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Mathematical Presentation of Teaching and Learning: Assessing the Influence of Learner-Centric Factors Versus Fixed Parameters of Content and Resources

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Abstract: *This study uses mathematical presentation to quantify the impact of learners' needs, motivation, and readiness on teaching effectiveness. It found that active engagement with resources and information leads to meaningful teaching. Teachers used formal assessments and had over ten years of experience. The biggest obstacles were lack of resources and class size. Students recognized their learning demands and evaluated instructional strategies as effective. The study introduced two mathematical presentations: a linear presentation and a differential presentation. The linear presentation depicts instruction as a function of needs, content, learners, and resources, while the differential presentation records change over time. The study has discovered that teaching and learning needs careful attention from planning to evaluation of educational attainment as it involves complex processes through which some are taken for granted, yet without them the teaching will not be effective. For example, content and resources of teaching should always be available according to the learning needs and not focusing to the learners only. Educational planners, curriculum developers and implementers should always take into consideration of reliability of the content, resources and then move to the needs of the learners before executing the teaching and learning.*

Keywords: Mathematical Presentation, Teaching and Learning and Learners' needs, readiness and desire

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1. Introduction

The processes of teaching and learning are affected by numerous interconnected factors like teachers' skills of teaching, teaching resources, infrastructure, content, learners' interest, learners' needs and learners 'desire to mention few. This study utilizes mathematical presentationing to examine the effect of learners' needs, readiness, and desire/motivation on educational effectiveness against factors which are normally kept constant (content and resources) (Ussenova, G. S., & Issayeva, G. B. 2024). Content entails what to be learnt and resources refers to the human resources (Teachers and supporting staff), fiscal resources (Financial support) and physical resources (Infrastructures) (Mwania, J. M., & Murithi, T. 2017).

By creating mathematical presentations that represent the reality of teaching and learning, this study seeks to establish a quantitative framework for enhancing educational strategies.

Nevertheless, grasping the interaction between students, their needs, preparedness, motivation and factors which are always kept constant (content and resources) in education continues to be a complex issue (Schank, J. F., Harrell, M. C., Sollinger, J. M., Pinto, M. M., & Thie, H. J. 1997). Conventional teaching methods frequently fall short of providing quantitative presentations that can accurately forecast educational results. This research tackles this issue by creating mathematical presentations to evaluate the relative influence of these factors.

1.1 Objectives

1. To formulate a mathematical equation that presents teaching effectiveness based on learners and their learning needs.
2. To determine the mathematical relationships between learners' readiness, desire to learn, and their impact on the learning process.
3. To identify and analyze the cautions or limitations associated with factors that are often assumed to be constant in teaching and learning, such as content and learning resources.

1.2 Research questions for the study

i. How can teaching effectiveness be mathematically presented based on learners and their needs?

ii. What mathematical relationships describe the impact of readiness and desire on learning?

iii. What is the caution for the factors which are always considered to be constant?

2. Literature Review

2.1 Theoretical Framework

This study is guided by constructivist theory of learning with the aim of holistic understanding of how effective learning is considered to be. Below is the discussion.

2.1.1 Theory of Constructivist Learning

In accordance with the theory of constructivist learning, students create knowledge through interaction with their immediate surroundings and reflective engagement rather than simply taking in it (Zajda, 2021). This viewpoint holds that learning happens when individuals combine new knowledge with what they already knew to produce a richer conceptual understanding. In response to recent studies, constructivism encourages critical thinking, problem-solving, and creative engagement—skills judged important in education for the twenty-first century (Ramanathan & Umamah, 2024).

Constructivist learning theory is especially helpful in this study's setting because it emphasises how important learner preparedness, motivation, and individual needs are as preconditions for effective learning. Triantafyllou, (2022) goes on to emphasise that constructivist methods change the learner's position from that of a passive recipient to that of an active participant who takes part in learning activities that are pertinent and personally meaningful. This supports the claim that in order to ensure that students are motivated and sufficiently equipped to interact with the material, successful education must be created to fulfil their cognitive, emotional, and social needs. Furthermore, recent study shows that constructivist instructional techniques including inquiry-based assignments, group projects, and experiential learning improve the capacity of learners to apply what they have learnt to real-world situations (Aljohani, 2023). These results show that the theory of constructivism offers a potent basis for creating learning settings that take into account students' unique differences, thereby encouraging inclusivity and participation. Thus, learner preparedness, motivation, and needs—the three primary variables that directly affect learning outcomes—are determined by the present research using the theory of constructivist learning as a guide.

2.1.2 Instructional Design presentations

Instructional design presentations, which offer organised techniques for producing successful learning experiences, are a useful addition to the constructivist approach. The systematic method of determining student needs, developing methods for teaching, producing resources, conducting lessons, and assessing results is known as educational design (Senadheera et al., 2024). The ADDIE presentation (Analyse, Design, Create, Implement, Evaluate), Bloom's Taxonomy, and Gagné's Nine Events of Instruction are some of the most commonly used frameworks. Every one of these presentations offers distinct perspectives on how to modify education to optimise student learning. For instance, Gagné's presentation places a strong emphasis on organising learning experiences in ways that support cognitive functions like attentional acquisition, recall stimulation, and improved retention and transfer (Khalil & Elkhider, 2016).

In this study, constructivist ideas are combined with instructional design frameworks to create mathematical depictions of learning processes. This study specifically examines how instructional efficiency can be predicted and maximised by mapping the variables of preparedness, motivation, and learner needs onto frameworks like

Bloom's Taxonomy and ADDIE. Since the majority of current research uses these frameworks qualitatively rather than statistically, this method is novel. In addition to capturing the theoretical aspects of teaching and learning, the study converts them into decision-making tools for educational stakeholders by creating mathematical presentations.

2.1.3 Synthesis and study gap

Although instructional design presentations and constructivist learning theory offer strong conceptual frameworks, there is still a significant void in the research. The integration of these concepts into mathematical presentations that can dynamically depict the interaction between learner preparedness, motivation, and requirements has been the subject of very few, if any, empirical research. Without operationalising these characteristics in a way that enables predictive analysis, the majority of current research stays descriptive or conceptual (Ramanathan & Umamah, 2024; Senadheera et al., 2024).

By creating two mathematical presentations that illustrate the connections between the key factors found, this work aims to close this gap. Teachers, curriculum designers, and legislators are among the stakeholders for whom these presentations are intended to be both useful and accessible. The study intends to improve evidence-based educational planning and the alignment of instructional tactics with student characteristics by translating theoretical ideas into quantitative frameworks.

In the end, this research has a solid foundation thanks to the use of instructional design frameworks and constructivist learning theory. While instructional design offers the methodical procedures required to convert these ideas into organised learning experiences, constructivism guarantees that the human elements of learning—motivation, readiness, and needs—are prioritised. When combined, they facilitate the creation of mathematical presentations that accurately depict the dynamics of education, opening up new avenues for the advancement of theory and practice in the process of teaching and learning.

2.2 Limitations

This study was done in the teaching of Tanzanian schools; these schools have challenges within the Sub-Saharan African context. Whereby, it is well known that these countries are still struggling to transform their education systems. Nevertheless, these limitations are acknowledged:

2.2.1 Shortage of teachers

The ongoing lack of trained educators in Tanzanian schools is a major obstacle. As of 2022, for example, there was a shortage of about 100,958 teachers, or 36.8% of the required number. The deficits in secondary schools (46.9%) and special needs education (59%) were even more severe (Taylor, 2024). The situation is still dire: for the 2025–2026 budget cycle, there was an 85.9% gap in pre-primary education, 124,826 of the 298,687 teachers needed in primary schools, and 82,517 of the 177,436 needed in secondary schools (Taylor, 2024). Some districts frequently have high student-teacher ratios, with classrooms significantly larger than what is advised, which significantly restricts the ability to implement curricula effectively.

2.2.2 Limited Professional Development Opportunities for Teachers

Teachers always need to develop their teaching skills. Nonetheless, systemic obstacles affect their process of development. Inadequate funding, a lack of devoted time, and heavy workloads frequently hinder teacher training sessions (Komba and Mwakabenga, 2019). Furthermore, professional development programs are often donor-driven, dispersed, and not harmonised with the objectives of the national curriculum (Komba and Mwakabenga, 2019). The ability of teachers to implement creative methods of instruction, which is a prerequisite for the successful implementation of the study's presentations, is compromised by this discrepancy.

2.2.3 Insufficient Teaching and Learning Resources

After curriculum revisions, inclusive and successful teaching are undermined by schools frequently operating without necessary supplies due to limited financing, few resources of teaching, lack of ICT tools and inclusive learning aid (Jacob, 2025). Large class numbers, which frequently reach 50 or even 100 students, make it challenging to properly apply constructivist and learner-centred practices.

2.2.4 Transfer ability of Findings

The study's presentations have limited regional application because they were created in Tanzanian and Sub-Saharan African educational contexts. Problems like resource shortages and core curriculum disagreements have mostly been overcome in affluent nations. Rather, more complex topics like global skills, personalised learning routes, 21st century skills and artificial intelligence integration are now frequently discussed in educational discourse. As a result, even if the study makes a substantial contribution to Tanzania and similar contexts, its presentations could probably not work well in environments with different structural capabilities and educational priorities.

3. Methodology

Mixed method was employed to gather data from the respondents (Ivankova, N. V., & Creswell, J. W. 2009). Where by data collection tools were questionnaires and interview questions to both teachers and students. Quantitative and analytical research approach employed mathematical presentationing techniques (Heinz, S. 2011: Creswell & Plano Clark, 2018; Fetters et al., 2013).

3.1 Target Population

Students and teachers were all included in the target group. Based on their direct participation in the educational process as well as their experiences in teaching and learning in academic settings. This is in line with contemporary demands for inclusive educational research that considers many viewpoints in learning settings by involving a varied range of stakeholders (Zawacki-Richter et al., 2022; Holmes et al., 2023).

3.2 Sampling Technique

To ensure representation across various demographics and educational positions, stratified random sampling was used to choose participants from teachers, and students (Etikan & Bala, 2017). Stratification was based on academic experience.

3.3 Participants

There were 110 participants in the study: 80 students and 30 teachers. For the mixed-methods study, this sample size was adequate, striking a balance between the requirements for qualitative depth and quantitative generalization (Guest, Namey, & Chen, 2020). When the objective is to comprehend perceptions and experiences in educational settings rather than to draw generations about the entire country, smaller sample sizes are especially suitable.

3.4 Data Collection Tools

In order to increase validity and trustworthiness, this study used methodological triangulation, which is the practice of studying the same phenomenon using various approaches (Denzin, 1978; Creswell & Plano Clark, 2011). By collecting information using both questionnaires and interviews, the study minimized the drawbacks of depending solely on one technique while utilizing the advantages of both (Brookhart & Durkin, 2003; Harris & Brown, 2008).

Questionnaires for the quantitative component were sent to students in hard copy and sent to teachers electronically through Google Forms, WhatsApp, and email. Effective self-reported data collecting across various respondent groups was made possible by this method, which also made statistical analysis—such as translating frequencies into percentages—more straightforward.

Moreover, teachers were interviewed over the phone to learn more about their perspectives, experiences, and ideas. The combination of in-person interviews and surveys enhanced the dataset by offering rich, contextual information to triangulate findings as well as numerical patterns (Guion et al., 2011; Patton, 1999).

4. Results and Discussion

In the questionnaires it was revealed that the teaching is highly affected by limited resources, large class size and classroom engagement. See table 1 below:

Table 1: Presentation of Teacher Questionnaire Responses

Question	Response Option	Percentage (%)	Mean
1. Teaching Experience	Less than 1 year	10.0	-
	1–3 years	10.0	-
	4–7 years	10.0	-
	More than 10 years	50.0	-
	Not in the range	20.0	
2. Assessing Learner Needs	Formal assessments	60.0	-
	Informal observations	30.0	-
	Discussions with students/parents	0.0	-
	Not responded	10.0	
3. Impact of Learner Needs on Teaching Methods	Always	30.0	3.7
	Frequently	40.0	-
	Occasionally	0.0	-

	Rarely		30.0	-
4. Challenges in Adapting Teaching Methods	Time	Insufficient	10.0	-
		Not a factor	90	-
	Resources	Limited	70.0	-
		Available	30.0	
	Class sizes	Large	70.0	-
		Small	30.0	-
	Needs	Specific	20.0	-
		Not specificl	80.0	
5. Measuring Teaching Effectiveness	Student performance	High	50.0	-
		Low	50.0	
	Classroom engagement	High	70.0	-
		Low	30.0	
	Feedback from students/parents	Effective	20.0	-
		Not Effective	80.0	
	Peer/supervisor evaluations		30.0	-
	Non peer/supervisor evaluation		70.0	-
6. Impact of Student Readiness on Learning Progress	A great deal		60.0	4.3
	A moderate amount		10.0	-
	A little		10.0	-
	No response		20	-
	Not at all		0.0	-

Source: Field data March 2025, n = 30

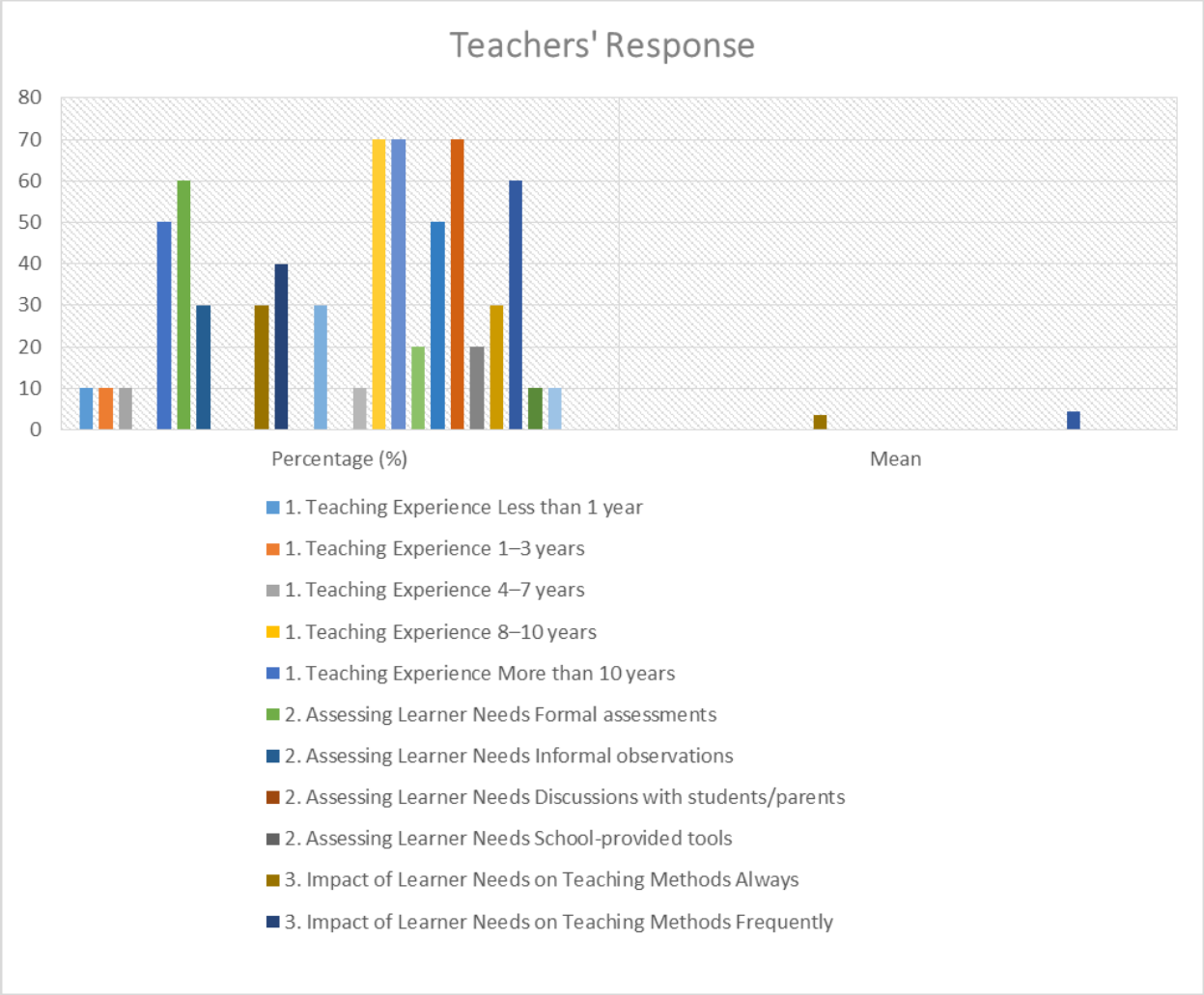


Figure 1: Teachers' response

4.1 Discussion interpretation of the findings from the teachers

According to the data from table 1 and figure 1 above, 50% of teachers have worked as educators for more than ten years, indicating that most have substantial teaching experience. This suggests an experienced teaching staff. Informal observations (30%) also play a part in learner assessment, although formal assessments (60%) are the most widely utilized approach. There may be room for improvement in terms of involving stakeholders in lesson design, though, as none of the teachers mentioned using conversations with parents or students.

Different percentages of respondents said that their needs influence instruction "frequently" and 30% said that they do it "always." But another 30% say "rarely," suggesting a potential discrepancy in how teaching methods are modified. Large class numbers (70%) and resource constraints (70%) are the main obstacles to method adaptation, which may hinder individualized instruction. Another issue is the difficulty in determining the particular needs of each student (20%).

Student performance (50%) and classroom engagement (70%) are the main metrics used to measure effectiveness. However, the utilization of parent and student input (20%) is less common, indicating a chance to improve feedback and communication systems.

Last but not least, 60% of educators think that student motivation and preparedness have a big influence on learning, highlighting how crucial it is to encourage enthusiasm and involvement in the classroom.

All things considered, even if educators use a variety of evaluation and effectiveness measuring techniques, resolving issues like resource constraints and raising parental involvement could improve student learning results.

Table 2: Presentation of Student Questionnaire Responses

Question	Response Option	Percentage (%)	Mean
1. Perception of Teaching Methods	Very effective	60.0	4.3
	Somewhat effective	20.0	3.6
	Neutral	10.0	3.0
	Somewhat ineffective	10.0	2.5
	Very ineffective	0.0	-
2. Learning Needs Considered in Lesson Planning	Always	70.0	4.7
	Sometimes	30.0	3.0
3. Motivation to Learn New Concepts	Very motivated	50.0	4.2
	Somewhat motivated	10.0	3.5
	Neutral	30.0	3.0
	Not very motivated	0.0	-
	Not at all motivated	0.0	-
	No response	10.0	
4. Factors Affecting Willingness to Learn	Teacher's teaching style	23.0	-
	Classroom environment	39.0	-
	Personal interest in the subject	15.0	-
	Support from parents and peers	15.0	-
	Availability of learning materials	8.0	-
5. Readiness to Learn in Different Subjects	Science	50	3.0
	Language	50	5.0

Source: Field data March, 2025, n = 80

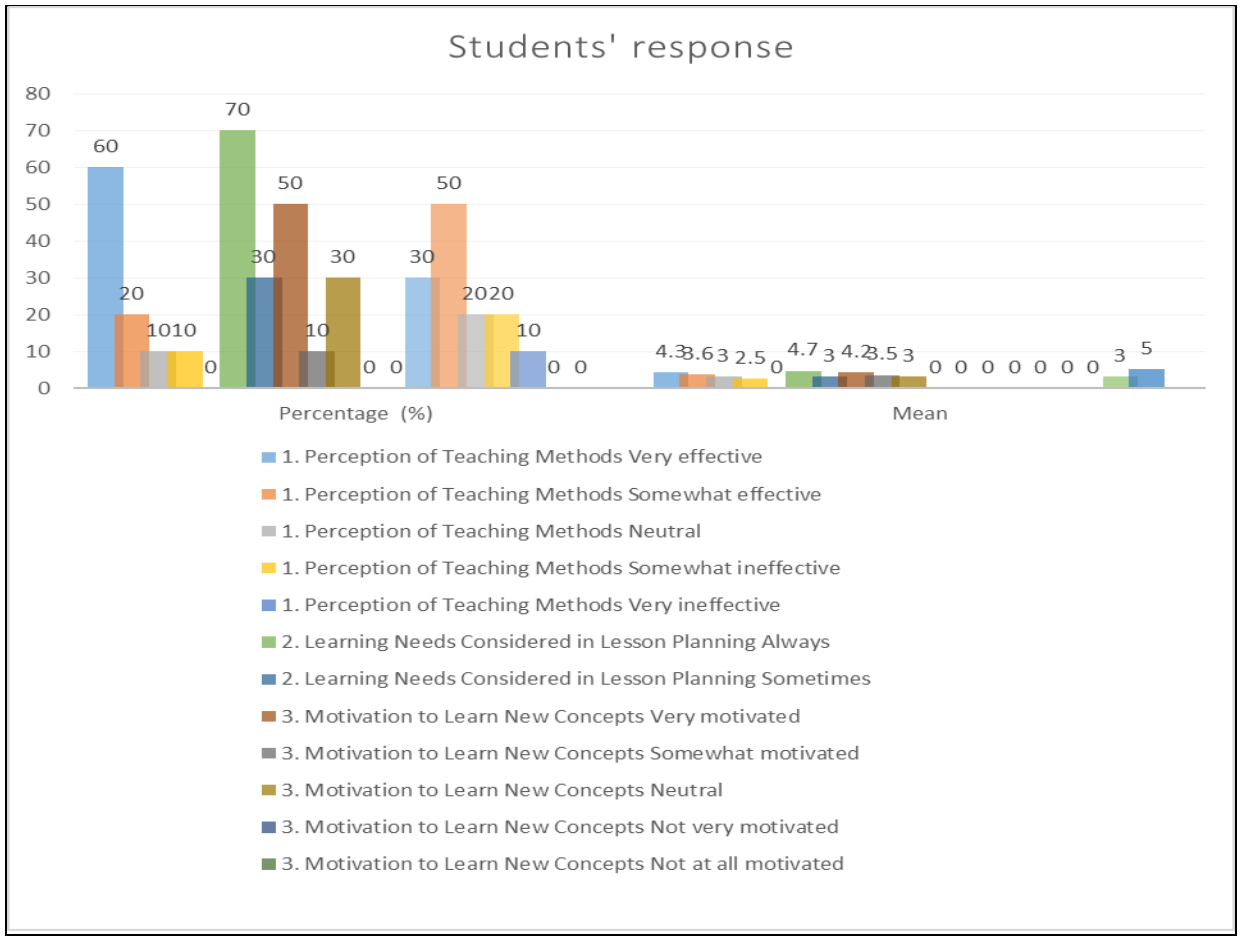


Figure 2: Students response

4.2 Discussion interpretation of the findings from the students

With 60% of students evaluating teaching techniques as "very effective" from table 2 and figure 2, and an overall mean score of 4.3, the analysis of the questionnaire responses shows that most students believe that teaching methods are effective. A tiny percentage (10%), however, believe they are only moderately effective, suggesting that teaching strategies need to be improved. 70% of respondents say that pupils' learning needs are "always" considered, whilst 30% think that it only occurs "sometimes." This points to a generally favourable but still room for improvement degree of inclusion in lesson design. Although half of the students' report feeling "very motivated," a significant 30% are neutral. This suggests that student engagement tactics may be lacking.

The classroom atmosphere (50%) and the teacher's teaching style (30%) are the two most important factors influencing students' willingness to learn. This emphasises how crucial it is to provide a supportive learning environment and use interesting teaching strategies. Additionally, the degree of willingness to learn varies by subject, with language receiving the greatest rating (5.0) and science receiving a moderate level (3.0). This suggests that different topics may differ in terms of perceived difficulty, educational efficacy, or interest (Scheerens, J. 2016).

Enhancing motivation and addressing subject-specific learning problems are necessary, even though teaching strategies and learning settings seem to help students' educational experiences overall.

In Interview teachers and students declared that teaching and learning is largely affected by the availability of teaching resources, few teachers, increased number of students, poor infrastructure, lack of monitoring and evaluation, together with students not being aware of what to learn which affects their readiness to learn.

The arguments from the interview is bringing another line of argument, for example scarcity of teaching and learning resources, teachers not being aware with the use of technology, few teachers in schools and students are not

ready to learn (Mwakalinga, 2024). Bearing in mind that resources are always considered to be available and taken as constantly available but in reality it is not always true. Here there is a danger of learners learning without understanding (Mwakalinga, 2024).

From the quantitative and qualitative findings, it can be noted that the teaching depends on many factors including the needs, resources, content, learners' readiness and others. Also, learning depends on students' readiness, content, resources and desire to learn. This led to the formation of the two presentations, namely the linear presentation and the differential presentation as described below.

4.3 Developing Mathematical Presentations

The development of the presentation is based on the findings and the discussion. Through reflecting what has been contented by the respondents it is now the time to connect the ideas antithetically. Below is the mathematical development of the presentations.

a. Linear presentation

Teaching (T) is a function of learners (L), content (Co), resources (R) and needs (N) (Adler, J. 2000).

Taking content and resources being constant, then F (T) is proportion to learners (L) and needs (N)

Arithmetically:

F (T) = C x L x N ……..i

Where: Teaching effectiveness (T) is presentationed as a function of learner factors (L), needs (N), and a constant factor (C) representing fixed resources and content, such that:

T=C·L·NT = C \cdot L \cdot NT=C·L·N where C accounts for infrastructure and teaching materials assumed constant in the analysis.

While

Learning is a function of readiness, content, resources and desire (Conrad & Donaldson, 2011). Taking content and resources constant, then F (L) is proportional to readiness (R) and desire (D)

F (L) = C x R x D …….ii

Where C refers to the constant factors (content and resources)

Then combining the teaching and learning equation i and ii: then

F (T and L) = **C** x L x N x R x D

This can be interpreted as:

C (Bolded) = Factors kept constant (resources and the content) are supposed to be considered in bold, that means they should be as many times as required because of their fundamental roles they play in the process of the teaching and learning.

b. Differential presentation

From the linear equations:

F (T) = C x L x N …….i

F (L) = C x R x D …….ii

Differentiating both equations with respect to time (t): Because learning takes place at different times and is assumed to have a positive improvement as time goes

$\frac{d(T)}{d(t)}=C(\frac{dL}{dt}N+L\frac{dN}{dt})$…….i

$\frac{d(L)}{d(t)}=C(\frac{dR}{dt}D+R\frac{dD}{dt})$……ii

Combining equations i and ii

$\frac{d(TL)}{d(t)}=\boldsymbol{C}(\frac{dL}{dt}NRD+L\frac{dN}{dt}RD+LN\frac{dR}{dt}D+NLR\frac{dD}{dt})$……iii

C tells that resources and content are provided in suitable amounts to assist teaching and learning by considering their impact in the teaching and learning process.

4.4 Validation of the presentation

Consider two scenarios: one when all factors increase and second when all factors decrease by percentages.

a. Factors are increasing

- Number of learners (**L**) increases by 5% per month.
- Needs satisfaction (**N**) increases by 3% per month.
- Readiness (**R**) increases by 6% per month.
- Desire (**D**) increases by 5% per month.

From the combined presentation

F (T L) = **C** x L x N x R x D

Differentiating with respect to time:

$\frac{d(TL)}{d(t)}=\boldsymbol{C}(\frac{dL}{dt}NRD+L\frac{dN}{dt}RD+LN\frac{dR}{dt}D+NLR\frac{dD}{dt})$……iii

$\frac{dL}{dt}$ = 0.05L, $\frac{dN}{dt}$ = 0.03N, $\frac{dR}{dt}$ = 0.06R and $\frac{dD}{dt}$ = 0.05D

Substituting to equation (iii)

$\frac{d(TL)}{d(t)}$=C(0.05 x NRD+Lx 0.03 x RD+LN x 0.06 x D + NLRx0.05)

= 0.19CNLRD

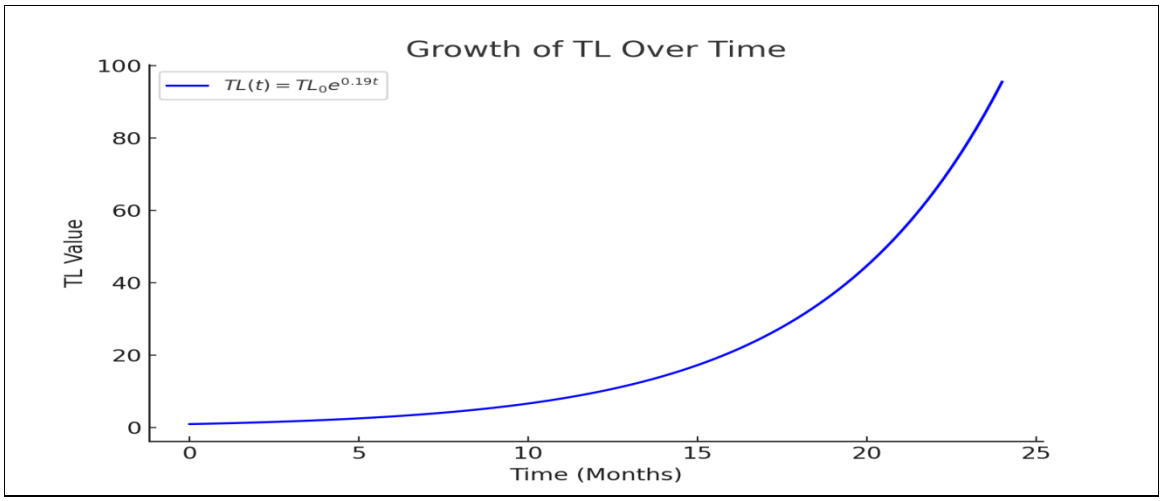
Since the factor is positive, the presentation predicts the rise of effective teaching and learning when learners, needs, readiness and desire for learning increases.

Graphically this can be represented by doing the following

- ✓ L(t) grows by 5% per month → $L(t)=L_0e^{0.05tL}(t) = L_0 e^{\{0.05t\}}$ $L(t)=L0e^{0.05t}$
- ✓ N(t)N(t)N(t) grows by 3% per month → $N(t)=N_0e^{0.03tN(t)} = N_0 e^{\{0.03t\}}$, $N(t)=N0e^{0.03t}$
- ✓ R(t)R(t)R(t) grows by 6% per month → $R(t)=R_0e^{0.06tR(t)} = R_0 e^{\{0.06t\}}$, $R(t)=R_0e^{0.06t}$
- ✓ D(t)D(t)D(t) grows by 5% per month → $D(t)=D_0e^{0.05tD(t)} = D_0 e^{\{0.05t\}}$, $D(t)=D_0e^{0.05t}$

Thus:

TL (t) =$TL_0e^{(0.05+0.03+0.06+0.05)\,t} = TL_0e^{0.19t}$



b. Factors are decreasing

- Number of learners (**L**) decreases by 2% per month.
- Needs satisfaction (**N**) decreases by 1.5% per month.
- Readiness (**R**) decreases by 3% per month.
- Desire (**D**) decreases by 2.5% per month.

$\frac{dL}{dt}$ = -0.02L, $\frac{dN}{dt}$ = -0.015N, $\frac{dR}{dt}$ =- 0.03R and $\frac{dD}{dt}$ = -0.02D

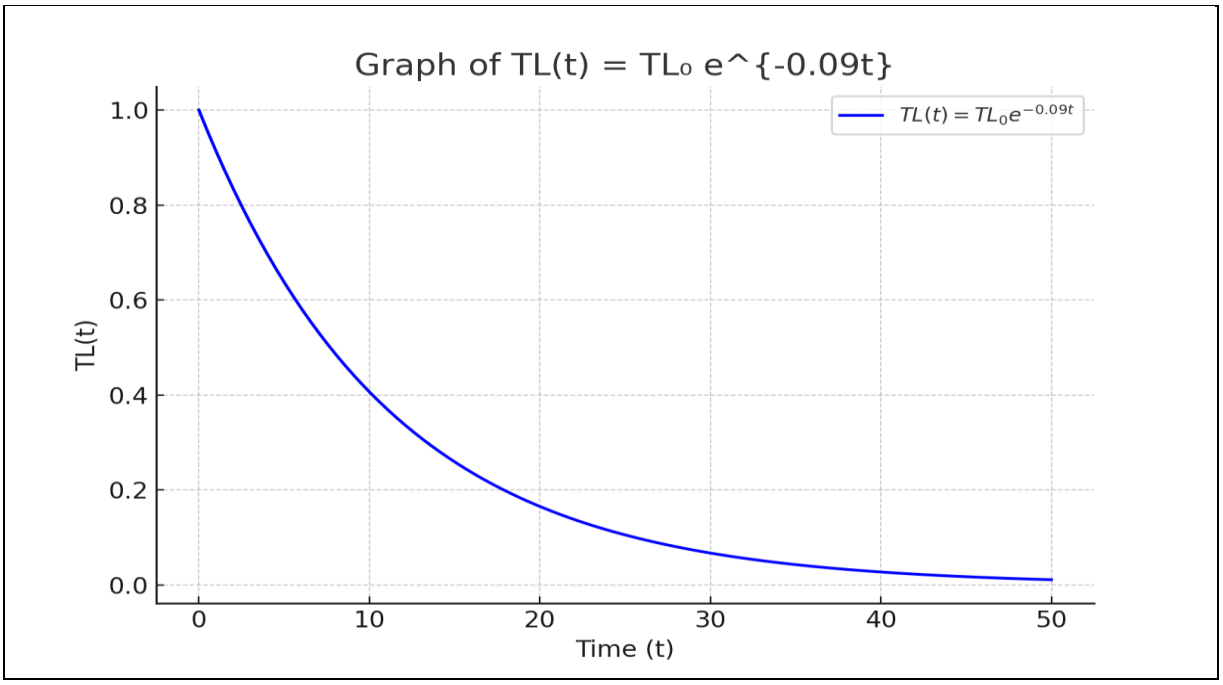
Substituting to equation (iii)

$\frac{d(TL)}{d(t)}$=$-C2$(0.02 x NRD+Lx 0.015 x RD+LN x 0.03 x D + NLRx0.025)

= - 0.09C^2 NLRD

Since the factor is negative, the presentation predicts a decline in effective teaching and learning when learners, needs, readiness and desire for learning decrease.

Graphically the decay/decrease rate can be presented as:



These outcomes validate the presentation's validity in the following sense:

a. Learning effectiveness rises as the influencing factors get better.
b. Learning effectiveness drops when the influencing factors drops

This indicates the predictive potential of the presentation. The presentation demonstrates that it can be used to design teaching strategies for effective learning.

4.5 Discussion about the constant factors

Content and resources are always considered to be constant, meaning that they are enough available, according to this study it has been suggested that the factors which are always taken to be constant should be available as square as to the amount required. Nevertheless, from the questionnaires and interviews it has been noted that resources are scarce and therefore the content can be affected by the scarce resources. Yet referring to the two presentation the resources and content need to be available as square as the amount required.

Application of the presentations

a. **Teachers' Instructional Strategies:**
These presentations can be used by educators to pinpoint areas where students lack motivation and preparation and modify their teaching strategies accordingly (Adler, 2000). Personalized Teaching: Teachers can implement differentiated teaching by comprehending how learner needs (N) and readiness (R) impact outcomes (Conrad & Donaldson, 2011). Resource Allocation: Teachers must make sure that appropriate materials are available to help learning since C (content and resources) is essential (Adler, 2000).

b. **Curriculum Developers Content Adaptation:**
Curriculum designers can guarantee that educational resources correspond with the requirements and incentives of students (Conrad & Donaldson, 2011). Balancing Theoretical and Practical Learning: They can improve engagement by implementing tactics that increase student preparedness (Adler, 2000).

c. **Policy Makers' Resource Distribution:**
The presentation's use of C emphasizes how crucial sufficient funding for education is (Adler, 2000). Equity in Education: To guarantee that every student benefits equally, policies should work to lessen differences in learning resources (Conrad & Donaldson, 2011).

d. **Educational Stakeholders' Investment in Learning Environments:**
Organization and schools can use this presentation to evaluate how teaching resources and infrastructure affect student learning results (Adler, 2000). Professional Development: Teacher training programs can emphasize strategies to improve students' motivation and preparedness (Conrad & Donaldson, 2011). Analysis of Differences and Their Consequences:

These variables are dynamic, as demonstrated by the differentiation of teaching and learning equations about time (t) (t) (Adler, 2000; Conrad & Donaldson, 2011). Better learning outcomes should result from learner readiness, needs, and motivation changes over time, according to the positive derivative values (Conrad & Donaldson, 2011). To adjust tactics appropriately, this approach recommends ongoing monitoring of teaching and learning variables (Adler, 2000). Hence by applying the proposed presentation, school administrators can predict student performance trends and allocate teaching resources efficiently, ensuring that motivation and readiness factors are optimized for improved learning outcomes

5. Conclusion and Recommendations

5.1 Conclusion

This study has revealed that teaching and learning is a complex process which needs careful attention in all aspects facilitating it and not learners only through mathematical presentations. Even though learners are the centre of the learning process, there are things that educational planners should not just take for granted. For example, what to be taught (The content) and What to be used in teaching and learning for the successful learning process (Resources) are very important things for effective teaching and learning. Referring to the linear presentation, it entails that effective teaching is essentially dependent on the traits and needs of the learners themselves by conceptualizing teaching effectiveness (T) as a function of learner variables (L) and needs satisfaction (N). Likewise, learning is framed in the second presentation as a function of resources, desire (D), content quality, and readiness (R). So the integration of the two presentations enhances effective teaching and learning process.

5.2 Recommendations

5.2.1 Educational planners

Educational planners should balance learner-centered approaches with other instructional components. While learners are central in the teaching and learning process, planners should ensure that equal attention is given to curriculum content, instructional resources, and the broader learning environment to support meaningful learning outcomes.

5.2.2 Curriculum developers

Curriculum developers should carefully design relevant and high-quality content. The effectiveness of teaching and learning largely depends on what is taught. Therefore, curriculum developers should ensure that learning content is relevant, well-structured, and aligned with learners' needs, societal demands, and educational goals.

5.2.3 Education stakeholders

Education stakeholders should ensure the availability and effective use of teaching and learning resources. Schools and educational institutions should provide adequate instructional materials, technologies, and facilities to support the learning process, since resources significantly influence learning effectiveness.

5.2.4 Teachers in teaching

Teachers should integrate learner characteristics and needs into their instructional practices. Teachers should understand learners' traits, abilities, motivations, and readiness levels to design appropriate teaching strategies that enhance learning effectiveness.

5.2.5 Researchers

Further research should explore mathematical and conceptual models of teaching and learning.
Researchers should continue to investigate and refine theoretical and mathematical presentations of teaching and learning processes to better understand how different variables interact to influence educational outcomes.

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