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# A Peep into Exploring the Application of Linear Programming in the Day-to-Day Living of Learners in Zambia: A Hermeneutic Phenomenological Approach

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**Abstract:** *The purpose of the study was to explore the application of linear programming in the day-to-day living of learners in Zambia. The study was qualitative in nature and hermeneutic phenomenological design guided the study. The study had 12 participants who were selected through homogenous purposive sampling. The production of data was through semi structured interviews and focus group discussion schedules. Then generated data was thematically analysed.*

*Findings of the study were that linear programming enabled learners in budgeting and financial planning, diet planning, time management, transportation and travel, resource allocation, inventory budgeting and decision making in day to day life.*

**Keywords:** *Linear programming, hermeneutic phenomenological, budgeting and financial planning, management.*

## 1. Introduction

The industries of today demand a different kind of engineer. Along with the standard knowledge of mathematical modeling, today's students also need to learn problem solving and communication skills, creativity and critical thinking, management, planning and allocation of finite resources. Conversely, conventional mathematics courses typically presume that students understand ideas and theories without requiring them to be connected to actual issues (Tarmizi, et al, 2010).

Students need to have learning experiences that are demanding, relevant, and get progressively more complex. In order for them to tackle day to day problems, they must be trained in the modeling of increasingly complicated problems, improve their ability for abstraction, and manage more potent mathematical structures. In addition, in order to engage in tasks related to mathematical modeling and decision making, students must acquire the abilities necessary to become self-directed and self-motivated (Bamford, Karjalainen & Jenavs, 2012).

Using a hermeneutic phenomenological approach, this study will explore how linear programming concepts and techniques are applied in the daily lives of novices in Zambia. Specifically, it will focus on how these applications can improve learners' educational experiences and outcomes. This method would entail comprehending and analyzsing learners in Zambia, with a focus on how linear programming is used in novices' daily lives there.

## 2. Significant of The Study

This study may provide mathematics teachers with knowledge on the subject's significance to students and the general public in addition to themselves. Furthermore, policy officials in the Ministry of Education may find the material in this study useful in understanding the daily experiences of Zambian students. Additionally, the information may be crucial to academics wishing to go deeper into the topic of linear programming, and ultimately, this work may contribute new insights to the body of existing literature.

## 3. REVIEW OF THE RALATED LITERITURE

A mathematical technique called linear programming is used to maximize the distribution of scarce resources in order to accomplish predetermined goals. Although novices may not immediately see its direct application in their daily lives, its principles are applicable in a many situations, including time management, transportation and travel, budgeting, inventory management, diet planning, and resource allocation (Winston, 2003).

### 3.1. Budgeting

Budgeting, as defined by Bazaraa, Jarvis, and Sherali (2010), is the process of setting expense and revenue targets for a given period of time. This submission aligns with the belief that budgeting, through the use of linear programming techniques, enables students to manage their finances more responsibly. It follows a rigorous spending plan and allocates funds to different expenses (rent, grocery, and entertainment) (Bazaraa, Jarvis, & Sherali, 2010). The allocation of resources is then planned and overseen using the generated budget. These resources include of making capital expenditures, employing people, and covering operating expenses. Gupta (2019), who argued that using tools for planning, scheduling, budgeting, and education can change learners in Asia, supports this viewpoint.

### 3.2. Diet Planning

By constructing a linear programming problem to plan a balanced diet within particular restrictions (nutritional requirements, calorie intake, etc.), learners can plan on the correct diet and what to buy. Furthermore, Hillier & Lieberman (2009) proposed that learners might maximize their dietary selections to save money or follow certain guidelines. Linear programming can help restaurants and catering companies create menus that feature a range of meals while taking seasonal variations, client preferences, and ingredient availability into account.

Linear programming takes ingredient costs into account and can reduce overall expenses while satisfying dietary restrictions or nutritional needs. This is especially helpful for establishments trying to provide nutritious meals at a reasonable price, such as cafeterias, schools, and hospitals (Hillier & Lieberman, 2013). Apart from that, by maximizing purchases based on meal plans, reducing waste, and guaranteeing the availability of supplies needed for scheduled meals, linear programming can assist in managing inventory levels.

### 3.3. Time Management

Novices are capable of time management. Novices can benefit from the use of linear programming concepts in their time management. One way to optimize productivity and balance diverse activities is to allocate time to different tasks based on their priority and available time slots (Bazaraa, Jarvis, & Sherali, 2010).

Students frequently lament finishing all of the assignments given to them. Feelings that there isn't enough time to finish all of their work well might overwhelm students. Aside from that, students who lack time management skills may find it difficult to adjust to the flexibility and freedom of a university setting. This viewpoint is consistent with that of Arbin et al. (2016), who pointed out that time management has a significant impact on students' life, especially for those enrolled in higher education institutions where there is no parental or teacher supervision available.

Stated differently, the secret to achieving success in life is giving adequate thought to organizing and overseeing this common resource. The competitive conditions that require exceptional performance compel organizations and directors to be efficient with their time, leading to a constant search for time management solutions. Students are encouraged to efficiently organize and manage their time in today's competitive climate, even in elementary school. Every one of these time management behaviors seems to have a clear and simple purpose for efficient work.

Necati and Sevil (2010) looked into how students' attitudes and time management skills affected their academic achievement. The results indicated that the intermediate small number have high level skills. Additionally, 7.9% of students have time management skills that are associated with academic success, according to the research.

Conversely, certain researches found no discernible variation in the ways that men and women manage their time (Razali et al 2018). The literature research revealed conflicting results about the connection between academic success and time management. Remarkable empirical research indicates a relationship between academic success and efficient time management (Scherer, Talley, and Fife, 2017).

### 3.4. Transportation and Travel

Making the round trip from home to school requires budgetary awareness. Even a novice can utilize techniques from linear programming to find the most practicable route or mode of transportation when factors like time, money, and distance are taken into consideration. These are useful tips for organizing travel or commutes. According to Heider et al. (2016), logistics and transportation assumes the optimal routes for movement while accounting for capacity, cost, and distance.

The Linear Programming model (LP) was applied by Berhan et al. (2014), Nyor et al. (2014), Abdullah and Masadeh (2019) to allocate or schedule bus - transportation service in Addis Ababa, in and around the city in Ethiopia, Niger state for intrastate and interstate routes in Nigeria, and City of Aqada in Jordan. The outcomes show that the number of buses operating per shift, reduce commuter waiting times at bus terminals, and assign the appropriate number of buses to each route.

A study by Filabadi et al. (2022) explored the scheduling of Istanbul's Metro bus fleet BRT system, proposing to use a multiple depot vehicle scheduling problem (MDVSP) model with a developed heuristic called trips merger (TM). In a similar vein, Sevim et al.'s (2022) investigation of the scheduling of commuter waiting times and journey times showed that commuters' overall related time decreased.

### 3.5. Resource Allocation

Linear programming has several uses in education, including learner transformation and social livelihood. Linear programming is crucial to many aspects of learners' daily life Linear programming can be used to increase the efficiency of resource allocation, including scheduling, money for educational projects, classroom space, and staff time. By establishing constraints and goals, linear programming models facilitate the allocation of resources in a way that maximizes educational output (Winston, 2003).

Novices can benefit from linear programming when allocating resources. This lends credence to the assertions made by Hillier & Lieberman (2009) that linear programming can aid in maximizing the allocation of resources and day-to-day tasks, such as scheduling household chores, dividing up study time among several subjects, or handling work obligations with constrained time.

The application of "scarce or limited" resources, such as labour, material, machinery, time, warehouse space, etc., to multiple competing activities, such as jobs, projects, new equipment, services, and products, is made possible by the mathematical modeling technique known as limited production (LP) based on a specified set of optimality criteria.

Building the greatest study frameworks possible requires taking into account limitations like teacher availability, time slots, and course prerequisites. O'Neill (2015) states that linear programming can help educational institutions set up their curricula to maximize student learning within the limitations of limited resources. The use of linear programming to course or subject combination to optimize learning outcomes within predetermined parameters can aid in the design and optimization of educational curricula. To enhance the learning experience, this requires considering factors such as subject prerequisites, teacher availability, and student preferences.

### 3.6. Inventory Management.

(Mankiw & Taylor, 2014) state that by taking into account the costs of ordering, maintaining inventory, and demand unpredictability, linear programming can help optimize inventory levels. It aids in excessive and insufficient inventory. By figuring out the best places for warehouses, distribution hubs, and product allocation to satisfy demand while minimizing transportation costs, LP may help create an effective distribution network.

Students who manage household goods or small enterprises may be taught how to maximize inventory levels to satisfy demand while minimizing expenses (Hillier & Lieberman, 2009).

According to O'Neill's (2015) research, by accounting for factors including class size, available space, teacher preferences, and student expectations, linear programming aids in the creation of efficient schedules for students. It aims to make better use of resources and lessen conflict. Students' assignments and placements can be optimized, for instance, by placing them in courses that best suit their interests, abilities, and constraints. It ensures that students are distributed fairly and effectively across various educational programs. Linear programming can help in creating the most effective timetables and schedules for classes, exams, and other educational activities. It ensures efficient resource use, minimizes conflicts, and makes the most of available time slots to foster a positive learning environment.

### 3.7. Decision-Making

Linear programming methods evaluate measures of educational achievement and pinpoint areas in need of improvement. It makes data-driven decisions possible to enhance academic outcomes and instructional practices (Hillier & Lieberman, 2013). Linear programming can be used to optimize several elements of online education, including resource allocation for personalized learning experiences, adaptive learning systems, and material distribution (Hillier & Lieberman, 2014).

Students can formulate fact-based decisions models. This claim is consistent with Singh & Singla (2012) analysis of a variety of scenarios and limitations, and it says that students can use linear programming models to optimize policies related to educational equity, access, and allocation as well as infrastructure development, ultimately leading to improved learner performance.Therefore, it follows that linear programming could help the learner revolution if it is properly taught to and absorbed by pupils.

The European study also emphasized the significance of linear programming in resource allocation, financial and investment planning, economic and agricultural planning, supply chain management and logistics, and energy and environmental management. In order to optimize production and achieve effective resource use through production, distribution, and resource allocation, European countries often incorporate Linear Programming models into their economic plans (Hamdy A. Taha, 2016).

According to Hoong, Zhi, and Aldy (2016), the goal of linear programming is to contribute to the creation of an ideal society in which every individual is capable of being independent. Through linear programming, which benefits all socioeconomic classes and paves the way for decision-making, students acquire fundamental concepts. It takes effective supply chain and logistics management for linear programming to function.

Applying linear programming can optimize distribution networks, transportation routes, and inventory management across Europe and around the world, resulting in cost savings and enhanced efficiency. In Hamdy A. Taha (2016) study, the energy sector in Europe was examined with a focus on how linear programming techniques are used to improve energy generation, delivery, and consumption. Furthermore, by simplifying the disposal of rubbish, these models promote environmental management in keeping with Europe's emphasis on sustainability and green initiatives. By simplifying waste disposal, recycling practices, and emission reduction strategies, these models aid in environmental management.

In European agriculture, crop selection, land use, and resource allocation are all optimized by the application of linear programming techniques. These techniques increase productivity while taking the needs of the market and the environment into account (Hillier, Frederick & Gerald 2014).

Healthcare systems in Europe benefit from the use of linear programming models in resource allocation, staff scheduling, hospital resource management, and inventory optimization. These models help to ensure cost-effective and efficient healthcare delivery. Linear programming is used in European financial institutions for risk management, asset allocation, and portfolio optimization. This helps them handle financial risks effectively and make well-informed investment decisions.

Europe is becoming more and more important as new methods and advancements in technology allow it to reach greater potential. It is currently an essential tool for complex system optimization and decision-making across many European industries.

Furthermore, low levels of public participation and linear programming among students and the wider public were discovered by Shapiro & Brown (2018) investigation throughout numerous US states. Furthermore mentioned in the research was about public involvement strategies, rights and obligations, and governmental structure. Suffice it to say, a significant portion of modern life involves linear programming.

In Brazil, farm schools were established, according to a 2017 study by Carina, to provide students enrolled in Agricultural Technical Programs with an environment where they could participate in "learning to do by doing" activities (Franco, 1994).

The school must offer a range of cattle-raising, agricultural, and agro-industrial (food processing) activities for the goal of teaching and learning.

In Brazil, a number of agricultural schools offering this program are also residential schools; therefore they are also fulfilling a social function. This system has dominated professional agricultural education in Brazil for a long time, providing educational opportunities as well as housing, food, medical and dental care, clothing, and other items and services to low-income rural people (Conceição, 2010).

This strategy is still employed by public and private organizations, providing young people in rural areas with a real opportunity to pursue careers in agribusiness. Not only do boarding students live on these farms due to their remote location from major cities, but workers also live there with their families. According to Abu Abdallah and Masa'deh (2019), the farms must generate enough food on their own because the locations of these farm-boarding schools restrict the number of goods that can be acquired on the market.

Ethiopia has also worked very hard to increase smallholder productivity through sustainable and innovative smallholder agriculture. This is because, as the study by Meselu et al. (2018) shows, smallholder agriculture has the capacity to contribute to both national economic growth and food security despite agriculture's poor productivity.

Currently, these initiatives constitute a strong representation of Ethiopia's 2012 Strategy. These plans seek to increase the productivity of smallholder agriculture with the ultimate goal of achieving middle-income economy status by 2025 through the adoption of a "green growth path." However, crop output is the primary goal of these techniques; improving resource utilization efficiency through better design is not a certainty.

## 4. METHODOLOGY

The study was qualitative in nature and was driven by a hermeneutic phenomenological approach. Munkuye Secondary School in Zambia's Western Province's Nkeyema District served as the study's site. Homogenous purposive sampling was used to select 12 people. This sample size is appropriate for phenomenological investigations, which often focus on a group of eight to twelve people, as stated by Ray (1994) in Sim et al. (2018). Furthermore, samples in an interpretative study should be both large enough to generate sufficient data about the phenomena and small enough to avoid precluding data analysis, according to Sandelowski (1995). As a result, focus groups and semi-structured interviews were used to collect the data, which were then thematically analysed.

## 5. PRESATAIONS AND DISCUSSION OF FINDINGS

Eight (8) themes emerged from the participants, including study time management, financial budgeting, resource allocation, budget allocation, investment management, and production planning. Stated differently, the majority of participants expressed the opinion that knowing and teaching linear programming aids in resolving everyday problems *[corporeality]*. Students were able to gain expertise in study time management, financial budgeting, budget allocation, resource allocation, investment management, production planning, course scheduling, transportation and logistics, thanks to the courses in spatiality taught in secondary school.

The minority's opinions, as reported by the researcher, were that everyday life was less positively impacted by spatiality—linear programming—in secondary school.

These examples show how versatile linear programming is in solving optimization problems, and students may use these ideas to improve their decision-making to everyday situations, such as time management. When scheduling activities and deadlines for a variety of projects or assignments, students can effectively take dependencies and time limitations into account (Taha, Hamdy, 2016). Productivity, deadlines, exam dates, and personal obligations, students can also utilize linear programming ideas to effectively divide their study time among various subjects or projects (Hillier, Frederick & Gerald 2014).

According to the study by Anderson, David, et al. (2016), linear programming optimize the distribution of time across different study subjects or tasks while taking into account restrictions such time availability, subject priority, and intended goals.

Frederick et al. (2016) claim that the optimal approach for limits is the one that makes use of potential outcomes. It entails maximizing or reducing while adhering to a set of restrictions on linear inequality and equality. Examining these resources will provide a comprehensive understanding of linear programming, its applications, and various techniques for tackling optimization problems.

> *"Traveling back and forth from home to school require being careful. Ngo stated, "I schedule my movements so that I have enough money to last the entire month." I decided on the cost and the method of transportation" (Ngo, 12.11.2023).*

When time, money, and distance constraints are taken into account, novices determine the most practical route or form of transportation. These ideas can be used by students to efficiently plan trips or commutes. Logistics and Transportation figuring out the best routes for transportation while taking capacity, cost, and distance into account (Abu Abdallah and Masa'deh, 2019).

According to Winston's (2014) study, gaining knowledge of linear programming facilitates day-to-day management. Time is an inexhaustible resource that keeps moving forward. Effectively managing this resource, which everyone has equal access to, and placing enough focus on planning are the keys to success in life.

According to *Kamuke,*

> *"Linear Programming helps me because it allowed me to create a flexible study schedule." Similar to my current location in [spatiality], I study more than I have fun. I make care to maximize the temporal aspect of my study time."(Kamuke, 04.11. 2023).*

According to a study by Winston &Wayne (2014), supports *Kamuke* comments, students' concepts to effectively divide their study time among several subjects or tasks productivity while taking deadlines, exam dates, and personal obligations into account.

In a similar vein, Hillier & Gerald (2014) concurred with *Kamuke* position, stating that optimize time allocation among different study subjects or tasks while taking into account constraints like time availability, subject priority, and desired goals (Anderson, David et al, 2016).

Many disciplines, including economics, finance, engineering, operations research, and more, have used linear programming. According to Hamdy A. Taha (2016), it is utilized in scheduling, resource allocation, production planning, transportation issues, and other decision-making processes.

Furthermore, pupils must be adept in time management because competitive educational *[spatiality]* environments demand excellence in performance. Students are encouraged to efficiently organize and manage their time in today's competitive climate, even in elementary school.

According to Mercanlioglu (2010), time management is self-management that explicitly considers time when making decisions about what to do, how much time to devote to each task, how to complete tasks more quickly, and when a certain activity is appropriate.

Time attitudes are more fundamentally attitude-based. Long-range planning competency is the capacity to prioritize and set goals by delaying everyday work while meeting critical deadlines. Every one of these time management behaviors seems to have a clear and simple purpose for efficient work.

Conversely, students may find it difficult to succeed in the flexible and free-form nature of the school setting. Students' lives are greatly impacted by time management, particularly those enrolled when parental and instructor monitoring is not available (Necati & Sevil, 2010).

To achieve a certain objective, the distribution of limited resources is maximized through the application of a mathematical technique known as linear programming. Students who want to spend their finances wisely can benefit from linear programming. Learners can allocate limited finances for different expenses including tuition, books, rent, and recreational activities using linear programming to maximize their spending.

It can also be used to build a portfolio of investments that minimizes risk for a given level of return or optimizes returns for a given level of risk. LP assists in identifying the ideal asset allocation by taking into account a variety of assets, their predicted returns, volatilities, and correlations (Hillier & Lieberman, 2013).

When making capital budgeting decisions, linear programming can help identify the most profitable projects that optimize return on investment while adhering to budgetary constraints in situations where there are several investment projects and sufficient funds (Charnes, Cooper, & Henderson 1953). By improving hedging methods or minimizing possible losses given specific risk factors, LP models can aid in financial risks. By allocating available funds to meet different responsibilities, optimize cash flow management in scenarios where there are restrictions on financial inflows and outflows (Bazaraa, Jarvis & Sherali, 2009).

Students can use linear programming to efficiently distribute money among numerous departments or projects when working in firms, governments, or organizations. This is carried out within constraints like goals and objectives.

A mathematical technique called system's resource allocation within predetermined bounds. It entails satisfying while maximizing numerous disciplines, including operations research, engineering, economics, and more, can benefit from the implementation of this optimization technique (Bazaraa, Jarvis, & Sherali, 2013).

Linear programming determining the most cost-effective method of allocating resources and controlling distribution, transportation, and inventory networks in order to optimize revenues. Create investment portfolios that maximize returns by carefully arranging assets and taking investment constraints, predicted returns, and risk tolerance into consideration.

According to *Wize,*

> *"Linear Programming helps me to allocate resources and controlling distribution, transportation, by optimize returns at a given degree of time and location[spatiality]. This has helped me to maximize the little money." (Wize, 10.11. 2023).*

It also maximizesincome while reducing expenses and resource wastage. Linear programming determines in distributing resources across several media channels to optimize marketing campaigns or advertising campaigns in order to enhance reach or sales while adhering to budgetary restrictions.Reducing expenses and negative environmental effects while satisfying demand and adhering to regulations by optimizing energy production, distribution, and consumption (Vanderbei, 2008).

Numerous techniques, including the simplex method, interior point approaches, and specialized algorithms, tackle linear programming issues. These optimization problems are often solved with software tools like MATLAB, Python libraries like SciPy with its linear programming module, and commercial software programs like IBM CPLEX or Gurobi (Winston, 2003).These resources provide in-depth key actors in the study*[corporeality]*, generally agreed that teaching and mastering linear programming was important because it helped students develop qualities of good time management, scheduling, production planning, finance, and portfolio optimization.

According to *Kambwi* observation,

> *"They [learners] have developed the aspect of tolerance, understanding, self-esteem and self-confidence [corporeality]."(Kambwi, 28. 11.2023).*

The new information aligns with theories put forth in this study by Hamdy A. Taha (2016), who revealed that learners' knowledge of day-to-day tasks was reinforced by linear programming. In accordance with Kambwi findings, it was also demonstrated that linear programming improved students' positive attitudes and behaviors by motivating them to apply linear programming models to maximize and minimize tasks related to *[relationality]*, among other things. Furthermore, their study demonstrated that students' sense of accountability increased *[temporality]* and they were given a range of duties in certain tasks, which encouraged students to be honest in completing assignments and taking tests on time.

Prior findings, Winston & Wayne's (2014) study demonstrates that linear programming design optimal resource allocation, which includes allocating team members to various tasks or projects while taking their skill sets and availability into consideration. The work by Bazaraa, Jarvis, and Sherali (2009) supports the aforementioned conclusions by claiming that mathematical technique for figuring out how result in a particular mathematical model for a set of linear relationships.

As a result, it is believed that linear programming facilitates learner change. In light of the cultivated qualities of self-worth and discipline, among other things, *Kamuke* and the other participants acknowledged that linear programming is essential to determining or optimizing objective set of sound relationships [relationality] among learners within the school system *[spatiality]* and the outside world *[relationality]*.

The majority of participants believed *[corporeality]* that learners needed to know linear programming. The study also showed that the subject helped students become responsible members of society. This is constant with the observations made by Hillier & Lieberman (2013), who stated that citizens are developed through linear programming and are inspired to become competent economists.

Additionally, Bautista, Pereira, and Lopes (2019) argued that learning through linear programming helped students develop transferable skills that they could use to optimize resource allocation in educational contexts. For example, they could learn how to distribute teaching resources and facilities in the best possible way to reduce crowding and maximize learning outcomes. It can create schedules that maximize teacher-to-student ratios and classroom use. Furthermore, course scheduling and curriculum planning can be made as efficient and well-rounded educational programs as possible by utilizing linear programming.

In support of this viewpoint, Bautista, Pereira, and Lopes (2019) noted that linear programming aids in the mastery of the subject, requiring both theoretical comprehension and real-world application. For skill development in this discipline, working through examples, solving issues, and applying the principles in real-world circumstances are essential.

Accordingly, Gameiro, Rocco, and Caixeta-Filho (2016) state that linear programming can assist in figuring out the best combination of assets in a portfolio while taking into account variables like risk tolerance, expected returns, and restrictions on the kinds of investments (e.g., stocks, bonds, commodities). Depending on the amount of risk in the portfolio, the goal may be to maximize expected return or decrease risk in order to achieve a desired return.

It assists in figuring out the necessary alterations to asset allocations while taking other limitations and transaction costs into account. By taking into account altering market circumstances and long-term shifting investment objectives, it can be expanded to multi-period portfolio optimization. This entails balancing and transaction costs while optimizing decisions over a number of time periods. Stated differently, the only goal is to teach people how to do things correctly.

Participants saw that learners' linear programming skills were improved by linear programming in schools *[spatiality]*. This was true in that students were able to grow as critical thinkers, use newly learned skills, and assess and analyze societal economic challenges.

*Masisi* noted that,

> *"Learners are able to make wise decisions" (Masisi, 03.11.2023).*

As to *Masisi* viewpoint, learners can develop critical thinking skills and make informed judgments by using the knowledge and abilities they have acquired through linear programming.

Moreover, *Gongi* noted that,

> *"Students have acquired abilities in Linear Programming by analyzing circumstances in their localities (spatiality)." (Gongi, 28.11.2023).*

This result is consistent with that of Hillier & Lieberman (2014), who also found that Linear Programming may be used in environment to optimize a number of different areas, including distribution, transportation, inventory management, production planning, and more. When determining the ideal production volumes for various items, LP can take into account limitations such as labor, raw materials, and machine shortages, demand projections, and production capacities. Additionally, it may decide how best to divide up resources (such labor, raw materials, and machinery) output while taking capacity, demand, and time restrictions into account (Bautista, Pereira & Lopes, 2019).

Suffice it to state that there are several applications for linear programming, a mathematical technique for allocating resources optimally, in the daily lives of students.

Participants held the opinion [corporeality] that students learned about inequities when asked to describe how the subject promoted learner transformation possibilities in schools.

*Kama's* thoughts were that,

> *"Students lacked knowledge in numerous areas, including making the most of study time; linear programming has greatly benefited them. Several students believed that studying was acceptable and that it was natural to be lazy,"(Kama, 15.11.2023).*

However, *Kama* said,

> *"I was able to know dos and don'ts since [temporality] i began learning linear programming."(Kama, 15.11.2023).*

Most frequent opinions from influential participants suggested that the topic was crucial since it gave students an understanding on how it affects their daily activities. The knowledge gained is essential because it makes students aware of how daily living affects both local communities and the overall national economy *(spatiality).*

Production planning, inventory management, distribution, and transportation are just operations that linear programming optimizes. Based on factors such as limited resources (labor, raw materials, machinery), demand projections, and production capacities, Linear Programming can assist in determining the best production numbers for various products (Hillier & Lieberman, 2014).

According to the majority of participants, learners were able to understand real-world expectations through linear programming. "They now know issues related to their economy and prudence in spending *[spatiality]* to spend on unnecessary things,"

*Kamango* stated,

> *"Learning of Linear Programming has helped me in that; I can make informed decisions," (Kamango, 01.11.2023).*

Similarly, *Pombo* noted that,

> *"Learning linear programming teaches students how to maximize income and minimize careless spending, both of which they were unaware of...Students understand when to spend and when to refrain from [corporeality]" (Pombo, 27.11.2023).*

The findings reported by *Kamango* and *Pombo* above align with the research carried out by (Gameiro, Rocco & Caixeta-Filho, 2016). In Brazil, linear programming improved the allocation of resources, scheduling of production, logistics, financial portfolio optimization, and other decision-making processes that include striking a balance between available resources and intended results.

The research conducted in 2016 by Gameiro, Rocco, and Caixeta-Filho concurs with the findings of Parisio and Jones (2015), who discovered method utilized to maximize resource distribution. In order to efficiently assign instructors, classrooms, and courses based on predetermined goals and limits,

course scheduling involves the use of linear programming. Because it promotes the idea of equal maximizing for everyone, linear programming has a favourable use in course scheduling. This indicates that the topic encouraged maximizing, allowing students to advocate for the decreasing and minimizing of aspects. Put simply, learning about real-world situations on a daily basis was made possible by linear programming.

Gameiro, Rocco, and Caixeta-Filho (2016) discuss the role that linear programming plays in the optimization of farming and the pursuit of self-sufficiency. Students can learn in a farming environment that strikes a balance between production and instruction by providing resources for hands-on learning and food for farm residents from a budget that has been predetermined by the sponsoring organization.

Additionally, *Pombo* said that

> *"Learning linear programming teaches learners how to maximize farming productivity and minimize careless spending income and become self-reliant...Learners can employee others [relationality]." (Pombo, 27 .11. 2023).*

This directly affects improving citizens' economic status and well-being. Herd dynamics, which is still related to animal production, was planned similarly to that of Gameiro et al. (2016), who similarly took into account a stable herd but assigned animal categories based on weight. It was possible to plan for agro industrial production on plant and animal output while still allowing for some degree of flexibility (Carina et al., 2017).

Taskin, Unal, and Semra Agrali (2016) a mathematical optimization method mathematical model having linear relationships must be maximized or minimized while taking into account a set of linear equality and inequality constraints.

Taking into account different transportation options and constraints like time and money, students can utilize linear programming to optimize their travel routes and timetables in order to minimize travel time or expenses (Pinedo, Zacharias, and Zhu, 2015).

Sevimet al, (2022) assert that decision Planning to commute can benefit from the application of linear programming, which optimizes routes and timetables to reduce travel times, expenses, or other constraints. According to Henao, Munoz, and Ferrer (2015), it facilitates the effective decision-making process in transportation by helping to determine the optimal routes for buses, trains, and carpooling services while taking into consideration a range of factors like resource availability, distance, and traffic congestion.

By figuring out the ideal times for traffic signals or the greatest places for toll booths or traffic control points to ease congestion, it can help manage the flow of traffic. By optimizing routes and passenger assignments to minimize travel time or distance for all participants, match commuters for ride-sharing or carpooling services (Chopra & Meindl, 2015).

Linear programming aids in resource allocation by lowering expenses or travel for businesses that offer employee shuttle services or plan transportation for events. By reducing expenses or travel time, linear programming aids in the efficient allocation of resources for businesses that provide employee shuttle services or event transportation (Bazaraa, Jarvis, & Sherali, 2011).

## 6. CONCLUSION

The study finds that learning and teaching linear programming improved students' knowledge. Participants observed that the subject offered students the chance to broaden their understanding of planning, economic development, resource allocation, and entrepreneurship as well as their attitudes and abilities in these areas.

## 7. RECOMMENDATIONS

The study's recommendations are that, the state should partner with the Curriculum Development Center (CDC) to enhance the subject's unique scope and hire more qualified mathematics teachers to teach in schools in order to improve learner retention of resumes and topic delivery.

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