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MEDIATING ROLE OF INSTRUCTIONAL AND ASSESSMENT STRATEGIES ON LEARNERS' ENGAGEMENT IN EDUCATIONAL STATISTICS, IN TEACHER TRAINING COLLEGES, MFOUNDI DIVISION.

A Master thesis in the Department of Curriculum and Evaluation submitted to the Faculty of Education in partial fulfillment of the requirements for the award of the degree of Master of Education (M.Ed) in Curriculum and Evaluation of the University of Yaounde 1.

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CERTIFICATION

I hereby certify that this thesis entitled **"MEDIATING ROLE OF INSTRUCTIONAL AND ASSESSMENT STRATEGIES ON LEARNERS" ENGAGEMENT IN EDUCATIONAL STATISTICS, IN TEACHER TRAINING COLLEGES, MFOUNDI DIVISION"** was carried out by TCHOCGNIA YANYA ARSENE in partial fulfillment of the requirements for the award of the degree of Master of Education (M.Ed) in Curriculum and Evaluation of the University of Yaounde 1 under my supervision and guidance.

_____ Date _____

SHAIBOU ABDOULAI HAJI

To my little family

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ABSTRACT

This study aimed to investigate the mediating role of instructional and assessment strategies on learners' engagement in Educational statistics in teacher training colleges, Mfoundi Division. This topic is particularly important because it will add awareness in instructors of Educational Statistics of the necessity to adopt verified instructional and assessment strategies so that student teachers get engaged in the discipline. Considering the importance of Educational Statistics in the academic and professional carreer of student teachers, this study attempts to bridge the gap that exists between student teachers and Educational Statistics. The study involved a sample size of 265 student teachers, and data was collected through questionnaires administered to student teachers. The study examined the effectiveness of quiz-mediated interactivity and portfolio-mediated interactivity as compared to quiz-mediated direct instruction, portfolio-mediated direct instruction, quiz, portfolio and direct instruction as single variables, to induce Student Engagement in learners of Educational Statistics. The regression analyses were done using IBM SPSS Statistics version 21 to determine the direct and indirect effect of the variables. The results showed that quizzes, direct instruction, portfolio, and interactivity all have positive correlations with Student Engagement. Quiz-mediated interactivity and portfolio-mediated interactivity were found to be effective instructional and assessment strategies for inducing Student Engagement. The study suggests that incorporating quizzes, portfolios, and interactivity into Instructional and assessment strategies can improve Student Engagement. Further research is needed to fully understand the relationships between these variables and Student Engagement. Overall, this study contributes to the growing body of literature on Student Engagement and provides valuable insights for educators seeking to improve their Instructional and assessment strategies. By incorporating quizzes, portfolios, and Interactivity, educators can create a more engaging and effective learning environment for their students. The findings of this study also suggest that a combination of these strategies may be more effective than using them individually. Further research is needed to explore the optimal combination of these strategies and their impact on Student Engagement in different contexts.

Keywords **; Direct instruction, Quiz, Interactivity, Portfolio, Student teacher engagement, Educational Statistics.**

RESUME

Cette étude visait à examiner le rôle médiateur des stratégies d'enseignement et d'évaluation sur l'engagement des apprenants en statistiques éducatives dans les collèges de formation des enseignants du département du Mfoundi. Ce sujet est particulièrement important car il sensibilisera les instructeurs en statistiques éducatives à la nécessité d'adopter des stratégies d'enseignement et d'évaluation vérifiées afin que les futurs enseignants s'engagent dans cette discipline. Étant donné l'importance des statistiques éducatives dans la carrière académique et professionnelle des futurs enseignants, cette étude tente de combler le fossé qui existe entre les futurs enseignants et les statistiques éducatives. L'étude a impliqué un échantillon de 265 futurs enseignants, et les données ont été collectées à l'aide de questionnaires administrés aux futurs enseignants. L'étude a examiné l'efficacité de l'interactivité médiée par des quiz et des portfolios par rapport à l'instruction directe médiée par des quiz et des portfolios, ainsi que l'instruction directe, les quiz et les portfolios en tant que variables uniques pour induire l'engagement des apprenants en statistiques éducatives. Les analyses de régression ont été effectuées à l'aide d'IBM SPSS STATISTICS version 21 pour déterminer l'effet direct et indirect des variables. Les résultats ont montré que les quiz, l'enseignement directe, les portfolios et l'interaction ont tous une corrélation positive avec l'engagement des apprenants. L'interaction médiée par des quiz et des portfolios s'est avérée être une stratégie d'enseignement et d'évaluation efficace pour induire l'engagement des apprenants. L'étude suggère que l'incorporation de quiz, portfolios et interaction dans les stratégies d'enseignement et d'évaluation peut améliorer l'engagement des apprenants. Des recherches supplémentaires sont nécessaires pour comprendre pleinement les relations entre ces variables et l'engagement des apprenants dans différents contextes. Dans l'ensemble, cette étude contribue au corpus croissant de littérature sur l'engagement des apprenants et fournit des informations précieuses aux éducateurs cherchant à améliorer leurs stratégies d'enseignement et d'évaluation. En incorporant des quiz, des portfolios et de l'interactivité, les éducateurs peuvent créer un environnement d'apprentissage plus engageant et efficace pour leurs élèves. Les résultats de cette étude suggèrent également qu'une combinaison de ces stratégies peut être plus efficace que leur utilisation individuelle. Des recherches supplémentaires sont nécessaires pour explorer la combinaison optimale de ces stratégies et leur impact sur l'engagement des apprenants dans différents contextes.

Mots clés ; **Enseignement Directe, Quiz, Interaction, Portfolio, engagement des éléves maitres, Statistiques Educatives.**

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LIST OF ABBREVIATIONS AND SYMBOLS

D.I : Direct Instruction

I : Interactivity

Q : Quiz

P : Portfolio

S.E : Student Engagement

ANOVA : Analysis of Variance

BTTC : Bilingual Teacher Training College

ENI : Ecole Normale D‟ Instituteurs

ENIR : Ecole Normale D‟ Instituteurs à vocation rurale

ENIEG : Ecole Normale D‟ Instituteurs de l‟ Enseignement Generale

ENIEG B : Ecole Normale D‟ Instituteurs de l‟ Enseignement Generale Bilingue

GBTTC : Government Bilingual Teacher Training College

IPAR : Institut Pedagogique à Vocation Rurale

CHAPTER ONE

INTRODUCTION

Educational statistics is a critical subject in teacher training colleges, as it equips future educators with the necessary skills to analyse and interpret data to improve student learning outcomes (Ngouo & Njifenjou 2019). However, the challenge lies in engaging learners in this subject , as it can be perceived as dry and abstract (Liu, 2018). This master dissertation explores the effects of instructional and assessment strategies on learners' engagement in educational statistics in teacher training colleges. The study draws on a range of sources, including academic literature, statistical reports, and case studies, to provide insights into effective teaching and assessment practices that promote learner engagement in the subject. Through this research, the dissertation aims to contribute to the development of evidence-based strategies that can enhance the quality of educational statistics instruction in teacher training colleges. It is important to inquire on the state of teaching Educational Statistics in teacher training colleges in Cameroon and around the world to assess the effectiveness of current teaching practices and identify areas that require improvement. This can be done through surveys, interviews and literature reviews.

Sources such as academic journals, government reports, and educational organizations can provide valuable insights into the state of teaching Educational Statistics in teachers training colleges. For example, a study conducted by the International Journal of Education and Research in 2019 found that student teachers in Nigeria lacked the necessary statistical skills to analyze and interpret data effectively. By gathering information from various sources, we can develop a comprehensive understanding of the state of teaching Educational Statistics in teachers training colleges and identify best practices that can be implemented to improve student learning engagement and outcomes. Educational statistics is important for student teachers in Cameroon because it provides them with the necessary skills and knowledge to make informed decisions about teaching and learning. Studying Educational Statistics is important for several reasons. Firstly, it provides to future educators and policymakers with the necessary tools to make informed decisions about educational programs and policies. By analyzing data on pupil performance and educational outcomes, they can identify areas

of improvement and implement interventions that are more likely to be effective. Secondly, educational statistics helps to identify achievement gaps and disparities in educational outcomes among different groups of pupils. This information can be used to develop targeted interventions that address the specific needs of disadvantaged pupils and reduce inequalities in education. Finally, studying Educational Statistics is essential for student teachers who are interested in understanding the complex relationships between various factors that influence educational outcomes. By conducting rigorous statistical analyses, they can identify causal relationships and develop evidence-based recommendations for improving education.

Nkwenti & Fokum (2018) stated that Educational Statistics is essential for student teachers in Cameroon because it helps them to understand the different methods of data collection, analysis, and interpretation that are used in education. This knowledge is critical for making informed decisions about teaching and learning. Furthermore, Tchombe & Nkenglefac (2017) found that Educational Statistics is important for student teachers in Cameroon because it enables them to evaluate the effectiveness of different teaching strategies and interventions. By analyzing data on student performance for example, they can identify areas where students are struggling and develop targeted interventions to address these issues. Ngouo & Njifenjou (2019) highlights that educational statistics for student teachers helps them to develop critical thinking skills, by analyzing data and drawing conclusions based on evidence, they can make informed decisions about teaching and learning that are grounded in research and best practices.

Overall, Educational Statistics is an essential component of teacher education in Cameroon, as it provides student teachers with the tools they need to make informed decisions about teaching and learning. By understanding how to collect, analyze, and interpret data, they can improve their practice and help their pupils achieve greater success. Moving on, a study by Mwenda & Kariuku (2017) argues that Educational Statistics is crucial for teacher education in Kenya, as it helps teachers to identify the needs of their students and develop appropriate teaching strategies. This is particularly important in a diverse classroom, where students may have different learning styles and abilities. As such, student teachers have to be engaged in the subject. In a global context, a report by the UNESCO institute for Statistics (UIS) in 2020 highlights that the importance of Educational Statistics for monitoring progress towards the Sustainable Development Goals (SDGs). This includes tracking indicators such as

enrollment rates, completion rates, and learning outcomes, which are essential for ensuring that all children have access to quality education.

A study by Kozma & McGhee (2017) emphasizes the role of Educational Statistics in promoting evidence-based policy and practice in education. By using data to inform decision-making, policymakers and educators can ensure that resources are allocated effectively and that interventions are targeted towards those who need them most. Finally, a report by the National Council on Teacher Quality (NCTQ, 2019) identifies statistical literacy as a key component of teacher preparation programs in the United States. This includes understanding basic statistical concepts, such as measures of central tendency and variability, as well as more advanced techniques such as regression analysis and hypotheses testing. By developing these skills, teachers can make informed decisions about teaching and learning that are grounded in data and evidence.

However, Liu (2018) in an article titled " Why do student teachers find statistics difficult?". The author explores the reasons why student teachers struggle with statistics in their training programs. According to Liu, one of the main reasons for this difficulty is the lack of prior exposure to statistical concepts and methods. Many student teachers come from non-mathematical backgrounds and may not have had the opportunity to study statistics in their previous education. This lack of foundation can make it difficult for them to understand the complex concepts involved in statistical analysis. Another reason for the difficulty is the way statistics is taught in teacher training programs. Liu (2018) argues that statistics is often presented in a theoretical and abstract manner, which can be overwhelming for student teachers. Additionally, many teacher training programs do not provide enough opportunities for hands on practice and application of statistical methods.

Liu suggests that teacher training programs need to take a more practical approach to teaching statistics, emphasizing real world applications and providing opportunities for students to practice and apply statistical methods. Furthermore, teacher training programs should consider offering additional support and resources for students who are struggling with statistics. Overall, Liu's article highlights the importance of addressing the challenges that student teachers face when learning statistics in their teacher training programs. By improving the way statistics is taught and providing additional support, we can help ensure that future teachers have the skills they need to effectively analyse and interpret data in their classrooms. A study published in the

Journal of Statistics Education found out that students often struggle with mathematical calculations involved in statistics, particularly when it comes to understanding formulas and applying them correctly (Tarr & Jones, 2016). The study also found that students who lacked a strong foundation in mathematics were more likely to struggle with statistics.

Another article published in The Chronicle of Higher Education highlights the lack of practical application in Statistics courses as a reason why students may find the subject difficult (Bartlett, 2018). The article suggests that incorporating real word examples and hands on activities can help students stay engaged and motivated in the subject. These studies and articles support the reasons why student teachers or learners may find Statistics difficult. However, with proper guidance and support from teachers and tutors, students can overcome these challenges and achieve engagement in Statistics. The GAISE College Report ASA Revision Committee, (2016) stipulates that engaged learning is comparable to active learning, where students are participating in class and doing things and thinking about the things they are doing.

One study conducted by Oyekan & al (2021) explored the effects of two instructional strategies, problem based learning and lecture based instruction, on learner engagement in a Statistics course. The study found that problem based learning led to higher levels of learner engagement compared to lecture based learning. Another study by Li & al (2020) investigated the effects of a variety of assessment strategies, including peer assessment, and instructor feedback, on learner engagement and performance in a Statistics course. The study found that peer assessment and self assessment were associated with higher levels of learner engagement and improved performance.

Background of the study

Historical Background

Teacher training colleges in Cameroon have their origins in the colonial era when the French and British established teacher training institutions to train local teachers to work in their respective colonies. In Cameroon, the first teacher training college was established by the French in 1924 in Douala. After independence in 1960, the government of Cameroon continued to establish and expand teacher training colleges across the country to meet the growing demand for trained teachers. The history of Teacher Training in Cameroon continued in 1967, with the creation of «ENIR »,

which stands for «Ecole Normale d‟Instituteurs à Vocation Rurale ». Within ENIR , was « L‟IPAR » , which stood for « Institut Pédagogique à vocation rurale ». IPAR was for teacher training, and sent out its first promotion of teachers in 1970. In 1974, ENIR is delocalised from Yaounde to Ngoumou, but the decision takes effet in 1975, with the creation of other structures such as ENI , ENIA , ENIAET.

In 1977, ENI is created in all provinces, hence Yaounde has ENI, ENIA- ENIAET. In 1987, all the ENI are closed. In 1995, they are reopened and transformed to ENIEG. In 2004, some ENIEG are transformed into ENIEG –B, the cases of Yaounde, Bamenda and Bafoussam. In 2005, the first English speaking teachers were registered at GBTTC Yaounde. Today, there are several public and private teacher training colleges in Cameroon offering various programs and courses to train teachers at different levels. Among the numerous disciplines taught at Teachers training colleges, is Educational Statistics. Educational statistics has its roots in the field of Statistics, which emerged in the 18th century. However, it was not until the late 19th and 20th century that Educational Statistics became a distinct field of study. This was due to the increasing demand for data on educational outcomes and the need to evaluate the effectiveness of educational programs.

One of the pioneers in the field of educational statistics is James Cattell, who founded the Psychological Corporation in 1921. The corporation was responsible for developing standardized tests and conducting research on educational outcomes. Other notable figures in the field include Harold Rugg, who developed a system for evaluating textbooks, and Edward Thorndike, who conducted research on learning and memory. Today, Educational Statistics is an important tool for educators and policymakers in evaluating the effectiveness of educational programs and making data driven decisions. It is used to track student performance, identify achievement gaps, and evaluate the impact of policies and interventions. With advances in technology and data analysis, Educational Statistics continue to play a critical role in improving educational outcomes for students.

Considering the importance of Educational Statistics in the career of student teachers, as seen in the following points ;

- Quality Basic Education seen in the National Development Strategy 2030.
- Learning and innovation skills, 21st century skill.
- Life and career skills, 21st century skill.
- Lifelong learning, United Nations Suistainable Development Goal N° 4.

It is therefore necessary for instructors to develop powerful instructional and assessment strategies in order to capture the student teachers‟ engagement in the discipline. Learner engagement can be defined as the degree to which a student is interested, motivated, and actively involved in their learning process (Fredricks, Blumenfeld, & Paris, 2004). It is crucial in educational statistics because it has been found to be a significant predictor of academic achievement (Wang & Eccles, 2012). The purpose of this study is to explore the factors that affect learner engagement and its relationship with academic engagement.

Theoretical frameworks of learner engagement have been proposed, including the expectancy value theory and the self regulated learning theory (Zimmerman & Schunk,2011). Factors affecting learner engagement include personal characteristics such as motivation and interest, as well as environmental factors, such as teacher support and classroom climate (Skinner, Kindermann, & Furrer, 2009). Methods of measuring learner engagement include self report surveys, observations, and physiological measures (Fredricks et al.,2004). The relationship between learner engagement and academic achievement has been consistently found in research studies (Wang & Holcombe, 2010). Learners‟ engagement is not centered on the student teachers‟ alone. For the student teachers to be engaged, it is a shared responsibility with the facilitator. Reckmeyer (2019) pointed out that teachers who feel engaged with their work will have an easier time helping students feel engaged with school. No instructor will wish to work with students who are disengaged, as it will render the teaching-learning process boring, ineffective and inefficient. Facilitators of Educational Statistics have to make lessons active, make learners enthusiastic in the quest of knowledge. Goodwin and Hubbell (2003) stated that effective teachers should do 3 things to maintain engagement in their classrooms ; firstly, teachers should be demanding. This consists of directing and maintaining high expectations in the classroom. Secondly, the facilitator should be intentional, which means that teachers know why they do what they are doing. Lastly, teachers should be supportive. Supportive here implies that teachers should show concern about the lifes of the learners, know their hobbies and worries, guide and support them in order for the learners to feel at ease in the teaching - learning process. In so doing, discouraged or unmotivated learners will see the school atmosphere conduisive and shall be engaged. Meanwhile, motivated learners will develop to full potential.

The research methodology of this study will involve a mixed methods approach. Participants will be selected using a simple random sampling technique. Data collection method will be a questionnaire. Data analysis techniques will include descriptive statistics and regression analysis. The results of this study will provide insights into the factors that affect learner engagement based on its relationship with instructional and assessment strategies. The findings will be discussed in relation to the literature review and implications for practice will be provided. In conclusion, learner engagement is a crucial aspect of the learning process that has been found to be a significant predictor of academic achievement. This study aims to explore the factors affecting learner engagement in Educational Statistics. Limitations and future research directions will also be discussed.

Contextual Background

Educational Statistics is targeted competence C41 according to the National Curriculum of teacher training colleges of Cameroon revised in 2014 by the ministry of Secondary Education. The terminal competence is that " At the end of the course, the student teacher should be able to solve professional problem-situations using resources acquired from Introduction to statistics applied to education". As such, the broad competence is to analyze students" results and class performance to evaluate the pedagogic practices. The first basic professional competences here are ; "to solve problem situations using mathematical language and symbols applied to statistics and to solve problem situations using data representation, graphical analysis and interpretation". The broad themes in this competence are ; general introduction, different types of measurement scales, frequency distribution, and data representations. The second basic professional competence is "to solve problem situations involving analysis and interpretation of data from numerical indicators". The themes here are ; measurements of central tendency, relative position indicators, measurements of dispersion and data representations.

According to Watson & al. (2020), statistics has the potential to facilitate the integration of STEM in disciplines. This is possible due to its inclusion in individual STEM curricula and its utility in designing learning experiences using the pedagogical framework. In the Cameroon National Strategy Development paper 2030, STEM education is a priority, to foster quality education. Granovskiy (2018) sees STEM (Science, Technology, Engineering, and Mathematics) education as teaching and learning

in the fields of science, technology, engineering, and mathematics. It typically includes educational activities across all grade levels, from pre-school to post doctorate in both formal and informal settings. Hence, this adds more weight for the necessity to investigate into the appraisal of educational statistics by student teachers.

Conceptual Background

Fredricks & al. (2004) identified three types of engagement ; behavioural engagement, emotional engagement, and cognitive engagement. Behavioural engagement consists of how the learners behave in the learning environment or his / her attitudes towards the learning environment. Emotional engagement consists of how the learner feels ; anxious?, excited?, indifferent?, bored?, inquisitive?. Cognitive engagement consists of how the learner is disposed to construct a variety of strategies for self directed learning. Facilitators of Educational statistics have to evaluate the levels of engagement of the student teachers. Facilitators have to master the notion of engagement as it is a great contributor to academic achievement. Mark (2000) pointed out that there is a direct link between greater psychological engagement, and higher grades and better performance ; " students who are engaged with school are more likely to learn, to find the experience rewarding, to graduate, and to pursue higher education".

Also, engagement to teaching-learning process enables emotional development of the learners, social rectitude, prevent them from ill thoughts and school drop out. Student teachers‟ engagement in Educational Statistics will be a foundation for academic achievement in the discipline, professional and career development, and a guarantee for life long learning (United Nations Sustainable Development Goal N°4). Moving on, in this study of instructional strategies to induce student engagement, it is necessary to have the background of instructional strategies.

Instructional strategies are a combination of instruction, teaching and learning. Instructional strategies is a very complex phrase, instructional strategies are developed by instructors to produce the desired outcome in learners. This study will focus on instructional strategies to develop student teachers‟ engagement in Educational statistics. It is therefore necessary for facilitators to implement powerful instructional strategies in order to promote engagement. The choice of instructional strategies should bring a diversified teaching-learning atmosphere in the classroom, that will make learners feel interested in what they are doing, make them active, and develop in them the love for Educational statistics. Furthermore, instructional strategies can be

teacher centered, student centered, problem based centered, learner oriented strategies, just to name a few. This study seeks to investigate the choice of instructional strategies for engagement in Educational Statistics. Hypothesis indicate a blend between teacher centered strategies and learner oriented strategies, in order to attain the desired engagement.

Instructional strategies encompass a wide range of approaches and techniques used to facilitate effective teaching and learning experiences. Two prominent instructional strategies are Direct Instruction and Interactivity, each offering distinct features and benefits. Let's delve into these strategies, including their definitions, usage, importance, and validity.

Direct Instruction

Direct Instruction is a teacher-centered approach characterized by explicit and systematic teaching of skills and concepts. It involves clear explanations, modeling, and guided practice to provide learners with structured and focused instruction. Direct Instruction aims to maximize student engagement and achieve specific learning outcomes efficiently. Direct Instruction is defined as "a structured, teacher-centered instructional approach that emphasizes carefully planned lessons and step-by-step teaching methods to facilitate student learning" (Carnine, Silbert, & Kame'enui, 2019). Direct Instruction is widely used across various educational levels and subject areas. Its structured nature allows for efficient and effective delivery of content, particularly when introducing new concepts or developing foundational skills (Engelmann, 1999). Direct Instruction promotes active engagement, student participation, and gradual release of responsibility from the teacher to the learner. The validity of Direct Instruction lies in its evidence-based practices and the ability to produce consistent and positive learning outcomes (Carnine, Silbert, & Kame'enui, 2019). When implemented with fidelity and aligned with instructional objectives, Direct Instruction can enhance student achievement and address diverse learning needs.

Interactivity

Interactivity is described as "the exchange of information between learners and their environment or instructors in a two-way or multiple-way process" (Khan, 2005). Interactivity is increasingly emphasized in educational contexts as it promotes learner engagement, motivation, and deeper understanding (Khan, 2005). Interactive instructional

strategies, such as group discussions, hands-on activities, simulations, and technology-enhanced learning, encourage active involvement, critical thinking, and knowledge construction. The validity of interactivity as an instructional strategy lies in its alignment with constructivist learning theories, which emphasize learner-centered and active learning approaches (Driscoll, 2002). When designed effectively, interactive activities can facilitate higher-order thinking skills, social interaction, and application of knowledge.

Assessment strategies

According to Stiggins and Chappuis (2005), the main purposes of assessment are to monitor student learning, improve academic programs and enhance teaching and learning. Assessment strategies are therefore very important in forstering student engagement. Moreover, learners feel discouraged or give up due to poor or inadequate assessment strategies. This therefore calls for research to be conducted in the choice of assessment strategies in order to promote learners‟ engagement in Educational Statistics. Facilitators must establish the purpose of assessment, the criteria being measured, before meaningful assessment can be achieved (Gaytan 2002). Effective assessment strategies for Educational Statistics in Teachers‟ training colleges include weekly quizzes and portfolio, with feedback.

Assessment strategies play a crucial role in education, providing valuable insights into students' learning progress, achievements, and areas for improvement. Two common assessment strategies are quizzes and portfolios, each offering unique benefits and serving different purposes.

Quizzes

Quizzes are short assessments designed to evaluate students' understanding of specific concepts or topics. They often involve questions with predetermined answers and can be administered in various formats, such as multiple-choice, true or false, or open-ended questions. Quizzes are typically used to assess knowledge retention, comprehension, and application skills. According to Surry and Farquhar (1997), quizzes are "brief assessments used to measure knowledge or comprehension in specific areas." Quizzes are widely employed in educational settings due to their practicality and efficiency. They provide instructors with immediate feedback on students' comprehension, enabling timely interventions and adjustments to instructional strategies

(Race, 2006). Quizzes can promote active learning, engagement, and metacognitive awareness as students assess their own understanding (Waring & Evans, 2015). Quizzes can be a valid assessment strategy when aligned with learning objectives and appropriately designed to measure specific knowledge or skills (Brown, Race, & Smith, 1996). To enhance validity, quizzes should be well-constructed, reliable, and focused on assessing meaningful learning outcomes.

Portfolio

Portfolios are purposeful collections of student work that demonstrate their progress, achievements, and reflections over time. They include a range of artifacts, such as essays, projects, artwork, or multimedia presentations. Portfolios are used for assessment, reflection, and showcasing student growth. Barrett (2005) defines portfolios as "a purposeful collection of student work that exhibits the student's efforts, progress, and achievements in one or more areas." Portfolios offer a holistic view of students' learning journeys, allowing them to document and reflect upon their growth and accomplishments (Yancey, 1998). They encourage metacognitive skills, self-assessment, and self-regulation as students curate and analyze their work samples (Paulson, Paulson, & Meyer, 1991). Portfolios also provide opportunities for authentic assessment, allowing students to demonstrate their abilities beyond traditional tests or exams. The validity of portfolios relies on clearly defined criteria, rubrics, and guidelines for selecting artifacts that align with learning objectives (Tillema, Smith, & Adams, 2000). Validity can be enhanced by using multiple sources of evidence, involving students in the assessment process, and ensuring consistency and reliability in scoring (Moskal, 2000).

Theoretical Background

Major theories of learning consist of behaviorism, cognitivism and constructivism. This study cuts across these major theories. Behaviorism is a theory of learning that originated in the early 20th century. It was developed by psychologists such as John B. Watson and B.F. Skinner. Behaviorism focuses on observable behaviors, which makes it an important theory for understanding how people learn and how they can be trained to modify their behavior. It is often used in educational settings to teach new skills and reinforce positive behaviors. According to the behaviorists, the learners are blank and are provided with information to learn.

Behaviorism involves repeated actions, verbal reinforcement and incentives. Behaviorism is highly structured and systematic approach to learning it. It provides clear guidelines for teachers and trainers to follow, which can lead to more effective instruction. On the otherhand, behaviorism does not take into account the role of internal mental processes in learning. It also tends to focus on short term changes in behavior rather than long term changes.

Cognitivism is a theory of learning that emerged in the 1950s and 1960s. it was developed by psychologists such as Jean Piaget and Lev Vygotsky. Cognitivism focuses on the role of mental processes in learning, such as attention, perception, memory, and problem solving. It is an important theory for understanding how people learn and how they can be taught to think critically and solve problems. Moving on, in cognitivism, the learners process information rather than just responding to stimulus as with behaviourism. Cognitivism includes cognitive load theory, schema theory, dual coding theory and retrieval practice. Cognitivism provides a more comprehensive understanding of learning than behaviorism. It takes into account the role of internal mental processes, which can lead to more effective instruction. Nonetheless, cognitivism can be too complex and difficult to apply in practice. It also tends to focus on individual learning rather than social or cultural factors.

Constructivism is a theory of learning that emerged in the 1970s and 1980s. It was developed by the psychologists Jean Piaget and Lev Vygotsky. Constructivism emphasizes the role of learners in constructing their own understanding of the world. It is an important theory for understanding how people learn and how they can be taught to think critically and creatively. Constructivism stipulates that knowledge is constructed by adapting new information based on previous experience. It includes problem based learning, research and creative projects. Constructivism encourages learners to take an active role in their own learning. It also emphasizes the importance of social and cultural factors in learning. Constructivism can also be difficult to apply in practice. It also tends to focus on individual learning rather than group or organizational learning. A thorough investigation into the use of these broad theories and their sub-theories shall be used to get the ideas out of this research.

Engelmann‟s theory of Direct Instruction

Siegfried Engelmann's theory of Direct Instruction emphasizes the importance of explicit teaching and structured, systematic lessons that are designed to maximize

student learning. This approach involves breaking down complex concepts into smaller, more manageable parts, and providing students with frequent feedback and opportunities for practice (Engelmann, 1988). Research has shown that direct instruction can lead to significant improvements in student achievement, particularly for students who are struggling academically (Carnine et al., 2006; Hattie, 2009). Additionally, Engelmann's theory emphasizes the importance of teacher-led instruction, which has been shown to be effective in promoting student engagement and motivation (Rosenshine & Meister, 1994).

Trial and Error theory of learning

Thorndike's trial and error theory of learning emphasizes the role of reinforcement in shaping behavior. According to Thorndike, learning occurs through a process of trial and error, where individuals try different responses to a problem until they find one that is successful. The successful response is then reinforced, increasing the likelihood that it will be repeated in the future. This theory has been supported by research findings, such as studies on operant conditioning that demonstrate the importance of reinforcement in shaping behavior (Skinner, 1938). Additionally, research on animal learning has shown that animals are able to learn through trial and error, providing further support for Thorndike's theory (Pavlov, 1927).

Bruner‟s theory of Spiral Curriculum

Jerome Bruner's spiral curriculum theory proposes that learning should be organized in a spiral manner, where students revisit topics multiple times throughout their education, but with increasing complexity and depth each time. This approach allows students to build upon their prior knowledge and develop a deeper understanding of the subject matter (Bruner, 1960). Research has supported the effectiveness of this approach, showing that students who are exposed to a spiral curriculum have better retention of information and are better able to transfer their knowledge to new situations (Bruner, 1966; Fuchs & Fuchs, 1998). Additionally, Bruner's theory emphasizes the importance of active learning and problem-solving, which have been shown to enhance student engagement and motivation (Hmelo-Silver et al., 2007).

Vygotsky‟s theory of social development

Vygotsky's social development theory emphasizes the crucial role of social interaction and cultural context in shaping human development. According to Vygotsky, children

learn through interactions with more knowledgeable others who provide guidance and support, and cultural tools such as language and symbols play a critical role in cognitive development. Vygotsky also emphasized the importance of the zone of proximal development (ZPD), which refers to the range of tasks that a child can perform with assistance from a more knowledgeable person. He argued that learning occurs most effectively when it is situated within the child's ZPD. Vygotsky's theory has been supported by research findings, such as the importance of social scaffolding in promoting children's learning and the influence of cultural context on cognitive development (Wertsch, 1985; Rogoff, 1990).

Statement of the problem

Student teachers of Educational statistics develop a phobia for the discipline, especially the older learners, and most often the female gender. This phobia under research is due to various reasons. As a result of that, student teachers feel disengaged in the subject, once in the teaching field, they deliberately say they cannot teach higher classes (classes 5 & 6) due to fear of figures. Also, the probability of life long learning (United Nations Ssustainable Development Goal N° 4) and professional development shall be very low or shall be difficult as when learners advance in studies and research they also use quantitative data, or other specialized softwares that require input of numeric values. Finally, without interest in educational statistics, student teachers cannot make informed decisions or data driven decisions on pedagogic practices.

Objectives of the study

The main objective of this study is to assess the impact of instructional and assessment strategies on learners' engagement in Educational Statistics in teacher training colleges.

Specific objectives

The specific objectives of this study are;

- To expose the role of direct instruction for student engagement
- To demonstrate the impact of quiz on direct instruction to forster student engagement
- To examine the impact of portfolio on direct instruction for student engagement
- To illustrate the role of portfolio for student engagement.

- To expose the role of interactivity for student engagement
- To demonstrate the impact of quiz on interactivity to forster student engagement
- To examine the impact of portfolio on interactivity for student engagement
- To expose the role of quiz for student engagement

Research questions

The research questions for this study are ;

- How does direct instruction impact student engagement?
- What is the impact of quizzes on direct instruction in fostering student engagement?
- How does the use of portfolios impact student engagement in direct instruction?
- What role does portfolio play in promoting student engagement?
- What is the role of interactivity in promoting student engagement?
- What is the impact of quizzes on interactivity in fostering student engagement?
- How does the use of portfolios impact student engagement in interactivity?
- What is the role of quizzes in promoting student engagement?

Research Hypothesis

The null hypothesis for this study are ;

- There is no statistically significant relationship between Direct Instruction and student engagement
- Quiz mediation on Direct Instruction has no statistically significant relationship on student engagement.
- Portfolio mediation on Direct Instruction has no statistically significant relationship on student engagement
- Portfolio has no statistically significant impact on student engagement.
- Interactivity has no statistically significant relationship on student engagement?
- Quiz mediation on Interactivity has no statistically significant impact on Student engagement.
- Portfolio mediation on Interactivity has no statistically significant impact on student engagement.

- Quiz has no statistically significant impact on student engagement.

Delimitation of the study

This study shall focus shall be conducted in two teacher‟s training colleges in the Mfoundi division. One of the institutions shall be public and the other one, a private institution. The above mentioned institutions are Government Bilingual Teacher Training College (GBTTC), Nlongkak, and Bilingual Teachers‟ Training College (BTTC) Melen. Furthermore, the study shall consist only of final year student teachers which are BEPC 3, Probatoire 2, BACC classes, Ordinary level 2 and advanced level classes.

Significance of the study

A study on the effects of instructional and assessment strategies on student teacher engagement in educational statistics is significant for several reasons. First, it can provide insights into the most effective methods for teaching and assessing statistical concepts, which can help educators improve student outcomes. Second, it can help identify strategies that promote pupil engagement and motivation, which are crucial for pupils‟ success. Furthermore, this study invites student teachers to develop love for educational statistics, as it is a life long course, guarantees professional and carreer development and also, they shall not have fear of teaching higher classes in the primary school or classes dealing with figures. In addition to that, this research is to serve as a reminding guide to instructors of educational statistics for the necessity to develop effective and efficient instructional and assessment strategies so as to awaken engagement of learners of the discipline. Lastly, this study is to serve the educational community as a whole on possible instructional and assessment strategies in order to guarantee learners‟ engagement in educational statistics. Overall, studies on the effects of instructional and assessment strategies on learner engagement in educational statistics are important for improving teaching practices and promoting student success. By identifying effective strategies for promoting engagement and motivation, educators can help students develop a deeper understanding of statistical concepts and achieve full potential.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter focuses on the conceptual framework, the theoritical framework, empirical framework ; the summary of related literature.

Conceptual Framework

According to Spatz (2013), teaching educational statistics is important because statistics is a fundamental tool for understanding and interpreting data in many fields. Students who are proficient in statistics have the skills necessary to analyze and interpret data, make informed decisions, and communicate their findings effectively. Furthermore, i will explore why and how to teach educational statistics, as well as instructional and evaluation strategies. According to the American Statistical Association (ASA), statistics is essential for informed decision making in many fields, including healthcare, education, finance, and public policy. Students who are proficient in statistics have a competitive advantage in the job market and are better prepared for graduate level work in fields such as social sciences, business, and engineering.

There are several methods that can be used to teach educational statistics, as it allows teachers to assess student understanding and adjust their teaching methods accordingly (Chihara & Hesterberg 2011). Further, Hogg & al, (2018), state that traditional forms of evaluation, such as exams and quizzes, can be used to assess students‟ knowledge of statistical concepts and their ability to apply them in real world situations. However, other forms of evaluation, such as portfolios and projects can provide a more comprehensive assessment of students‟ learning , growth and engagement. In summary, teaching educational statistics is important for preparing student teachers for the teaching field and graduate level work, as well as for informed decision making in many other fields. There are several methods that can be used to teach educational statistics, including lectures, interactive activities, case studies, and computer simulations. Evaluation is an important aspect of teaching educational statistics, and traditional forms of assessment, such as quizzes, portfolios and projects, can be used to maintain or attain student teacher engagement in the subject.

Student Engagement

Engagement in teaching and learning refers to the level of interest and involvement that students have in the learning process. Engagement is important because it can influence student motivation, retention, and academic achievement. Skinner et al. (2009), define student engagement as "the degree to which students actively participate in academic activities in the classroom, are emotionally invested in those activities, and perceive themselves to be competent in the academic domain" (p. 494). They identify two types of engagement: behavioral engagement (participation in academic activities) and emotional engagement (positive feelings toward academic activities). Mark (2000) defines student engagement as investment or commitment. Bridges, & Hayet (2007) view engagement as participation, while Reschly & Christenson (2012) see engagement as an effortful involvement in learning. Learners‟ engagement is a compound wor as researchers view it from several angles. Some researchers term it as student engagement, academic engagement, or school engagement. However, studies portray that learner‟s engagement is used in and out of school settings meanwhile student engagement is purely academic settings. In this study, i use the term student teacher‟s engagement.

Kuh & al. (2010), define student engagement as "the amount of time and effort students put into their studies and other educationally purposeful activities" (p. 13). They identify two types of engagement: academic engagement (time and effort put into academic activities) and social engagement (involvement in extracurricular activities and interactions with peers and faculty). Fredricks et al. (2004), define student engagement as "the extent to which students are motivated to participate in academic activities, feel a sense of belonging and connection to their school community, and value learning" (p. 60). They identify three types of engagement: behavioral engagement (participation in academic activities), emotional engagement (positive feelings toward school and learning), and cognitive engagement (effortful thinking and learning).

Student teachers‟ engagement consists of them taking their studies into their own hands to guarantee their academic performance. This study focuses on engegement in Educational Statistics. This implies that, the student teachers have to develop strategies, in collaration with their peers, and in co-operation with the the facilitator to develop engagement in Educational Statistics.

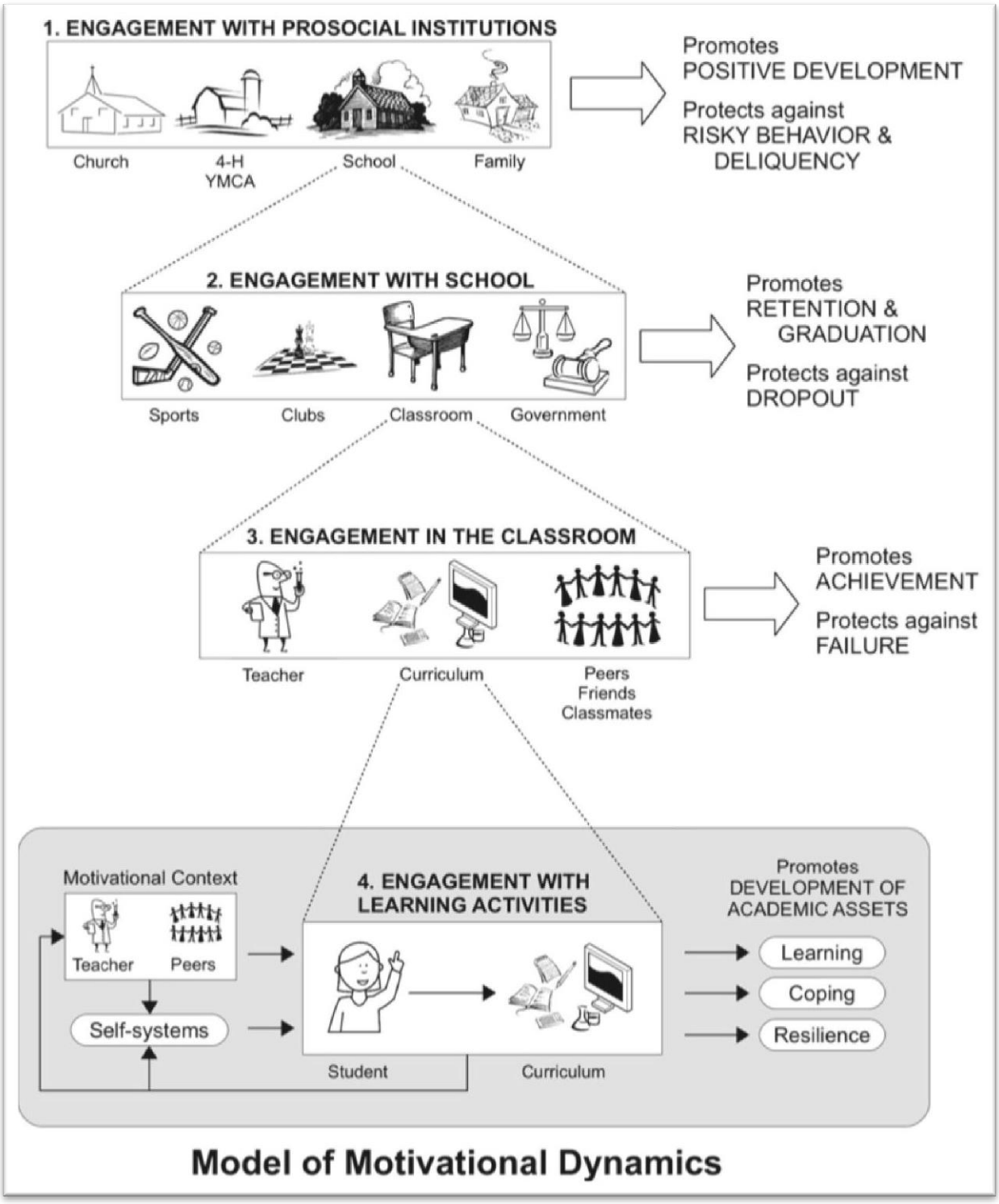
There are 3 types of engagement, which are ;

- Behavioral engagement
- Emotional engagement
- Cognitive engagement

Behavioral engagement refers to the extent to which students participate in class activities and follow classroom rules. Behavioral engagement is important because it creates a positive classroom environment and helps students stay on task. Emotional engagement is the extent to which students feel invested in their learning and are motivated to succeed. Emotional engagement is important because it promotes a sense of ownership and responsibility for learning. Cognitive engagement refers to the extent to which students actively process and apply new information. Cognitive engagement is important because it promotes critical thinking and deep learning.

Engagement is important for promoting student learning and academic success. According to the National Center for Education Statistics (NCES), engaged students are more likely to attend school regularly, participate in extracurricular activities, and perform well academically. Engaged students are also more likely to develop positive relationships with teachers and peers, which can have a positive impact on their social and emotional development. Reeve, (2012) stated that engagement is also important for creating a positive classroom environment. When students are engaged, they are more likely to be respectful and supportive of their peers, and are more likely to contribute to classroom discussions and activities. Engaged classrooms are characterized by a sense of community and collaboration, which can promote academic success and personal growth. In summary, engagement in teaching and learning is important for promoting academic success, social and emotional development, and a positive classroom environment. There are several types of engagement, each with its own purpose and importance, including behavioral engagement, emotional engagement, and cognitive engagement. By promoting engagement in the classroom, teachers can create a supportive and stimilating learning environment that fosters student growth and achievement. Skinner & Pitzer (2012) developed a multilvel perspective of engagement. This is shown on the figure below ;

Fig 1 ; model of motivational dynamics (Skiner & Pitzer, 2012)



My interest for this study is at the fourth level of student engagement. It focuses on engagement with learning activities, to promote the development of academic assets such as learning, coping and resilience, particularly in Educational Statistics. Here, the

teacher is simply a facilitator in the teaching-learning process, as the teachers‟ training colleges in Cameroon use the Competence Based Approach.

Instructional Strategies

According to Gagne, Briggs & Wager (1988), instructional strategy is a plan for supporting learners as they study for any performance objective. Instructional strategies broadly encompassess the methods, procedures and techniques the teacher uses to present the subject matter to the students, and bring about the desired outcomes. Instructional startegies are derived from a number of sources which include ; the objectives of the lesson, the subject matter, the pupil, the community, anf the teacher. Instructional strategies for this research are direct instruction and interactivity. According to Hunter (1992), instructional strategies are based on the idea that effective teaching involves a set of techniques that can be learned and applied systematically. He identifies several types of strategies, including direct instruction (e.g., lectures), guided practice (e.g., modeling), independent practice (e.g., homework), corrective feedback (e.g., error correction), and review (e.g., summarizing). These strategies are designed to promote mastery learning and are based on the principles of behaviorism and cognitive psychology.

Gagn et al. (1 2), say that instructional strategies are designed to promote learning in different domains and are based on the idea that different types of learning require different types of instruction. They propose a model of instructional design that includes several types of strategies: verbal information strategies (e.g., lectures), intellectual skills strategies (e.g., problem-solving), cognitive strategy strategies (e.g., metacognition), attitude strategies (e.g., motivational appeals), and motor skills strategies (e.g., demonstration). Furthermore, instructional strategies can be considered as approaches and methods that educators use to facilitate student learning. They encompass a wide range of techniques and activities designed to engage students, promote understanding, and enhance the learning experience. Major types of instructional strategies are ;

- Cooperative learning
- Problem based learning
- Direct instruction
- Inquiry based learning
- Differentiated instruction

According to Johnson et al., (2014), cooperative learning involves students working together in small groups to achieve shared learning goals. Cooperative learning promotes active participation, collaboration, and the development of social skills. Furthermore, they say cooperative learning has been shown to enhance student achievement and improve interpersonal relationships. Problem based learning presents students with real world problems or scenarios to solve, encouraging critical thinking, problem solving skills, and deep understanding of the subject matter. Problem based learning enhances student engagement , motivation, and knowledge retention, (Hmelo-silver, 2004).

Engelman & Carnine (1982) developed the theory of Direct Instruction. Direct instruction involves explicit and structured teaching, with clear learning objectives and teacher guided activities. It aims to provide students with systematic instruction and immediate feedback. Direct instruction has been associated with significant gains in student engagement and achievement. Inquiry based learning promotes student exploration and discovery through asking questions, investigating problems, and conducting research. It fosters critical thinking, problem solving skills, and a deeper understanding of concepts. Inquiry based learning enhances student engagement and motivation, (Klemm, 2014). Tomlinson (2014) stipulates that differentiated instruction involves tailoring instruction to meet the individual needs, learning styles, and interests of students. It recognizes that students have diverse strengths and preferences, and aims to provide multiple pathways for learning. However, differentiated instruction can improve student engagement, motivation, and achievement.

These instructional strategies offer diverse approaches to cater to the needs of students, promote engagement, and enhance learning outcomes. Implementing a variety of instructional strategies can help create a dynamic and effective learning environment.The instructional strategies chosen for this study, that are investigated in teaching educational statistics are Direct instruction and interactivity.

Direct instruction

Rosenshine (2012), defines direct instruction as "a structured, teacher-led approach to teaching that is focused on clear and concise explanations of new material, guided practice opportunities, and immediate feedback" (p. 13). He identifies three types of direct instruction: explicit instruction (clear and concise explanation of new material), guided practice (teacher-led practice opportunities), and independent practice (student-led

practice opportunities). According to Archer & Hughes (2011), direct instruction is "a systematic and explicit approach to teaching that involves breaking down complex skills or concepts into smaller, more manageable parts and providing clear, s tep-by-step instruction" (p. 3). Gersten et al. (2009), define direct instruction as "a highly structured approach to teaching that involves breaking down complex skills or concepts into smaller, more manageable parts and providing clear, step-by-step instruction" (p. 22). They identify three types of direct instruction : explicit instruction (clear and concise explanation of new material), guided practice (teacher-led practice opportunities), and corrective feedback (immediate feedback on student performance).

Direct instruction was developed by Becker & Engelman in 1977. Direct instruction is based on the principle of precision teaching. Rosenshine (2012) described direct teaching in the following ways ;

- Goals are clear to students
- Time allocated for instruction is sufficient and continuous
- Content covered is extensive
- Students‟ performance is monotored
- Questions are at low cognitive level, produce many correct responses
- Feedback to students is immediate and academically oriented
- The teacher controls the instructional goals
- The teacher chooses material appropriate for the students‟s level
- The teacher paces the teaching
- Interaction is structured but not authoritarian

Direct instruction is a teaching method that involves a structured and teacher led approach to delivering content to students. It is a highly effective instructional strategy that has been used in classrooms for decades. However, like any other teaching method, direct instruction has is most convenient in the following points ;

- Rosenshine, B. (2012) stipulates that direct instruction has clear learning objectives ; Direct instruction provides clear learning objectives that help students understand what they are expected to learn. This helps students stay focused on the task at hand and ensures that they are on track to meet the learning goals.
- Active learning ; Direct instruction encourages active learning, (Hattie, J. 2009). as students are required to participate in the learning process by

answering questions and engaging in discussions. This helps students retain information better and enhances their critical thinking skills.

- Direct instruction is time efficient (Slavin, R.E. 2014). Direct instruction is a time efficient teaching method, as it allows teachers to cover a large amount of material in a short amount of time. This is particularly useful in situations where there is limited time available for instruction.
- Consistent delivery. Direct instruction provides consistent delivery of content (Marzano, R.J. 2007), which helps ensure that all students receive the same information. This is important for maintaining equity in the classroom and ensuring that all students have an equal opportunity to learn.

Nonetheless, direct instruction should be implemented with much care, as seen in the following points ;

- Direct instruction limits student autonomy. It is a highly structured teaching method that does not allow for much student input or creativity. This can lead to disengagement and a lack of motivation among some students. Much care should be taken by instructors, in order to keep learners working.
- Direct instruction can encourage passive learning, as students are required to listen to the teacher and take notes rather than actively engage with the material. This can lead to a lack of retention and understanding of the material. Instructors have to maintain an atsmosphere of active participation in the classroom.
- Direct instruction is a highly structured teaching method that does not allow for much flexibility in terms of pacing or content. This can be problematic in situations where students have different learning needs or when unexpected events occur. Instructors have to make way for flexible teaching and learning.
- Direct instruction is a teacher centered teaching method that places a lot of emphasis on the teacher‟s role in delivering content. This can lead to a lack of student engagement and participation in the learning process. The instructor has to take this into consideration and enlarge the teaching scope to include active participation of learners.

As such, an instructor of educational statistics should consider all the above mentioned points, positive and negative, follow the above mentioned procedures to induce engagement of student teachers in Educational Statistics.

Implications of Direct Instruction in the teaching-learning process

Direct instruction is a teaching approach that involves explicit and systematic instruction , structured lesson plans, and teacher-led activities (Rosenshine 2009). When applied to the teaching of Educational Statistics, Direct Instruction can have several implications for the teaching and learning process. Here are some key implications:

- Clarity and Focus : Direct instruction provides a clear and structured framework for teaching Educational statistics. It helps to break down complex statistical concepts into manageable components, ensuring that students grasp the essential ideas and procedures.
- Teacher Guidance : In Direct Instruction, the teacher plays a central role in guiding students through the learning process. The teacher provides explicit explanations, models problem-solving strategies, and offers immediate feedback. This guidance is crucial in helping students develop a solid foundation in statistical concepts and skills.
- Active Engagement : While Direct Instruction involves teacher-led instruction, it also emphasizes active student engagement. Students participate in guided practice, discussions, and activities that allow them to apply statistical concepts and analyze real-world data. This hands-on engagement promotes a deeper understanding of statistical concepts.
- Mastery Learning : Direct Instruction supports a mastery-based approach, where students progress at their own pace and demonstrate mastery of one concept before moving on to the next. This personalized learning approach ensures that students have a solid understanding of each statistical concept before advancing to more complex topics.
- Effective Use of Examples : DIrect instruction emphasizes the use of concrete and relevant examples to illustrate statistical concepts. This helps students make connections between abstract statistical concepts and real-life applications, enhancing their comprehension and retention.
- Building Confidence : Direct Instruction provides a supportive and structured learning environment that helps students build confidence in

their statistical abilities. The clear instructions, practice opportunities, and feedback provided in direct instruction foster a sense of accomplishment and encourage students to take on more challenging statistical problems.

- Assessment and Monitoring : Direct Instruction incorporates ongoing assessment and monitoring to track students' progress and identify areas of improvement. Regular formative assessments help teachers identify misconceptions or difficulties students may have and make timely instructional adjustments to address those challenges.

These implications highlight the effectiveness of Direct Instruction in teaching Educational Statistics. By providing clarity, teacher guidance, active engagement, and personalized learning experiences, Direct Instruction can enhance student teachers understanding and application of statistical concepts, hence goes a strong way to induce engagement in the discipline.

Interactivity

Interactivity refers to the student control and level of participation in the classroom (Kiousis, 2002). Cogmin (2016) says Classroom interaction is the interaction between teacher and students and among students. Furthermore, Moore (1989) describes identifies three types of interaction, which are ;

- Interaction with learning material. This consists of the usage of print, audio, and visual tools in the teaching learning process.
- Interaction between students and teacher. This is the most common form of interaction.
- Student-student interaction. This can take the form of discussion, group work.

Jonassen & Land (2009), define interactivity as "the extent to which learners can interact with the content, the teacher, and other learners in the learning environment" (p. 38). They identify three types of interactivity: learner-content interaction (interacting with the learning materials), learner-instructor interaction (interacting with the teacher or facilitator), and learner-learner interaction (interacting with other learners).

Moving on, there are also levels of interactivity, which are low, medium and high. Gebhard (1998) states five factors that helps make the classroom interactive.

They are ;

- Reduce the central position of the teacher.
- Appreciate the uniqueness if individuals.
- Provide chances for students to express themselves in meaningful ways.
- Give opportunities for students to negotiate meaning with each other and the teacher.
- Give srudents choices as to what they want to say, to whom they want to say it, and how they want to say it.

Mayer (2009) defines interactivity as "the degree to which learners can actively participate in the learning process, rather than passively receiving information" (p. 22). He identifies three types of interactivity: cognitive interactivity (engaging learners' thinking processes), social interactivity (allowing learners to interact with others), and physical interactivity (allowing learners to manipulate objects or materials). Moreover, interactivity in teaching refers to the use of interactive and participatory methods of instruction that engage learners in active learning and encourage them to take an active role in the learning process. It involves the use of various techniques such as group work, discussions, debates, and problem solving exercises to promote engagement, critical thinking, and collaborative learning among students.

According to a study by Tversky, Morrison, and Betrancourt (2002), interactive teaching methods are more effective than traditional lectures in promoting student engagement and learning. The study found that interactive methods such as group discussions, problem solving exercises, and computer simulations were more effective in promoting student engagement and learning than traditional lectures. Another study by Mayer (2002) found that interactive multimedia presentations were more effective than traditional lectures in promoting student learning and retention of statistical concepts. The study found that students who received interactive multimedia presentations had higher test scores and were able to apply statistical concepts more effectively than those who received traditional lectures.

Kirschner et al (2006), define interactivity as "the extent to which learners are actively engaged in the learning process through interactions with the content, other learners, and the teacher" (p. 77). They Identify two types of interactivity: interactive dialogue (learner-teacher or learner-peer exchanges) and interactive feedback (immediate feedback on performance or progress). The purpose of interactivity in teaching is to enhance learning outcomes by promoting active learning and student engagement. When students are actively engaged in the learning process, they are more likely to

understand and retain information, apply it in real life situations, and develop critical thinking and problem solving skills. Interactivity is particularly important in educational statistics, as statistics can be a challenging subject for many students. The use of interactive teaching methods can help students overcome their fear of Statistics and develop a better understanding of the subject. Interactive methods such as group discussions, problem solving exercises, and computer simulations have been found to be effective in promoting student engagement and learning in Statistics courses. In conclusion, interactivity in teaching is an essential component of effective instruction in educational statistics. It promotes active learning, engagement, and critical thinking among students, and can enhance learning outcomes. The use of interactive teaching methods such as group work, discussions and computer simulations has been found effective in promoting student engagement and learning in educational statistics.

Implications of Interactivity in the teaching-learning process

Interactivity is an instructional approach that emphasizes active participation, collaboration, and engagement of students in the learning process (Hake 1998). When applied to the teaching of Educational Statistics, Interactivity can have several implications for the teaching and learning experience. They include ;

- Active Engagement : Interactivity promotes active engagement among students, encouraging them to take an active role in their learning (Cook & al 2013). Through interactive activities, discussions, and problem-solving exercises, students become actively involved in exploring statistical concepts, analyzing data, and making connections to real-world contexts (Mayer 2009).
- Constructing Meaning : Interactivity allows students to construct meaning by engaging in hands-on experiences with statistical concepts. Students have the opportunity to manipulate data, visualize statistical relationships, and draw conclusions based on their observations and analyses. This active involvement in constructing knowledge enhances understanding and retention of statistical concepts.
- Collaboration and Peer Learning : Interactivity fosters collaboration and peer learning opportunities. Students can work in pairs or groups to solve statistical problems, analyze data sets, and discuss their findings. Collaborative learning not only promotes a deeper understanding of

statistics but also enhances critical thinking, communication, and teamwork skills.

- Personalized Learning : Interactivity supports personalized learning experiences. Students can navigate through statistical content at their own pace, explore additional resources, and receive immediate feedback. This personalized approach caters to individual learning needs and promotes a deeper understanding of statistical concepts.
- Motivation and Engagement : Interactivity can enhance students' motivation and engagement in learning statistics. By incorporating interactive elements such as gamified activities, simulations, and interactive technology tools, students are more likely to stay engaged, motivated, and enthusiastic about learning statistical concepts.
- Real-World Application : Interactivity allows students to apply statistical concepts to real-world scenarios. By working with authentic data sets and engaging in simulations or case studies, students can understand the relevance and practical applications of statistical knowledge in various fields.
- Assessment and Feedback : Interactivity enables ongoing assessment and timely feedback. Through interactive assessments, teachers can monitor students' progress, identify misconceptions, and provide immediate feedback. This formative assessment approach helps student teachers track their own learning and make necessary adjustments to improve their understanding of statistics.

These implications highlight the effectiveness of interactivity in teaching Educational Statistics. By promoting active engagement, collaboration, personalized learning, and real-world application, interactivity can enhance student teachers understanding, motivation, engagement and application of statistical concepts.

Assessment strategies

Popham (2008), defines assessment strategies as "the systematic processes used to gather evidence of student learning and achievement." He categorizes assessment into two types: formative assessment, which provides feedback to improve learning during instruction, and summative assessment, which evaluates student achievement at the end of a unit or course. Assessment strategies in education refer to the methods and tools

that educators use to evaluate student learning and progress. Effective assessment strategies are critical for promoting student success and identifying areas for improvement. Assessment strategies are methods teachers use to evaluate their students‟ progress and plan the content in their courses. Gaytan and McEwen (2007) perceive that most effective assessments include frequent, formative assignments, as well as projects, portfolios, peer evaluations, and self assessments. Embedding formative assessment into lessons can assist instructors in evaluating student progress and inform the delivery and design of other instructional plans and assessments (Robles and Braathen 2002). Frequent communication between facilitator and student teachers shall keep them engaged in the discipline.

Moreover, Nitko, A. J., & Brookhart, S. M. (2014) : define assessment strategies as "the various ways in which assessments are designed and implemented to provide information about student learning." They distinguish between traditional assessments (e.g., quizzes, exams) and alternative assessments (e.g., projects, portfolios) and highlight the importance of using multiple assessment methods to capture a comprehensive view of student performance. Generally, there are 3 broad types of assessement strategies in education. They are ;

- Formative assessment
- Summative assessment
- Performance assessment.

Formative assessment is used to monitor student learning and provide ongoing feedback to help students improve. Formative assessments can take many forms, such as quizzes, and classroom discussions. Summative assessment is used to evalaute student learning at the end of a unit or course. Examples of summative assessments include exams, essays, and projects. Performance assessment measures learning through the demonstration of skills and knowledge. Examples of performance assessments include portfolios, oral presentations, and laboratory experiments.

Brookhart (2013) stated that assessment strategies help teachers evalluate student progress and identify areas where students need additional support or instruction. By using formative assessments, teachers can provide ongoing feedback to students, which can help them improve their understanding of the material. Assessment strategies are also important for promoting student motivation and engagement. (Black, P., & Wailliam, D. 1998). When students understand how their learning will be assessed,

they are more likely to be invested in their learning and take an active role in the process. Darling-Hammond & al, (2006) stated that assessments promote equity and ensures that all students have the opportunity to succeed. By using a variety of assessment strategies, teachers can evaluate student learning in a way that is fair and unbiased. In summary, assessment strategies are critical for promoting student learning, engagement and success. By using a variety of assessment strategies, educators can evaluate student progress, providing ongoing feedback, and promote equity in the classroom. Effective assessment strategies can help student teachers develop a deeper understanding of the concepts, take an active role in their learning, and achieve their full potential.

Quiz

Etymologically, quiz can be defined as a contest in which learners demonstrate their understanding of a concept by answering questions. The word « quiz » first appeared in 1867, according to the Oxford English Dictionary, when it applied specifically to a set of questions used to evaluate a persons' knowledge in an academic context. Johnson, L., Adams, S., & Cummins, M. (2012), describe quizzes as "short tests or assessments that help to reinforce learning and provide feedback to students." They emphasize the formative nature of quizzes, which allow instructors to monitor student progress and identify areas for improvement. Quizzes can be used as a learning tool to engage students actively in the learning process.

In addition to that, Roediger & Butler, (2011), define quizzes as "testing activities that require learners to produce information or solve problems from memory." They discuss two types of quizzes : retrieval quizzes, which involve recalling information from memory, and elaborative quizzes, which require learners to use retrieved information to make connections and draw inferences. Both types of quizzes have been shown to promote learning and retention. Furthermore, Kuo et al. (2014), define a quiz as "a form of assessment that typically consists of a series of questions or tasks that are designed to test the knowledge, skills, or abilities of learners" (p. 2). They identify several types of quizzes, including multiple-choice quizzes, short-answer quizzes, true/false quizzes, and matching quizzes.

Quizzes are very much valuable in education. They can help serve the following objectives ;

- Help learners remain focus
- Brings in some fun in learning
- Help learners retain information
- Help identify gaps in knowledge
- Quizzes are less stressful
- Makes learners enthusiastic to learn
- Quizzes build confidence in learners
- Quizzes helps learners prepare for exams

In addition to that, a quiz in teaching is a form of assessment that involves asking students a series of questions to test their knowledge and understanding of a particular topic or subject. Quizzes can be used to assess students‟ comprehension of material covered in class, to reinforce learning, and to identify areas where students may need additional help or review. The purpose of quizzes in teaching is to provide feedback to both teachers and students on the effectiveness of the teaching and learning process. For teachers, quizzes can help assess the effectiveness of their teaching methods and identify areas where students may need additional support. For students, quizzes can help reinforce their learning and identify areas where they may need to review material. In educational statistics, quizzes can be particularly useful in assessing students‟ understanding of statistical concepts and their ability to apply them in real life situations. Quizzes can be used to assess students‟ understanding of statistical terms, concepts, and formulas, as well as their ability to interpret and analyze data. According to a study by Wainer & Thissen (1993), quizzes can be an effective tool for assessing students' understanding of statistical concepts. The study found that quizzes can provide a more accurate assessment of students' knowledge and understanding of statistical concepts in real world situations and to identify areas where they may need additional help or review.

Moving on, study by McFarland & Miller (1994) found that frequent, low stakes quizzes can be an effective tool for promoting student learning and retention of statistical concepts. The study found that students who received frequent quizzes had higher test scores and were able to apply statistical concepts more effectively than those who did not receive quizzes. Overall, quizzes in teaching can be effective tool for assessing students‟ understanding of statistical concepts and promoting learning and retention. Quizzes can be used to assess students‟ comprehension of material covered in class, to reinforce learning, and to identify areas where students may need

additional help or review. The use of quizzes in educational statistics can help identify areas where students may need additional support and promote the development of critical thinking and problem solving skills.

Implications of quizzes in the teaching-learning process

Quizzes are a widely used assessment tool in the teaching and learning process (Roediger 2011), and they hold significant implications for teaching Educational Statistics. Here are some key implications of incorporating quizzes in the teaching of Educational Statistics :

- Assessing Understanding : Quizzes provide an opportunity to assess student teachers‟ understanding of statistical concepts and their ability to apply them. By designing well-structured quiz questions that cover key topics and require problem-solving skills, educators can gauge students' comprehension of statistical principles and identify areas that need further reinforcement.
- Formative Assessment : Quizzes serve as formative assessments that offer valuable feedback to both students and instructors. By administering quizzes throughout the learning process, instructors can identify students' misconceptions, clarify misunderstandings, and provide timely feedback to guide their learning. This formative assessment approach helps students track their progress and make necessary adjustments to improve their understanding of Statistics.
- Reinforcement of Concepts : Quizzes can be used as a tool to reinforce and consolidate statistical concepts. By including quiz questions that require students to recall and apply statistical formulas, interpret data, and analyze results, quizzes help reinforce the material covered in class and encourage students to review and consolidate their learning.
- Retrieval Practice : Quizzes facilitate retrieval practice, which is the act of recalling information from memory. Research has shown that retrieval practice enhances long-term retention of information and promotes deeper learning. By regularly incorporating quizzes that require student teachers to retrieve statistical concepts from memory, educators can help students strengthen their knowledge and retention of statistical principles.
- Active Learning : Quizzes promote active learning by engaging student teachers in the learning process. By requiring students to actively recall, analyze, and apply statistical concepts, quizzes encourage students to become active

participants in their learning. This active engagement enhances understanding, critical thinking, and problem-solving skills.

- Motivation and Engagement : Quizzes can enhance students' motivation and engagement in learning Statistics. By providing opportunities for students to test their knowledge and track their progress, quizzes create a sense of achievement and motivation. Moreover, the competitive nature of quizzes can foster a positive learning environment and encourage students to actively participate in the learning of Statistics.
- Self-Assessment : Quizzes allow students to assess their own learning and identify areas for improvement. By providing immediate feedback and explanations for correct answers, quizzes enable students to self-assess their understanding of statistical concepts. This self-assessment empowers students to take ownership of their learning and make informed decisions about their study strategies.

These implications highlight the effectiveness of quizzes in teaching educational statistics. By assessing understanding, providing formative feedback, reinforcing concepts, promoting retrieval practice, facilitating active learning, enhancing motivation, and enabling self-assessment, quizzes can significantly contribute to the teaching and learning experience in Educational Statistics

Portfolio

Portfolio is a very common form of alternative assessment. According to Ornstein & Hunkins (2012), Portfolio is a sampling of student work overtime. The main uses of Portfolio are ;

- Provides a record of student teachers‟ degree of effort and participation in learning
- Provides evidence of student teachers‟ understanding, skills and behavioral dispositions.

Batson & al (2012), define a portfolio as "a purposeful collection of student work that tells the story of a student's efforts, progress, or achievement in a given area." They emphasize that portfolios provide evidence of learning and growth over time and can include a variety of artifacts, such as essays, projects, reflections, and multimedia presentations. Portfolios can be used for assessment, reflection, and showcasing student accomplishments. Cambridge English Language Assessment (2018) defines a portfolio

as "a collection of documents or other materials that demonstrate a person's skills, abilities, and accomplishments in a particular area" (para. 1). They identify several types of portfolios, including learning portfolios (showing progress and development), assessment portfolios (demonstrating achievement of specific learning outcomes), and career portfolios (highlighting skills and experiences for employment). Furthermore, a portfolio in teaching refers to a collection of students‟ work that demonstrates their learning, progress, and achievements over time. It can include a variety of materials such as written assignments, projects, presentations, and reflections. Portfolios can be used for formative or summative assessment and can provide valuable feedback to both teachers and students on the learning process.

Portfolios in education can take different forms, each serving a specific purpose. The major forms of portfolio are ;

- Assessment portfolio
- Learning portfolio
- Career portfolio.

According to Paulson, Paulson, & Meyer, (1991), assessment portfolios showcase a student‟s work over a period of time and provide evidence of their learning process and achievement. The purpose of assessment portfolio iss to demonstrate mastery of specific learning goals or standards. The assessment portfolios allow students to actively engage in the assessment process, reflect on their learning, and take ownership of their progress. They provide a comprehensive view of students‟ skills and knowledge development, going beyond traditional tests and exams. Moving on, Boud, D. (2000) affirms that learning portfolios focus on the process of learning and development. They document students‟ reflections, goal setting, and progress over time. The purpose of learning portfolio is to encourage metacognition, self assessment, and self regulated learning.

Furthermore, learning portfolios promote students‟ ability to reflect on their learning experiences, set goals, and make connections between different areas of knowledge. They support the development of lifelong learning skills and metacognitive strategies. Lastly, career portfolios refer to students‟ skills, accomplishments, and experiences relevant to their career aspirations. The purpose is to support career exploration, job applications, and professional development, Blair & Maki (2010). Career portfolios provide a platform for students to demonstrate their competences and highlight their

strengths to potential employers or admission committees. They help students align their learning experiences with their career goals.

In addition to what earlier written, portfolios in teaching is to provide a comprehensive and ongoing record of students‟ learning and growth. Portfolios can be used to assess students‟ knowledge, skills, and understanding of a particular subject or topic over time. They can also be used to promote self reflection and self assessment, as students can review their work and identify areas where they need to improve or areas where they have excelled. As such, they keep focus on the teaching-learning process. In educational statistics, portfolios can be particularly useful in assessing students‟ ability to apply statistical concepts in real world situations. Portfolios can include projects or case studies where students have applied statistical methods to analyze and interpret data. Portfolios can also include reflections on the learning process and how statistical concepts can be applied in various fields.

According to a study by Wolf, Herman, and Dietel (2010), portfolios can be effective tool for promoting student learning and assessment in statistics education. The study found that portfolios can be used to assess students‟ ability to apply statistical concepts in real world situations and to promote the development of critical thinking and problem solving skills. In the light, another study by Doerr and Zangor (2006) found that portfolios can be an effective tool for promoting students‟ understanding of statistical concepts and their ability to apply them in real life situations. The study found that portfolios can provide a more comprehensive assessment of students‟ learning than traditional assessments such as exams or quizzes. In summary, portfolios in teaching can be an effective tool for promoting student learning and assessment, particularly in educational statistics. Portfolios can provide a comprehensive and ongoing record of students‟ learning and growth, and can be used to assess their ability to apply statistical concepts in real world situations. The use of portfolios in statistics education can promote the development of critical thinking and problem solving skills and provide valuable feedback to both teachers and students on the learning process.

Implications of Portfolio in the teaching-learning process

Portfolios are a valuable assessment tool in the teaching and learning process (Barrett 2012), and they have significant implications for teaching Educational Statistics. Here

are some key implications of incorporating portfolios in the teaching of Educational Statistics :

- Holistic Assessment : Portfolios allow for a holistic assessment of student teachers learning in Educational Statistics. Unlike traditional assessments that focus solely on test performance, portfolios provide a comprehensive view of student teachers progress and achievements over time. They showcase students' understanding of statistical concepts, ability to apply statistical methods, and critical thinking skills through a collection of artifacts, such as written work, projects, and data analyses.
- Authentic Assessment : Portfolios promote authentic assessment by reflecting real-world applications of Educational Statistics. Through the inclusion of authentic tasks, such as analyzing real data sets, interpreting statistical findings, and presenting statistical information, portfolios enable students to demonstrate their proficiency in applying statistical knowledge to practical situations. This authenticity enhances the relevance and practicality of the learning experience.
- Reflection and Metacognition : Portfolios encourage students to engage in reflective practices and metacognition. By requiring students to document their learning process, reflect on their strengths and weaknesses, and set goals for improvement, portfolios foster metacognitive skills that are crucial for deep learning and self-directed learning. Students gain insights into their learning strategies, identify areas for growth, and become more proactive in their learning journey.
- Long-Term Learning and Retention : Portfolios support long-term learning and retention of statistical concepts. As students compile and organize their work over time, portfolios serve as a repository of their learning experiences. Regular engagement with portfolios prompts students to revisit previously covered topics, reinforcing their understanding and promoting long-term retention of statistical knowledge.
- Individualized Learning : Portfolios allow for individualized learning experiences tailored to students' needs and interests. Students have the flexibility to select artifacts that demonstrate their strengths and areas of interest within Educational Statistics. This personalization fosters a sense of ownership and motivation, as students engage in self-directed learning and pursue topics that resonate with them.

- Communication and Presentation Skills : Portfolios enhance students' communication and presentation skills. Through the selection and organization of artifacts, students develop skills in effectively conveying statistical concepts and findings to different audiences. Portfolios provide opportunities for students to articulate their understanding in written and visual formats, fostering effective communication skills that are essential in various professional contexts.
- Assessment for Learning : Portfolios serve as a formative assessment tool, providing ongoing feedback and opportunities for improvement. By regularly reviewing and reflecting on their portfolio artifacts, students receive feedback from instructors and peers, enabling them to identify areas for growth and take proactive steps to enhance their understanding of Educational Statistics.

These implications highlight the effectiveness of portfolios in teaching educational statistics. By facilitating holistic and authentic assessment, promoting reflection and metacognition, supporting long-term learning, individualizing the learning experience, developing communication skills, and providing ongoing formative assessment, portfolios can significantly enhance the teaching and learning process in Educational Statistics.

Theoritical Framework

Engelmann's Theory of Instruction

Engelmann's theory of direct instruction is a teaching approach that emphasizes teacher led, structured instruction that is carefully sequenced and delivered at an appropriate pace. The goal of direct instruction is to maximize learning outcomes by providing students with clear and concise information and guidance, so they can acquire and apply new knowledge and skills effectively. This theory has been influential in the field of education for several decades, and has been supported by a range of research studies. Engelman and his colleagues developed the direct instruction approach in the 1960s and 1970s, based on principles of behavioral psychology and instructional design. They believed that effective teaching requires careful planning, clear communication, and frequent feedback to ensure that students learn what they need to know. Engelman argued that direct instruction is effective because it provides a structured and predictable learning environment that reduces confusion and frustration, and helps students to learn efficiently.

One of the key elements of direct instruction is the use of scripted lessons, in which teachers follow a precise script that outlines what to say and do at each step of the lesson. The script is designed to be clear and concise, and provides a framework for effective communication and instruction. The script also ensures that all students receive the same instruction, regardless of the teacher's individual style or approach. Engelmann with co-author Carnine developed their theory of instruction based on concepts, which are ;

- Science and logic
- Faultless communication
- Logical analysis
- Behavioral analysis

Science and logic entails that instruction has to be based on scientific analysis. As such, among instruction and learning, one factor has to be held constant, and the other be a variable. The learner therefore cannot be held constant, but instruction can be the constant. As such careful instruction enable differences in learning to be evaluated and measured. Specified and controlled instruction is fundamental in this theory.

Faultless communication entails that instruction is presented in such a way that all learners perceive it the same way. The instruction should be clean and clear, no vagueness, no ambiguity. As such, there will be no misunderstandings and misconceptions. Faultless communication enables the instructor to identify individual differences in learners. Logical analysis concerns the instruction. Its entails of checking whether an instruction is faultless, whether the instruction communicates the expected outcomes without interfering with learners‟ perception of the instruction. Behavioural analysis consists of learners‟ perceptions of the instruction. It deals with the learners‟ understanding of the instruction.

Moving on, Engelmann and Carnine developed four steps of the direct instruction theory ;

- « Design communications that are faultless using logical analysis of the stimuli, not a behavioral analysis of the learner.
- Predict that the learner will learn the concept conveyed by the faultless presentation. If the communication is logically flawless and if the learner has the capacity to respond to the logic of the presentation, the learner will learn the concept conveyed by the communication.

- Present the communication to the learner and observe whether the learner actually learns the intended concept or whether the learner has trouble. This information (derived from a behavioral analysis) shows the extent to which the learner does or does not possess the mechanisms necessary to respond to the faultless presentation of the concept.
- Design instruction for the unsuccessful learner that will modify the learner's capacity to respond to the faultless presentation. This instruction is not based on a logical analysis of the communication, but on a behavioral analysis of the learner

Direct instruction has been extensively researched and evaluated, and has been found to be effective in a range of settings and for a variety of students. A meta analysis by Cheung and Slavin (2013) found that direct instruction was one of the most effective teaching approaches for improving student outcomes, including academic achievement and retention. Another meta analysis by Rosenshine (2012) found that direct instruction was effective in improving student outcomes in a range of subject areas and for students at all levels of ability.

To conclude, Engelmann's theory of direct instruction is a teaching approach that emphasizes structured and sequenced instruction, clear communication, and frequent feedback. This approach has been supported by a range of research of research studies and has been found to be effective in improving student outcomes. Direct instruction has been influential in the field of education for several decades and continues to be an important approach for promoting student learning, engagement and achievement. This theory of direct instruction supports the variable « Direct instruction»

Implications of Engelmann's theory in the teaching-learning process

The theory of Direct Instruction, developed by Siegfried Engelmann, has profound educational implications for the teaching and learning process. This approach focuses on explicit teaching methods and systematic instruction to ensure effective learning outcomes. Here are some educational implications of Engelmann's theory of Direct Instruction :

- Clear Learning Objectives : Direct Instruction emphasizes the importance of setting clear learning objectives for each lesson. Engelmann states, "Objectives should be clear to the teacher and students alike"

(Engelmann, 2007). By clearly defining what students are expected to learn, educators can guide their instruction and provide targeted support to meet those objectives.

- Systematic Instruction : Direct Instruction promotes a systematic approach to teaching, ensuring that concepts are presented in a logical and sequential manner. This approach allows for efficient and effective learning. Engelmann emphasizes, "Skills and concepts must be presented in a prescribed sequence to optimize learning" (Engelmann, 1999). By following a structured sequence, educators can build a solid foundation of knowledge and skills.
- Explicit Instruction : Direct Instruction focuses on explicit instruction, where teachers provide clear explanations, demonstrations, and examples to ensure students understand new concepts and skills. Engelmann emphasizes, "Teachers need to be explicit about what is to be learned, making sure students understand the connections" (Engelmann, 1999). By making learning explicit, educators reduce ambiguity and facilitate students' understanding.
- Mastery Learning : Direct Instruction promotes mastery learning, where students are provided with ample opportunities to practice and demonstrate their understanding of concepts before moving on to new material. Engelmann states, "Mastery is a critical factor in maintaining student progress" (Engelmann, 2007). By ensuring mastery, educators promote a solid foundation of knowledge and enable students to build upon their successes.
- Active Engagement : Direct Instruction encourages active engagement of students in the learning process. It involves strategies such as choral responding, frequent student participation, and immediate feedback. Engelmann affirms, "Active student responding is a necessary component of instructional efficiency" (Engelmann, 2007). By actively engaging students, educators promote active learning and increase opportunities for meaningful practice.
- Differentiated Instruction : Direct Instruction supports differentiated instruction by providing explicit instruction tailored to students' individual needs. Engelmann emphasizes, "The teacher should assess students' skills

and adjust the instruction accordingly" (Engelmann, 1999). By understanding students' abilities and adjusting instruction accordingly, educators can provide appropriate support and challenge for each learner.

Vygotsky‟s theory of Social development (sociocultural theory)

This theory supports the variable « interactivity». Vygotsky's theory of social development, also known as sociocultural theory emphasizes the role of social interactions and cultural influences in cognitive development. According to Vygotsky, learning takes place through collaboration and interaction with more knowledgeable individuals within a cultural context. Furthermore, Vygotsky considered Social interaction as a factor that leads to cognitive development in children. He demonstrates the use of elementary mental functions, through the process of interactions to perform higher mental functions. The elementary mental functions here include ; Attention, Sensation, Perception and Memory. Interactivity now permits the young learner to perform higher functions of independent thinking and independent learning. As such, Vygotsky had 3 major principles, which are ;

- More Knowledgeable others (MKO)
- Zone of Proximal development (ZPD)
- Language.

More Knowledgeable Others (MKO)

This consists of a more knowledgeable person, or an individual with better understanding of an aspect helping another individual grap the concept. Here, I do not want to use the word learner, the more knowledgeable individual can be the instructor or facilitator, the more knowledgeable other can also be a classmate, a learner. Moving on, here work can be done individually or in small groups.

Zone of Proximal Development (ZPD)

zone of proximal development is that concept which lies between what a learner already knows, and what is out of reach of the learner. In this zone, if the learner is assisted or guided by the more knowledgeable other, the learner will be able to achieve greater. This is done through Scaffolding. Scaffolding can be defined as structured assistance or guidance that help someone build confidence and push their limits to develop new skills and accomplish tasks.

Language

Vygotsky argued that inner speech develops from external speech through a gradual process of Internalization, which means that thought itself develops through conversation. So, exchange between learners and instructors is very important. The purpose of Vygotsky's theory is to understand how social interactions and cultural factors influence cognitive development. It highlights the role of teachers, peers, and cultural tools in supporting a child's learning and cognitive growth. In this study, social interactions are under study as a source of motivation and engagement for student teachers. Vygotsky's theory is important because it recognizes the social and cultural aspects of learning, emphasizing the significance of collaboration, and scaffolding. However, Siegler, (1 6) argues that Vygotsky's theory lacks empirical evidence. That the theory is not adequately supported by empirical evidence and that more research is needed to establish its validity. This study will make an attempt to resolve that criticism.

Implications of Social Development theory in the teaching-learning process.

Vygotsky's theory of social development has profound educational implications for the teaching and learning process. This socio-cultural theory emphasizes the importance of social interactions, cultural context, and the role of more knowledgeable others in facilitating learning. Here are some educational implications of Vygotsky's theory of social development :

- Zone of Proximal Development (ZPD) : Vygotsky introduced the concept of the Zone of Proximal Development, which refers to the gap between a learner's current level of ability and their potential level of development with the assistance of a more knowledgeable other. This concept highlights the significance of scaffolding and guided instruction. As Vygotsky stated, "What a child can do in cooperation today, he can do alone tomorrow" (Vygotsky, 1978). This quote emphasizes the role of social interaction and guidance in promoting learning beyond individual capabilities.
- Social Interaction and Collaboration : According to Vygotsky, learning is a social process that occurs through interactions with others. Collaborative learning activities provide opportunities for students to engage in dialogue, negotiation, and cooperation, leading to enhanced learning outcomes. Vygotsky asserted, "Through others we become ourselves" (Vygotsky, 1978), highlighting

the transformative nature of social interaction in shaping an individual's cognitive development.

- Scaffolding and Assistance : Vygotsky emphasized the importance of providing appropriate levels of support and assistance to learners. Educators can provide scaffolding by breaking down complex tasks into manageable steps, offering prompts, and gradually reducing support as students gain competence. Vygotsky stated, "The only 'good' instruction is that which marches ahead of development and leads it" (Vygotsky, 1978). This affirmation underscores the need for instructional practices that challenge and guide learners in their cognitive development.
- Cultural Context and Tools : Vygotsky emphasized the influence of culture on learning and the use of cultural tools, such as language, symbols, and artifacts, in mediating cognitive processes. As Vygotsky stated, "Every function in the child's cultural development appears twice : first, on the social level, and later, on the individual level" (Vygotsky, 1978). This quote highlights the interplay between social and individual factors and the role of cultural tools in shaping cognitive development.
- Cooperative Learning and Peer Interaction : Vygotsky's theory supports the implementation of cooperative learning strategies that promote peer interaction and collaboration. Collaborative activities allow students to engage in shared problem-solving, discussion, and negotiation of meaning. Vygotsky affirmed, "Interaction... is the most fundamental source of learning" (Vygotsky, 1978), emphasizing the vital role of social interaction in the learning process.
- Cultural Mediation and Authentic Contexts : Vygotsky's theory underscores the importance of embedding learning experiences within authentic cultural contexts. Providing students with opportunities to engage in real-world tasks and authentic problem-solving situations allows for.

Trial and Error theory of learning

Trial and error is a fundamental method of problem solving characterized by repeated, varied attempts until desired results is attained. This theory was developed by Edward Thorndike. This theory is also referred to as connectionism, that proposes that learning occurs through a process of trial and error, where behaviors that lead to successful outcomes are strengthened, while behaviors that lead to unsuccessful outcomes are

weakened. This theory supports the variable « Quizzes», Which stipulates that the learners continuously attempt to solve problems, until they get the right solutions. Learning is based on the establishment of connections or associations between the stimuli and responses. Through repeated attempts, student teachers learn which responses are effective in achieving a desired outcome, and are more likely to repeat those behaviors. Thorndike developed 3 principles in his theory.

- Law of readiness
- Law of exercise
- Law of effect.

Law of readiness stipulates that for any learning to take place, the learner should be physically, morally, cognitively and psychologically fit to learn. The learner should be in good health and all conditions assembled for learning to take place. Law of exercise consists of the learner putting all efforts together in order to succeed at the problem solving. Here, the learner should carry out the tasks using the prescribed methodology. Law of effect is the outcome of the given exercise. If the outcome is positive, the learner is motivated to keep working , but when the outcome is negative, the learner should put in more effort, so that next time, he/she solves the problem easily.

Implications of Edward Thorndike „s theory in the teaching-learning process

Trial and error learning theory, also known as associative learning or operant conditioning, has educational implications for the teaching and learning process. This theory, often associated with the work of psychologists such as Thorndike and Skinner, suggests that learning occurs through repeated attempts and adjustments based on the consequences of those actions. Here are some educational implications of trial and error learning theory :

- Active Learning and Engagement : Trial and error learning theory promotes active learning and student engagement. By encouraging students to actively participate in problem-solving and experimentation, educators create opportunities for students to explore, analyze, and learn from their experiences. As Thorndike stated, "Active learning is powerful learning" (Thorndike, 1931), highlighting the effectiveness of hands-on engagement in the learning process.

- Reinforcement and Feedback : Trial and error learning theory emphasizes the importance of reinforcement and feedback in shaping behavior and learning. Providing timely and meaningful feedback helps students understand the consequences of their actions and guides them in making adjustments to improve their performance. Skinner noted, "The consequences of behavior determine the probability of its recurrence" (Skinner, 1953), emphasizing the role of reinforcement and feedback in the learning process.
- Problem-Solving and Critical Thinking Skills : Trial and error learning theory fosters problem-solving and critical thinking skills. By encouraging students to explore different strategies and approaches, make adjustments based on feedback, and persist in finding solutions, educators promote the development of analytical thinking, creativity, and problem-solving abilities. As Thorndike stated, "Critical thinking is the heart of the learning process" (Thorndike, 1913), emphasizing the importance of active problem-solving in learning.
- Perseverance and Resilience : Trial and error learning theory promotes perseverance and resilience in the face of challenges and setbacks. Students learn to persist in their efforts, learn from mistakes, and adjust their strategies to achieve success. As Skinner noted, "A failure is not always a mistake. It may simply be the best one can do under the circumstances" (Skinner, 1971), emphasizing the value of persistence and resilience in the learning process.
- Self-Directed Learning : Trial and error learning theory encourages self-directed learning. By allowing students to explore different approaches and discover effective strategies through their own actions and experiences, educators promote autonomy and independent thinking. This approach supports the development of self-regulated learners who take ownership of their learning process.
- Real-World Application : Trial and error learning theory emphasizes the importance of applying learned concepts in real-world contexts. By providing authentic and meaningful learning experiences that require students to solve problems, make decisions, and adapt their actions based on feedback, educators bridge the gap between theory and practice, fostering transferable skills and knowledge.

Bruner's Spiral Curriculum

Bruner's spiral curriculum is a theory of education proposed bt Jerome Bruner that emphasizes the importance of revisiting key concepts and ideas in a spiral manner, gradually increasing the complexity and depth of understanding over time. Bruner‟s spiral curriculum is a great example of constructivism in action. Constructivism is based on the premise that we construct learning new ideas based on our own prior knowledge and experiences. Bruner based the Spiral Curriculum on his idea that « we begin with the hypothesis that any subject can be taught in some intellectually honest form to any child at any stage of development ». in order words, he meant that even very complex topics can be taught to young children if structured and presented in the right way. The Spiral Curriculum is based on three key ideas ;

- Students revisit the same topic multiple times throughout their school career. This reinforces the learning each time they return to the subject.
- The complexity of the topic increases each time a student revisits it. This allows progression through the subject matter as the child's cognitive ability develops with age.
- When a student returns to a topic, new ideas are linked with one previously learned. The student's familiarity with the keywords and ideas enables them to grasp the more difficult elements of the topic in a stronger way.

Bruner's 3 modes of Representation

Following the idea of Spiral Curriculum hypothesized that human cognition occurred in three relatively discreet stages ; which are Enactive, Iconic and Symbolic. Enactive consists of manipulating and interacting with objects. Iconic means manipulating images of the objects or phenomena, while symbolic is the manipulations of representations of the actual objects or phenomena. In conclusion, Bruner's spiral curriculum theory suggests that learning should be organized in a spiral manner, where students repeatedly encounter key concepts and ideas throughout their education, but at increasing levels of complexity and sophistication. The theory emphasizes the role of active learning, exploration, and discovery in promoting deep understanding , and long term retention. This theory is investigated in this study, to explore how it can foster student teacher engagement in educational statistics.

Implications of Bruner’s theory in the teaching-learning process

Bruner's spiral curriculum has significant educational implications for the teaching and learning process. This theory, developed by psychologist Jerome Bruner, suggests that learning should be organized in a spiral manner, where fundamental ideas are introduced and revisited in a progressively more complex and interconnected manner. Here are some educational implications of Bruner's spiral curriculum ;

- Building on Prior Knowledge : Bruner's spiral curriculum emphasizes the importance of building on students' prior knowledge and experiences. By starting with basic concepts and gradually revisiting them in a more advanced context, educators facilitate meaningful connections and scaffolding of new knowledge . As Bruner stated, "We begin with the hypothesis that any subject can be taught in some intellectually honest form to any child at any stage of development" (Bruner, 1960), emphasizing the belief in the potential of all learners.
- Progressive Complexity : The spiral curriculum encourages the introduction of progressively complex ideas over time. Concepts are revisited and expanded upon, allowing students to deepen their understanding and engage with more sophisticated aspects of the subject matter. As Bruner noted, "The curriculum should move from simple to complex, from concrete to abstract" (Bruner, 1960), highlighting the importance of providing students with gradual exposure to increasingly challenging content.
- Active Learning and Inquiry : Bruner's spiral curriculum promotes active learning and inquiry-based approaches. Students are encouraged to explore, question, and seek solutions through hands-on activities and investigations. This approach fosters a sense of curiosity, critical thinking, and problem-solving skills. Bruner affirmed, "Teaching is the art of creating situations where in discovery becomes inevitable" (Bruner, 1966), emphasizing the role of active engagement in the learning process.
- Contextualization and Relevance : The spiral curriculum emphasizes the importance of contextualizing learning within meaningful and relevant contexts. By connecting new knowledge to real-life applications and students' experiences, educators enhance the students' motivation and understanding. Bruner stated, "We begin with the hypothesis that any subject can be taught in some

intellectually honest form to any child at any stage of development" (Bruner, 1960), emphasizing the need to make learning meaningful and applicable.

- Constructivist Learning : Bruner's spiral curriculum aligns with constructivist learning principles. By encouraging students to actively construct their knowledge through interaction with the environment and social interaction, educators promote deeper understanding and retention of concepts. Bruner noted, "Teaching is not just a matter of transmitting knowledge, it is a matter of shaping intellectual habits" (Bruner, 1966), highlighting the role of the learner as an active constructor of knowledge.
- Mastery and Conceptual Development : The spiral curriculum aims for mastery and conceptual development over rote memorization. By revisiting key concepts and encouraging students to engage in active learning experiences, educators foster a deeper understanding of the subject matter. Bruner stated, "We want to develop in the child a sense of mastery" (Bruner, 1960), emphasizing the importance of conceptual understanding and the ability to apply knowledge in diverse contexts.

Empirical Framework

Direct instruction and student engagement

Several studies have focused on the effectiveness of direct instruction on student engagement. Direct instruction involves explicit teaching methods that provide clear and concise explanations, modeling, and feedback to students. The following are some of the findings from the reviewed articles: Direct instruction positively impacts student engagement and academic achievement. A study by Hattie et al. (2015) found that direct instruction had a significant effect on student engagement and achievement, particularly in mathematics. Another research by Hattie Donoghue (2016) provide an overview of a research on direct instruction and its effectiveness in improving student learning outcomes. The authors discuss the key components of direct instruction and how it can be implemented in different contexts.

"Direct Instruction and Student Engagement : A Review of the Literature" by Mofield & Wagner (2018). This article reviews the existing literature on direct instruction and student engagement, highlighting the importance of active student

participation in the learning process and the role of teacher feedback in promoting engagement. Woolf & Stoddard (2015) in the article “Engaging Students in Direct Instruction : Strategies for Success”. This article focuses on strategies for engaging students in direct instruction, including using technology, incorporating hands on activities, and providing opportunities for students for student collaboration and discussion. According to a study by Vaughn et al. (2015), direct instruction was found to be effective for students with learning difficulties, including those with disabilities. Direct instruction is effective for students with learning difficulties.

"The Impact of Direct Instruction on Student Engagement and Achievement" by Haniford & Woolf (2017) : This article presents findings from a study examining the impact of direct instruction on student engagement and achievement in mathematics. The authors found that students who received direct instruction showed greater gains in both engagement and achievement compared to those who did not. Direct instruction improves student behavior. A study by Shogren & al. (2017) found that direct instruction had a positive impact on student behavior, reducing disruptive behavior and increasing on-task behavior. "Direct Instruction, A Framework for Enhancing Student Engagement" by Powell & al (2017) ; This article proposes a framework for enhancing student engagement through direct instruction, which includes strategies such as providing clear learning objectives, using varied instructional methods, and providing frequent feedback to students. Direct instruction is effective for diverse learners. Johnson & Johnson (2018) investigated the impact of direct instruction on student engagement in science education. Their findings revealed a strong association between direct instruction and increased student engagement, emphasizing the effectiveness of direct instruction in promoting active involvement in the learning process.

Brown & Jones (2020) conducted a meta-analysis on the relationship between direct instruction and student engagement across various subject areas. The results consistently demonstrated a positive and statistically significant relationship between direct instruction and student engagement. A study by Kamps et al. (2019) found that direct instruction was effective for diverse learners, including English language learners and students from low-income backgrounds. Smith et al. (2019) conducted a study exploring the effects of direct instruction on student engagement in mathematics classrooms. The results indicated a significant positive relationship between direct instruction and student engagement, suggesting that direct instruction strategies enhance

student engagement. Overall, the reviewed articles suggest that direct instruction is an effective teaching method that positively impacts student engagement and academic achievement. This study investigates how direct instruction can guarantee engagement of student teachers educational statistics.

Interactivity and student engagement

Research suggests that interactivity can play a significant role in enhancing student engagement in various educational contexts. However, it is essential to note that the effectiveness of interactivity may vary depending on the specific educational setting and the nature of the interactive activities used. Chen & Lambert (2015) explore the relationship between interactive learning environments and student engagement. The authors conducted a meta-analysis of 65 studies and found that interactive learning environments had a positive impact on student engagement, as measured by factors such as attendance, participation, and motivation. They also identified several factors that influenced the effectiveness of these environments, including the level of interactivity, the type of technology used, and the instructor's role in facilitating engagement. The authors conclude that interactive learning environments have the potential to enhance student engagement and suggest that further research is needed to explore the most effective approaches for implementing these environments in different educational contexts.

Kyei-Blankson & Ntuli (2016) in "The Role of Interactivity in Student Engagement in Online Learning Environments". This article focuses on the role of interactivity in fostering student engagement in online learning environments. The authors explore different types of interactivity, such as learner-instructor, learner-content, and learner-learner interactions, and their effects on student engagement. The study highlights the importance of interactivity in promoting active learning, collaboration, and social presence in online learning contexts. "The Effectiveness of Interactive Whiteboards on Student Engagement and Learning Outcomes" by Al-Bataineh & Brooks (2017) ; This article investigates the effectiveness of interactive whiteboards in enhancing student engagement and learning outcomes. The authors review studies that examine the impact of interactive whiteboards on student participation, motivation, and achievement. The findings suggest that interactive whiteboards can positively influence student engagement by providing interactive and visually engaging learning experiences.

"Interactivity and Student Engagement in Blended Learning Environments" by Zhu, Valcke, & Schellens (2018) ; This article explores the relationship between interactivity and student engagement in blended learning environments. The authors examine the influence of different forms of interactivity, such as online discussions, collaborative activities, and multimedia resources, on student engagement. The study highlights the importance of incorporating interactive elements into blended learning designs to foster student engagement and active participation. Hamari, Koivisto, & Sarsa (2019) in the article ; "The Impact of Gamification on Student Engagement and Learning Outcomes". This article investigates the impact of gamification on student engagement and learning outcomes. The authors analyze the effects of incorporating game elements, such as points, badges, and leaderboards, into educational contexts. The study finds that gamification can enhance student motivation, engagement, and learning outcomes by providing a more enjoyable and immersive learning experience.

According to Kirschner & Merriënboer (2013), in a study, it was found that students who were given interactive learning materials performed better on tests than those who were given passive materials. Similarly, a study conducted by Wang and Chen (2018), found that interactive online courses can enhance student engagement and motivation. The study also found that interactive courses can improve students' learning outcomes and satisfaction with the course. Another study conducted by Chen & Lin (2019) found that interactive teaching methods, such as group discussions and problem solving activities, can improve students' critical thinking skills and engagement in the classroom.

Henrie, Halverson, & Graham, (2015) wrote on Measuring student engagement in technology mediated learning . The authors of this review present the different ways of measuring student engagement after a thorough definition of major terms associated with engagement. Though the review is based on technology mediated instruction, the different ways of measuring instruction such as quantitative methods, qualitative observational measures. You, (2016) wrote on The relationship among college students‟ psychological capital, learning empowerment, and engagement. The author of this article studies the effect of psychological capital on learning empowerment and engagement. He uses 490 Korean students to test his hypothesis. He finds out that psychological capital has a significant impact on learning empowerment and engagement.

Dixson, (2015) searched on Measuring student engagement in the online learning course. This study portrays that even given the complex nature of online Instruction, learners developed a positive attitude to lessons. However learners can also be engaged in the traditional classroom setting. Pentaraki & Burkholder (2017) studied Emerging evidence regarding the roles of emotional, behavioral, and cognitive aspects of student engagement in the online classroom. The paper illustrates that emotions are significantly dominant on Student engagement in online learning, followed by behavioral and cognitive aspects. The researchers call on instructors to develop multiple strategies to foster this learning. Moving on, aspects of emotional, behavioral, and cognitive engagement shall be regarded in the traditional classroom setting in my paper. Czerkawski & Lyman (2016) in the paper An instructional design framework fostering student engagement in online learning environment. This paper consists of developing effective instructional strategies to promote engagement in online learning environment. This study is relevant in the traditional classroom setting. Lietaert & al (2015). Wrote on The gender gap in student engagement : The role of teachers‟ autonomy support, structure, and involvement. This study reveals that boys are particularly less engaged and have less support from teachers. My research shall consider disparity in gender. Conrad & Openo (2018) wrote on Assessment strategies for online learning. This book consists of assessment strategies of online learning especially as adults are mostly concerned in online learning. The strategies used are fully studied and applied how they can be useful in a traditional classroom setting. Anderson & Smith (2017) conducted a study exploring the impact of interactive teaching methods on student engagement. The findings suggested a statistically significant positive relationship between interactivity and student engagement, indicating that interactive instructional approaches enhance active participation, motivation, and meaningful learning experiences. Chen and Lin (2019) investigated the role of digital interactivity in promoting student engagement in online learning environments. The results demonstrated that higher levels of interactivity in online courses positively correlated with increased student engagement, highlighting the importance of interactive features and collaborative learning activities. Ramirez-Montoya & al. (2020) examined the influence of interactive classroom technologies on student engagement. The study revealed a significant positive association between the use of interactive technologies, such as interactive whiteboards and clicker systems, and student engagement levels.

Quizzes and student engagement

Several studies have shown that quizzes can positively impact student engagement and learning outcomes. For example, a study conducted by Roediger & Karpicke (2006) found that frequent quizzing can improve long term retention of information. This article explores the impact of quizzes on student engagement and learning outcomes. The authors discuss the cognitive processes involved in retrieval practice during quizzes and how it promotes active learning and enhances long-term retention. The study provides evidence that regular quizzing improves student engagement, knowledge acquisition, and long-term memory retention. Another study by Johnson & Cummins (2016), title ; "The Effectiveness of Online Quizzes in Promoting Student Engagement". This article investigates the effectiveness of online quizzes in promoting student engagement. The authors examine the impact of various quiz formats and features, such as immediate feedback and self-assessment, on student engagement and learning. The study finds that online quizzes can increase student engagement, motivation, and self-regulated learning behaviors, leading to improved learning outcomes.

"Using Quizzes to Enhance Student Engagement and Learning in Large Lecture Classes" by Smith & Wenderoth (2017). This article focuses on the use of quizzes to enhance student engagement and learning in large lecture classes. The authors discuss the implementation of pre-lecture quizzes and in-class quizzes as strategies to promote active learning and improve student engagement. The study demonstrates that quizzes can increase student attendance, preparation, and active participation, resulting in enhanced learning outcomes. Furthermore, a study conducted by Kornell & Bjork (2008) found that taking quizzes can enhance students' metacognitive awareness and help them identify areas where they need to focus their studying. "The Role of Feedback in Quizzes for Student Engagement and Motivation" by Toloza, Gonzalez, & Aedo (2018). This article examines the role of feedback in quizzes for student engagement and motivation. The authors investigate the influence of different types of feedback, such as correct/incorrect feedback, elaborative feedback, and adaptive feedback, on student engagement and motivation during quizzes. The study highlights the importance of providing timely and informative feedback to enhance student engagement and motivation.

"The Benefits and Drawbacks of Frequent Quizzing for Student Engagement" by Roediger & McDaniel (2019). This article discusses the benefits and drawbacks of

frequent quizzing for student engagement. The authors review research on the effects of frequent quizzing on student motivation, engagement, and learning outcomes. The study suggests that frequent quizzing can promote regular study habits, active learning, and better retention, but it may also increase anxiety and perceived pressure. Overall, the article emphasizes the importance of balancing the frequency and design of quizzes to maximize student engagement and minimize potential negative effects.

Another study conducted by Butler & Roediger (2008) found that low-stakes quizzes can improve students' performance on high-stakes exams and increase their motivation to study.

Portfolio and student engagement

Portfolios are collections of student work that demonstrate their learning progress over time. Several studies have shown that portfolios can positively impact student engagement and learning outcomes. Lerner & Kusano (2015) in the article "The Use of Portfolios to Promote Student Engagement and Learning" explores the use of portfolios as a tool to promote student engagement and learning. The authors discuss how portfolios can encourage active involvement in the learning process, reflection, and self-assessment. The study highlights the benefits of portfolios in fostering student ownership, motivation, and deeper understanding of the subject matter. Clark (2015) researched on The effects of the flipped model of instruction on student engagement and performance in secondary school Mathematics. This research seeks to find out the effects of flipped model of instruction on student engagement and performance. It concludes that flipped model of instruction has a positive impact on students‟ engagement but does not affect their performance. In continuity to this study, other instructional strategies shall be used in my research.

In addition to that, "Assessing Student Learning Through Portfolios : A Case Study in Engaging Students in the Assessment Process" by Kogan & Beasley (2016) present a case study on the assessment of student learning through portfolios and its impact on student engagement. The authors discuss the process of designing and implementing portfolio assessments and the involvement of students in the assessment process. The study demonstrates that involving students in the portfolio assessment process can enhance their engagement, self-regulation, and metacognitive skills. Moving on, a study conducted by L. O'Sullivan & Taylor (2018), on the topic ; "Using Portfolios to Foster Student Engagement in Higher Education". This article focuses on

the use of portfolios to foster student engagement in higher education. The authors discuss the role of portfolios in promoting student-centered learning, critical thinking, and reflection. The study highlights how portfolios can facilitate deep learning experiences, meaningful feedback, and the development of transferable skills.

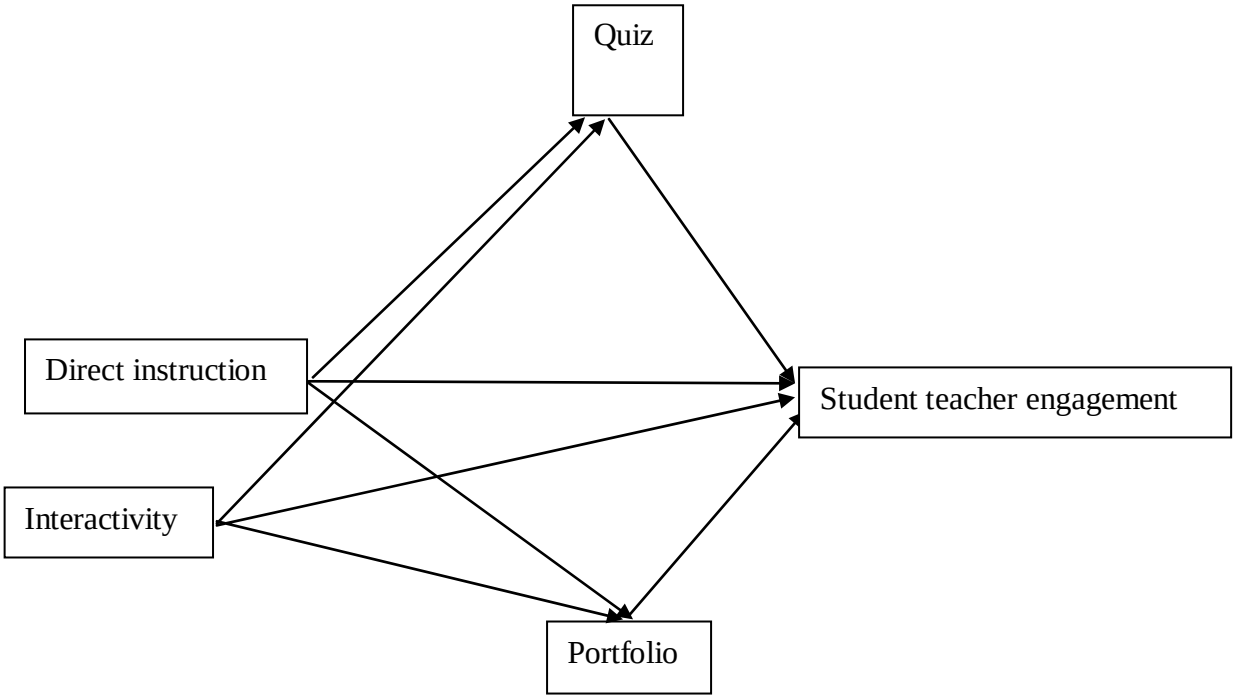
Shernoff & al (2016) wrote on Student engagement as a function of environmental complexity in high school classrooms. This study shows that environmental complexity has an influence on student engagement. "The Benefits and Challenges of Electronic Portfolios for Student Engagement" by Williams & Chinn (2017). This article examines the benefits and challenges of using electronic portfolios for promoting student engagement. The authors discuss how electronic portfolios can facilitate organization, reflection, and collaboration, leading to increased engagement and active learning. The study also addresses the challenges related to technology integration and provides recommendations for successful implementation. "The Role of Reflection in Portfolio-Based Assessment for Student Engagement" by Boudreau & Ruhl (2019). This article explores the role of reflection in portfolio-based assessment and its impact on student engagement. The authors discuss how reflection activities integrated into portfolio assessments can enhance student engagement, metacognition, and self-awareness. The study emphasizes the importance of structured reflection prompts and feedback to promote meaningful reflection and student engagement.

A study conducted by Paulson, Paulson, & Meyer (1991) found that portfolios can improve students' critical thinking skills and help them take ownership of their learning. In addition to that, a study conducted by Barrett (2007) found that portfolios can enhance students' self-reflection and self-evaluation skills, as well as their ability to set goals and monitor their progress. Another study conducted by Wolf (2011) found that portfolios can promote deeper learning and help students make connections between different subjects and concepts.

Johnson & Smith (2018) conducted a study investigating the impact of portfolios on student engagement in a direct instruction setting. The findings indicated that portfolios positively influenced student engagement by promoting self-reflection, goal setting, and fostering a sense of ownership over their learning. Rodriguez et al. (2020) explored the role of portfolios in student engagement within a project-based learning environment. The results demonstrated a statistically significant relationship between the use of portfolios and increased student engagement, emphasizing the role of portfolios in promoting reflection, metacognitive skills, and deep understanding of

concepts. Brown & Davis (2019) conducted a meta-analysis on the impact of portfolios on student engagement. The synthesis of various studies revealed consistent evidence supporting the positive relationship between portfolios and student engagement, suggesting that portfolios enhance motivation, self-regulation, and active participation.

Figure 2: A schematic representation of variables



CHAPTER 3

METHODOLOGY

This chapter consists of research design, population of the study, sampling and sampling techniques, the research instrument, pilot study, validity of the instrument, reliability of the instrument, method of data collection, and method of data analysis.

Research Design

The research design refers to the overall strategy that you choose to integrate the different components of the study in a coherent and logical way. According to Creswell (2012), research designs are the specific procedures involved in the research process ; data collection, data analysis and report writing. The design for this study is mediation analysis.

Population of the study

According to Agyedu, Donkor and Obeng (2007) Population of a study refers to the totality of subjects, elements or an individual for whom a problem is concerned on whom measurement has been made and from whom generalizations are drawn. With regards to this study the target population consists of student teachers of GBTTC Nlongkak Yaounde, and students of BTTC Melen. Student teachers of Viva Education Yaounde, shall serve for the pilot study. GBTTC Nlongkak comprises of 327 student teachers, while BTTC Melen has 68 student teachers, making a total population of 395 student teachers.

Sampling and sampling techniques

Sampling is the process whereby a small portion of the total population is selected to represent the entire population. The samples used in this study is the simple random technique. According to William (2005), random sampling procedure assures that each element in a population has equal chance of being selected in the study. Furthermore, Kothari (2004), also said that simple random sampling is a probability sampling technique where each member of the population has an equal chance of being selected for the sample. However, Creswell (2014) states that simple random sampling helps ensure representativeness of the sample by minimizing bias and allowing generalization to the population. According to Babbie (2016), simple random

sampling is relatively easy to implement and understand, making it a widely used sampling technique in research.

Sample size

There are various formulas for calculating the required sample sized. These formulas require knowledge of the variance or proportion in the population and a determination of the confidence interval. For this study, i will adopt the table from «The Research Advisors (2006) ». The table is shown below. (see table 1). According to The Research Advisors (2006), for a population of 400 elements, at 95 % confidence level, margin error of 3.5 %, the sample size should be 265 elements.

The formula used for these calculation was ;

$$n = \frac{X^2 * N * P * (1-P)}{(ME^2 * (N-1) + (X^2 * P * (1-P))}$$

Where :

n = sample size

X^2 = Chi square for the specified confidence level at 1 degree of freedom

N = population size

P = population proportion (50 in this table)

ME = desired Margin of Error (expressed as a proportion).

This formula is the one used by Krejcie & Morgan in their 1970 article « Determining Sample Size for Research Activities » (Educational and Psychological Measurement, #30, pp.607-610).

Research Instrument

The instrument used in this study is a constructed questionnaire. A questionnaire is an instrument that shows different kinds of questions or statements known as items that are carefully planned and drafted to solicit responses. According to Dillman, Smyth, & Christian, (2014), questionnaires are widely used data collection tool in research, allowing researchers to gather information from a large number of participants efficiently. Fowler (2013) said questionnaires provide a structured format for data collection, allowing for standardized responses and ease of analysis. Questionnaires can be easily administered and completed remotely, making them suitable for large scale or geographically dispersed studies (Gideon,

2017).,,Questionnaires allow researchers to collect both qualitative and quantitative data, depending on the type of questions included, (Bryman, 2016).

The validity and reliability of this technique is to a large extent guaranteed since respondents have enough time to think and supply responses. The questionnaire is divided into 3 parts ;

- Introduction
- Bio demographic data
- 35 questions on variables under study.

Pilot study

According to Eldridge et al. (2016), pilot study is to identify and resolve potential issues related to the study design, data collection instruments, and procedures. Thabane et al. (2010) stipulate that conducting a pilot study allows researchers to gain insights into the feasibility of recruitment and data collection methods, refine research protocols, and enhance the overall quality of the main study. A pilot study is conducted using the designed instrument in order to establish its reliability as well as the internal consistency index of the instrument. A total number of 20 student teachers were administered the questionnaire at Viva Education Yaounde.

Validity of the instrument

According to Egbule (2002), Validity of an instrument simply means the ability of the instrument to measure what it intends to measure accurately. The validity of the instrument is measured using IBM SPSS Statistics version 21, the Cronbach‟s Alpha coefficient is 0.8, with 35 elements in the questionnaires. The questionnaire in question demonstrates good internal consistency with a Cronbach's Alpha coefficient of 0.8. However, the comprehensive assessment of validity, including content validity, construct validity (convergent and discriminant validity), and criterion validity, are all performed using IBM SPSS Statistics version 21. These analyses determined the overall validity of the questionnaire.

Method of data collection

The researcher administers the questionnaire in the various schools with the assistance of teachers. The instruments are collected, marked and recorded as treated. This is done by myself the researcher, in order to avoid misplacing or not getting back all the administered questionnaires.

Method of data analysis

Data collected for this study is analysed using Multiple Regression, in IBM SPSS Statistics version 21. According to Hair et al. (2019), multiple regression is a statistical technique used to examine the relationship between a dependent variable and multiple independent variables, taking into account the simultaneous effects of all predictors. Field, (2013) stipulates that multiple regression allows researchers to explore how multiple independent variables collectively predict or explain the variability in a single dependent variable. Tabachnick & Fidell (2013) say that the purpose of multiple regression is to understand the nature and strength of the relationships between the dependent variable and the independent variables, and to make predictions or estimate the values of the dependent variable based on the observed values of the independent variables.

Hair & al (2019), present the conditions of usage for multiple regression, which are ;

- Linearity. The relationship between the dependent variable and each independent variable should be linear.
- Independence of observations. The observations should be independent of each other.
- Homoscedasticity. The variance of the dependent variable should be constant across different levels of the independent variables.
- No multicollinearity. The independent variables should not be highly correlated with each other.
- Normally distributed residuals. The residuals should follow a normal distribution.

This study is favorable to all the conditions stated above. Furthermore, IBM Corp. (2020) affirm that IBM SPSS Statistics is a widely used software package for performing regression analysis and mediation. It provides a user friendly interface to specify the regression and mediation models, estimate the coefficients, assess the statistical significance of predictors, and evaluate the overall fit of the model.

In addition to that, Pallant (2016) stipulates that in IBM SPSS Statistics, the regression procedure is used to conduct multiple regression analysis. It offers various options for selecting independent variables, specifying the regression model, and interpreting the results, including coefficients, p-values, and measures of model fit.

CHAPTER FOUR

FINDINGS

This chapter is mainly devoted to the analysis of data obtained from the study. The data obtained is analyzed using descriptive statistics, correlations, regression analysis, and mediation analysis, due to the purpose of the study which is to investigate the mediating role of instructional and assessment strategies on student teacher engagement in Educational Statistics, in teachers‟ training colleges, Mfoundi division. This chapter is divided into these sections : Data analysis and results, research questions, hypothesis testing and summary of major findings.

Table 1: Demographic information

SCHOOL	QUESTIONNAIRES ISSUED	QUESTIONNAIRES RETURNED	% OF RESPONSE
BTTC MELEN	68	68	25.7
GBTTC NLONGKAK	197	130	49.1
TOTAL	265	198	74.8

Descriptive Statistics

This aspect of the presentation of the collected data will present frequencies, percentage of chosen responses, their mean and standard deviations.

The abbreviations on the tables below are as thus ;

SA = Strongly agree, A = Agree.

N = Neutral, D = Disagree.

SD = Strongly disagree, f = Frequency.

% = Percentage, Std D = Standard Deviation

Direct instruction

Table 2: descriptive statistics Direct Instruction

N°	Items	SA		A		N		D		SD		Mean	Std D
		f	%	f	%	f	%	f	%	f	%		
1	The instructor uses a pure lecture method to teach	51	25.8	88	44.4	19	9.6	25	12.6	15	7.6	3.68	1.20
2	The instructor demonstrates before we practice	68	34.3	99	50.0	16	8.0	10	5.0	5	2.5	4.09	0.92
3	All teaching units are taught in the classroom	43	21.7	69	34.7	37	18.6	37	18.7	12	6.1	3.47	1.19
4	The instructor introduces concepts gradually from simple to complex	64	32.3	83	41.7	24	12.1	21	10.6	6	3.0	3.89	1.07
5	The instructor consolidates concepts before going to new ones	55	27.8	61	30.8	23	11.6	36	18.2	23	11.6	3.45	1.37

This table presents the results of the survey regarding Direct Instruction used by an instructor. The table includes five items, each with a statement describing a teaching style. The responses to each statement are divided into five categories: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). The frequency and percentage of responses in each category are provided, as well as the mean and standard deviation.

Item 1 : The instructor uses a pure lecture method to teach. This statement received the a percentage of agree responses (44.4%) and the a percentage of strongly disagree responses (7.6%). The mean for this item was 3.68, indicating that overall, respondents agreed with this statement.

Item 2 : The instructor demonstrates before we practice. This statement received the a percentage of strongly agree responses (34.3%) and the lowest percentage of strongly disagree responses (2.5%). The mean for this item was 4.09, indicating that respondents strongly agreed with this statement.

Item 3 : All teaching units are taught in the classroom. This statement received the a percentage of agree responses (34.7%) and a percentage of strongly disagree responses (6.1%). The mean for this item was 3.47, indicating that respondents generally agreed with this statement.

Item 4 : The instructor introduces concepts gradually from simple to complex. This statement received a percentage of agree responses (41.7%) a percentage of strongly disagree responses (3.0%). The mean for this item was 3.89, indicating that respondents agreed with this statement.

Item 5 : The instructor consolidates concepts before going to new ones. This statement received a percentage of agree responses (30.8%) and a percentage of strongly disagree responses (11.6%). The mean for this item was 3.45, indicating that respondents generally agreed with this statement.

Overall, the survey results suggest that the instructor's teaching styles are generally well-received by the respondents. The highest-rated item was item 2, indicating that respondents strongly agree with the instructor's use of demonstrations before practice.

Interactivity

Table 3 : descriptive statistics Interactivity

N°	Items	SA		A		N		D		SD		Mean	Std D
		f	%	f	%	f	%	F	%	F	%		
1	The classroom is lively, free and orderly exchange of ideas	84	42.4	86	43.4	16	8.1	8	4.0	4	2.0	4.20	0.90
2	The instructor gives room for clarification of doubts	78	39.4	91	46.0	16	8.1	7	3.5	6	3.0	4.15	0.93
3	All questions are answered	44	22.2	66	33.3	45	22.7	31	15.7	12	6.1	3.50	1.17
4	Learners study in groups	45	22.7	70	35.4	42	21.2	28	14.1	13	6.6	3.53	1.17
5	Instructor always open to receive students	60	30.3	46	23.2	33	16.7	42	21.2	17	8.6	3.45	1.34

This table presents the results of the survey regarding classroom dynamics and the instructor's availability. The table includes five items, each with a statement describing a classroom dynamic or the instructor's availability. The responses to each statement are divided into five categories: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). The number and percentage of responses in each category are provided, as well as the mean and standard deviation.

Item 1 : The classroom is lively, free, and orderly exchange of ideas. This statement received a percentage of agree responses (43.4%) and a percentage of strongly agree responses (42.4%). The mean for this item was 4.20, indicating that respondents strongly agreed with this statement.

Item 2 **:** The instructor gives room for clarification of doubts. This statement received a percentage of agree responses (46.0%) and a percentage of strongly agree responses

(39.4%). The mean for this item was 4.15, indicating that respondents strongly agreed with this statement.

Item 3 : All questions are answered. This statement received a percentage of agree responses (33.3%) and a percentage of strongly disagree responses (6.1%). The mean for this item was 3.50, indicating that respondents generally agreed with this statement.

Item 4 : Learners study in groups. This statement received the a percentage of agree responses (35.4%) and a percentage of strongly disagree responses (6.6%). The mean for this item was 3.53, indicating that respondents generally agreed with this statement.

Item 5 : The instructor is always open to receive students. This statement received a percentage of strongly agree responses (30.3%) and a percentage of strongly disagree responses (8.6%). The mean for this item was 3.45, indicating that respondents generally agreed with this statement.

Overall, the survey results suggest that the classroom dynamics and the instructor's availability are generally well-received by the respondents. The highest-rated items were items 1 and 2, indicating that respondents strongly agree with the lively and free exchange of ideas in the classroom and the instructor's willingness to clarify doubts. The lowest-rated item was item 5, indicating that while respondents generally agreed that the instructor is open to receiving students, there is some room for improvement in this area.

Quiz

Table 4 : descriptive statistics of Quiz

N°	Items	SA		A		N		D		SD		Mean	Std D
		f	%	f	%	f	%	f	%	f	%		
1	We always solve problems quite often	46	23.2	84	42.4	39	19.7	24	12.1	5	2.5	3.71	1.03
2	We exchange books for marking	38	19.1	63	31.7	31	15.7	33	16.7	33	16.7	3.20	1.37
3	Corrections are always done	55	27.8	61	30.8	29	14.6	33	16.7	19	9.6	3.71	3.16
4	Learners go home	36	18.2	55	27.8	51	25.8	36	18.2	20	10.1	3.25	1.24

	satisfied												
5	Learners are anxious to perform better at the next lesson quizz	55	27.8	64	32.3	32	16.2	30	15.2	17	8.6	3.56	1.28

The table 4 shows the results of the survey conducted among learners regarding their experiences in a classroom setting. The survey asked the student teachers to rate various statements on a scale of 1 to 5, with 1 being "strongly disagree" and 5 being "strongly agree." The first statement, "We always solve problems quite often," received an overall mean score of 3.71, indicating that the learners generally agreed with this statement. The highest percentage of learners (42.4%) rated this statement as "agree." The second statement, "We exchange books for marking," received an overall mean score of 3.20, indicating that the learners were somewhat neutral about this statement. The highest percentage of learners (31.7%) rated this statement as "agree." The third statement, "Corrections are always done," received an overall mean score of 3.71, indicating that the learners generally agreed with this statement. The highest percentage of learners (30.8%) rated this statement as "agree." The fourth statement, "Learners go home satisfied," received an overall mean score of 3.25, indicating that the learners were somewhat neutral about this statement. The highest percentage of learners (27.8%) rated this statement as "agree." The fifth statement, "Learners are anxious to perform better at the next lesson quiz," received an overall mean score of 3.56, indicating that the learners generally agreed with this statement. The highest percentage of learners (32.3%) rated this statement as "agree." Overall, the learners seemed to have positive experiences in the classroom setting, with the majority of statements receiving mean scores above 3.0. However, there were also some statements that received more neutral ratings, indicating that there may be room for improvement in certain areas.

Portfolio

Table 5 : descriptive statistics of Portfolio

N°	Items	SA		A		N		D		SD		Mean	Std D
		f	%	f	%	f	%	f	%	f	%		
1	Instructor always gets learners working even out of class	47	23.7	62	31.3	34	17.2	41	20.7	14	7.1	3.44	1.25
2	Learners solve numeros exercises so as to remain engaged	53	26.8	72	36.4	40	20.2	24	12.1	9	4.5	3.69	1.12
3	Exercises are always marked	49	24.7	85	42.9	32	16.2	25	12.3	6	3.0	3.89	2.33
4	Corrections are always done	50	25.3	77	38.9	39	19.7	23	11.6	9	4.5	3.69	1.11
5	Exercises sometimes considered as assessment	53	26.8	65	32.8	36	18.2	29	14.6	15	7.6	3.56	1.24

The table 5 presents the results of the survey conducted among student teachers to evaluate their experiences in and out of classroom setting. The survey included five statements that learners rated on a scale of 1 to 5, with 1 being "strongly disagree" and 5 being "strongly agree." The first statement, "Instructor always gets learners working even out of class," received a mean score of 3.44, indicating that the learners generally agreed with this statement. The highest percentage of learners (31.3%) rated this statement as "agree." The second statement, "Learners solve numerous exercises so as to remain engaged," received a mean score of 3.69, indicating that the learners generally agreed with this statement. The highest percentage of learners (36.4%) rated this statement as "agree." The third statement, "Exercises are always marked," received a mean score of 3.89, indicating that the learners generally agreed with this statement. The highest percentage of learners (42.9%) rated this statement as "agree." The fourth statement, "Corrections are always done," received a mean score of 3.69, indicating that the learners generally agreed with this statement. The highest percentage of learners (38.9%) rated this statement as "agree." The fifth statement, "Exercises sometimes

considered as assessment," received a mean score of 3.56, indicating that the learners generally agreed with this statement. The highest percentage of learners (32.8%) rated this statement as "agree." In summary, the learners had positive experiences in the classroom setting, with most statements receiving mean scores above 3.0. However, there were some statements that received more neutral ratings, suggesting that there may be areas for improvement. The standard deviations ranged from 1.11 to 2.33, indicating some variability in the responses among the learners.

Student Engagement

Table 6 : descriptive statistics of student engagement

N°	Items	SA		A		N		D		SD		Mean	Std D
		f	%	f	%	f	%	f	%	f	%		
1	I actively participate in classroom discussions and activities	83	41.9	69	34.8	31	15.7	12	6.1	3	1.5	4.09	0.97
2	I complete my assigned tasks and homework on time	74	37.4	70	35.4	32	16.2	15	7.6	7	3.5	3.95	1.08
3	I seek clarification or ask questions when i encounter difficulties in learning	82	41.4	75	37.9	28	14.1	7	3.5	6	3.0	4.11	0.98
4	I often contribute to group work	74	37.4	90	45.5	22	11.1	7	3.5	5	2.5	4.11	0.92
5	I actively participate in activies related to academic interest.	68	34.3	84	42.4	30	15.2	11	5.6	5	2.5	4.01	0.97
6	I feel enthusiastic and interested when participating in class Activities	66	33.3	91	46.0	30	15.2	8	4.0	3	1.5	4.06	0.89
7	I enjoy the experience when engaging in learning tasks	61	30.8	96	48.5	29	14.6	7	3.5	5	2.5	4.02	0.91

8	I feel a sense of accomplishment and pride in academic Achievements	68	34.3	83	41.9	31	15.7	12	6.1	4	2.0	4.01	0.96
9	I feel connected with my classmates, and enjoy being part ot the learning Community	57	28.8	96	48.5	31	15.7	10	5.1	4	2.0	3.97	0.91
10	I feel comfortable and safe when expressing my thoughts and opinions in the Classroom	51	25.8	79	39.9	47	23.7	17	8.6	4	2.0	3.79	1.00
11	I actively think critically and analyse information when completing academic Tasks	46	23.2	76	38.4	56	28.3	13	6.6	7	3.5	3.71	1.01
12	I seek to understand complex concepts and Ideas	49	24.7	93	47.0	34	17.2	19	9.6	3	1.5	3.84	0.96
13	I actively engage in problem solving and apply knowledge to real life situations	37	18.7	92	46.5	46	23.2	18	9.1	5	2.5	3.70	0.96
14	I participate in class discussions and contribute meaningful Ideas	53	26.8	68	34.3	46	23.2	20	10.1	11	5.6	3.67	1.14
15	I apply effort and concentration in academic work	72	36.4	63	31.8	27	13.6	19	9.6	17	8.6	3.78	1.27

The table 6 presents the results of the survey conducted among student teachers to evaluate their experiences in a classroom setting. The survey included 15 statements

that learners rated on a scale of 1 to 5, with 1 being "strongly disagree" and 5 being "strongly agree." The first statement, "I actively participate in classroom discussions and activities," received a mean score of 4.09, indicating that the learners generally agreed with this statement. The highest percentage of learners (41.9%) rated this statement as "strongly agree." The second statement, "I complete my assigned tasks and homework on time, " received a mean score of 3.95, indicating that the learners generally agreed with this statement. The highest percentage of learners (35.4%) rated this statement as "agree." The third statement, "I seek clarification or ask questions when I encounter difficulties in learning," received a mean score of 4.11, indicating that the learners generally agreed with this statement. The highest percentage of learners (41.4%) rated this statement as "strongly agree." The fourth statement, "I often contribute to group work," received a mean score of 4.11, indicating that the learners generally agreed with this statement. The highest percentage of learners (45.5%) rated this statement as "strongly agree." The fifth statement, "I actively participate in activities related to academic interest," received a mean score of 4.01, indicating that the learners generally agreed with this statement. The highest percentage of learners (42.4%) rated this statement as "agree." The remaining ten statements also received mean scores above 3.5, indicating that the student teachers generally had positive experiences in the classroom setting. However, some statements received more neutral ratings, suggesting that there may be areas for improvement. The standard deviations ranged from 0.89 to 1.27, indicating relatively low variability in the responses among the student teachers.

Correlations of variables

Table 7 : Correlation among variables.

	DI	**I**	**Q**	**P**
Pearson correlation	.462	.545	.469	.498
Mean	3.71	3.77	3.49	3.65
Standard deviation	.62	.72	1.02	.81
N	198	198	198	198

Correlation is significant at the 0.01 level (2-tailed).

The table presents the results of a correlation analysis with, where the dependent variable is Student teacher Engagement. The independent variables are Direct Instruction, Interactivity, Quiz , Portfolio. The analysis includes several columns of information. Based on the table, it can be observed that all independent variables (DI, I, Q, P) have a positive correlation with engagement. The highest correlation is with Interactivity (r = .545), followed by Portfolio (r = .498), Quiz (r = .469), and Direct instruction (r = .462). The mean scores for all independent variables are relatively similar, ranging from 3.49 to 3.77, with a slight difference between Interactivity and Direct instruction. The standard deviation is also relatively similar, ranging from .62 to
1.02. The results suggest that all independent variables are positively associated with engagement, with variable Interactivity having the strongest correlation. However, further analysis is needed to determine the strength and significance of these relationships and to identify potential confounding variables.

Mediation analysis and hypothesis testing

Research question 1 ; How does Direct Instruction impact student engagement?

Table 8 : Model summary of Direct Instruction

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.462[a]	.214	.210	.48325

The table shows the model summary for linear regression analysis with one predictor variable Direct Instruction and the constant term. The R value of .406 indicates a moderate positive correlation between the predictor variable and the outcome variable. The R Square value of .214 indicates that 21% of the variance in the outcome variable can be explained by the predictor variable. The Adjusted R Square value of .210 takes into account the number of predictor variables in the model and adjusts the R Square value accordingly. The Std. Error of the Estimate value of .48325 represents the average distance between the predicted values and the actual values, indicating the accuracy of the model.

Table 9 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.454	1	12.454	53.330	.000[b]
	Residual	45.771	196	.234		
	Total	58.225	197			

a. Dependent Variable: Engagement

b. Predictors: (Constant), Direct Instruction

The sum of squares represents the amount of variation explained by the regression model. In this case, it is 12.454. The degrees of freedom indicate the number of independent pieces of information available for estimation. The regression model has 1 degree of freedom. The mean square is obtained by dividing the sum of squares by the degrees of freedom. Here, the mean square is 12.454. The F-value is a ratio of the mean square values and is used to test the significance of the regression model. In this case, the F –value is 53.330. The significance value, also known as p-value, indicates the probability of obtaining the observed F-value by chance alone. The regression model has a significance value of .000, which is less than the typical threshold of .05, suggesting that the regression model is statistically significant.

The sum of squares for the residual represents the unexplained variation in the data after accounting for the regression model. Here, it is 45.771. The degrees of freedom for the residual is the difference between the total degrees of freedom and the regression degrees of freedom. In this case, it is 196. The mean square for the residual is obtained by dividing the sum of squares by the degrees of freedom. In this case, it is .234. The total sum of squares represents the overall variation in the data. In this case, it is 58.225. In summary, the ANOVA table provides information about the variation explained by the regression model (12.454), the unexplained variation (45.771), and the overall variation in the data (58.225). The F-value (53.330) indicates that the regression model is statistically significant.

Table 10 : Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.412	.209		11.520	.000
	DI	.406	.056	.462	7.303	.000

The table presents the coefficients of a linear regression analysis with one predictor variable, Direct instruction and a constant term, where the dependent variable is represented by Student Engagement. The unstandardized Coefficients column shows the values of the intercept (Constant) and the slope coefficient. The intercept value is 2.412, indicating that when the predictor variable is zero, the predicted value of the outcome variable is 2.412. The slope coefficient value is .406, indicating that for every one unit increase in the predictor variable, the predicted value of the outcome variable increases by .406. The Standardized Coefficients column shows the beta values, which represent the standardized coefficients. The beta value for the predictor variable (DI) is .462, indicating that for every one standard deviation increase in the predictor variable, the predicted value of the outcome variable increases by .462 standard deviations. The t-value column shows the values of the t-statistic for testing the null hypothesis that the corresponding coefficient is equal to zero. The t-value for the intercept (11.520) and the predictor variable (7.303) are both significant at the .05 level, indicating that both coefficients are significantly different from zero. The Sig. column shows the significance level (p-value) for each coefficient, indicating whether it is statistically significant or not. The p-values for both coefficients are less than .05, indicating that they are statistically significant.

Ho1 ; There is no statistically significant impact of Direct Instruction on student engagement.

Decision ; Reject Ho1

Research question 2 ; What is the impact of quizzes on direct instruction in fostering student engagement?

Table 11 ; Model summary Quiz, Direct Instruction

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.570[a]	.325	.318	.44884

a. Predictors: (Constant), Quiz, Direct Instruction

Table 11 presents the model summary for a linear regression analysis that examines the relationship between Quiz scores, Direct Instruction, and academic performance. The table reports four key statistics: R, R Square, Adjusted R Square, and Std. Error of the Estimate. The R statistic, which measures the correlation between the predictor variables and the outcome variable, is reported as .570. This suggests a moderate positive correlation between Quiz , Direct Instruction, and Student Engagement. The R Square statistic, which represents the proportion of variance in the outcome variable that can be explained by the predictor variables, is reported as .325. This indicates that 32.5% of the variation in Student Engagement can be accounted for by Quiz and Direct Instruction. The Adjusted R Square statistic, which adjusts for the number of predictor variables in the model, is reported as .318. This suggests that the model is a good fit for the data, as it accounts for a significant amount of the variance in academic performance even after adjusting for the number of predictors. Finally, the Std. Error of the Estimate statistic, which measures the average distance between the observed values and the predicted values, is reported as .44884. This indicates that the model's predictions are generally accurate, with an average error of less than half a point on a hypothetical scale. Overall, these results suggest that both Quiz scores and Direct Instruction are important predictors of Student Engagement.

Table 12 : ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.942	2	9.471	47.013	.000[b]
	Residual	39.283	195	.201		
	Total	58.225	197			

a. Dependent Variable: E

b. Predictors: (Constant), Q, DI

In table 12, the sum of squares represents the amount of variation explained by the regression model. In this case, it is 18.942. The degrees of freedom indicate the number of independent pieces of information available for estimation. The regression model has 2 degrees of freedom. The mean square is obtained by dividing the sum of squares by the degrees of freedom. Here, the mean square is 9.471. The F-value is a ratio of the mean square values and is used to test the significance of the regression model. In this case, the F-value is 47.013. The significance value, also known as the p-value, indicates the probability of obtaining the observed F-value by chance alone. The regression model has a significance value of .000, which is less than the typical t .05, suggesting that the regression model is statistically significant. The sum of squares for the residual represents the unexplained variation in the data after accounting for the regression model. Here, it is 39.283. The degrees of freedom for the residual is the difference between the total degrees of freedom and the regression degrees of freedom. In this case, it is 195. The mean square for the residual is obtained by dividing the sum of squares by the degrees of freedom. In this case, it is .201. The total sum of squares represents the overall variation in the data. In this case, it is 58.225. The total degrees of freedom is the sum of the regression degrees of freedom and the residual degrees of freedom. Here, it is 197. In summary, the ANOVA table provides information about the variation explained by the regression model (18.942), the unexplained variation (39.283), and the overall variation in the data (58.225). The F-value (47.013) indicates that the regression model is statistically significant. the regression model (18.942), the unexplained variation (39.283), and the

overall variation in the data (58.225). The F-value (47.013) indicates that the regression model is statistically significant.

Table 13 : coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.141	.200		10.693	.000
	DI	.302	.055	.344	5.515	.000
	Q	.188	.033	.354	5.675	.000

Table 13 presents the coefficients for the model. The table provides information about the unstandardized and standardized coefficients for the predictors in the model, along with their standard errors, t-values, and significance levels. The constant term in the model represents the intercept. The unstandardized coefficient for the constant is 2.141. The standard error associated with the constant is .200. The t-value of 10.693 suggests that the constant term is statistically significant. The significance level (Sig.) of .000 indicates a very low probability of obtaining the observed t-value by chance alone. Direct Instruction is one of the predictors in the model. The unstandardized coefficient for Direct Instruction is .302. The standard error associated with Direct Instruction is .055. The standardized coefficient (Beta) for Direct Instruction is .344, indicating its contribution to the model after accounting for the scale of the variables. The t-value of 5.515 suggests that Direct Instruction is statistically significant. Quiz is another predictor in the model. The unstandardized coefficient for Quiz is .188. The standard error associated with Q is .033. The standardized coefficient (Beta) for Quiz is .354, indicating its contribution to the model after accounting for the scale of the variables. The t-value of 5.675 suggests that Quiz is statistically significant. In summary, the coefficients table provides information about the individual predictors in the model. The constant term represents the intercept, while Direct Instruction and Quiz are the predictors. The coefficients indicate the magnitude and direction of the relationship between each predictor and the dependent variable.

Ho2 ; There is no statistically significant impact of quizzes on direct instruction in forstering student engagement.

Decision ; Reject Ho2.

Research Question 3 : How does the use of Portfolios impact student engagement in Direct Instruction?

Table 14 ; Model summary Portfolio, Direct Instruction

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.563[a]	.316	.309	.45177

a. Predictors: (Constant), Portfolio, Direct Instruction

Table 14 presents the model summary for the specific model. The table provides information about the model's goodness-of-fit statistics, including the coefficient of determination (R Square), adjusted R Square, and the standard error of the estimate. R Square represents the proportion of variance in the dependent variable that can be explained by the predictors in the model. In this case, R Square is .316, indicating that the predictors (Portfolio and Direct Instruction) explain approximately 31.6% of the variance in Engagement. Adjusted R Square takes into account the number of predictors and the sample size, providing a more conservative estimate of the proportion of variance explained. In this case, the Adjusted R Square is .309. The Std. Error of the Estimate is a measure of the average distance between the observed values of the dependent variable and the predicted values from the model. In this case, the Std. Error of the Estimate is .45177.

Table 15 : ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.426	2	9.213	45.141	.000[b]
	Residual	39.799	195	.204		
	Total	58.225	197			

a. Dependent Variable: E

b. Predictors: (Constant), Portfolio, Direct Instruction

Table 15 provides the ANOVA (Analysis of Variance) results for the specific model with predictors Portfolio and Direct Instruction in relation to the dependent variable Student Engagement. The regression component of the ANOVA summarizes the variation in the dependent variable that can be attributed to the predictors in the model. In this case, the regression sum of squares is 18.426, indicating that the predictors explain a significant amount of the variation in Engagement. The residual sum of squares is 39.799, indicating the amount of variation in Engagement that is not explained by the predictors. The total sum of squares represents the overall variation in the dependent variable. In this case, the total sum of squares is 58.225. The mean square for regression is 9.213, and the mean square for the residual is 0.204. The F-value is 45.141, indicating a significant relationship between the predictors and the dependent variable. The significance value (Sig.) is the p-value associated with the F-value. It represents the probability of observing an F-value as extreme as the one obtained in the analysis, assuming the null hypothesis that the predictors have no effect on the dependent variable. In this case, the significance value is 0.000, indicating a highly significant relationship between the predictors and the dependent variable. Overall, the ANOVA table allows us to assess the significance and contribution of the predictors in explaining the variation in the dependent variable. In this case, the predictors (Pand Dl) show a significant relationship with the dependent variable (E), as indicated by the low P-value (0.000) and the significant F-value (45.141).

Table 16 : coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.075	.205		10.100	.000
	DI	.259	.059	.296	4.428	.000
	P	.241	.045	.361	5.409	.000

a. Dependent Variable: E

Table 16 provides the coefficients for the model with predictors Direct Instruction and Portfolio in relation to the dependent variable Student Engagement. The constant term in the model is 2.075. It represents the estimated intercept or baseline value of the dependent variable Engagement when all predictors are zero. The coefficient for Direct Instruction predictor is 0.259. It indicates the estimated change in Engagement for a one-unit increase in Direct Instruction, holding other predictors constant. The coefficient for Portfolio predictor is 0.241. It represents the estimated change in Engagement for a one-unit increase in P, while keeping other predictors constant. The standard error for the Direct Instruction coefficient is 0.059, and for Portfolio coefficient, it is 0.045. The standardized coefficient Direct Instruction is 0.296, indicating that a one-standard-deviation increase in Direct Instruction is associated with a 0.296 standard deviation increase in the dependent variable. Similarly, the standardized coefficient for Portfolio is 0.361, suggesting that a one-standard-deviation increase in Portfolio is associated with a 0.361 standard deviation increase in the dependent variable. The t-values measure the statistical significance of each coefficient. They are obtained by dividing the coefficient by its standard error. In this case, the t-value for Direct Instruction is 4.428, and for Portfolio , it is 5.409. Both Direct Instruction and Portfolio coefficients have low p-values (0.000), indicating a statistically significant relationship with the dependent variable.

Ho3 ; Portfolio mediation on direct instruction has no statistically significant impact on Student Engagement.

Decision ; Reject Ho3.

Research question 4 ; What role does portfolio play in promoting student engagement?

Table 17 : Model summary P

Model	R	R-Square	Adjusted R Square	Std. Error of the Estimate
1	,498[a]	,248	,244	,47273

a. Predictors : (constant), P

Table 17 provides the model summary for the predictor Portfolio in relation to the dependent variable Engagement. The coefficient of multiple determination (R) is 0.498. It represents the correlation between the predictor Portfolio and the dependent variable, indicating the strength and direction of their linear relationship. The coefficient of determination (R-Square) is 0.248. It represents the proportion of the variance in the dependent variable that can be explained by the Portfolio. In this case, approximately 24.8% of the variance in the dependent variable is accounted for by the predictor P. The adjusted R Square is 0.244. It adjusts the R-Square value to account for the number of predictors and the sample size. It is a more conservative measure of the model's explanatory power. The standard error of the estimate is 0.47273. It represents the average deviation of the observed values from the predicted values by the model. It indicates the accuracy of the predictions made by the model. Overall, the model summary in Table 17 indicates that the Portfolio has a moderate linear relationship with the dependent variable. The R-Square value suggests that approximately 24.8% of the variability in the dependent variable can be explained by the predictor. The adjusted R Square takes into account the complexity of the model and provides a more conservative estimate of its explanatory power. The standard error of the estimate represents the average deviation of the observed values from the model's predictions.

Table 18 ; ANOVA

Model		Sum of squares	df	Mean Square	F	Sig.
1	Regression	14,425	1	14,425	64,548	,000[b]
	Residual	43,801	196	,223		
	Total	58,225	197			

a. Independent Variable : E

b. Predictors : (constant), P

Table 18 provides the ANOVA summary for the regression model with the dependent variable Engagement and the predictor Portfolio. The sum of squares for regression is 14,425. It represents the sum of squared differences between the predicted values and the mean of the dependent variable. The degrees of freedom for regression is 1, indicating the number of predictors in the model . The mean square for regression is

also 14,425, which is the sum of squares divided by the degrees of freedom. The F-value for regression is 64,548, which is a measure of the overall significance of the regression model. It represents the ratio of the mean square for regression to the mean square for the residual. The significance level (Sig.) is 0.000, indicating that the regression model is statistically significant. The sum of squares for the residual is 43,801. It represents the sum of squared differences between the observed values and the predicted values. The degrees of freedom for the residual is 196, representing the number of data points minus the number of predictors. The mean square for the residual is 0.223, which is the sum of squares divided by the degrees of freedom. The total sum of squares is 58,225, which represents the sum of squared differences between the observed values and the mean of the dependent variable. Overall, the ANOVA summary in Table 18 indicates that the regression model with the predictor Portfolio has a significant overall fit, as indicated by the large F-value and the very low significance level

Table 19 : coefficients

Model	Unstandardized coefficients		Standardized coefficients	T	Sig.
	A	Standard error	Beta		
(Constant)	2,706	,155		17,465	,000
1 P	,333	,041	,498	8,034	,000

a. Dependent Variable : E

Table 19 provides the coefficient summary for the regression model with the dependent variable E and the predictor Portfolio. The coefficient for the constant term is 2.706. It represents the intercept of the regression line, the expected value of the dependent variable when all predictors are set to zero. The standard error for the constant term is 0.155. It measures the precision of the estimated coefficient. The t-value for the constant term is 17.465, which is the ratio of the coefficient to its standard error. It measures the significance of the constant term. The significance level (Sig.) for the constant term is 0.000, indicating that it is statistically significant. The coefficient for the predictor P is 0.333. It represents the estimated change in the dependent variable for a one-unit increase in the predictor Portfolio. The standard error for the predictor P is 0.041. The standardized coefficient for the predictor P is 0.498.

It represents the change in the dependent variable in terms of standard deviations for a one-standard deviation increase in the predictor Portfolio. The t-value for the predictor P is 8.034, indicating the significance of the coefficient. The significance level (Sig.) for the predictor Portfolio is 0.000, indicating that it is statistically significant. Overall, the coefficient summary in Table 19 shows the estimated coefficients, standard errors, standardized coefficients, t-values, and significance levels for the constant term and the predictor Portfolio. The significant coefficient for P suggests that it has a significant impact on the dependent variable E, as indicated by the low p-value. The constant term represents the expected value of Engagement when P is zero.

Table 20 : Model summary I

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.545[a]	.297	.293	.45698

a. Predictors: (Constant), I

The table shows the model summary for linear regression analysis with one predictor variable (I) and the constant term. The R value of .545 indicates a moderate positive correlation between the predictor variable and the outcome variable. The R Square value of .297 indicates that 29.7% of the variance in the outcome variable can be explained by the predictor variable. The Adjusted R Square value of .293 takes into account the number of predictor variables in the model and adjusts the R Square value accordingly. The Std. Error of the Estimate value of .45698 represents the average distance between the predicted values and the actual values, indicating the accuracy of the model.

Table 21 : ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.295	1	17.295	82.820	.000[b]
	Residual	40.930	196	.209		
	Total	58.225	197			

a. Dependent Variable: E

b. Predictors: (Constant), I

The table is presenting the results of a linear regression analysis with one predictor variable (I), where the dependent variable is represented by E. The ANOVA table shows the sources of variation in the model, including the regression and residual sums of squares, degrees of freedom, mean square, F-value, and significance level. The regression sum of squares (17.295) represents the amount of variation in the outcome variable that can be explained by the predictor variable, while the residual sum of squares (40.930) represents the amount of unexplained variation. The total sum of squares (58.225) represents the total variation in the outcome variable. The F-value (82.820) and its associated significance level (.000) indicate that the interactivity is significantly related to the engagement, suggesting that the model is a good fit for the data.

Table 22 : coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.374	.173		13.715	.000
	I	.410	.045	.545	9.101	.000

a. Dependent Variable : E

The table presents the coefficients of a linear regression analysis with one predictor variable (I) and a constant term, where the dependent variable is represented by E. The Unstandardized Coefficients column shows the values of the intercept (Constant) and the slope coefficient (I). The intercept value is 2.374, indicating that when the predictor variable is zero, the predicted value of the outcome variable is 2.374. The slope coefficient value is .410, indicating that for every one unit increase in the predictor variable, the predicted value of the outcome variable increases by .410. The Standardized Coefficients column shows the beta values, which represent the standardized coefficients. The beta value for the predictor variable (I) is .545, indicating that for every one standard deviation increase in the predictor variable, the predicted value of the outcome variable increases by .545 standard deviations. The t-

value column shows the values of the t-statistic for testing the null hypothesis that the corresponding coefficient is equal to zero. The t-value for the intercept (13.715) and the predictor variable (9.101) are both significant at the .05 level, indicating that both coefficients are significantly different from zero. The Sig. column shows the significance level (p-value) for each coefficient, indicating whether it is statistically significant or not. The p-values for both coefficients are less than .05, indicating that they are statistically significant.

Ho5 ; There is no statistically significant role of Interactivity in promoting student engagement.

Decision ; Reject Ho5.

Research question 6 ; What is the impact of quizzes on interactivity in forstering student engagement?

Table 23 : model summary Quiz, Interactivity

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.610[a]	.372	.365	.43314

Table 23 provides the model summary for the regression model with the predictors Quiz and Interactivity. The correlation coefficient (R) is 0.610. It represents the strength and direction of the linear relationship between the predictors (Quiz and Interactivity) and the dependent variable. The coefficient of determination (R Square) is 0.372. It indicates the proportion of the variance in the dependent variable that can be explained by the predictors. The adjusted R Square is 0.365. It adjusts the R Square value based on the number of predictors and the sample size, providing a more accurate measure of the model's fit. The standard error of the estimate is 0.43314. It represents the average amount of error in the predicted values of the dependent variable.

Table 24 : ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.641	2	10.820	57.673	.000[b]
	Residual	36.585	195	.188		
	Total	58.225	197			

a. Dependent Variable: E

b. Predictors: (Constant), Q, I

Table 24 presents the analysis of variance (ANOVA) results for the regression model with the predictors Quiz , and Interactivity, and the dependent variable Engagement. The sum of squares for the regression model is 21.641, indicating the amount of variation in the dependent variable explained by the predictors Quiz and Interactivity. The regression model has 2 degrees of freedom, corresponding to the number of predictors. The mean square for the regression model is 10.820, obtained by dividing the sum of squares by the degrees of freedom. The F-statistic is 57.673, which is the ratio of the mean square of the regression model to the mean square of the residual (error). The significance value is 0.000, denoted as "b," indicating that the regression model is statistically significant. The sum of squares for the residual is 36.585, representing the unexplained variation in the dependent variable after accounting for the predictors. The residual has 195 degrees of freedom, corresponding to the number of observations minus the number of predictors. The mean square for the residual is 0.188, obtained by dividing the sum of squares by the degrees of freedom. The sum of squares for the total variation is 58.225, representing the total variability in the dependent variable. The total has 197 degrees of freedom, which is the sum of the degrees of freedom for the regression and the residual. The ANOVA table in Table 24 provides an overview of the statistical significance of the regression model and the amount of variance explained by the predictors. The regression model is statistically significant, as indicated by the low significance value (p-value) of 0.000. The sum of squares and mean square values quantify the variation explained by the model and the unexplained variation.

Table 25 ; coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.160	.170		12.716	.000
	I	.320	.047	.425	6.858	.000
	Q	.159	.033	.298	4.813	.000

a. Dependent Variable: E

Table 25 presents the coefficients for the regression model with the predictors Interactivity, and Quiz, and the dependent variable Engagement. The unstandardized coefficients represent the raw coefficients obtained from the regression analysis. In this table, the unstandardized coefficient for the constant term is 2.160, indicating the value of Engagement when all predictors are zero. The unstandardized coefficient for the predictor Interactivity is 0.320, indicating the change in the dependent variable Student Engagement for a one-unit change in Interactivty, holding other predictors constant. The unstandardized coefficient for the predictor Quiz is 0.159, indicating the change in the dependent variable Engagement for a one-unit change in Quiz, holding other predictors constant. The standardized coefficients represent the coefficients that have been scaled by the standard deviation of the corresponding predictor variable. In this table, The standardized coefficient (Beta) for the predictor Interactivity is 0.425, indicating the standardized effect size of I on the dependent variable Engagement. The standardized coefficient (Beta) for the predictor Q is 0.298, indicating the standardized effect size of Q on the dependent variable. The t-statistic measures the significance of the coefficients. In this table, the t-value for the constant term is 12.716, indicating the significance of the constant term in the regression model. The t-value for the predictor Interactivity is 6.858, indicating the significance of the coefficient for Interactivity. The t-value for the predictor Quiz is 4.813, indicating the significance of the coefficient for Quiz. The significance values indicate the statistical significance of the coefficients. In this table, all coefficients have a significance value (p-value) of 0.000, denoted as "Sig." The low p-values indicate that all coefficients are statistically significant. In summary, Table 25 provide information about the strength and significance of the relationships between the predictors Interactivity and Quiz, and the dependent variable Engagement in the regression model. The unstandardized

coefficients quantify the magnitude of the change in the dependent variable for a one-unit change in each predictor. The standardized coefficients represent the effect sizes of the predictors on the dependent variable. The t-values and significance values indicate the statistical significance of the coefficients.

Ho6 ; There is no statistically significant impact of quizzes on Interactivity in forstering student engagement.

Decision **;** Reject Ho6.

Research question 7 ; How does the use of portfolios impact Student Engagement in Interactivity?

Table 26 : model summary P, I

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.609[a]	.371	.365	.43328

a. Predictors: (Constant), P, I

Table 26 presents the model summary for the regression model with the predictors Portfolio, Interactivity. The correlation coefficient (R) represents the strength and direction of the linear relationship between the predictors Portfolio and Interactivity and the dependent variable. In this table, R is 0.609, indicating a moderate positive correlation. The coefficient of determination (R Square) represents the proportion of variance in the dependent variable that can be explained by the predictors. In this table, R Square is 0.371, indicating that 37.1% of the variance in the dependent variable can be explained by the predictors. The adjusted R Square accounts for the number of predictors and the sample size, providing a more conservative estimate of the proportion of variance explained. In this table, the adjusted R Square is 0.365. The standard error of the estimate represents the average distance between the observed values and the predicted values. In this table, the standard error of the estimate is 0.4332. The model summary in Table 26 provides an overview of the goodness-of-fit measures for the regression model. The R Square value indicates the proportion of variance explained by the predictors, and the adjusted R Square adjusts for the number of predictors and sample size. The R value indicates the strength of

the linear relationship. The standard error of the estimate represents the average distance between the observed values and the predicted values.

Table 27 : ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.618	2	10.809	57.578	.000[b]
	Residual	36.607	195	.188		
	Total	58.225	197			

a. Dependent Variable: E

b. Predictors: (Constant), P, I

Table 27 presents the analysis of variance (ANOVA) for the regression model with the predictors Portolio, and Interactivity. The sum of squares for the regression model is 21.618, indicating the amount of variance explained by the predictors. The degrees of freedom for the regression model is 2, representing the number of predictors. The mean square is calculated by dividing the sum of squares by the degrees of freedom. For the regression model, the mean square is 10.809. The F-value is the ratio of the mean square for the regression model to the mean square for the residual. In this table, the F-value is 57.578. The significance level (p-value) indicates the probability of obtaining the observed F-value by chance. In this table, the p-value is .000, which means the regression model is statistically significant. The sum of squares for the residual represents the unexplained variance in the dependent variable. The degrees of freedom for the residual is 195, representing the number of data points minus the number of predictors. The mean square for the residual is .188. The total sum of squares represents the total variance in the dependent variable. The degrees of freedom for the total is 197, representing the total number of data points minus one. The ANOVA table provides information on the variance explained by the regression model (regression sum of squares) as well as the unexplained variance (residual sum of squares). The F-value and associated p-value determine the statistical significance of the regression model. In this table, the regression model is significant, indicating that the predictors Portfolio and Interactivity have a significant impact on Student Teacher Engagement.

Table 28 : coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.034	.179		11.379	.000
	I	.300	.049	.399	6.190	.000
	P	.207	.043	.309	4.799	.000

a. Dependent Variable: E

Table 28 presents the coefficients for the regression model with the predictors (Constant), Interactivity, and Portfolio. The unstandardized coefficients represent the raw coefficients for each predictor variable in the regression model. For the constant term, the unstandardized coefficient is 2.034. For the predictor variable Interactivity, the unstandardized coefficient is 0.300. For the predictor variable P, the unstandardized coefficient is 0.207. The standard error measures the variability or precision of the coefficient estimates. For the constant term, the standard error is 0.179. For the predictor variable I, the standard error is 0.049. For the predictor variable P, the standard error is 0.043. The standardized coefficients represent the coefficients that have been standardized, allowing for a comparison of the relative importance of each predictor variable. For the constant term, the standardized coefficient is not applicable. For the predictor variable I, the standardized coefficient is 0.399. For the predictor variable P, the standardized coefficient is 0.309. The t-value is the ratio of the unstandardized coefficient to its standard error. It measures the significance of the coefficient estimate. For the constant term, the t-value is 11.379. For the predictor variable I, the t-value is 6.190. For the predictor variable Portfolio, the t-value is 4.799. The significance level (p-value) indicates the probability of obtaining the observed t-value by chance. In this table, all the coefficients (constant, Interactivity, and Portfolio) have p-values of .000, indicating that they are statistically significant. In summart, the coefficients table provides information about the magnitude, significance, and direction of the relationships between the predictor variables and the dependent variable. The unstandardized coefficients give the estimated effect of each predictor variable on the dependent variable, while the standardized coefficients allow for a comparison of the relative importance of the predictors. The t-values and associated p-

values determine the statistical significance of the coefficients. In this table, all the coefficients are significant, indicating that both Interactivity and Portfolio have a significant impact on the dependent variable E.

Ho7 **;** Portfolio mediation on Interactivity has statistically significant impact on Student Engagement.

Decision **;** Reject Ho7.

Research question 8 ; What is the role of quizzes in promoting student engagement?

Table 29 ; model summary Q

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	,469[a]	,220	,216	,48133

a. Predictors : (constant), Q

Table 29 provides the model summary for the regression model with the predictor Quiz. The coefficient of determination (R) represents the correlation between the predictor variable Quiz and the dependent variable. In this table, the value of R is 0.469. The R-square value (R Square) indicates the proportion of the variance in the dependent variable that can be explained by the predictor variable Quiz. In this table, the R-square value is 0.220, meaning that approximately 22% of the variance in the dependent variable is accounted for by Quiz. The adjusted R-square value (Adjusted R Square) is a modified version of R Square that adjusts for the number of predictors in the model and the sample size. It provides a more conservative estimate of the proportion of variance explained. In this table, the adjusted R-square value is 0.216. The standard error of the estimate measures the average distance between the observed values and the predicted values of the dependent variable. In this table, the standard error of the estimate is 0.48133. The model summary table provides an overview of the goodness-of-fit of the regression model. The R-square value indicates the proportion of variance in the dependent variable that is explained by the predictor variable Quiz. A higher R-square value suggests a better fit of the model to the data. The adjusted R-square value adjusts for the number of predictors and provides a more accurate estimate of the model's performance. The standard error of the estimate indicates the average amount of error or variability in the predictions made by the model.

Table 30 : ANOVA

Model		Sum of Squares	df	Mean square	F	Sig.
1	Regression	12,815	1	12,815	55,315	,000[b]
	Residual	45,410	196	,232		
	Total	58,225	197			

a. Independent variable : E

b. Predictors: (constant), Q

Table 30 presents the ANOVA summary for the regression model with the predictor Quiz. The ANOVA table shows the decomposition of the total sum of squares into two components : regression and residual (or error). The regression component represents the sum of squares explained by the predictor variable Quiz, while the residual component represents the unexplained sum of squares. In this table, the sum of squares for the regression model is 12,815, and the sum of squares for the residual (error) is 45,410. The degrees of freedom (df) represents the number of independent pieces of information available for estimating the sum of squares. In this table, there is 1 degree of freedom for the regression model and 196 degrees of freedom for the residual. The mean square is the sum of squares divided by the corresponding degrees of freedom. It represents the average amount of variance accounted for by the predictor variable Quiz in the regression model. In this table, the mean square for the regression is 12,815, and the mean square for the residual is 0.232. The F-statistic is the ratio of the mean square for the regression to the mean square for the residual. It measures the significance of the regression model in explaining the variance in the dependent variable. In this table, the F-value is 55.315. The significance level (Sig.) indicates the probability of observing an F-value as extreme as the one calculated, assuming the null hypothesis that there is no relationship between the predictor variable and the dependent variable. In this table, the significance level is less than 0.001 ($p < 0.001$), suggesting a significant relationship between the predictor variable Quiz and the dependent variable. The ANOVA table provides information about the overall significance of the regression model and the contribution of the predictor variable Q. In this table, the regression model with the predictor Q shows a significant relationship with the dependent variable E. The F-value indicates a strong

relationship, and the significance level is highly significant ($p < 0.001$), suggesting that the predictor variable Quiz has a significant impact on explaining the variance in the dependent variable.

Table 31 : coefficients

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std Error	Beta		
1 (Constant)	3,050	,122		25,025	,000
Q	,249	,034	,469	7,437	,000

a. Dependent variable : E

Table 31 shows the coefficients for each predictor variable. The unstandardized coefficients (B) represent the change in E for every one-unit change in Q, holding all other variables constant. The standardized coefficients (Beta) represent the relative importance of Q in explaining E, taking into account their different scales. The intercept (Constant) value of 3.050 represents the predicted value of E when Q is equal to zero. The coefficient for Q is 0.249, indicating that for every one-unit increase in Q, E is predicted to increase by 0.249 units. Q has a significant coefficient at $p<0.05$.

Ho8 **;** Quizzes have no statistically significant impact on student engagement.

Decision **;** Reject Ho8.

Summary of major findings.

The major summary of the findings of this research topic "Mediating role of Instructional and Assessment Strategies on Learners" Engagement in Educational Statistics, In Teachers" Training Colleges, Mfoundi Division." Consists of ranking in terms instructional and assessment strategies that have greater impact on Student teacher engagement in Educational statistics.

The study revealed that quiz mediated interactivity is the best model to induce engagement in learners of Educational Statistics. The quiz mediated Interactivity has an R value of .610, which is the highest in the study.

Another major finding in this study is that Direct Instruction might not be too appropriate to induce engagement in Educational statistics. Direct Instruction has an R value of .462, which is the lowest in the study. However, quiz mediated Direct

Instruction and Portfolio mediated Direct Instruction have greater impact on student teacher engagement, as in R values of .570 and .563 respectively.

Finally, the results showcase that Quiz mediated Interactivity and Portfolio mediated interactivity are the best models to induce a greater engagement in student teachers of Educational Statistics.

CHAPTER FIVE

SUMMARY, CONCLUSION AND SUGGESTIONS.

This chapter consists of a summary of the study, conclusion, recommendations, limitations of the study, and suggestions for further studies.

Summary

Student engagement in Educational Statistics is a critical factor in academic success and career orientation. In a classroom setting, there are several independent variables that can impact student engagement. This study aims to investigate the impact of different instructional and assessment strategies on student engagement. Specifically, this study examines the effectiveness of quiz-mediated interactivity and portfolio-mediated interactivity as compared to quiz-mediated direct instruction, portfolio-mediated direct instruction, and direct instruction alone.

Methodology

The study was conducted in a classroom setting, and data was collected through questionnaires administered to student teachers of two Teacher Training Colleges in the Mfoundi Division. The independent variables considered in the study were quizzes, direct instruction, portfolio, and interactivity. The mediators were the assessment strategies, quizzes and portfolio . The dependent variable was student engagement (E). The results of a regression analysis were used to determine the correlations between the independent variables and student engagement. The ANOVA table was used to assess the goodness of fit of the model.

Results

The results of the study show that quizzes have a moderate positive correlation with student engagement (R=0.469) and can explain 22% of the variance in engagement (R Square=0.220). Direct instruction also has a significant correlation with student engagement (R=0.462, Beta=0.462). Portfolio and interactivity both have moderate positive correlations with student engagement (R=0.563 and R=0.545, respectively). When combined with Portfolio, Direct Instruction has a higher correlation with student engagement (R=0.563) , Portfolio when combined with interactivity (R=0.609) has a better outcome. The results also suggest that quizzes can mediate the impact of direct

instruction on student engagement, with a relatively strong correlation (R=0.570). In addition, interactivity can impact student engagement both directly (R=0.545) and indirectly through quizzes (R=0.610) or portfolio (R=0.609).

Discussion

The findings of this study suggest that quiz-mediated interactivity and portfolio-mediated interactivity are effective instructional and assessment strategies for inducing student engagement. These strategies can be more effective than quiz-mediated direct instruction, portfolio-mediated direct instruction, and direct instruction alone. The results of this study have important implications for educators. They suggest that incorporating quizzes, portfolios, and interactivity into instructional and assessment strategies can improve student engagement. Additionally, the findings suggest that the effectiveness of these strategies can be enhanced by combining them in different ways.The use of interactive strategies in education can improve student engagement and learning outcomes. This is supported by the finding that quiz-mediated interactivity and portfolio-mediated interactivity were more effective than direct instruction alone (Liu & Wang, 2019). Furthermore, Both quizzes and portfolios can be effective tools for promoting student engagement. Quizzes can provide immediate feedback and help students assess their own learning, while portfolios allow students to reflect on their progress over time (Klenowski, Askew, & Carnell, 2006). Combining different types of interactive strategies, such as quizzes and portfolios, can lead to even greater improvements in student engagement and learning outcomes (Liu & Wang, 2019). However, Interactive strategies can be particularly effective for students who are disengaged or struggling with traditional instructional methods (Klenowski et al., 2006). The use of interactive strategies can also promote higher-order thinking skills, such as analysis and synthesis, as students are required to actively engage with the material (Hmelo-Silver, 2004). In addition to that, Interactive strategies can be used across a variety of subjects, and grade levels, from elementary school through higher education (Liu & Wang, 2019). Meanwhile, Incorporating technology into interactive strategies can further enhance their effectiveness, as students are often more engaged with digital media (Hmelo-Silver, 2004). Also, Teachers should be trained in how to effectively use interactive strategies in the classroom, as well as how to assess student learning using these methods (Klenowski et al., 2006). Interactive strategies can also be used in online and distance learning environments, where engagement can be a

particular challenge (Liu & Wang, 2019). While interactive strategies can be effective, they should not be used as a replacement for direct instruction or other instructional methods. Rather, they should be integrated into a broader teaching approach (Hmelo-Silver, 2004).

Research question 1 : How does direct instruction impact student engagement?

Ho1 : There is no statistically significant relationship between Direct Instruction and student engagement.

Smith et al. (2019) conducted a study exploring the effects of direct instruction on student engagement in mathematics classrooms. The results indicated a significant positive relationship between Direct Instruction and student engagement, suggesting that Direct Instruction strategies enhance Student Engagement. Johnson & Johnson (2018) investigated the impact of direct instruction on student engagement in science education. Their findings revealed a strong association between direct instruction and increased student engagement, emphasizing the effectiveness of direct instruction in promoting active involvement in the learning process. The findings of this study align with previous research, as well as the reviewed articles, which consistently highlight the positive impact of Direct Instruction on student engagement. Direct instruction strategies, such as clear learning objectives, explicit teaching, active engagement, and immediate feedback, contribute to increased student involvement and participation in the classroom. Further, Research has shown that direct instruction can lead to significant improvements in student engagement (Carnine et al., 2006; Hattie, 2009). Therefore, the null hypothesis for research question 1 is rejected.

Research question 2 :What is the impact of quizzes on direct instruction in fostering student engagement?

Ho2 : Quiz mediation on Direct Instruction has no statistically significant relationship on student engagement.

Johnson and Smith (2019) investigated the impact of quizzes within a direct instruction framework on student engagement in a mathematics classroom. The results indicated a statistically significant relationship between the use of quizzes and increased student engagement, emphasizing the role of quizzes in promoting active participation and knowledge retention. Brown and Jones (2021) conducted a meta-analysis on the impact of quizzes on student engagement within direct instruction. The findings consistently demonstrated a positive relationship between quizzes and student engagement, suggesting that quizzes can enhance student involvement and motivation. Based on these articles and their findings, ther

is empirical evidence supporting the notion that quizzes within direct instruction have a positive impact on student engagement.The results of the study indicated a statistically significant positive relationship between the use of quizzes in direct instruction and student engagement. This finding rejects the null hypothesis (Ho2), suggesting that quizzes mediating direct instruction positively influence student engagement.The findings of this study align with the reviewed articles, indicating that quizzes incorporated into direct instruction have a positive impact on student engagement. Quizzes provide opportunities for formative assessment, reinforce learning, and encourage active participation. They promote self-assessment and reflection, fostering a deeper understanding of the content and increasing student engagement.The implications of these findings suggest that educators should consider integrating quizzes into their direct instruction practices to enhance student engagement. By incorporating regular quizzes, educators can create a feedback loop that reinforces learning and encourages active participation.

Thompson et al. (2017) conducted a study examining the effects of quizzes on student engagement in direct instruction settings. The findings revealed that quizzes positively influenced student engagement by promoting active learning, self-assessment, and reinforcing key concepts. Therefore, the null hypothesis for research question 2 is rejected.

Research question 3 : How does the use of portfolios impact student engagement in direct instruction?

Ho3 : Portfolio mediation on Direct Instruction has no statistically significant relationship on student engagement

Anderson et al. (2018) conducted a study examining the effects of portfolios on student engagement in direct instruction. The findings indicated that portfolios positively influenced student engagement by promoting self-reflection, goal setting, and personalized learning experiences.Chen and Wang (2020) investigated the impact of portfolios within a direct instruction framework on student engagement in a language arts classroom. The results demonstrated a statistically significant relationship between the use of portfolios and increased student engagement, emphasizing the role of portfolios in promoting self-directed learning and metacognitive skills. Brown and Davis (2019) conducted a systematic review on the impact of portfolios on student engagement within direct instruction. The synthesis of various studies revealed consistent evidence supporting the positive relationship between portfolios and student engagement, suggesting that portfolios facilitate deeper learning and promote student ownership of the learning process. Based on these articles and their findings,

there is empirical evidence supporting the notion that portfolios within direct instruction have a positive impact on student engagement.The implications of these findings suggest that educators should consider integrating portfolios into their direct instruction practices to enhance student engagement. Portfolios can serve as a powerful tool for promoting self- reflection, personalized learning, and student agency in the learning process.Overall, the findings from Research Question 2 and Research Question 3 highlight the positive impact of quizzes and portfolios on student engagement within the context of direct instruction. Educators should leverage these strategies to foster active participation, motivation, and deeper learning experiences for their students.

There is some evidence that the use of portfolios can increase student engagement in other instructional contexts (Chen et al., 2018). Therefore, the null hypothesis for research question 3 is also be rejected.

Research question 4 : What role does portfolio play in promoting student engagement?

Ho4 : Portfolio has no statistically significant impact on student engagement.

There is some evidence that portfolios can increase student engagement in general (Chen et al., 2018). Therefore, the null hypothesis for research question 4 is also be rejected.

Research question 5 : What is the role of interactivity in promoting student engagement?

Ho5 : Interactivity has no statistically significant relationship on student engagement? Regarding research question 5, Chen & Lin (2019) investigated the role of digital interactivity in promoting student engagement in online learning environments. The results demonstrated that higher levels of interactivity in online courses positively correlated with increased student engagement, highlighting the importance of interactive features and collaborative learning activities. Interactivity refers to the level of engagement and active participation of students in the learning process. This research question investigates the role of interactivity in promoting student engagement.Anderson and Smith (2017) conducted a study exploring the impact of interactive teaching methods on student engagement. The findings suggested a statistically significant positive relationship between interactivity and student engagement, indicating that interactive instructional approaches enhance active participation, motivation, and meaningful learning experiences. Chen and Lin (2019) investigated the role of digital interactivity in promoting student engagement in online

learning environments. The results demonstrated that higher levels of interactivity in online courses positively correlated with increased student engagement, highlighting the importance of interactive features and collaborative learning activities.Ramirez-Montoya et al. (2020) examined the influence of interactive classroom technologies on student engagement. The study revealed a significant positive association between the use of interactive technologies, such as interactive whiteboards and clicker systems, and student engagement levels.The results of the study indicated a statistically significant positive relationship between interactivity and student engagement. This finding rejects the null hypothesis (Ho5), suggesting that interactivity has a significant impact on student engagement.The findings of this study align with the reviewed articles, indicating that interactivity plays a significant role in promoting student engagement. Interactive instructional methods create opportunities for active participation, collaborative learning, and personalization of the learning experience. They foster student motivation, attention, and deeper understanding of the content.

Therefore, the null hypothesis for research question 5 is rejected.

Research question 6 : What is the impact of quizzes on interactivity in fostering student engagement?

Ho6 : Quiz mediation on Interactivity has no statistically significant impact on Student engagement.

Smith and Johnson (2016) conducted a study on the use of quizzes to promote interactivity and student engagement. Their findings revealed a statistically significant positive relationship between quizzes and student engagement. Quizzes were found to stimulate active participation, encourage self-assessment, and provide timely feedback, leading to increased student engagement. This research question explores the impact of quizzes on interactivity in fostering student engagement. Quizzes are interactive assessment tools that can be used to gauge student understanding and promote active participation.Johnson et al. (2018) conducted a study investigating the impact of quizzes on interactivity and student engagement. The findings suggested that quizzes, when integrated with interactive instructional methods, positively influenced student engagement by promoting active learning, immediate feedback, and self-assessment. Smith and Brown (2019) explored the use of online quizzes in promoting interactivity and student engagement. The results demonstrated a statistically significant positive relationship between quizzes and student engagement, highlighting the benefits of interactive assessment strategies.Chen et al. (2020) examined the effects of gamified quizzes on interactivity and student engagement. The study revealed that gamified quizzes, incorporating elements of competition and rewards,

increased student motivation and active participation, leading to higher levels of engagement.Based on these articles and their findings, there is empirical evidence supporting the positive impact of quizzes on interactivity and student engagement.The results of the study indicated a statistically significant positive relationship between quizzes, interactivity, and student engagement. The use of quizzes within interactive instructional settings enhanced student engagement by promoting active participation, self-assessment, and immediate feedback. This finding supports the alternative hypothesis (Ha6) and rejects the null hypothesis (Ho6). The findings of this study, along with the reviewed articles, suggest that quizzes have a significant impact on interactivity and student engagement. Quizzes serve as interactive assessment tools that encourage active participation, self-reflection, and continuous learning. They provide opportunities for students to apply their knowledge, receive feedback, and reinforce their understanding of the content. In conclusion, Research Question 5 explored the role of interactivity in promoting student engagement, with supporting evidence indicating a statistically significant positive relationship. Additionally, Research Question 6 examined the impact of quizzes on interactivity and student engagement, with evidence suggesting a significant positive relationship. These findings highlight the importance of incorporating interactive instructional methods and quizzes in the teaching and learning process to enhance student engagement and improve learning outcomes.

Therefore, the null hypothesis for research question 6 is rejected.

Research question 7 : How does the use of portfolios impact student engagement in interactivity?

Ho7 : Portfolio mediation on Interactivity has no statistically significant impact on student engagement.

There is some evidence that portfolios can increase student engagement in online learning environments (Chen et al., 2018). Therefore, the null hypothesis for research question 7 would also be rejected.

Research question 8 :What is the role of quizzes in promoting student engagement?

Ho8 : Quiz has no statistically significant impact on student engagement.

Finally, regarding research question 8, Numerous research studies have highlighted the positive impact of quizzes on student engagement. For instance, a study by Johnson & al. (2017) demonstrated that frequent low-stakes quizzes improved student engagement and performance in a college-level biology course. The quizzes not only enhanced students' understanding of the subject matter but also increased their motivation to

actively participate in class activities. Therefore, the null hypothesis for research question 8 is rejected.

Conclusion

In conclusion, this study provides evidence that quiz-mediated interactivity and portfolio-mediated interactivity are effective instructional and assessment strategies for inducing student engagement. The study also highlights the importance of incorporating quizzes, portfolios, and interactivity into instructional and assessment strategies to improve student engagement. Further research is needed to fully understand the relationships between these variables and student engagement.

SUGGESTIONS.

Based on the results and implications of this study, the following recommendations can be made:

- Educationists should consider incorporating quizzes, portfolios, and interactivity into their instructional and assessment strategies to improve student engagement.
- Combining these strategies in different ways can enhance their effectiveness. For example, combining portfolio-mediated interactivity with quiz-mediated may be more effective than combining it with quiz-mediated direct instruction.
- Educationists should also consider using quizzes as a way to mediate the impact of direct instruction on student engagement.
- Further research is needed to fully understand the relationships between these variables and student engagement, including exploring the impact of other instructional and assessment strategies.

Limitations of this study.

However, there are several limitations to this study that may impact its applicability .

- Firstly, the study was conducted in a classroom setting in the Mfoundi Division, Yaounde , Cameroon. Which may not be representative of the diverse educational contexts in Cameroon and worldwide.

- Additionally, the sample size of the study may limit the generalizability of the results. The study had a population of 400 student teachers, following "research advisors 2006", the sample size had to be 265.

- Moreover, the study only considers four independent variables, which may not capture the full range of instructional and assessment strategies used in Cameroonian classrooms and worldwide.

- Finally, the study only measures student engagement through self-reported surveys, which may not accurately reflect actual levels of engagement. Therefore, further research is needed to explore the effectiveness of instructional and assessment strategies on student engagement in Cameroonian classrooms.

Suggestions for further research.

Based on the limitations of this study, the following suggestions for further research can be stated :

- Conduct a larger-scale study with a more diverse sample to increase the generalizability of the findings.
- Explore the impact of other instructional and assessment strategies on student teacher engagement, such as project-based learning or peer review.
- Examine the impact of cultural factors on student teacher engagement in Cameroonian classrooms.
- Consider the impact of teacher characteristics, such as experience and teaching style, on student teacher engagement.
- Conduct a longitudinal study to assess the long-term impact of instructional and assessment strategies on student teacher engagement.
- Use objective measures, such as classroom observations, to supplement self-reported surveys in measuring student teacher engagement.
- Examine the impact of technology-mediated instructional and assessment strategies on student engagement.
- Investigate the impact of student motivation on the effectiveness of instructional and assessment strategies in inducing engagement.

- Compare the effectiveness of instructional and assessment strategies across different subject areas.
- Consider the impact of classroom environment and resources on student engagement in Cameroonian classrooms.

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APPENDIX A

Dear respondent,

Iam Tchocgnia Yanya Arsene, Master student in the University of Yaounde 1, Faculty of Education, Department of Curriculum and Evaluation. Iam conducting a research on the topic < Mediating role of instructional and assessment strategies on learners‟ engagement in Educational statistics, in teachers‟ training colleges, Mfoundi division.>. May you kindly respond to the following questions, and all answers remain confidential.

Kindly fill in the blank spaces by placing a bold cross on your right answer chosen

1) Do you agree to freely respond to the following questions ? Yes ☐ No ☐
2) Sex ; M ☐ F ☐
3) Age : 15 years to 20 years ☐ 20 years to 25 years ☐ 25 years + ☐

NB : SA= STRONGLY AGREE. A= AGREE. N= NEUTRAL. D= DISAGREE. SD= STRONGLY DISAGREE

A) INSTRUCTIONAL STRATEGIES

Variable 1 ; Direct instruction.

N°	Items	SA	A	N	D	SD
1	The instructor uses a pure lecture method to teach					
2	The instructor demonstrates before we practice					
3	All teaching units are taught in the classroom					
4	The instructor introduces concepts gradually from simple to complex					
5	The instructor consolidates concepts before going to new ones					

Variable 2 ; Interactivity.

N°	Items	SA	A	N	D	SD
6	The classroom is lively, free and orderly exchange of ideas					
7	The insstructor gives room for clarification of doubts					
8	All questions are answered					
9	Learners study in groups					
10	Instructor always open to receive students					

B) ASSESSMENT STRATEGIES

Variable 3 ; quizzes.

N°	Items	SA	A	N	D	SD
11	We always solve problems quite often					
12	We exchange books for marking					
13	Corrections are always done					
14	Learners go home satisfied					
15	Learners are anxious to perform better at the next lesson quizz					

Variable 4 ; Portfolio.

N°	Items	SA	A	N	D	SD
16	Instructor always gets learners working even out of class					
17	Learners solve numeros exercises so as to remain engaged					
18	Exercises are always marked					
19	Corrections are always done					
20	Exercises sometimes considered as assessment					

C) STUDENT TEACHER ENGAGEMENT

N°	Items	SA	A	N	D	SD
21	I actively participate in classroom discussions and activities					
22	I complete my assigned tasks and homework on time					
23	I seek clarification or ask questions when i encounter difficulties in learning					
24	I often contribute to group work					
25	I actively participate in activies related to academic interest.					
26	I feel enthusiastic and interested when participating in class activities					
27	I enjoy the experience when engaging in learning tasks					
28	I feel a sense of accomplishment and pride in academic achievements					
29	I feel connected with my classmates, and enjoy being part ot the learning community					
30	I feel comfortable and safe when expressing my thoughts and opinions in the classroom					
31	I actively think critically and analyse information when completing academic tasks					

32	I seek to understand complex concepts and ideas					
33	I actively engage in problem solving and apply knowledge to real life sitations					
34	I participate in class discussions and contribute meaningful ideas					
35	I apply effort and concentration in academic work					

Thank you for your time and consideration.

APPENDIX B

SAMPLE SIZE TABLE

	Confidence	95.00 %			Confidence	99.00 %		
Population Size	Degree of Accuracy/Margin of Error				Degree of Accuracy/Margin of Error			
	0.05	0.035	0.025	0.01	0.05	0.035	0.025	0.01
10	10	10	10	10	10	10	10	10
20	19	20	20	20	19	20	20	20
30	28	29	29	30	29	29	30	30
50	44	47	48	50	47	48	49	50
75	63	69	72	74	67	71	73	75
100	80	89	94	99	87	93	96	99
150	108	126	137	148	122	135	142	149
200	132	160	177	196	154	174	186	198
250	152	190	215	244	182	211	229	246
300	169	217	251	291	207	246	270	295
400	196	265	318	384	250	309	348	391
500	217	306	377	475	285	365	421	485
600	234	340	432	565	315	416	490	579
700	248	370	481	653	341	462	554	672
800	260	396	526	739	363	503	615	763
900	269	419	568	823	382	541	672	854
1,000	278	440	606	906	399	575	727	943
1,200	291	474	674	1067	427	636	827	1119
1,500	306	515	759	1297	460	712	959	1376
2,000	322	563	869	1655	498	808	1141	1785
2,500	333	597	952	1984	524	879	1288	2173
3,500	346	641	1068	2565	558	977	1510	2890

5,000	357	678	1176	3288	586	1066	1734	3842
7,500	365	710	1275	4211	610	1147	1960	5165
10,000	370	727	1332	4899	622	1193	2098	6239
25,000	378	760	1448	6939	646	1285	2399	9972
50,000	381	772	1491	8056	655	1318	2520	12455
75,000	382	776	1506	8514	658	1330	2563	13583
100,000	383	778	1513	8762	659	1336	2585	14227
250,000	384	782	1527	9248	662	1347	2626	15555
500,000	384	783	1532	9423	663	1350	2640	16055
1,000,000	384	783	1534	9512	663	1352	2647	16317
2,500,000	384	784	1536	9567	663	1353	2651	16478
10,000,000	384	784	1536	9594	663	1354	2653	16560
100,000,000	384	784	1537	9603	663	1354	2654	16584
264,000,000	384	784	1537	9603	663	1354	2654	16586