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Teacher Training Program on Secondary Mathematics and Science Teachers' Attitude and Confidence of Teaching

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Abstract: When teachers are confident in their ability to teach mathematics and science, it can inspire students to have confidence in their own abilities. Students are more likely to engage with and enjoy these subjects when they see their teacher's interest and belief in the material. This study aimed at exploring teachers' confidence of teaching mathematics and science as result of continuous professional development by the African Institute for Mathematical Science (AIMS Rwanda) through its Teacher Training Program (AIMS-TTP). It employed an ex post facto research design targeting 351 secondary school teachers. The findings revealed a positive and significant relationship ($p < 0.05$) between AIMS-TTP interventions and teachers' confidence to teach mathematics and science. Besides, linear regression model indicated that the dependent variable Teachers' Confidence to teach mathematics and science was regressed on predicting variables of improved capacity to plan, adapting teaching to the level of learners, Information Communication Technology (ICT) integrated in teaching and learning; learning from peers; addressing cross-cutting issues; effective implementation of the competence-based curriculum; and the application of bloom's taxonomy. The independent variables significantly predict teachers' confidence of teaching mathematics and science, $F(7,326) = 183.843$, $p < 0.001$, which indicates that the factors under study have a significant impact on teachers' confidence of teaching mathematics and science. Moreover, the findings (Adjusted $R^2 = 0.822$, $F_{(8,\ 342)} = 197.055$, $p = 0.000$ $p < 0.05$) indicated that 82.2% of the variance in improved teachers' attitude in teaching mathematics and science evidences a significant influence on the total variance. Our research suggests that policymakers should consider developing and endorsing training on innovative teaching and learning methods to boost teachers' confidence and attitude when it comes to instructing mathematics and science at basic levels. Trainings should also be extended to Technical Secondary School STEM teachers.

Keywords: continuous professional development, innovative teaching methods, mathematics education, science education, teacher training program

1. Introduction

Education stands as a fundamental necessity for a nation's progress. It is widely recognized that education plays a pivotal role in cultivating profound understanding, fostering positive attitudes, instilling values, promoting active participation in decision-making, and nurturing capabilities that collectively contribute to societal well-being. Teachers serve as the cornerstone of the education framework and are the architects of society [1]. The progress of a country depends upon the quality of its teachers and education system, closely related to this Rwanda has shifted from knowledge-based curriculum to competence-based curriculum (CBC). The decision to make this shift was driven from several factors, including the recognition that traditional knowledge-based education was not adequately preparing students for the demands of the modern workforce and global economy [2]. Teachers continued to teach as they were taught employing lecture teaching methods [3]. Thus, a need to train them on innovative teaching methods to cope with the 21st century learning models increases their confidence and attitude to teach STEM subjects.

To complete the Government efforts, the African Institute for Mathematical Science through its Teacher Training Program (AIMS-TTP) in partnership with MasterCard Foundation trained Mathematics and science teachers within a period of 5 years from 2017 to 2022.

The AIMS Teacher Training Program (TTP) is making a significant impact on the quality of education for secondary school students in Rwanda. By providing a range of training workshops, top-notch classroom resources, and cutting-edge technology such as Smart Classrooms, TTP is helping teachers to enhance their pedagogy and prepare their students for tertiary STEM education.

With the AIMS-TTP's ongoing support, teachers are better equipped to deliver effective, engaging, and equitable mathematics and STEM education to their students, it provides secondary school educators with teaching tools tailored to gender responsiveness in mathematics and science, facilitates the creation of smart classrooms, and aids in enhancing school leadership capacities. AIMS' initiatives in public engagement and outreach foster greater support for STEM education, with a particular focus on encouraging participation of both female and males.

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2. Literature Review

2.1. Continuous professional development and teachers' confidence of teaching mathematics and science

Continuous professional development (CPD) for mathematics and science teachers is of paramount importance as it ensures that educators stay updated with the latest advancements, innovative pedagogical techniques, and curriculum changes in these critical subjects. Mathematics and science are fundamental pillars of education, laying the groundwork for problem-solving skills, critical thinking, and scientific literacy, which are vital in our increasingly complex and technology-driven world [4]. CPD enables teachers to enhance their instructional strategies, adapt to evolving educational standards, and foster a deeper understanding of these subjects among their students [5]. By staying current and continually improving their teaching practices, mathematics and science teachers empower the next generation with the knowledge and skills needed to tackle the challenges of the 21st learning century and contribute to scientific, pedagogical, and technological advancements [6].

CPD plays a pivotal role in boosting teachers' confidence of teaching the subjects through exposure to innovative teaching approaches as they gain deeper understanding of the content, become more proficient in explaining complex concepts, and develop the skills to address students' questions and misconceptions [1]. This increased competence leads to greater self-assurance in the classroom, enabling teachers to inspire and engage students more effectively [7]. As confidence grows, educators are more likely to take risks, explore creative teaching techniques, and adapt to the evolving needs of their students, ultimately fostering a positive learning environment and nurturing students' interest for mathematics and science [8].

2.2. Attitude of teaching mathematics and science subjects

The attitude toward teaching mathematics and science subjects plays a crucial role in shaping students' academic experiences and future success. A positive attitude from educators can inspire curiosity, critical thinking, and a deep appreciation for these subject [9]. When teachers approach mathematics and science with eagerness, patience, and a willingness to adapt their teaching methods to meet the diverse needs of their students, it fosters an environment where students feel encouraged to explore, ask questions, and embrace the challenges these subjects present [10, 11]. Conversely, a negative or disengaged attitude can discourage students, leading to a lack of interest and confidence in these fundamental areas of education. Therefore, cultivating a positive and engaging attitude in educators is essential for nurturing a generation of scientifically and mathematically literate individuals who can contribute meaningfully to our ever-evolving word [12].

Regular CPD sessions have a significant impact on improving teachers' attitudes toward teaching mathematics and Science subjects. These sessions provide educators with opportunities to enhance their knowledge, teaching strategies, and classroom management skills. As teachers become more proficient and confident in their subject matter expertise, their attitude toward teaching these subjects tends to become more positive [1]. They begin to see the potential for creativity and innovation in their teaching approaches, which can make the learning experience more engaging and enjoyable for students. Moreover, CPD can introduce teachers to the latest development and resources in mathematics and science education, helping them stay up-to-date with best practices and cutting-edge research. This newfound knowledge and exposure can reinvigorate their passion for teaching these subjects and inspire a sense of purpose in their work [13].

Additionally, CPD sessions often foster a sense of community and collaboration among educators. When teachers come together to learn and share their experiences, they can offer each other support and encouragement [14]. The collaborative environment can have a positive impact on teachers' attitudes by reducing feelings of isolation and burnout, which are common in the teaching profession. Moreover, when teachers witness the positive outcomes of implanting new strategies or resources learned through CPD, it reinforces their belief in the value of teaching mathematics and Science, further improving their attitude and dedication to these crucial subjects [13].

2.3. AIMS-teacher training program theory of change in Rwanda

The effective teaching and learning of mathematics and science form the basis for fostering human capacity in an innovative knowledge-based economy. Nevertheless, traditional methods that do not promote literacy and positive attitude toward teaching science and mathematics currently dominate the teaching of mathematics and science. Teachers continue to over-rely on teacher-centered approaches and inadequately integrate ICT in teaching and learning [15].

Several challenges preclude the use of innovative teaching methods; these include inadequate teaching resources such as laboratories, chemicals, apparatus, and physical infrastructure, limited pedagogical skills to implement advanced teaching methods that engage both girls and boys, among others. Consequently, students loose interest in studying mathematics and science and emerge from learning institutions with gaps in competencies and skills necessary to address individual as well as societal needs for economic development [16, 17].

AIMS believes the quality of secondary schools' mathematics and science teachers will improve when teachers are provided with the right tools and resources to deliver the subjects in a way that engages girls and boys in a conducive environment. Consequently, this will lead to the improvement of both girls' and boys' performance in mathematics and science, thus increasing the number of students pursuing STEM courses at the advanced level of secondary schools. Addressing these issues requires training of pre-service and in-service teachers on innovative gender-responsive pedagogic skills, training on relevant subject matter content, English language proficiency, and in techno-pedagogical skills. There is a need for adequate teaching materials, infrastructure to support students' learning, outreach to facilitate the appreciation of the role of mathematics and science in the development of the country as well as policy dialogue for a conducive environment of teaching and learning.

Furthermore, AIMS-TTP assumes that this theory will hold if a number of assumptions hold, including mainstreaming of gender equality and inclusion to close the gender gap in the number of girls and boys pursuing STEM at the advanced level of secondary schools. Moreover, there exists a historical and concerning disparity in STEM [18, 19]. Therefore, a comprehensive strategy involves assisting policymakers globally in addressing the gender disparity in STEM fields, with basic education playing a pivotal role.

The research was motivated by the observation that despite the adoption of a CBC, certain teachers persist in employing traditional teaching methods, primarily lecturing, and exhibit low confidence in instructing mathematics and science, coupled with a diminished

interest to teach these subjects. Consequently, the ongoing professional development initiative seeks to align with the vision of the Rwandan Ministry of Education, which endeavors to cultivate a knowledge-based economy. This program aims to enhance, rectify, and strengthen teaching practices, thus fostering a more dynamic and effective approach to education that empowers both educators and students alike [20].

The AIMS-TTP is making a significant impact on the quality of education for secondary school teachers by providing a range of training workshops, including trainings on the CBC, techno-pedagogical skills, and hands-on activities, use of improvisation, gender-responsive pedagogy, and assessment. Thus, the main goal of this study is to examine the impact of AIMS-TTP on teachers' confidence and attitude of teaching mathematics and science with the following two hypotheses and one research question.

2.4. Hypotheses

H_0: There is a statistical significance between AIMS-TTP interventions and teachers' attitude to teach mathematics and science.
H_0: There is a statistical significance between AIMS-TTP interventions and teachers' confidence of teaching mathematics and science.

2.5. Research question

What are the views of teachers about their attitude and confidence to teach mathematics and science after being trained by AIMS-TTP?

3. Methodology

The study employed a mixed research approach and an ex post facto research design. Participants were all mathematics and science secondary teachers from 14 districts under AIMS-TTP interventions and 351 (101 females and 250 males) were purposively sampled with different years of teaching experience as 0–5 years, 6–10, and more than 10 years of teaching experience (119, 91 and 141), respectively. The study applied a survey research design to collect quantitative data with the Pearson correlation coefficient of 0.71 while qualitative data were collected through essay writing. The questionnaire was composed of 15 items among which 8 were to collect data about teachers' attitude and 7 items for confidence. The questionnaire was scaled rating from strongly disagree = 1, Disagree = 2, Neutral = 3, Agree = 4 and Strongly Agree = 5. Quantitative data were analyzed using regression analysis and thematic analysis for qualitative data.

3.1. Data analysis

The collected data were analyzed using regression and thematic analyses since we aimed to predict AIMS-TTP interventions on teachers' attitude and confidence of teaching mathematics, science, and examining teachers' views about the matter under investigation.

4. Findings and Discussions

4.1. Teachers' attitude to teach mathematics and science subject

As shown in Table 1, the results of simple correlation (r) between the independent variables (training on the use of science kits, participating in PAMO, training on improvisation, training on ICT, learning from peers, science award ceremony, equipping smart classroom and industrial visits) and the dependent variable (improved interest to teach Math and science) were statistically significant ($p < 0.01$). The training on the use of science kits was significantly correlated with improved teachers' interest to teach maths and science ($r = 0.61$, $p < 0.01$), the participating in PAMO ($r = 0.43$, $p < 0.01$), the training on improvisation ($r = 0.74$, $p < 0.01$), training on ICT ($r = 0.44$, $p < 0.01$), learning from peers ($r = 0.86$, $p < 0.01$), science award ceremony ($r = 0.58$, $p < 0.01$), equipping smart classroom $r = 0.34$, $p < 0.01$) and industrial visits ($r = 0.27$, $p < 0.01$). The findings imply that AIMS interventions have improved teachers' interest to teach mathematics and science subjects and this can improve learners' academic achievement as the findings by Ukobizaba et al. [21] reported that teachers' attitude and confidence can influence learners' interest to learn the subjects. This corroborates the findings of Nkundabakura et al. [22] that CPD programs enhance the engagement, interest, confidence, and self-efficacy in teaching mathematics and science.

Table 1
Inter-correlations between AIMS-TTP interventions and teachers' interest to teach mathematics and science

Variables	r	Sig.
Training on the use of science kits	0.610**	0.000
Participating in PAMO	0.437**	0.000
Training on improvisation	0.745**	0.000
Training on ICT	0.747**	0.000
Learning from peers	0.866**	0.000
Science award ceremony	0.508**	0.000
Equipping smart classroom	0.342**	0.000
Industrial visits	0.278**	0.000

Note: **Correlation is significant at the 0.01 level (2-tailed). $p < 0.01$

To understand the relationship between AIMS interventions and improved teachers' interest in teaching mathematics and science, regression analysis was performed. The findings are presented in Table 2.

The results of the regression analysis showed that industrial visits, learning from peers, participating in PAMO, training on the use of science kits, equipping smart classroom, science award ceremony, training on improvisation, training on ICT contributed to improved teachers' interest in teaching mathematics and science, (Adjusted $R^2 = 0.822$, $F_{(8,\ 342)} = 197.055$, $p = 0.000$ $p < 0.05$). This finding indicated that approximately 82.2% of the variance in improved teachers' attitude in teaching mathematics and science can be accounted for by the linear combination of the AIMS interventions (industrial visits, learning from peers, participating in PAMO, training on the use of science kits, equipping smart classroom, science award ceremony, training on improvisation, training on ICT). The remaining 17.8% could be due to factors or errors not considered in the study. These findings show that CPD is crucial for mathematics and science teachers as it ensures they stay well-informed of evolving pedagogical methods and emerging trends in their fields, thereby enhancing their teaching effectiveness and fostering student engagement and achievement [23]. Additionally, it enables educators to continually refine their skills and deepen their subject knowledge, ultimately contributing to the advancement of STEM education as it was also reported in a study by Pylväs and Nokelainen [24].

Table 2
Summary of regression analysis

Model	*R*	*R* square	Adjusted square	Std. error of the estimate	
1.	0.906[a]	0.822	0.818	0.367	
Model	Sum of squares	*Df*	Mean of squares	*F*	*P*-value
Regression	212.554	8	26.569	197.055	0.000[b]
Residual	46.113	342	0.135		
Total	258.667	350			

Note: [a]Criterion Variable: Improved teachers' interest in teaching mathematics and science
[b]Predictors: (Constant), Industrial visits, learning from peers, participating in PAMO, Training on the use of science kits, equipping smart classroom, Science award ceremony, Training on improvisation, Training on ICT

Findings in Table 3 show that training on the use of science kits accounted for 37.2% of the total variance ($R^2 = 0.372$) in the improved teachers' interest in teaching mathematics and science. The participants in PAMO accounted for 19.1% of the total variance ($R^2 = 0.191$) in the improved teachers' interest in teaching mathematics and science. On the other hand, the training on improvisation accounted for 55.5% of the total variance ($R^2 = 0.555$), the training on ICT accounted for 55.7% of the total variance ($R^2 = 0.557$), the learning from peers accounted for 75.0% of the total variance ($R^2 = 0.750$), the science award ceremony accounted for 25.8% of the total variance ($R^2 = 0.258$), equipping smart classroom accounted for 11.7% of the total variance ($R^2 = 0.117$), and the industrial visits accounted for 7.7% of the total variance ($R^2 = 0.077$). Thus, from this finding, the AIMS interventions had a significant influence on the total variance in improved teachers' attitude in teaching mathematics and science. This was also evidenced by the fact that learners taught by these trained teachers improved their interest to learn mathematics and science and choose related subjects at the advanced level of secondary schools [20].

Table 3
Unique analysis of R^2 statistics for AIMS intervention and improved teachers' interest in teaching mathematics and science

Component	Coefficient of determination (R^2) Improved teachers' interest in teaching mathematics and science	*p*-value
Training on the use of science kits	0.372	.000
Participating in PAMO	0.191	.000
Training on improvisation	0.555	.000
Training on ICT	0.557	.000
Learning from peers	0.750	.000
Science award ceremony	0.258	.000
Equipping smart classroom	0.117	.000
Industrial visits	0.077	.000

From the model of the predictor variables shown in Table 4, the training on the use of science kits ($\beta = 0.092$; $p < 0.05$), training on improvisation ($\beta = 0.155$, $p < 0.05$), training on ICT ($\beta = 0.167$, $p < 0.05$), and learning from peers ($\beta = 0.596$, $p < 0.05$) were the significant predictors of the improved teachers' interest in teaching mathematics and science.

The findings of this research corroborate the results of Srinivasacharlu, Nauman Ahmed et al., and Fidele et al. [1, 7, 11], who reported that CPD sessions enable teachers to stay updated on recent advancements in their field, enabling them to deliver more captivating lessons tailored to contemporary students. Additionally, CPD empowers educators to acquire fresh skills and methodologies, thereby enhancing their overall effectiveness in teaching.

In addition, CPD sessions help keep mathematics and science teachers' skills and knowledge up-to-date; prepare them for greater responsibilities; boost their attitude and confidence; and help them become more creative in tackling new challenges. A teacher who lacks confidence is less inclined to take on the challenge of pushing students and exploring innovative methods.

Furthermore, teachers' attitudes toward teaching a subject hold significant importance as they impact their students in various ways and shape their learning journey [10, 23].

4.2. Teachers' confidence of teaching mathematics and science

The study seeks to explore the effect of each of the following (capacity of planning, adapting teaching to the level of learners, ICT integration in teaching and learning, learning from peers, addressing each cross-cutting issue while teaching, use CBC to develop learners' confidence, use bloom's taxonomy in assessing) on teachers' confidence to teach mathematics and science.

Predictors were grouped into four themes namely *training on pedagogy* (including the capacity of planning, adapting the teaching to the level of learners and learning from peers); *training on ICT*; *training on CBC* (including training on addressing cross-cutting issues and training on developing competences); training *on assessment*.

The dependent variable teachers' confidence to teach mathematics and science was regressed on predicting variables of improved capacity to plan, adapting teaching to the level of learners, ICT integrated in teaching and learning; learning from peers; addressing cross-cutting issues; use CBC to develop competences; and the use of bloom's taxonomy. As indicated by Table 5, the independent variables significantly predict teachers' confidence of teaching mathematics and science, F (7,326) = 183.843, $p < 0.001$, which shows that the factors under study have a significant impact on teachers' confidence of teaching mathematics and science. Moreover, the $R^2 = 0.723$ depicts that the model explains 72.3% of variance on teachers' confidence to teach mathematics and science.

Additionally, assessing coefficients in order to ascertain the influence of each of the factors on the criteria variable (teachers' confidence to teach mathematics and science) leads to rejecting 3

Table 4
AIMS interventions as predictors of the improved teachers' interest in teaching mathematics and science

		Unstandardized coefficients		Standardized coefficients		
	Model	B	Std. error	Beta	*t*	Sig.
1	(Constant)	−0.017	0.121		−0.141	0.888
	Training on the use of science kits	0.086	0.030	0.092	2.888	**0.004**
	Participating in PAMO	−0.007	0.027	−0.007	−0.240	0.811
	Training on improvisation	0.156	0.039	0.155	3.960	**0.000**[a]
	Training on ICT	0.164	0.039	0.167	4.236	**0.000**[a]
	Learning from peers	0.590	0.033	0.596	18.019	**0.000**[a]
	Science award ceremony	0.027	0.027	0.030	0.990	0.323
	Equipping smart classroom	−0.026	0.023	−0.035	−1.150	0.251
	Industrial visits	0.024	0.020	0.034	1.237	0.217

Note: [a]Dependent Variable: Improved interest to teach mathematics and science

Table 5
Multiple regression results

Model	*R*	*R* square	Adjusted *R* square	Std. error of the estimate	
1.	0.850[a]	0.733	0.721	0.539	
Model	Sum of squares	Df	Mean of squares	*F*	*P*-value
Regression	281.245	7	40.178 0.219	183.843	0.000[b]
Residual	71.246	326			
Total	352.491	333			

Note: [a]Criterion Variable: Interest in teaching mathematics and science
[b]Adjustment for multiple comparisons: Bonferroni

hypotheses and maintaining 4 among the seven tested as indicated by Table 6.

For example, H_{o6}: Evaluating whether the training on CBC (use CBC to develop competences among learners) significantly and positively affects teachers' confidence to teach mathematics and science. The results revealed that the mentioned training has a significant and positive impact ($B = 0.166$, $t = 2.654$, $p = 0.008$); hence, the hypothesis is supported. However, H_{o1}: Evaluating whether the training on planning (lesson planning and scheming) significantly and positively affects teachers' confidence of teaching mathematics and science. The statistical results show that the impact is not statistically significant ($B = 0.081$, $t = 0.1551$, $p = 0.122$). This implies that the important effects that is observable in reality, statistically is not significant.

The results corroborate the findings of Nkundabakura et al. [5] that CPDs allow teachers to learn new skills and techniques and improve their teaching abilities. Furthermore, teachers are motivated once they receive regular training which help them to fill the gap and facilitate them to interact with colleagues in the same domain [7]. According to Umugiraneza et al. [25], educators who have access to online instructional resources demonstrate increased confidence levels in teaching.

Moreover, our study validates the findings of Srinivasacharlu [1] that in order to effectively prepare teachers for the demands of the 21st century, it is imperative that educators maintain a consistently high level of expertise in the field. This is only attainable through their commitment to CPD, which encompasses a wide range of activities, both formal and informal. These activities are designed to enhance the intellectual capabilities of teachers (cognitive domain), boost their self-assurance, attitudes, interest, and values (affective), and further develop their competencies (psychomotor). Such comprehensive development is essential for cultivating

Table 6
Predictor of teachers' confidence to learn mathematics and science

		Unstandardized coefficients		Standardized coefficients		
	Model	B	Std. error	Beta	*t*	Sig.
1	(Constant)	0.068	0.119		0.569	0.570
	Improved capacity to plan (Scheming, lesson planning)	0.081	0.052	0.082	1.551	0.122
	Adapt teaching to the level of learners	0.156	0.054	0.153	2.899	0.004
	ICT integrated in the teaching and learning process	0.015	0.038	0.015	0.396	0.693
	Learning from peers developed the teaching capacity	0.138	0.057	0.138	2.411	0.016
	Addressing CCIs among learners in my class	0.100	0.056	0.098	1.791	0.074
	Use CBC to develop competencies among learners	0.166	0.063	0.165	2.654	0.008
	Use of Bloom's taxonomy while assessing	0.331	0.049	0.325	6.729	0.000[a]

Note: [a]Dependent Variable: Confidence to teach mathematics and science

well-rounded individuals capable of fulfilling their roles within the teaching profession in alignment with the evolving requirements of both prospective teachers and the society as a whole.

4.3. Views of teachers about their attitude and confidence to teach mathematics and science

To respond to the above-mentioned, we also analyzed the views of teachers about their attitude and confidence toward teaching mathematics and science subjects. The questionnaire contained an open question that was responded through different themes, and the findings revealed that AIMS-TTP trainings influenced teachers' attitude and confidence to teach mathematics and science.

While analyzing qualitative data, respondents were given codes (numbers) such as T1: teacher one, T2: teacher two, ...up to teacher number 20 (T20).

4.3.1. Motivation and confidence of teaching mathematics and science

Teachers confirmed that the trainings motivated them to teach mathematics and science at secondary school levels. "Am now motivated and confident on teaching mathematics and science"; "I am now a competent teacher through trainings"; "With the package gained from AIMS-TTP trainings I'm proud to be a teacher"; "we have acquired skills that helped us to teach our students adequately and we really enjoyed the trainings and found them relevant" (T1, T2, T3, T5, T6, T7, T8, T8).

4.3.2. Trainings on the use of improvisation

Hands-on trainings using locally available materials stimulated teachers' attitude to teach mathematics and science of teachers among 14 Districts. "The training helped me to use improvisation in my teaching process**";** **"**Before trained by AIMS, I was not aware of using improvisation but after being trained, I am now able to improvise materials in order to make easy teaching mathematics and science" (T1, T5, T6, T7, T8, T9, T10).

4.3.3. Training on CBC

Teachers' trainings on the implementation of the CBC equipped teachers with innovative teaching strategies to use while teaching, and this improved positively their attitude to teach mathematics and science. "I have positively improved my approach to lesson preparation and delivery, as well as the strategies of engaging students, addressing cross-cutting issues to achieve the instructional objectives"; "I improved interest to teach mathematics and science through peer learning"; "assessment {Blue print (table of specification)}, double check that the assessment meets the required criteria" (T1, T5, T6, T7, T8, T9).

4.3.4. Trainings on ICT

Trainings by AIMS-TTP was proven to improve teachers' abilities to use ICT in the process of teaching and learning. "By using ICT in teaching and learning, also problem-solving skills and assessment skills" (T1, T2, T4, T5, T6, T7, T8, T9).

4.3.5. Trainings on subject content and giving facilities to teachers

The AIMS-TTP trainings helped teachers to master the content of teaching, hence smooth facilitation to learners. "Through training and getting monthly internet bundles"; "I became more self-confident and content master through AIMS-TTP"; "the content has become easy to teach after being trained on some units that seemed to be difficult" (T1, T4, T5, T6, T7, T8, T9).

4.3.6. Trainings on gender-responsive pedagogy

The trainings by AIMS-TTP that aimed to create an inclusive, gender-responsive learning environments for the capacity building of mathematics and science teachers who recognize the influence of their own attitudes and preconceptions regarding gender on their teaching, and actively work to prevent gender bias and discrimination in their classrooms leads to the positive attitude of mathematics and science teachers toward teaching the subjects. "Training on gender-responsive pedagogy ensures that both female and male students have equal opportunities to engage in discussions and group activities, and can take on diverse roles as required" (T1, T2, T3, T5, T6, T7, T8, T9).

5. Conclusion

The study aiming at examining the impact of the AIMS-TTP on teachers' attitude and confidence of teaching mathematics and science among 14 districts of Rwanda revealed noteworthy improvements in teachers' attitude and confidence regarding their competence in teaching mathematics and science. This improvement was attributed to the training in pedagogy, ICT integration in teaching and learning, implementation of the CBC, and the training of assessment method and techniques. Moreover, CPD sessions not only enhance teachers' knowledge and skills but also contribute significantly to a more positive and effective approach to teaching mathematics and science.

Furthermore, the findings of this study indicate that approximately 82.2% of the variance in improved teachers' attitude in teaching mathematics and science is accounted by the linear combination of the AIMS interventions (industrial visits, learning from peers, participating in PAMO, training on the use of science kits, equipping smart classroom, science award ceremony, training on improvisation, training on ICT). In addition, the training on the use of science kits, training on improvisation, and training on ICT and learning from peers were the significant predictors of the improved teachers' attitude in teaching mathematics and science.

6. Recommendations

Mathematics and science teachers should use innovative teaching methods, strengthen the culture of peer learning to implement the CBC, and incorporate technology into teaching and learning to engage learners actively.

Education stakeholders should support ongoing professional development for teachers and encourage participation in workshops that equip them to learn the best ways to deal with learners' diversity.

Trainings should be extended to Technical Secondary School teachers, and their learners should be exposed to inspirational activities and to female and male STEM role models.

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Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

The data supporting the findings are not accessible to the public because of confidentiality. However, anonymized data can be obtained from the author upon reasonable request.

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