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Extent In-Service Training Strategy Employed by Heads of Schools for Teachers Enhances the Teaching of Basic Mathematics Subject in Public Secondary Schools in Iringa, Tanzania

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Abstract: This study examined the extent to which the in-service training strategy employed by the head of a public secondary Schools for teachers enhanced the teaching of Basic Mathematics in the Iringa Region, Tanzania, and was guided by instructional Leadership theory by Bolma and Deal (1990). The study adopted a convergent design under a mixed-methods Approach. The target population of 688 included 5DEOs, 143 Heads of schools, 143 Heads of Basic Mathematics departments, 339 Mathematics teachers, and 5 Quality Assurers. A sample of 67 participants, including 39 Mathematics teachers, was selected using stratified random sampling, with criteria for 10 HoSs and 10 HMDs, and Key informants for 4 DEOs and 4 QAs. Data collection tools comprised interview guides, questionnaires, and a document analysis guide. The data collection instruments were validated by three research experts in Education Planning and Administration from MWECAU. Reliability was ensured using a Cronbach's alpha coefficient of 0.892 for the teachers' questionnaire tools, indicating high internal consistency within the group. Quantitative data were analysed using descriptive statistics, and qualitative data were analysed using thematic analysis. The trustworthiness of the qualitative data was ensured through triangulation of information. Ethical considerations included research permits, informed consent, anonymity, confidentiality, and acknowledgement of sources. The findings revealed that to a high extent, heads of secondary schools employed in-service training strategy for teachers to enhance the teaching of Basic Mathematics in Iringa such as departmental training, seminars, mentoring, workshops, internal expertise, whereby departmental training and seminars were most priotised by the heads of school as trategies which enhanced Mathematics subject teaching, content delivery, teamwork, and teachers' skills teaching techniques. The inconsistent implementation of in-service training limited enhancement. The study concludes that heads of schools' in-service training strategies enhance the teaching of Basic Mathematics to a high extent in secondary schools, although their enhancement varies across schools and is constrained by teacher shortages, limited resources, inadequate planning, inconsistent participation, and weak implementation.The study recommends that the Ministry of Education, DEOs, and HoSs strengthen teacher recruitment, institutionalise in-service training, expand stakeholder support, integrate it into school timetables, and promote collaborative leadership to improve Mathematics teaching.

Keywords: *Extent In-Service Training, Employed Strategy, Enhance Teaching, Mathematics Teachers, Mathematics Subject.*

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I. INTRODUCTION

Mathematics is indispensable to the world as it forms the foundation for logical reasoning, scientific advancement, and everyday decision-making, such as budgeting, cooking, and navigating. It is essential for technological innovation, economic planning, and understanding natural patterns. Teaching Basic Mathematics is necessary to build critical thinking skills, enhance economic ability, and prepare individuals for diverse, high-level careers in engineering, science, scinece and technology (Agbata et al., 2024). UNESCO 2024 regarded Basic Mathematics as a key means for achieving Sustainable Development Goal 4, on quality education and in equipping learners with the quantitative

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reasoning necessary for participation in a technology-driven world (Lina et al., 2025). International monitoring and policy reports also underscore the quality of Basic Mathematics teaching as crucial to achieving equitable and lifelong learning outcomes, thereby providing adequate support for mathematics teachers and strengthening learners' logical reasoning, critical thinking, and transferable skills across subjects. Consequently, quality Basic Mathematics teaching empowers individuals, supports workforce readiness, and drives national socio-economic development.(UNESCO, 2024).

Globally, education systems continue to face challenges such as limited access to education, poor learner retention, and inadequate progression, which restrict the development of foundational Basic Mathematics skills. Furthermore, ineffective teaching practices, inadequate teacher preparation, and limited instructional resources contribute to low learner achievement and poor mathematical proficiency.(UNESCO, 2023). United Nations (2026) reports that more than half of all children and adolescents worldwide are failing to meet minimum learning standards in Mathematics. According to Skipp and Dommett (2021), In England, ineffective Basic Mathematics teaching, driven by limited teacher autonomy and inadequate continuous professional development, contributes to low student achievement and highlights the need to strengthen the extent of in-service training provided by heads of public secondary schools. Moreover, in the United States, Basic Mathematics achievement remains below pre-pandemic levels, particularly among lower-achieving students, highlighting the need to strengthen teaching through active learning, mentoring, curriculum alignment, in-service training, and targeted professional development (Franklin & Chang, 2025). According to Maguate et al. (2024), the highlighted challenges in Philippines include insufficient planning and preparation of training programmes, inadequate resources and technological support, and low teacher participation, which reduce the effectiveness and long-term sustainability of professional development initiatives.

A study by Uworwabayeho (2024), pointed out the importance of in-service training programs for Mathematics teachers in secondary schools in Rwanda. In Kenya, a study by Ouro et al. (2024) highlighted the problem of the quality of in-service teacher training to enhance teacher commitment and foster more engaged teachers in the country. However, the extent to which in-service training strategies enhance the Teaching of mathematics is not well addressed. Therefore, this reinforces the argument that the extent of in-service training strategy employed by the heads of public secondary Schools for Mathematics Teachers Enhances the Teaching and Learning of the Mathematics Subject.

In Tanzania, the Education and Training Policy (ETP, 2014, revised 2023) and the Education Sector Development Plan (2025/26) emphasise continuous professional development, school-based training (MEWAKA), mentoring, coaching, and instructional leadership to strengthen Basic Mathematics teaching and improve learner outcomes (URT, 2023). Despite these initiatives, Mathematics performance remains persistently low: the 2025 CSEE Basic Mathematics pass rate increased by only 1.1 percentage points but is still classified by NECTA as below average, while Iringa Region continues to record pass rates below 16.32% (NECTA, 2025/2026;URT, 2026). Despite these policy efforts, the teaching of Basic Mathematics in Tanzania remains a major concern. Studies have identified several strategies affecting Mathematics teaching, including inadequate professional training among teachers, inappropriate teaching methods, limited classroom support, and large class sizes that restrict individual learner attention (Urio & Mwakabenga, 2025; Komomelo 2024; Deogratias & Paulo 2025). As reported by Assey and Babyegeya (2022), effective teaching of Basic Mathematics in community-based secondary schools in Tabora Region was affected by poor teaching environments, language-related challenges, teacher shortages, weak school management skills, and inadequate in-service training opportunities. According to the analysis by Iringa Region Education Office (2025), the pass rate in Basic Mathematics is 16.32 per cent, which is below the required standard in Tanzania, thus, indicating that most teachers struggle to improve competencies in Basic Mathematics in Iringa, as summarised in Table 1.1, showing the pass rate for three years.

Table 1. Three-Year Trend of Iringa Region Evaluation of CSSE Pass Rates of the Basic Mathematics Subject

Subject	2023	2024	2025
Basic Mathematics	17.4%	16.1%	18.6%

Source: URT (2023); Iringa Region Education (2025).

In Iringa Region, the teaching of Basic Mathematics `has remained persistently poor over several years despite efforts of improving it. According to Regional education reports, the pass rate of 17.4% in Mathematics is lower than is the case in other two regions of Mbeya (19.03%) and Njombe (18.07%), which also recorded low pass rates in the 2025 CSEE (URT, 2023; Iringa Region Education Office, 2025). The persistent poor performance in Basic Mathematics in Secondary schools in the region raises concerns about the effectiveness of school-level management in-service training strategy that support the teaching of Basic Mathematics. Iringa Region was chosen because Basic Mathematics performance is poor; thus, the region provides the setting in which the teaching of Basic Mathematics alongside the in-service training strategy used by Heads of School is examined. Although teachers are directly responsible for classroom teaching, Heads of School enhnace the conditions under which teaching occurs through supervision, professional development support, and the

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promotion of teamwork among Mathematics teachers. Understanding the in-service training used by Heads of School provides important insights into how they (School Heads) enhance the quality of Basic Mathematics teaching in public secondary schools.

Previous studies have examined strategy-enhanced Mathematics teaching performance; however, many have focused on teachers' competencies, instructional methods, learner attitudes, and the availability of resources. Limited attention has been paid to the in-service training strategy used by Heads of School, to enhance the teaching of Mathematics in public secondary schools in Iringa Region. Therefore, there is a need to investigate the extent to which in-service training contributes to enhancing the teaching of Basic Mathematics. This study therefore examines the extent to which the in-service training strategy used by Heads of Public Secondary Schools enhances the teaching of Basic Mathematics in Iringa Region, Tanzania.

- *Statement of the Problem*

Inadequate Teaching of Basic Mathematics continues to be a major social problem in the Iringa Region. This limits students' progress in Basic Mathematics, access to science and technology careers, and overall national development. Examination records in Iringa show low persistence in mathematics achievement, with an average performance of 17.43% over four consecutive years, indicating that most students fail to acquire basic mathematics skills (Iringa Educational Office, 2024). This situation has raised concerns among education stakeholders, including students, parents, government educators, and policymakers, about the limited improvement in mathematics teaching (URT, 2023). Previous studies, such as Nkya and Bimbiga (2023); Kyaruzi et al. (2023), focused on the positive effects of in-service training on science and mathematics teachers' teaching strategies, the importance of school-based mentorship and support for mathematics teachers' competencies, and the effectiveness of in-service teacher training programs in improving teaching quality and student achievement. However, there is a lack of clarity regarding the extent to which the in-service training strategies for mathematics teachers enhance the Teaching of mathematics. Therefore, this study was examined on the extent to which in-service training strategy employed by heads of schools for teachers enhance the Teaching of mathematics in public secondary schools in Iringa, Tanzania.

- *Research Question*

The following research question guided the study:

To what extent does the in-service training strategy used by the heads of Schools for teachers enhance the Teaching of Mathematics subjects in public secondary schools in Iringa region, Tanzania?

- *Significance of the study*

Findings of the current study are significant because they provide context-specific evidence on the in-service training used by Heads of public secondary schools in enhancing the teaching of Basic Mathematics. The study contributes to the implementation of the Education and Training Policy (ETP 2014/2023) by providing practical insights into extent to which the support provided by Heads of School enhances teachers' capacity, teaching supervision, and the overall quality of the teaching of Basic Mathematics. Specifically, the findings demonstrate the extent to which the in-service training strategy used by Heads of Schools enhances the Teaching of Mathematics. The study contributes to the existing body of literature by addressing the knowledge gap in the application of management strategies to enhance the teaching of Basic Mathematics in secondary schools on the extent to which in-service training strategies employed by school heads enhance Mathematics teaching in public secondary schools.The findings are also significant to key education stakeholders, including Quality Assurers, District Education Officers, Heads of Schools, and Heads of Basic Mathematics Departments, by providing useful information on effective in-service training strategies to enhance teaching supervision, support teachers' professional development, and improve classroom teaching practices. Finally, the study will extend the applicability of instructional leadership theory by empirically demonstrating how heads of schools' use of in-service training strategies directly supports mathematics teachers' teaching practices and enhances Mathematics teaching in real school contexts.

II. THEORETICAL FRAMEWORK

The current study was guided by Instructional Leadership Theory, developed by Hallinger and Murphy (1985) and later expanded by Leithwood (1992), which emphasises that school leaders improve teaching and learning by focusing on instructional rather than purely administrative responsibilities. The theory highlights key leadership practices, including setting clear academic goals, supervising instruction, monitoring student progress, promoting teachers' professional development, providing instructional resources, creating a positive learning environment, and fostering collaboration among teachers and other stakeholders. Its major strengths lie in enhancing teaching quality, teacher professional growth, accountability, and collaboration, all of which contribute to improved student achievement. However, the theory is limited by its heavy reliance on school leaders, the potential restriction of teacher autonomy through close supervision, and limited consideration of external factors such as community support, government policies, and socioeconomic conditions (Hallinger. Despite these limitations, the theory provides an appropriate framework for explaining how Heads of Public Secondary Schools can use management strategies to enhance the teaching of Basic Mathematics in Iringa Region, Tanzania.

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III. REVIEW OF EMPIRICAL STUDIES

This part presents a review of empirical studies on the extent to which the in-service training strategy employed by the head of the School for teachers enhances the Teaching of Mathematics subjects in public secondary schools in Iringa, Tanzania, to identify gaps related to focus, methodology, and context.

Pascual, (2024), examined the teaching competence level of 21st-century Mathematics Teachers: the basis for the in-service Training program in the Philippines. The study employed descriptive, correlational, and developmental research designs. The data were collected from 54 mathematics teachers. The findings indicated that the in-service training seminars were highly accepted and effective in maintaining teachers' high levels of competence in Mathematics. Yet, continuous professional development remains necessary to address remaining skill gaps and further enhance the professional capacity of Mathematics teachers in the Philippines. The study contributed to knowledge of the competence levels of mathematics teachers through in-service training in the Philippines. This study adds to the knowledge of the extent to which school heads use in-service training management strategies. Adding a convergent research design to the mixed-methods approach enriched the findings and triangulated data on the extent to which the in-service training strategy employed by the head of the School for teachers enhances the Teaching of Basic Mathematics subject in the Iringa region, Tanzania.

Sibanda and Amin, (2021), explored the link between a mentorship program for in-service teachers and their professional development in Pinetown, South Africa. Focused on under-qualified mathematics, science, and technology teachers employed in junior secondary schools. Using a mixed-methods approach, data were collected through a questionnaire and semi-structured interviews. The findings indicated a strong association between mentoring and the teachers' development of in-service teachers' built competence, particularly in enhancing their Mathematics subject content knowledge. The reviewed study provided insight into the professional development of in-service teachers, explained little of the extent of in-service training provided by school heads, and used semi-structured interviews. The current study employed a convergent mixed-methods research design, including questionnaires, interviews, and observations, to enrich the findings by triangulating data on the extent to which the in-service training strategy employed by the head of the School for Mathematics teachers enhances the Teaching of the Mathematics subject in the Iringa region, Tanzania.

Bugingo and Hesbon, (2024), investigated the impact of cooperative learning approaches on student performance in mathematics in public secondary schools in Rwanda. Focused on the role of face-to-face interaction, the influence of group accountability, and the effect of interpersonal skills on students' academic success. The study employed both quantitative and qualitative methodologies, using questionnaires, interviews, and observations to collect data. Results emphasised that face-to-face mentorship strengthens teamwork and problem-solving, enabling learners to quickly identify their teaching and learning strengths and areas for improvement in Mathematics, and that this is supported by timely, personalised teacher guidance. The reviewed study provides insight into face-to-face interaction approaches in Teaching and learning. However, the extent to which heads of schools employ in-service training was a gap for this study. Also provided insight into the mixed-methodology approach used. To address this gap, the current study employed a convergent mixed-methods design to investigate the extent to which the in-service training strategy implemented by the head of the Mathematics department for Mathematics teachers enhances the teaching of Mathematics in the Iringa region, Tanzania.

Uzorka et al. (2024), conducted a study on the effectiveness of in-service teacher training programs in enhancing teaching quality and student achievement in Kampala, Uganda. Focused on maintaining high standards in Teaching and student achievement. The study employed a mixed-methods approach, using a survey research design to collect data. The findings indicated that the workshop training increased Mathematics teachers' confidence, enhanced student engagement, teacher motivation and morale, and had an impact on student achievement in Mathematics. The reviewed study provided comprehensive insights into maintaining high standards in Teaching and student achievement in Kampala, Uganda. The study also noted that the survey design limits the clarity and rationality of the data. This study focused on the extent of the in-service training strategy to enhance Teaching in Mathematics in the Iringa Region. Enriching data, the current study employed a convergence research design to examine the extent to which the in-service training strategy employed by the head of the School for Mathematics teachers enhances Teaching of the Mathematics subject by utilising multiple tools of data collection, such as questionnaires, interviews and observation, for the generalizability and transferability of findings in the Iringa region, Tanzania.

Mchami and Mhando, (2023), explored the challenges facing in-service training operations in public secondary schools in Mbeya district, Tanzania. The study was guided by a convergent parallel research design within a mixed-methods approach. Questionnaires and interviews were used to collect data, which were analysed descriptively and thematically. The findings revealed that in-service training strengthens Mathematics teachers' subject knowledge, pedagogical and assessment skills, and their use of learner-centred approaches, thereby enhancing their professional competence. However, it has encountered several challenges, including insufficient budgets and inadequate time allocated for it in Mbeya district. The reviewed study provided insights into key aspects of teachers' in-service training and the challenges it poses. The extent to which the heads of schools in public secondary

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schools employed in-service training management strategies was the gap for this study. Also, the reviewed study provided awareness of the employment of a convergent parallel design. Adding a convergent research design within the mixed-methods approach enriches the findings through triangulation of data on the extent to which the in-service training strategy employed by the head of the Mathematics department for Mathematics teachers enhances the Teaching and learning of the Mathematics subject in the Iringa region, Tanzania.

Nkya and Bimbiga,(2023), investigated the effects of in-service training on the implementation of departmental strategies among secondary school teachers of science and mathematics in Mwanza, Tanzania. The study employed a mixed-methods research design combining quantitative and qualitative approaches, which were analysed descriptively and thematically. The findings revealed that departmental training increased teachers' confidence, knowledge, and skills, and enhanced engaged teaching practices. They underscored the importance of investing in teacher training programs to improve the quality of education in Tanzania. The reviewed study contributed important insights into the impacts of in-service training. Teachers who participate in in-service training benefit from increased confidence, knowledge, and skills, which can translate into more effective and engaging teaching practices. The extent to which the in-service training strategy employed by the head of the School for Mathematics teachers adequately addressed to enhance the teaching and learning The current study employed a convergent research design using mixed methods, including questionnaires, interviews, and observations, to enrich the findings by triangulating data on the extent to which the in-service training strategy employed by the head of the School for Mathematics teachers enhances the teaching of the Mathematics subject in Iringa region, Tanzania.

Generally, the empirical reviews identified knowledge gaps. The studies focused on the effectiveness of in-service teacher training programs (Uzorka et al., 2024), Sibanda & Amin, (2021), the study focuses on a mentorship program for in-service teachers and their professional development, and the effects of in-service training on the implementation of departmental strategies (Nkya and Bimbiga, 2023). The current study investigated the extent to which the in-service training strategy employed by the head of the Mathematics department for Mathematics teachers enhances Mathematics teaching and learning. The contextual gaps. Most studies were conducted outside Tanzania, and some were based on teachers as the unit of analysis (Pascual, 2024; Sibanda & Amin, 2021). The current study was conducted in Iringa Region, Tanzania. Methodological gaps based on the design used. The study by Pascual (2024) employed a developmental research design, and Uzorka et al. (2024) used a survey design. The current study employed a convergent design under a mixed-methods research approach to fill the gap on the extent to which the in-service training strategy employed by the head of the School for Mathematics teachers enhances the teaching of the Mathematics subject in Iringa region, Tanzania.

IV. DESIGN AND METHODOLOGY

This study adopted a pragmatic research paradigm as the guiding framework, allowing a mixed-methods approach. The targeted population comprised 688 individuals from 143 public secondary schools, including 5 DEOs, 143 HoSs, 392 Mathematics teachers, 143 HMDs, and 5 QAs; The study's sample comprised 67 participants from 27 public secondary schools, 10-30% used, including 4 DEOs and 4 QAs selected through key informant sampling, 10 HPSSs and 10 HMDs selected through criterion sampling, and 39 Mathematics teachers selected through stratified random sampling. The data collection instruments included an interview guide, questionnaires, and a document analysis guide. The data collection instruments were validated by three research experts in Education Planning and Administration from MWECAU. Pilot testing was conducted, constituting 10% of the sample size. The reliability of the quantitative data collection instrument was ensured using Cronbach's alpha, which yielded a coefficient of 0.892, as facilitated by SPSS version 27, indicating high internal consistency within the group. According to Creswell and Creswell (2023), a Cronbach's Alpha value of 0.70 or higher is considered reliable to continue with the study. The trustworthiness of the qualitative data was ensured through inter-coder agreement and Triangulation. Quantitative data were analysed using descriptive statistics (means and percentages) in SPSS version 27. Qualitative data were analysed using a seven-step thematic analysis framework that involves organising data, reading, coding, generating themes, describing, reporting, and interpreting meanings systematically, as described by Creswell and Creswell (2023). Both quantitative and qualitative data intemanagedtion were marged. The findings were triangulated through the interpretation of quantitative and qualitative data sets. The researcher observed some ethical considerations, including obtaining informed consent, obtaining research permits, maintaining confidentiality, and acknowledging sources.

V. RESULTS AND DISCUSSION

The study sought to establish the Extent to which the in-service training strategy employed by the heads of schools for Mathematics teachers enhances the Teaching and learning of Mathematics subjects in public secondary schools**.** The data were collected from Mathematics teachers, school heads, district education officers, quality assurance officers, and heads of Mathematics departments. Questionnaires, an interview guide, and a document analysis checklist were used to collect data. Likert scale responses from the questionnaires were interpreted using established classification schemes. According to Nyutu et al. (2020), the mean score of 4.21-5.00 is a Very High Extent, 3.41-4.20 as a High Extent, 2.61.3.40 as a Moderate Extent, 1.81-2.60 as a Low Extent, and 1.00- 1.80 as a Very Low Extent. The percentages are interpreted as follows: 0%-20% =Very Low Minority, 21%-40% =Low Minority, 41 - 60% =Moderate Majority, 61% - 80% =High Majority, 81%-

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100%=Very High Majority, as adapted from (Mazurek et al., 2021)

Table 2: Mathematics Teachers' Responses on the Extent to which the Heads of Schools used In-Service Training in Schools is Provided to Enhance the Teaching of Mathematics (n=36).

Statements	VLE		LE		ME		HE		VHE		mean
	f	%	f	%	f	%	f	%	f	%	
i. The head of the school often supports departmental training to address specific needs in Mathematics subjects to enhance interactive Teaching	0	0	3	8	11	31	16	44	6	17	3.69
ii. The head of School regularly organizes workshops that enhance instructional strategies for Mathematics teachers to improve classroom interactive teaching of the mathematics subject.	3	8	3	8	12	33	13	36	5	14	3.39
iii. The head of School usually facilitates teacher participation in seminars to enhance active Teaching of the Mathematics subject.	0	0	4	11	3	8	21	58	8	22	3.92
iv. The heads of the Schools commonly organizes crusters for Mathematics teachers to enhance teaching the Mathematics ssubject	1	3	4	11	16	44	9	25	6	17	3.42
v. Head of School regularly invites Mathematics experts to conduct training that enhances Mathematics teachers' ability to integrate curriculum content effectively into teaching the mathematics subject.	4	11	9	25	12	33	10	28	1	3	2.86
vi. The Head of School usually ensures practice-oriented in-service learning for ongoing improvement in Mathematics teaching.	1	3	4	11	13	36	14	39	4	11	3.44
vii. The head of the School provides mentoring and coaching support to Mathematics teachers to enhance Mathematics teaching.	0	0	4	11	11	31	17	47	4	11	3.58
viii. The head of School often promotes participation in Mathematics activities, such as Pi Day, to enhance shared Teaching of Mathematics subject	7	19	4	11	10	28	10	28	5	14	3.06
ix. The head of School frequently monitors the implementation of in-service training outcomes in Mathematics classrooms.	0	0	6	17	14	39	11	31	5	14	3.42
x. Head of School commonly allocates time within the school schedule for Mathematics in-service training activities for building teaching capabilities	1	3	4	11	12	33	15	42	4	11	3.47
Grand Mean											3.42

Source: Research Field (2025).

Key: 1. VLE = Very Low Extent, 2. LE = Low Extent, 3.ME = Moderate Extent, 4. HE = High Extent, 5.VHE = Very High Extent, f = Frequency, % = Percentage.

In Table 2, a majority of Mathematics teachers (61%) rated Heads of Schools to a high extent as employing departmental training designed to enhance interactive Teaching, teaching techniques, skills, and in-service training competence. A low minority (31%) of teachers rated the departmental training employed to a moderate extent, and a very low minority (8%) rated it to a low extent, resulting in a mean score of 3.69, indicating to a high extent. This implies that, to a high extent, heads of public secondary schools effectively use departmental training to enhance the teaching of Basic Mathematics by improving Mathematics teachers' professional competence, thereby improving instructional quality and the teaching of challenging Mathematics topics.

Data were triangulated using interview guides and a document analysis guide, which were integrated and presented through quotations and narratives. Interviews with Quality Assurers (QAs), District Education Officers (DEOs), Heads of School (HoS), and Heads of Mathematics Department (HMDs) revealed that HoS regularly organised seminars for Basic Mathematics teachers to enhance teaching practices and improve the delivery of the subject. As Quality Assurer responded, "*Heads of schools reported to them that they employed departmental in-service training through weekly MEWAKA sessions that equips teachers' knowledge for teaching, but teacher shortages and scheduling training after regular periods limit its enhancement"* (QA_1, 20th June 2025). DEOs said, "*heads of schools told them that they organised Teachers meetings in the Mathematics department to share strategies when faced with difficult topics, which helps to gain knowledge, and* HoS reported, "*They irregular organised departmental training in Mathematics, which occurs only when teaching challenges arise due to limited teacher expertise and staffing"* (HoS_3, 10th July, 2025). Heads of Mathematics

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Departments said, *"Heads of schools provided training in the department through Mathematics teachers who attended government-organised training sessions and then share the knowledge in departmental training sessions"* (HMD_2, 9th July 2025).

The views from Quality Assurers, District Education Officers, Heads of Schools, and Heads of Mathematics Departments indicate that Heads of Schools employed departmental in-service training as an important strategy for enhancing Basic Mathematics teachers' pedagogical knowledge and instructional skills through collaborative learning and knowledge sharing. However, its implementation is inconsistent across schools due to teacher shortages, limited expertise, inadequate staffing, and time constraints, reducing its effectiveness in improving the quality of Mathematics teaching.

Furthermore, a document analysis was conducted on a MEWAKA session titled "*Basic Mathematics departmental training to address teaching challenges*" This indicated that, in departmental training held on 10th August 2023, Basic Mathematics teachers discussed difficult topics, including three-dimensional figures and geometry, and reflected on students' performance. The document analysis implied that school heads employed in-service training for Basic Mathematics teachers to address challenges in Mathematics content areas. This helped teachers gain knowledge, ability, and confidence in teaching Mathematics. However, the training was irregular due to timetable barriers, limiting its effectiveness in improving Mathematics teaching. As a result, while some schools recorded improvement in Mathematics performance, others showed little or no change.

The study indicates that heads of schools employed a departmental training strategy to a high extent to improve Mathematics teachers' capacity, teaching techniques, content delivery, problem-solving ability, and knowledge sharing, which enhanced the quality of teaching Basic Mathematics. The results demonstrate that heads of schools employed departmental training as a strategy to improve teachers' capacity and enhance Mathematics teaching through partnership, structured knowledge exchange, and leadership guidance, while acknowledging challenges that hinder training and limit the Enhancement of Mathematics teaching. These findings align with Bugingo and Hesbon (2024), who emphasise that face-to-face professional interactions strengthen teamwork, problem-solving, and personalised teaching support. They are also supported by instructional leadership theory (Bolman & Deal, 1991), which identifies teamwork and systematic knowledge sharing as key mechanisms for enhancing Teaching.

The data in Table 2 show that a moderate majority of Mathematics teachers (50%) rated to a high extent that Heads of schools regularly organised workshops enhancing the Teaching of Mathematics. A low minority (33%) rated it to a moderate extent, and a very low minority (16%) rated it to a very low extent. The mean score of 3.39 indicates that, to a moderate extent, heads of public secondary schools organized workshop training that enhanced the teaching of Basic Mathematics. This implies that workshops contribute to improving teachers' competence, pedagogical skills, and overall teaching quality, which in turn enhances interactive teaching of Basic Mathematics subject.

In addition, during interviews, QAs, DEOs, HoSs, and HMDs were asked as to how Heads of School organised training workshops for Basic Mathematics teachers to enhance the teaching of Basic Mathematics. One Quality Assurer explained: *"Heads of schools reported to him that they Workshops are occasionally organised to address difficult Mathematics topics and share new methods which enhance teachers' quality and confidence in teaching, but mainly depend on serious challenges within the school"* (QA_3, 25th June 2025). Heads of Schools reported, "*Honestly, we have not initiated any workshops at the school. At times, such programs depend on teacher requests. However, since no such requests from Mathletics teachers have been made, we have not conducted any workshop training at our School" (HoS_{10}, July 24th 2025)*. The HMDs indicated, "*Thank you to the head of school's efforts of organising workshops which built our capacity in Teaching, although teachers attend workshops rarely. Mathematics workshop training ensures mathematics teachers' quality teaching techniques and classroom skills delivery"* (HMD_2, 9th July 2025).

The views from interviews revealed that heads of schools organised in-service training workshops for Mathematics teachers, enhancing skills growth and teaching quality,to address complex topics and impart teachers' competencies and teaching techniques, which enhanced the quality of teaching of Basic Mathematics. However, inadequate funds and limited training schedules constrain irregular implementation of in-service training, reliance on emerging challenges, and persistent shortages of Mathematics teachers across schools.

This study indicates that Heads of Schools organise workshop-based in-service training to a moderate extent, contributing to improved Basic Mathematics teachers' pedagogical competence and instructional skills, which enhance the teaching of Basic Mathematics through improved teaching quality. However, the implementation of these workshops is inconsistent due to inadequate funding, irregular training schedules, teacher shortages, and reliance on emerging instructional challenges rather than systematic professional development.These findings align with those of Uzorka et al. (2024), who emphasised peer teaching and hands-on in-service workshops as active in improving teacher quality and student achievement. Similarly, they are consistent with Leithwood's (1990–2000) leadership framework, as cited by Hompashe (2024), which highlights strengthening curriculum delivery, teacher competence, and instructional leadership in Mathematics subject.

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The data in Table 2 indicate that a low minority (31%) were rated to a high extent suggesting that heads of schools invited external experts to train Basic Mathematics teachers, a low minority (36%) of Mathematics teachers were rated to a low extent. A low minority (33%) of teachers were rated to a moderate extent, resulting in a moderate extent (2.86): this implies that to a moderate extent heads of public secondary schools invited external experts to facilitate in-service training within schools for improve teachers' skills and competence development, which enhances the teaching of the Basic Mathematics subject, but was not applied consistently across the surveyed schools.

The information was collected through interviews with the QAs, DEOs, HoSs, and HMDs who responded and confirmed the quantitative data on the invitation of external experts to facilitate in-service training for Mathematics teachers, as the Quality Assurer said,"*Yes, heads of schools reported to him that they are invited external Basic Mathemathmatics experts, often used internal competent Mathematics teachers from our ranks to share skills*"(QA_1,20th July 2025). Furthermore, the DEO responded, "*Heads said to her that they rely on our capable mathematics teachers who guide peers' training through complex content to part knowledge. This internal support enhances teaching strategies and strengthens mathematics teaching*" (DEO_3, 2nd July 2025).

As noted by HoS,

I like to invite external experts from the Ministry of Education to assist mathematics teachers in updating their knowledge in the new curriculum and improving teaching quality in Mathematics; however, a shortage of Mathematics teachers and limited funds hinder these efforts (HoS_3, 10th July 2025).

The head of school responded, "*Yes, since we have had only one mathematics teacher, we have not invited any external expert to assist teachers. This limitation reduces opportunities to strengthen teaching Basic Mathematics subject outcomes"* (HoS_{10}, 24th July 2025). The head of the Mathematics department expressed, *"The head of school provides minimal support from external exparts, and employs many internal mathematics teachers as experts to improve teachers' skills. Howver, little use of external exparts slows progress and reduces opportunities to strengthen mathematics teaching"* (HMD_1, 8th July 2025).

The opinions of Quality Assurers, District Education Officers, Heads of Schools, and Heads of Mathematics Departments indicate that Heads of Schools occasionally invite external Mathematics experts and competent internal teachers to facilitate in-service training for address challenging content, improve teaching techniques, and strengthen subject knowledge, thereby enhancing teaching quality in Mathematics.

The views indicated that heads of schools invited Mathematics experts to a moderate extent (Mean score = 2.86) to facilitate in-service training that imparted Mathematics teachers' skills, enhanced their knowledge and competence, and improved the teaching quality of Basic Mathematics. However, these enhancements are often limited by weak planning, insufficient sensitisation, lack of awareness among some school heads, administrative challenges, understaffing, dependence on financial resources, and persistent shortages of qualified external Mathematics experts. These findings align with Mchami and Mhando (2023) and instructional leadership theory, which emphasise that external expertise enhances teacher competence and pedagogical skills.

The data in Table 2 reveal that a moderate majority of mathematics teachers (58%) rated to a high extent that heads of school used mentorship to enhance the teaching of Basic Mathematics, a low minority (31%) indicated a moderate extent. A very low minority (11%) rated it to a very low extent. The overall mean score of 3.58 revealed that Mathematics teachers generally agreed to a high extent.This implies that heads of public secondary schools widely implemented mentorship programmes by assigning experienced Mathematics teachers to mentor junior teachers. This practice substantially enhanced junior teachers' instructional competence, improved curriculum articulation, and strengthened the quality of Basic Mathematics teaching.

The interview response was supported by quantitative data that the heads of the schools habitually provide mentoring and coaching support to mathematics teachers by pointing experienced Mathematics teachers to guide the inexperienced mathematics teachers, as the quality Assurer stated, *"The head of school reported to him that they actively point senior Mathematics teachers to mentor and coaches junior teachers to build the ability for mathematics subject teaching. So, during the school visit, we found ongoing support"* (QA_1, 20th June 2025). The response from the DEO revealed, *"Oh! Heads of schools reported to them that they used mentorship in Basic Mathematics by promoting team teaching, shared knowledge, and encouraging senior teachers to provide skills. Such efforts build capacity and improve teaching in mathematics"* (DEO_1, 1st July 2025). The insightful response from HoS highlights mentorship as a key strategy for school heads to train new teachers: "*Mentorship occurs through departmental discussions and tests to track progress. Although these activities support teachers in addressing difficult topics and improving competence and ability for Mathematics teaching, their irregular, task-focused nature limits consistent guidance between senior and junior teachers confidently"* (HoS_6, 16th, July 2025).

The Head of the Mathematics Department responded,

The Head of school as a member of our department, together with other senior mathematics teachers, supports teachers through mentoring and coaching and reflective

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practices to improve teaching skills, but irregular follow-ups and limited time for mentorship reduce its overall training (HMD7, July 17th, 2025)

The information revealed that heads of schools used mentorship by appointed senior and experienced mathematics teachers as a strategy to train junior teachers and improve their competencies, impart knowledge, confidence, and capacity in teaching Mathematics. It highlights genuine efforts to train, mentor, and support junior teachers through team teaching, reflection, and discussions to improve their ability and skills. However, limited time, irregular follow-ups, and workload pressures weaken continuity and limit the consistency of mentorship in enhancing the teaching of Basic Mathematics.

This study shows that heads of public secondary schools employed mentorship in-service training to a high extent to enhance the teaching of Basic Mathematics, thereby improving new teachers' teaching competence, curriculum understanding, and teaching quality through peer coaching and senior teacher-to-junior teacher mentoring. Nevertheless, some teachers experience difficulties in openly sharing their weaknesses in teaching, which might limit the full enhancement of the mentoring process. The study's findings align with Sibanda and Amin (2021), showing that mentoring enhances teachers' competence and teaching quality. However, an inconsistency arises as some teachers struggle to share weaknesses, limiting mentoring's effectiveness, whereas the literature assumes open participation is universal for optimal teacher development. Also, findings (Urio & Mwakabenga, 2025) indicated that in-service training helped mathematics teachers build learning communities with mentors, colleagues, students, and other professionals. Through structured mentorship and both face-to-face and online collaboration, teachers strengthened their collaborative skills and improved teaching and assessment practices.

The data in Table 2 show that a substantial to a high majority of mathematics teachers (80%) rated this practice to a very high extent head of schools organised seminar training, while a very low minority (8%) rated it to a moderate extent, and a very low minority (11%) rated it to a low extent, resulting mean score of 3.92 implies that Mathematics teachers strongly agreed that heads of schools ornganised in-service seminar training the strategy to a high extent enhanced teaching of Basic Mathematics Subject. Improved mathematics teachers' skills and knowledge support curriculum updates, encourage teaching innovations, and ultimately enhance the quality of mathematics teaching.

During the interviews, Quality Assurers' DEOs, HoSs, and HMDs' responses agreed with the quantitative data that the head of school usually facilitates teacher participation in seminars to enhance active Teaching of the Mathematics subject, as QA revealed, *"Heads of schools reported to them that they organised seminars through JZK groups and internal quality assurance teams whenever challenges arise on competence. These indoor trainings strengthen teaching practice and help address specific gaps in Basic Mathematics subject"* (QA_1, 20th June 2025).

One of the DEOs responded,

In our district, the head of school stated that they organise various Basic Mathematics in-service training seminars. For instance, last year, they had an in-service training seminar at the Open University, which lasted for almost two years. They selected five schools: A and B from the government, and other private schools. The in-service training seminar aimed to improve teachers' capacity to improvise teaching and learning aids aligned with the current Mathematics curriculum (DEO_2, 2nd July 2025).

The heads of schools, as said.

The government has taken commendable steps to strengthen in-service training by offering seminars for Mathematics teachers who are invited to attend. These in-service training seminars enhance teachers' skills and improve the overall quality of teaching of Basic Mathematics subject (HoS_4, 11th July 2025).

The head of the mathematics department responded, "*The Head of School ensures we have access to valuable in-service training seminars. Mathematics is well represented among the subjects. These initiatives uplift teachers' capacity, skills in teaching and student engagement"* (HMD_3, 10th July 2025).

The Views from QAs, DEOs, HoSs, and HMD indicate that heads of School usually facilitate teacher participation in seminars to enhance active Teaching of Mathematics through peer learning and school-based learning communities (JZK), enhancing teachers' skills, curriculum understanding, and classroom delivery. However, challenges persist, including limited teacher numbers, a lack of training timetables in school schedules, and occasional delays in implementing district-level Mathematics-focused training.

Furthermore, a document analysis guide showed that heads of schools ensured in-service training seminars for uplift teachers' skills. The invitation letter for the in-service training seminar written by heads of schools was analysed, which identified that heads of schools supported teacher development by granting permission for secondary school teachers to attend a five-day in-service training seminar for the Mathematics subject at Tukuyu–Mbeya Teachers' College from 26–30 June 2023. After returning from the national seminar, the timetable was arranged for train the remaining teachers at school. This in-service training seminar reflects the heads of schools support for teachers growth, competence, and skills enhancement. However, the training was occasional rather than regular, suggesting limited continuity in developing in-service training seminars for teachers.

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This study indicated that to a high extent, heads of public secondary schools facilitated in-service training seminars for Mathematics teachers to enhance the teaching of Basic Mathematics subject, as among the strategies that imparted and improved knowledge, quality of teaching and learning skills, teaching techniques competence, curriculum articulation and awareness in Mathematics delivery through partnership with some universities, improvisation of teaching aids, and knowledge sharing. However, the full facilitation of seminars to consistently improve Mathematics teaching was limited by inconsistent prioritisation of Mathematics seminars across schools, resulting in uneven implementation of in-service training. The findings align with Pascual (2024), showing that in-service seminars effectively enhance teachers' competence, teaching techniques, and curriculum awareness. However, a contradiction exists: inconsistent prioritisation across schools limits the full benefits of seminars, whereas the literature assumes uniform implementation for optimal professional development outcomes.

Generally, the findings reveal that to a high extent of 3.42, heads of public secondary schools in Iringa region, Tanzania, employed an in-service training strategy for Mathematics teachers through departmental training, mentorship training, workshop training, invitation of Mathematics experts and seminar training to impart improved knowledge, teaching skills, content delivery, problem-solving and ability of curriculum articulation, which enhanced the teaching of the Mathematics subject. Also, the findings imply that the employed in- service training strategy improves teaching quality, addresses teaching challenges, and fosters teachers' development competencies. However, the full enhancement of in-service teaching of Mathematics quality is limited by teacher shortages, limited financial and material resources, irregular scheduling, uneven prioritisation across schools, and inconsistent participation, which constrain the effectiveness and sustainability of these training strategies.

VI. CONCLUSION

This study concludes that, to a high extent, in-service training strategies employed by heads of schools for mathematics teachers enhance the teaching of Basic Mathematics in public secondary schools in Iringa, Tanzania. However, these strategies for enhancing the teaching of Basic Mathematics Subject differed across schools. However, the overall enhancement of in-service training was limited consistently due to ongoing challenges, including shortages of Mathematics teachers, limited financial resources, lack of training scheduling in the school timetable, inconsistent participation in training, and weak follow-up mechanisms; teachers' rejection and some heads of schools take in-service training slightly, which limits Mathematics teaching outcomes in Iringa region, Tanzania.

VII. RECOMMENDATIONS OF THE STUDY

This study recommends that the DEOs should employ more Mathematics teachers to address shortages of Mathematics in schools, thereby creating conditions that enable the provision of in-service training for Mathematics teachers. At the school level, Heads of Schools should formalise and integrate planned Mathematics departmental training, mentorship, and peer coaching into school timetables to mitigate mathematics teacher-related constraints. In addition, all education stakeholders should promote blended and cluster-based training strategies, expand access to external Mathematics expertise, and increase teacher awareness to encourage active participation in teachers' development activities. The Government should adopt trust-based professional leadership principles that will maximise the extent of Heads of Schools' roles in enhancing Mathematics teaching in public secondary schools in the Iringa Region, Tanzania.

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