.* (2019) assert that Teacher Pedagogy Content Knowledge is fundamental since it focuses on how the teacher presents their teachings. Facilitators possess outstanding Pedagogy Content Knowledge if they are able to engage learners with their lectures.

It is imperative to stress the critical significance that pedagogy plays. It was also found that the student teachers lacked instructional style, linear programming teaching skills, and subject-matter experience. Teachers were not using creative teaching strategies to encourage learning linear programming. In particular, using pertinent word problems and incorporating hands-on experiments into math lessons can improve student performance and learning. Suitable approaches must be used.

RECOMMENDATIONS

Based on the research findings therefore, the study recommended the following:

i. In order to improve successful delivery, teachers should use proper teaching techniques, particularly for learner-centered activities where students have a key role. This should also include the materials and strategies for pupils to understand better (Kaabo, 2019).

ii. To enhance performance, the government, should hire content-based, trained math teachers.

iii. To overcome pupils' fear of mathematics, teachers should encourage them and help them develop a positive attitude toward the subject.

iv In order to facilitate the shift from tangible to abstract mathematics, teachers should employ both virtual and concrete manipulatives in their lesson plans. Mathematics instruction can benefit from both tangible and digital manipulatives.

v. The mathematics curriculum has to be revised by the CDC (2013) to make it more manageable.

vi. In order for instructors to exchange current teaching ideas, the district should arrange staff development workshops at the regional, district, cluster, and school levels through the province and district

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