



AMERICAN JOURNAL OF MULTIDISCIPLINARY RESEARCH AND INNOVATION (AJMRI)

ISSN: 2158-8155 (ONLINE), 2832-4854 (PRINT)

VOLUME 2 ISSUE 3 (2023)



PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

Disablers Affecting Pupils Academic Performance in Linear Programming at Nkeyema Secondary School in Zambia: A Hermeneutic Perspective

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Article Information

Received: March 27, 2023

Accepted: April 10, 2023

Published: April 18, 2023

Keywords

*Academic Performance,
Disablers, Linear
Programming, Pupils,
Zambia*

ABSTRACT

The study examines the effects of disablers on pupils' academic performance in linear programming at Zambia's Nkeyema secondary school. The study applied interpretivist views and was entirely qualitative. The lived experiences of fifteen (15) participants which included 8 girls and 7 boys were also extracted using a homogenous (purposive) sample technique. These were previous Nkeyema secondary school pupils who had completed grade twelve. In-depth interviews and group discussions produced the data, which was then thematically analysed. The findings of this research showed that a number of disablers affected how well pupils performed academically in linear programming. One of them was the travel time required for pupils, as well as the lack of quality teaching and learning tools like textbooks. Furthermore, inefficient teaching methods employed by some teachers, lack of parental support, and pupils' lack of prior knowledge negatively affected performance in linear programming final examinations. In an effort to address the issues with teaching linear programming in grade twelve, the following suggestions were made: The Ministry of Education should build schools close to neighborhoods to minimise the distance that pupils must travel and also lower absenteeism. In order to ensure that pupils are learning properly, it should also make sure that universities and other educational institutions incorporate linear programming while training new teachers. Also, schools should receive enough funding to purchase instructional materials. Teachers should use learner-centered activities and 21st-century teaching techniques to impart the subject. To encourage pupils to attend class and learn, the government should build more boarding schools and school administration should arrange them meals. The study concluded that pupils in grade twelve performed poorly in linear programming. The lecture method of instruction and the prevalence of disablers in its delivery all led to the pupils' subpar academic achievement.

INTRODUCTION

In Zambia, pupils' mathematics performance on national examinations has remained continuously below average (ECZ, 2016). General Performance Analysis Reports from the Examinations Council of Zambia (ECZ, 2019) have shown that one of the topics in which pupils have continued to perform poorly throughout the national examinations at Ordinary Mathematics Levels is linear programming (Nkhata, 2018). Therefore, this article explores disablers affecting pupils' academic performance in Linear Programming at Nkeyema Secondary School in Western province of Zambia.

LITERATURE REVIEW

Disablers Affecting Pupils Academic Performance in Linear Programming

According to Idris, Sulfiaty (2015), one of the concepts that pupils have trouble understanding is linear programming. Pupils have trouble in understanding and grasping the concept due to the prior elements that must be acquired, such as linear equations and linear inequalities. Academics have disagreed quite a bit over the effectiveness of linear programming in relation to the specific countries where initially the topic resurfaced. In United states of America as well as Europe studies have revealed that, poor performance in linear programming is due to content given to teachers during teacher education training or

program. The colleges and universities have been criticised for equipping teachers with content knowledge that has little or no bearing on the real class room situation (Ball & MacDiarmid, 2010)

The study by Hess, Chang, & McDevitt, (1987), demonstrated that enhancing pupils' mathematics proficiency levels is the educational system's main focus now in America. Yet, cross national surveys show that American schoolchildren consistently do poorly in mathematics compared to their counterparts in China, Japan and Korea (Stevenson, *et al.*, 1990). It is likely that cultural and familial variables have a significant impact in the inequalities because they can be seen as early as Kindergarten.

The subject of family and parenting came up once more. Researchers have found that American pupils perform worse than Asian pupils for a variety of factors, such as curriculum variations, parental participation, time management, and teenagers' assessments of their own arithmetic comfort and aptitude. Traditional Chinese parenting and teaching methods have a significant negative impact on the academic success of those youngsters (Ho, 1994).

According to the literature on previous study, difficulties that pupils frequently face when solving linear programming problems are due to their poor comprehension and lack of prerequisite knowledge. This poses a challenge and

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negatively affect pupils' academic performance. This claim is in line with Skemp's (1971) assertion who posited that, learning of higher order concepts is only successful when learners have a firm understanding of the corresponding lower order concepts.

The study in Pakistan conducted by Munawar (2014), explored the impact of team teaching on the eighth (8th) grade learners' achievement in mathematics. The focus was on the conceptual understanding and procedural knowledge of learners in algebra and geometry. Pupils were unable to deduce symbolic inequalities from word problems given and confused the use of inequality signs ($<$ and $>$), textbooks, pupils also had problems with graphing inequalities. The study noted that errors were arising from pupils' low proficiency in mathematical language as reflected by the highest errors at the reading level and wordy problems which pupils did not understand. The conceptual understanding and procedural knowledge are very important.

School environment is another challenge which learners face in as far as learning linear programming is concerned. This assertion is line with the study done in U.K by Moschkovich (2018) who revealed that learners should participate in mathematical classroom discourse, they need to be engaged in purposeful written exercises, talks or interactions when involved in mathematical activities which can only happen in a conducive environment. It is through such classroom activities that teachers can assess if learners understand the concepts taught and determine the support needed. Learners should participate freely meaningfully.

Consistent with this assertion, Changwe and Mulenga (2018) stated that most teachers of mathematics were not well vested with linear programming, while others lacked competence. Similarly, the study established that the mathematical knowledge for teaching was missing because the university did not have a specific mathematics content course for those pupils who were to become teachers.

The findings of Changwe and Mulenga (2018) coincided with the study in Lesotho by Iheanachor (2017) on the influence of teachers' background, professional development and teaching practices on pupils' achievement in mathematics in Lesotho, have positively associated pupils' performance in mathematics to teaching methods. The teaching methods, teacher qualifications, subject majors and the years of experience were predictors of pupils' achievement in mathematics.

According to Adino (2015), negative attitude is considerably connected with failure in any endeavor, whereas a positive attitude is strongly correlated with success. It is important to notice that, when teaching and learning is interesting, fun, meaningful, and relevant, learners are determined to learn. They become inspired, pay attention, drawn and ready to absorb the information being presented.

Equally, NCDC (2018) performed a study in Uganda. The findings revealed that, pupils had negative attitudes toward mathematics, and more specifically in word problems.

Linear programming is taught in Ugandan lower secondary school in the eleventh grade (by using a graphical method). One of the goals of Uganda's lower secondary mathematics curriculum is to master linear programming, despite the pupils general and specific difficulties with mathematics learning. The aforementioned assertion was supported by Kenney (2020), who suggested that teachers can successfully educate pupils by mentoring and teaching them to develop a positive attitude towards linear programming's so as to overcome learning difficulties, which can be achieved through CPDs, where experienced teachers can impart the finest methods and approaches for developing and enhancing pupils' mathematical skills. Regardless of gender differences, schools' location, school status, or other background issues, teachers should collaborate to assist pupils in setting and achieving their goals while tackling mathematics problems outside the classroom. Yet, if the core ideas are misunderstood, pupils can be unable to properly reply to a specific Linear Programming challenge. Teachers should therefore go over and review the essential algebraic concepts that could aid or impede pupils' grasp of linear programming and subsequent learning (Kenney, 2020).

Scarcity of teaching/learning materials in linear Programming components are a challenge. This can pose a challenge to pupils as they don't have books to research from. Corresponding with the above findings, in Zambia, Mulenga and Kabombwe (2019) also reported that there was scarcity of teaching/learning materials in schools.

Therefore, lack of teaching /learning materials results in poor academic performance, the current research findings correspond with that of Mwanza and Silukuni (2020) who found that large classes, inadequate stocks of educational materials, inadequate classrooms and desks had a negative impact which led to poor performance of the learners in schools. It should be adequate to mention that a number of factors, including the teaching strategies, resources employed with the pupils, issues with policy, and change of curriculum, affect how well linear programming can be taught hence poor performs in mathematics.

In order to effectively teach and master linear programming, some teachers tend to employ a particular pedagogy. In Kenya Shikuku and Wasike (2015) performed research on how secondary school pupils used problem-based learning to apply their knowledge and skills in linear programming to real-world contexts. With problem-based learning, or learner-centered pedagogy, pupils really solve issues to develop understanding of a subject. Both domain knowledge and critical thinking abilities are gained. The goal of the problem-based learning approach is to assist pupils in efficiently and flexibly gaining knowledge. Pupils who get instruction utilising the problem-based learning method do better.

Secondary school pupils may find the content and concepts abstract and challenging if Linear Programming is not properly introduced to them. This could result from using equations and basic algebraic concepts incorrectly. This revelation corresponds with the findings of Ofori-Kusi

and Mogari (2017) who established that the challenge which pupils faced during teaching was the way linear programming was being taught. The method used can either help the pupils understand the concepts or fail to understand. This implies that, the heuristic teaching strategy should be employed in order to raise learners' academic performance. The study also advised incorporating this method into the study of other mathematical ideas and subjects. Additionally, the mathematisation of mathematical word problems is directly related to algebraic expressions, rules, and principles. it is sufficed to say that secondary school learners' ability for learning Linear Programming greatly depends on a prior conceptual understanding of algebraic expressions and associated ideas and the pedagogy applied. Which most teachers don't pay attention to. It calls for teachers to take their time when explaining algebraic concepts to the pupils especially that algebra provide tools for learning and understanding other mathematical concepts, (Ofori-Kusi and Mogari, 2017).

This is in tandem with UNESCO (2018), report that a necessary condition for teachers to teach mathematics was not only to know mathematics competent in understanding the basic contents, concepts and the associated skills. This means that teachers lacked competence ought to know what it meant to make pupils achieve good results in the subject. Teachers needed to consider pupils perceptions and the ideas the student bring into the classroom. It was therefore important that teachers should find what their pupils already know about the concepts or the principles that are to be introduced. The teacher needs to build on what the learners already know cascade from there to new realms of knowledge and understanding on introduced concepts in Mathematics. The teacher should not assume that the learners are blank slates on which to write new knowledge. Unddoubtedly, one may assert that school environments play avital role in lesson delivery and academic performance of learners. Recent curriculum reform in South Africa, and all over the world, reflects a change in what counts as mathematical learning (DoE 2017). The subject guidelines for mathematics claim that the learning is not just about the learning of procedures or methods of solving particular problems, but learners are also expected to explain the methods that they use, (DoE 2017). The learning environments have a significant impact on how well pupils perform in mathematics.

Bartlett, L. Paulo Freire (2018), conducted a study insisting on the use of dialogue method whereby teachers discussed with their pupils about their learning environments. The methods involved pupils discussing together or conversing, rather than using written books and syllabuses in a curriculum of study as what Paul Freire called banking education where teachers deposited knowledge to the pupils. Contrary to banking education, Freire proposed a problem posing education that encouraged pupils to become active in thinking.

The study done by Lee, Y., Capraro, R. M., &Capraro, M. M. (2018), reviewed that some teachers lack subject competence. Dearth of subject matter knowledge,

pedagogical content knowledge posing a challenge to teaching and learning. Certainly, teachers' insufficiency in content knowledge, curriculum knowledge and pedagogical knowledge, could be due to teacher inadequate training. Consistent with this assertion, Mulenga and Kabombwe (2019) emphasized the need for teachers to be well prepared for them to transmit worthwhile skills, appropriate attitudes and applicable knowledge into the learners for them to become relevant to their respective societies. One area that has been overlooked for a long time is the failure by curriculum designers as well as curriculum implementers to relate mathematics to real life experiences of the learner.

Language is another challenge that pupils face. Planas, N. (2018), agrees to this conception. This revelation corresponds with the findings of Barwell, R. (2018) who established that the challenge which pupils face during learning was the language.

In addition, Sakayombo (2018) further argued that the language that is used in mathematics was very difficult for some learners to understand making mathematics to be an abstract subject. This means that the finding by Sakayombo shows learners find difficult due to the language used in coordinating it well. This assertion is in agreement with Nkechi, P. M. E., Lillian, R. A. & Ngozi, E. E. (2015), who study on the Effects of Team Teaching on Pupils' Academic Achievement in English Language Comprehension, contended that a language deficit in mathematics leads to a mathematics deficit.

Several studies conducted in Zambia by academics including Mwape and Musonda (2014), Kafata and Mbetwa (2016), and Sakayombo (2018), as well as studies conducted outside of Zambia by Mbugua *et al.* (2012), have shown that learner performance in mathematics, particularly in linear programming, was poor. Poor learner performance in mathematics may have been influenced by a variety of factors, including conceptualization constraints, learner attitudes and beliefs regarding the topic, a lack of suitable teaching and learning tools in schools, and improper acquisition of ethno-mathematics among the pupils.

METHODOLOGY

Research Design

This research was purely qualitative. It is a phenomenological inquiry that uses a naturalistic approach that seeks to understand phenomenon in specific settings (White, L. (2018). It is an approach which explores individuals or groups ascribe to a social or human problem (Creswell, 2018). In light of this study hermeneutic phenomenological design was applied to explore disablers affecting pupils. All the participants were selected using homogenous purposive sampling. These methodologies and approaches are discussed hereunder;

In-Depth Interviews

In-depth interviews were held with the target group. Participants were asked the questions on a one-to-one

basis whilst the researcher was taking notes. In-depth interviews were used in order to get a lot of insight information on the research topic.

Focus Group Discussions (FGDs)

The focus group discussions were done by putting participants in groups of five. Focus group discussions encourage communication and shared understanding especially around difficult issues. It allows for the exploration of differences as well as similarities in experiences and in thinking (Shava, G. N. & Nkengbeza, D.2020). Focus Group Discussions and In-depth interviews were the instruments used to gather data from participants because they favour interaction and dialogue with the participants (Orodho, 2019).

The use of multiple tools strengthened the validity and reliability of the study findings as evidence was collaborated and triangulated from different viewpoints. Thereafter, the data was thematically analysed. This was done by grouping similar ideas together after data production process. The sample size for the study was 15 participants comprising 8 females and 7 males' former grade twelve pupils from Nkeyema secondary school.

DISCUSSIONS

The emergent themes were all linked to a series of stages namely; (i) Pupils Poor Learning Background (ii) Distance pupils were covering (iii) Teaching and Learning Aids (iv) Learning Environment (v) Pedagogy (vi) Pupils' Negative Perception towards Mathematics and (vii) Library.

Pupils Poor Learning Background

Poor pupil learning background [temporality] has negatively resulted into low acquisition of knowledge, skills and values as designed in any given curricular. This affects learners to catch up with learning in that, they lack pre requisite foundation. Mathematics is a subject that builds upon previously learnt concepts. This means learners to have prior knowledge before beginning to learn a new mathematics topic. The study by Bolaji, C: (2022) also revealed that learners could not link new topics to the one they have learnt before. Learners experienced some difficulty in demonstrating the problems. A pre-requisite concepts is an asset, if not essential, for connecting to Linear Programming.

In other words, Linear competence is an essential component in preparing pupils to deal with Linear Programming and it is needed to ensure the continuation of learning as learning is from known-to-unknown.

However, Pupils who lacked good foundation will have difficulties in comprehending concepts as observed by Mawilo, when he reflected on how he had challenges from grade eight and nine. This was due to his teacher failing to teach effectively because of too many pupils in a class. Mawilo recalled, how his teacher could just tell a story. This affected his performance more especially when he went to grade ten. His prior knowledge in mathematics was bad, for they say Learning is from known-to-unknown.

Mawilo assertion was echoed by Milangi who had to learn because he had to. Mawilo and Milangi assertions agrees with Changwe, (2017), Who posited that, if the results are to improve one would not undermine the importance of having a good foundation through effective teaching of mathematical concepts.

Distance

Just like background, distance [Spatiality] was highly rated as a critical ingredient in the education of pupils. Kande attributed his poor academic performance to distance he was covering. He observed that,

"The time I reach the school, i was already tired, [corporeality] I could not concentrate. At times I reach school without food [motivation], it was a challenge for me to concentrate and learn more especially a topic like linear programming." (Kande, 27.09.2021)

Kakumba, equally asserts that,

"When knocking off I reach home late and tired. The following morning wake up around 04:30hrs to the extent that I was even failing to do homework or any assignment given by teacher." (Kakumba, 16.09.2021)

The other revelation by Mungomba had this to say:

"Some boys and girls who come from long distance were compelled to rent houses and resorted to do bad things. They tend to join bad groups on the expense of learning. In a wrong ran their performance was affected." (Mungomba, 25.09.2021)

The assertion is consistent with the findings of Eric A. et al, (2010), who stated in his study findings that some pupils who come from far away rented thatched houses in nearby villages and spent most of their time looking for food, while others resorted to drinking beer [...], a situation that contributes to pupils' tardiness and absenteeism during learning hours.

Teaching and Learning Aids

Scarcity of teaching/learning materials in linear Programming components was another theme, which came out strongly from all the participants during data gathering process. The Teaching and Learning Aids are critical factors in pupils learning and academic performance. Njolo observed that,

"Teaching and learning aids were necessary as they were supposed to help us in understanding what was being taught especially topic like linear programming." (Njolo, 17.09.2021)

The institution appeared to be ill equipped with such tools as observed by Naku. Who had hoped that Nkeyema secondary school would provide him with materials to help him understand especially in topic like linear programming?

Mulenga and Kabombwe (2019) agree with this revelation because their study also discovered the competence-based curriculum, inadequate and inappropriate teaching and learning resources in schools [spatiality]. The current research findings correspond with that of Mwanza and Silukuni (2020) who found that large classes, inadequate stocks of educational materials, inadequate classrooms and desks had a negative impact on the provision of quality education which led to learners' poor performance

in schools. This was exactly the case hence learners were negatively affected in terms of learning and content delivery. In most cases where learners are not exposed to the updated learning and teaching materials [temporality] such as books, the pupils tend to miss valid information. This agrees Kiplangat, and Awino (2014) who stated that lack of good textbooks, poor content and context of instruction, poor and non-conducive environment among others are causes of poor performance.

Learning Environment

The learning environment has a significant impact on pupils learning and academic performance.

According to Naku and Njolo, a conducive learning environment was critical. The Learning Environment [Spatiality] is a motivating factor in any learning environment because it allows learners to freely participate. Naku observed that; The learning environment was not conducive. Naku observed that,

“Some teachers were not willing to guide some erring learners, the infrastructure was not adequate as learners were fighting for furniture.” (Naku, 18.09.2021)

When the environment is strong, pupils can learn effectively. The relationship between the learning environment and attitudes can never be avoided by trying to focus on factors that affect pupils’ mathematical performance. This assertion agrees with Enu, *et al.*, (2015), who posited that in a class or school environment that teachers consider as encouraging, tend to foster pupils’ sense of control and confidence in their ability to succeed.

Pedagogy

Comprehensive Pedagogy [constructivism] proved critical to the academic progression and success of pupils. Comprehensive Pedagogy was displayed through materials use for teaching/learning process. Both Kande and Kamasisi, recounted how their ‘teachers [Relationality] was struggling to teach linear programming, Kande and Kamasisi sentiments above fits well with Lamichhane’s (2017), findings on pedagogical adjustments required for inclusive education to take root.

The styles of teaching and content have a helpful effect on learning and success in mathematics. The, inappropriate teaching methods lead to problems and make it difficult to determine the relevance of mathematics for the pupils. Lee *et al.*, (2019), Teacher Pedagogy Content Knowledge centers on the style and approach adopted by the instructor in presenting their lessons in an exciting manner If facilitators can present their lessons to the learner in an appealing manner.

Studies done in America also made similar observations when they showed that poor Mathematics achievement is attributed to classroom factors such as poor teaching methods (Anney, V. N., & Bulayi, M. 2020).

Pupils Negative Perceptions towards Mathematics

Kabi said that, most Pupils had negative Perceptions

towards Mathematics. Kabi said:

“People told me that mathematics is difficulty to pass.” (Kabi, 22.09 2021).

The negative perception If not properly checked can affect performance. Negative attitudes can lead to a serious barrier to learning (Poku,2019). This assertion agrees with the findings of UNESCO (2017) who observed that people in some regions still beliefs that mathematics is difficult. Therefore, for a pupil to succeed in their academic pursuits, it takes one with a positive attitude to overcome secondary barriers emerging from negatively charged stakeholders. It is for this reason, Kabi argued that, ...it is never easy for un-gifted pupil or learner [corporeality] to make it to grade twelve [temporality]. Because where they come from [Spatiality], there is usually nothing to point at [in terms of support]. For instance, the time I was at...Secondary school, there was hardly any textbook in stock. This then entails that the education of the slow learner is entirely in the hands of the teacher [relationality].

Whereas some pupils in this study demonstrated a positive attitude mind-set as their biggest attribute to their academic success, others attributed failure [attribute model] to the negative attitude they had towards linear programming. Kabi and Njolo assertions agree with the findings of Poku (2019).

This is in agreement to what Kabi observed that male teachers were saying mathematics is for real men not women [Relationality]. Such sentiments discouraged pupils form positive attitudes toward mathematics. Equally pupils were discouraging one another by making mockery of classmates whenever they answered questions wrongly. This finding approves Asempapa, R. S. (2022).

Library

On analyzing learning materials, Kadzo and Timuna observed that, the school had no library. where pupils could borrow books for reference. Lack of Library [Spatiality] is an obstacle to successful learning effort of pupils.

One key infrastructure to the learning process identified by all pupils as being inaccessible was the school library. All of the fifteen pupils consulted had not used the library for learning purposes as the school had no library and study materials in stock. Whereas academic libraries are expected to provide services to learners who want to know more Nkeyema secondary school had none. The library [spatiality] support learning as pupils can access books relevant to what they are learning.

Equally, Mungomba attributed poor performance to lack of study materials. This is consistent with Ball, S.J (2011),’s findings which reveal that learning facilities do affect academic performance; these learning facilities include school libraries which occupy a dominant and crucial place in any school system and their absence has been looked at as a factor that affects academic performance because they provide service and guidance to readers through supporting all functions of school teaching. A well-equipped library serves pupils good as they research.

CONCLUSION

The purpose of the study was to explore the Disablers Affecting Pupils Academic Performance in Linear Programming at Nkeyema Secondary School in Zambia. The current study was qualitative in nature where interpretivist paradigms was applied. A hermeneutic phenomenological design also guided the study. This design was chosen because it enabled the researcher to deduce beyond what was communicated by the key insiders. In addition, it enabled the researcher to answer the research questions with less difficulty. All participants were sampled using homogenous purposive sampling technique. Therefore, data from the participants was generated using in-depth interview guides and group discussion schedule. The study revealed that linear programming at senior level was poorly performed due to a number of disablers. One of them was the travel time required for pupils (distance), as well as the lack of quality teaching and learning tools like textbooks, inefficient teaching methods employed by some teachers (pedagogy), lack of parental support, pupils' lack of prerequisite knowledge in linear programming (poor learning background), learning environment, pupils' negative attitude, and lack of a school library. Further, most of the teachers who taught the component were not conversant with linear programming.

RECOMMENDATIONS

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

1. Teachers should use pupil's learner centered activities to enhance learning outcomes as pupils actively participate in both the teaching and learning processes. Also, a variety of educational strategies and approaches should be used to help pupils comprehend the subject matter.
2. The ministry of education should employ proficient mathematics teachers to increase examination performance.
3. To help pupils develop a positive attitude toward mathematics, teachers should address pupils' mathematics anxieties.
4. The Ministry of Education should organize staff development workshops at the regional, district, cluster, and school levels throughout the province and district to allow teachers to share cutting-edge teaching strategies.
5. Teachers must devise clear methods for presenting material in an interactive setting.
6. The government should erect libraries in schools and fill them with useful teaching resources.
7. The school administration should create a productive production unit to feed pupils in order to reduce absenteeism.
8. The government should give teachers the graphing calculators and geometrical tools they need to teach linear programming.
9. Schools should establish vibrant mathematics clubs to encourage pupils' interaction.

Future Research Areas

More research is needed to understand the disablers that prevent pupils from succeeding in linear programming using phenomenological approaches. With the limited sample size of children, one may claim that there are still a lot of incapacities that both teachers and the entire ministry of education are unaware of. The hidden lived experiences of pupils must be uncovered in order to prevent academic failure. Future studies may center on the following area:

1. A comparison of the factors influencing pupils' success in public and private secondary schools. The results of this study may not be applied to the entire nation since it was only undertaken in one public secondary school. This necessitates a thorough study of the factors affecting pupils' performance in linear programming in public and private secondary schools alike.

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