



## Transforming STEM Pedagogy in Rwandan Classrooms: The Role of Continuous Professional Development in Teachers' Use of Innovative Tools and 5Es Instructional Model

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### Abstract

The present study assesses the impact of the Rwanda Quality Basic Education for Human Capital Development (RQBEHCD) project on Mathematics and Science education in Rwanda. The project emphasizes continuous professional development in Innovative Teaching Mathematics and Science (CPD-ITMS) for teachers from upper primary to lower secondary levels. The CPD focuses on enhancing teachers' proficiency in utilizing modern instructional tools in teaching Mathematics and Science and using innovative pedagogies, particularly the 5Es instructional model (Engage, Explore, Explain, Elaborate, Evaluate). The research used a mixed-methods approach, incorporating classroom observations and semi-structured interviews with a sample of 62 teachers. The study highlights the effective use of modern instructional tools. 81% of the observed teachers use the provided projectors and computers. Additionally, the study revealed that 59% of teachers use scripted lessons in teaching, while a considerable number, around 41% of teachers, did not use scripted lessons in their teaching. Most importantly, the findings indicated that 90% of the teachers who use scripted lessons can use them effectively and completely. In addition, the findings showed a high adoption rate of the 5Es model (84%), with the elaborate phase being the least implemented. The results from interviews indicated some teachers' challenges in implementing the skills from CPD-ITMS, such as lack of internet connection, lack of electricity in the classrooms, and unsupportive school leaders, to mention a few. This study recommends a thorough follow-up and sensitization at the school level to ensure the effectiveness of CPD programs in improving educational outcomes in Rwanda.

**Keywords:** CPD-ITMS, modernized instructional tools, innovative pedagogy, teachers' proficiency, 5Es

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## 1. Introduction

In the global pursuit of economic growth and innovation, education is universally recognized as a fundamental driver of development (World Bank, 2018). Nations aiming to transition into knowledge-based economies increasingly emphasize cultivating proficiency in key disciplines such as mathematics and science. This emphasis is crucial as these subjects form the backbone of technological advancement and skilled labor. In line with this global trend, Rwanda recognizes education's pivotal role in shaping its future (Yongabo, 2021; MINEDUC, 2017). Emphasizing competence in mathematics and science is crucial to nurturing a generation of skilled individuals who can contribute meaningfully to the nation's development. Central to this endeavor is the understanding that teachers are the architects of knowledge, guiding students toward proficiency.

Consequently, the commitment to providing continuous professional development for teachers becomes paramount, ensuring that they possess the requisite knowledge and skills to effectively support their students in Mathematics and Science. Certainly, teachers' proficiency is a paramount factor influencing students' learning, surpassing the impact of social and demographic variables, as highlighted by Hanushek (2014). Specifically, the direct correlation between teachers' competence knowledge and students' performance and interest in specific subjects has been substantiated in studies by Blazar and Kraft (2017), Hill et al. (2008), and Keller et al. (2017).

Competence, however, is not an inherent trait but a skill honed over time, as emphasized by Bandura (2001) and Dorsey & Patterson (2018). Therefore, there is a pressing need to equip teachers with enhanced professional support to continually refine and update their content and pedagogical knowledge (CPK). The strategic investment in mathematics and science teachers' professional development fortifies the educational landscape and lays the foundation for a sustainable and knowledge-driven economy in Rwanda. In alignment with this vision, the Government of Rwanda, through the Ministry of Education (MINEDUC) and the Rwanda Basic Education Board (REB), has undertaken the implementation of the "Rwanda Quality Basic Education for Human Capital Development" (RQBEHCD) project, Sub-component 1.2 (Worldbank, 2019). This sub-component is dedicated to supporting the professional development of mathematics and science teachers from

Primary four to senior three in Rwandan schools through a Continuous Professional Development in Innovative Teaching of Mathematics and Science (CPD-ITMS) certified program (WorldBank, 2019). The University of Rwanda College of Education (UR-CE) is a key partner in executing this project.

The primary objective of Sub-component 1.2 is to elevate students' learning gain in basic education by bolstering the professional development of Mathematics and Science teachers. The heart of the project initiative lies in its commitment to providing continuous professional training for mathematics teachers and recognizing the transformative potential of innovative teaching methodologies. The project places a particular emphasis on equipping teachers with innovative pedagogical approaches. Where among these approaches, the adoption of the 5Es model in teaching Mathematics and Science has been highlighted, reflecting a commitment to engage, explore, explain, elaborate, and evaluate in the teaching and learning process.

The provision of continuous professional development and modernizing instructional tools are the cornerstone of all the activities undertaken by RQBEHCD Sub-Component 1.2. to empower educators in their teaching activities. Within this framework, mathematics and science teachers from upper primary (P4-P6) to lower secondary (S1-S3) have been equipped with cutting-edge resources, including projectors, laptops, and formative assessment tools such as plickers, voting cards, and show-me boards. In addition, the project has developed the scripted lessons of all mathematics and science subjects from P4-S3 and made them available for teachers and students. Indeed, these tools are instrumental in creating dynamic and interactive learning environments, fostering student engagement and participatory learning.

Considering the significance of hands-on learning experiences in Science and Mathematics education, the project has also supplied teachers with science kits. These kits are designed to facilitate practical demonstrations, experiments, and different practical works, thereby enhancing the understanding of abstract concepts and promoting a deeper comprehension of scientific principles. Researchers DeCoito and Myszkal (2018) highlight a strong link between hands-on science teaching and teachers' self-efficacy, aligning with Bandura's self-efficacy theory. This theory suggests that confidence in one's abilities enhances his performance Bandura (1999). In teaching, hands-on activities boost student engagement and understanding and reinforce teachers' confidence in their methods. As teachers see positive outcomes, their self-efficacy grows, encouraging the continued use of innovative teaching strategies and tools creating a positive cycle of effective teaching and learning.

### **1.1. Objective of the study**

- ✓ Evaluate the extent to which trained teachers implement innovative pedagogy (5Es model) in teaching Mathematics and Science.
- ✓ To assess the level and proficiency of mathematics and science teachers in using the provided modernized instructional tools (computer and projectors, scripted lessons, math and science kits, formative assessment tools)

### **1.2. Research questions**

- ✓ To what extent do trained teachers implement the 5Es model of innovative pedagogy in teaching Mathematics and Science?
- ✓ What is the proficiency level of Mathematics and Science teachers in using modernized instructional tools (such as computers, projectors, scripted lessons, math and science kits, and formative assessment tools)?

## **2. Methodology**

### **2.1. Population and sample**

The target population for sub-component 1.2 is mathematics and science teachers from 16 districts of the RQBEHCD Sub-Component 1.2. intervention who successfully completed the training provided by the Rwanda Quality Basic Education for Human Capital Development Project Sub-Component 1.2. Among 2775 mathematics and science teachers who completed the training, a sample of 44 teachers was chosen, 18 of whom were school subject leaders (SSLs). The SSLs are the teachers who, in addition to completing CPD-ITMS training, completed the training on coaching and mentoring and Community of Practice. The participants in the study were selected purposefully to ensure a diverse representation across provinces, school location, subjects, and gender. This approach aimed to capture a comprehensive view of the impact of the training on innovative pedagogy and the provided modernized instructional materials across various schools.

### **2.2. Research design**

The present study used a mixed research approach to conduct a short-term impact assessment of the project's interventions for mathematics and science teachers. Both quantitative and qualitative data were collected from the participants. Quantitative data were collected using classroom observation,

while qualitative data were collected using an interview guide. The phase of classroom observation involved a sample of 43 teachers who attended the Continuous Professional Development in Innovative Teaching of Mathematics and Science (CPD-ITMS) program. This phase facilitated a meticulous examination of whether the materials provided by the project were being used effectively in the teaching and learning processes of Mathematics and Science. Simultaneously, the phase enabled the observation of teachers' adherence to innovative methodologies on which they have been trained. By directly observing classroom dynamics, this approach sought to provide tangible insights into the practical use of modernized instructional tools and the application of innovative teaching methods by teachers.

An interview component was incorporated into the research design in conjunction with classroom observations. This phase involved 17 teachers who, in addition to completing the CPD-ITMS program, attended the training on coaching, mentoring, and community practices. Through interviews with these teachers, the focus extended beyond merely utilizing materials and methodologies, delving into the intricacies of material maintenance and peer support. Teachers were probed on how they maintained and managed the provided materials, shedding light on the sustainability and care taken to preserve the longevity of the provided educational resources. Additionally, the interviews explored the support mechanisms employed by teachers in aiding their colleagues who had not undergone the training. This holistic approach aimed to capture the immediate impact within individual classrooms and the ripple effect of knowledge transfers and collaborative practices among educators. Together, these methods furnished a nuanced understanding of the project's influence on individual teaching practices and the broader professional dynamics among teachers.

### **2.3. Instruments for data collection**

#### **2.3.1. Classroom Observation for Mathematics and Science Teachers in CPD-ITMS**

The study employed classroom observation to evaluate the extent to which trained mathematics and science teachers utilize the modernized instructional materials provided by the project and to what extent they implement innovative teaching methodologies in the teaching process. This instrument was made of six main parts: Part 1 was about identification of the school, part 2 was part 3 is, identification of the observed class and lesson, part four concerned the lesson plan and delivery, part five consisted of questions about items that help to observe the Cross-Cutting Aspects of the lesson (these are aspects that are to be considered and assessed throughout all parts of the lesson:

introduction, development and conclusion) and while part six items help to assess the use of modernized instructional tools package Provided by REB Through QBEHCD sub-component 1.2 to teach Mathematics and Science subjects. This was digitalized using Kobotoolbox; for more about it, refer to <https://ee.kobotoolbox.org/x/fxSlxLve>

### **2.3.2. Semi-Structured Interview for School Subject Leaders (SSLs)**

The decision to use interviews was guided by the need for in-depth, qualitative responses from trained who are directly involved in implementing modernized instructional materials and who are supposed to support their peers at their schools. Semi-structured interviews were selected to balance a standardized framework and the flexibility to explore emergent themes during the conversations. Ten questions formed the interview guide.

### **2.4. Data analysis**

The quantitative data collected by using classroom observation for mathematics and science teachers who successfully completed the CPD-ITMS program were analyzed descriptively through the use of excel-16 and SPPSS 25.0, while the data collected by the use of semi-structured interviews from STEM school subject leaders were analyzed thematically through the use NVIVO software.

### 3. Findings

This section reports the quantitative findings about the current mathematics teachers' level of using the 5Es instructional model in teaching Mathematics and Science. The findings also indicate the teachers' level of using modernized instructional tools that have been provided to them to enhance the teaching and learning of Mathematics and Science. This section also reports the qualitative findings from SSLs interviews.

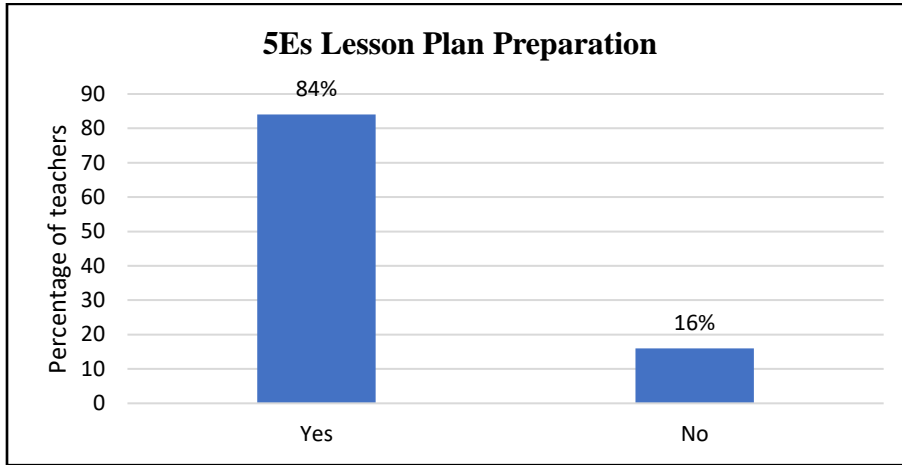
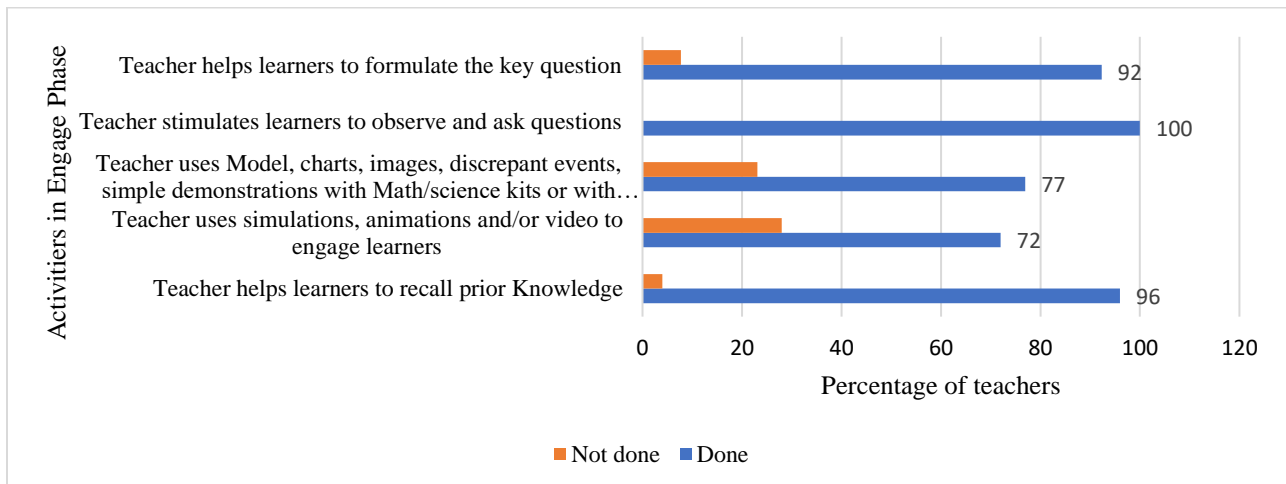


Figure 1: Teachers' proficiency in preparing 5Es lesson plan

#### 3.1. The analysis of all phases

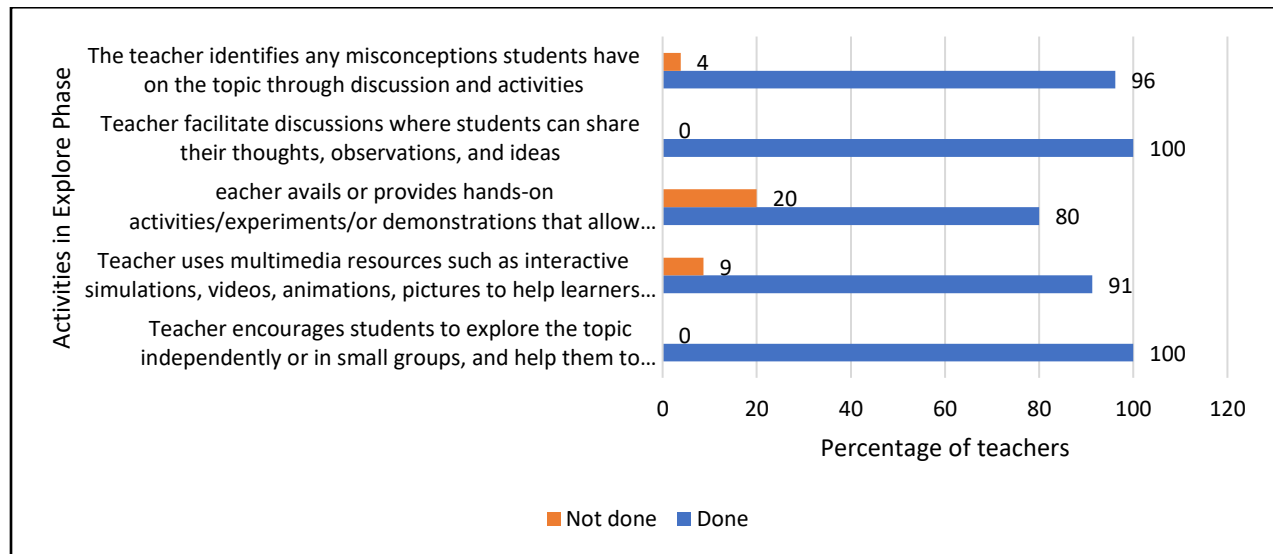
The analysis of all phases (engage or excite, explore, explain, elaborate, and evaluate) of 5Es instructional also shows the positive application of this approach in teaching mathematics and science. The following figure shows how teachers implement each phase of the 5Es instructional model in teaching mathematics and science.



**Figure 2: Strategies used by mathematics and science to engage /excite learners**

**Explore phase**

During the classroom observation of mathematics and science teachers on using the 5Es instructional model in the Explore step, nearly all teachers (99%) could identify students' misconceptions on the subject topic through discussion and activities. All teachers (100%) facilitated discussions where students could share their thoughts, observations, and ideas. Most teachers (80%) provided hands-on activities, experiments, or demonstrations that allowed students to interact with the material concretely. Additionally, 91% of teachers used multimedia resources such as videos and animations to help students explore the topic. Finally, all teachers (100%) encouraged students to explore the topic independently or in small groups and helped them to make initial predictions or formulate hypotheses.



**Figure 3: Strategies used by mathematics and science during the explore phase**

**Explain phase**

In the Explain phase of the 5Es instructional model, the observed practices of mathematics and science teachers revealed a commitment to fostering comprehensive understanding among students. Remarkably, 100% of teachers were consistently successful in inspiring learners to articulate and share their investigations and ideas in their own words, emphasizing a student-centric approach. Visual aids played a pivotal role, with 96% of teachers utilizing diagrams, charts, graphs, models, and other visual tools to enhance the understanding of key concepts, underscoring a visual reinforcement strategy. Additionally, 92% of teachers skillfully employed probing and guiding questions to facilitate

connections between new information or observations and students' prior knowledge. Finally, in a proactive approach, all teachers, at 100%, addressed and corrected any misconceptions identified during the lesson.

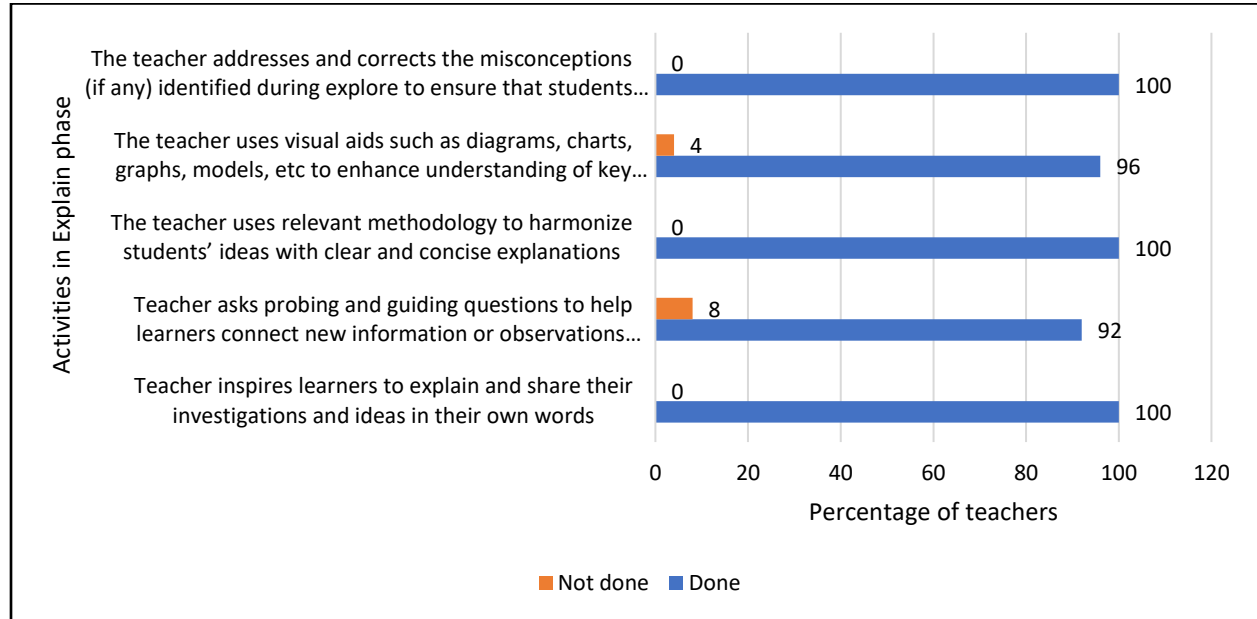
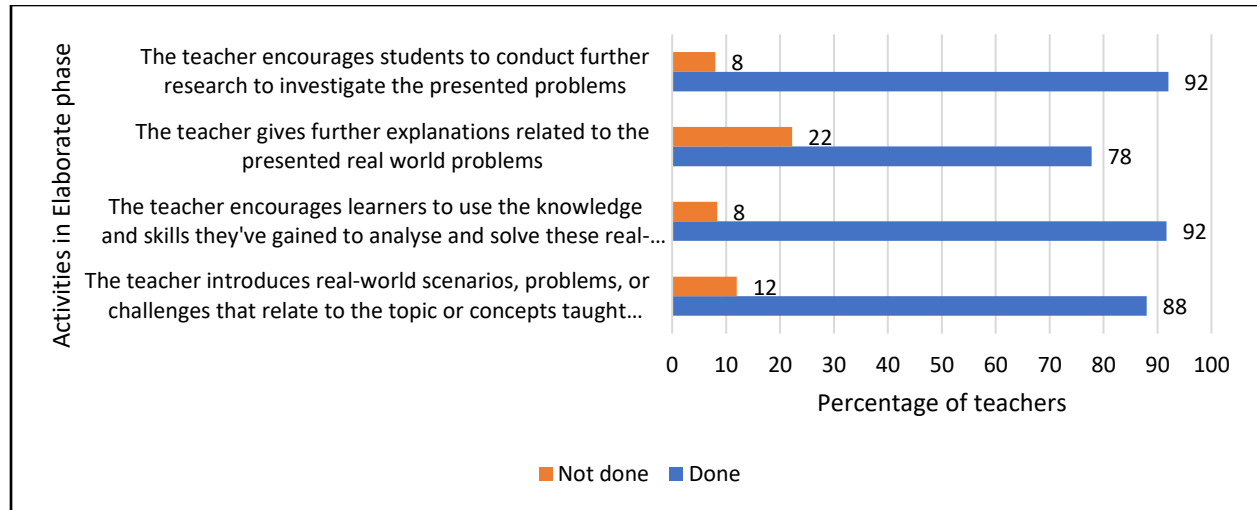


Figure 4: Strategies used by mathematics and science during the explain phase

**Elaborate phase**

In the Elaborate phase, most teachers (92%) effectively encouraged students to delve deeper by conducting further research on presented problems. While 78% provided additional explanations to solidify understanding, some (22%) missed this opportunity. Notably, 92% of teachers empowered students to apply their learning by analyzing and solving real-world problems related to the taught concepts. While most (88%) successfully integrated real-world scenarios and asked relevant questions, a smaller portion (12%) did not utilize this valuable strategy.



**Figure 5: Strategies used by mathematics and science during elaborate phase**

**Evaluate phase**

In evaluate phase, all teachers (100%) demonstrated a positive achievement while summarizing the lesson, giving students timely feedback, assessing the activities that are inclusive to cater to the learners’ needs, and giving students assessments that are aligned with the content and learning objectives.

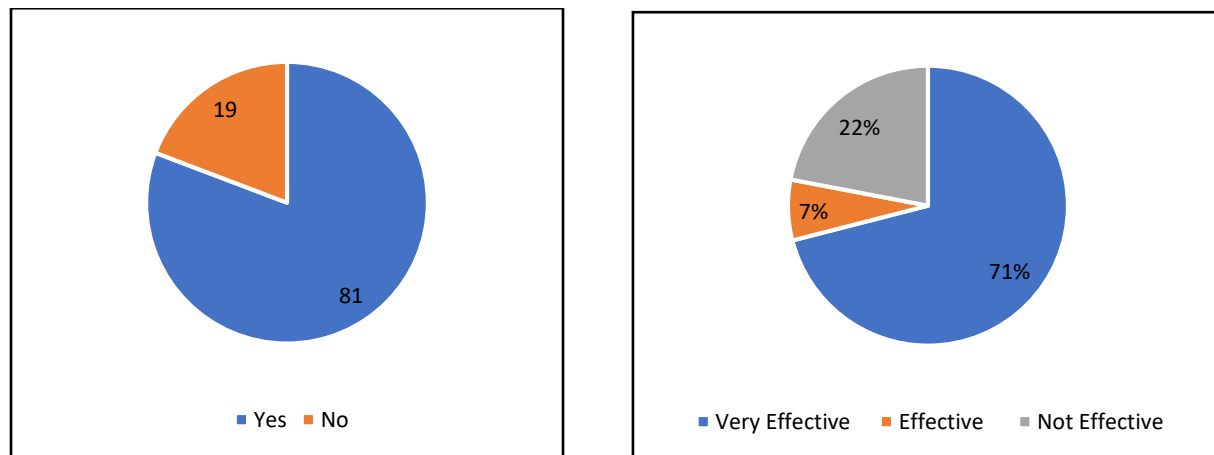
**3.2. Teachers’ Level of Using the Provided Modernized Instructional Tools**

In evaluating mathematics and science teachers' use of the provided modernized tools to enhance teaching methodologies, this report delves into the extent to which mathematics and science teachers have embraced modernized tools, including projectors, laptops, scripted lessons, and formative assessment tools, in their lessons. The overall results showed that teachers used the provided modernized assessment at a percentage of 69%. The integration of such technological and instructional resources has the potential to impact the teaching experiences significantly. By examining the utilization of these tools, we aim to gain insights into the evolving dynamics of the educational environment and identify opportunities for further enhancement and innovation in mathematics and science education.

**Teachers’ proficiency in using Computers and Projectors in teaching**

The findings in Figure 6 from the classroom observation on using modern tools, specifically projectors and computers, among mathematics and science teachers revealed a substantial integration of technology in teaching practices. A notable 81% of the observed teachers employed projectors and computers as part of their instructional tools in presentations of interactive simulations or other digital resources. However, it is noteworthy that 19% of teachers did not utilize these tools. *The major reason provided by teachers is that some computers are not working and need to be repaired.*

After observing the extent of using computers and projectors in mathematics and science lessons, we looked at whether teachers used those tools in an effective way and found that most teachers who use them are able to connect the projector to their computer for projecting their teaching content very effectively and effectively at the percentage of 71% and 7% respectively, while 22% were found not able to do so in an effective way. The lessons of the latter were disturbed by the need for assistance in fixing projections issues.

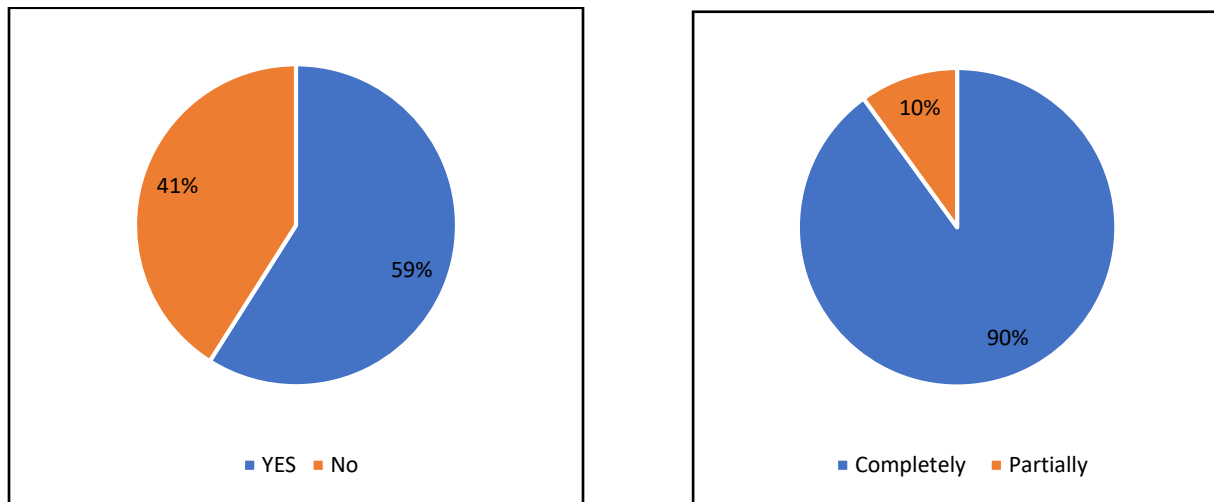


**Figure 6: Mathematics and science teachers' level and proficiency in using computer and projector**

### **Teachers' Level of Using Scripted Lessons**

The outcomes of the classroom observation focusing on using scripted lessons in mathematics and science instruction among teachers revealed that 59% use scripted lessons in teaching while a considerable number, 41% of teachers, did not use scripted lessons in their teaching. In this context, the major reason provided by the teachers who were not using the scripted lesson was that *their computers were not working, lack of internet connection, and some of them did not have access to MS 365.* After evaluating the level of using the scripted lesson, we assessed if those who used them in

teaching used them completely or partially. The results highlighted that 90% of those who use them in teaching use them completely, while 10% used scripted lessons partially



**Figure 7: Mathematics and science teachers' level of using scripted lesson**

#### ***Teachers level of Using Mathematics and Science Kits***

The overall results showed that mathematics and science teachers used the provided science kits at a percentage of 60%, while 40% of them did not use those kits. It was found that those kits were used mainly during practical work and lesson demonstrations. In this context, teachers explained that they did not use mathematics and science kits because some materials were damaged, while others reported that they were used by other teachers in the school. The outcomes of the classroom observation focused on mathematics and science teachers' use of mathematics and science kits indicate a high level of capability, with 82% of teachers deemed extremely capable of utilizing these instructional resources. However, it is noteworthy that 6% are perceived as only averagely capable, and 12% are identified as needing more training.

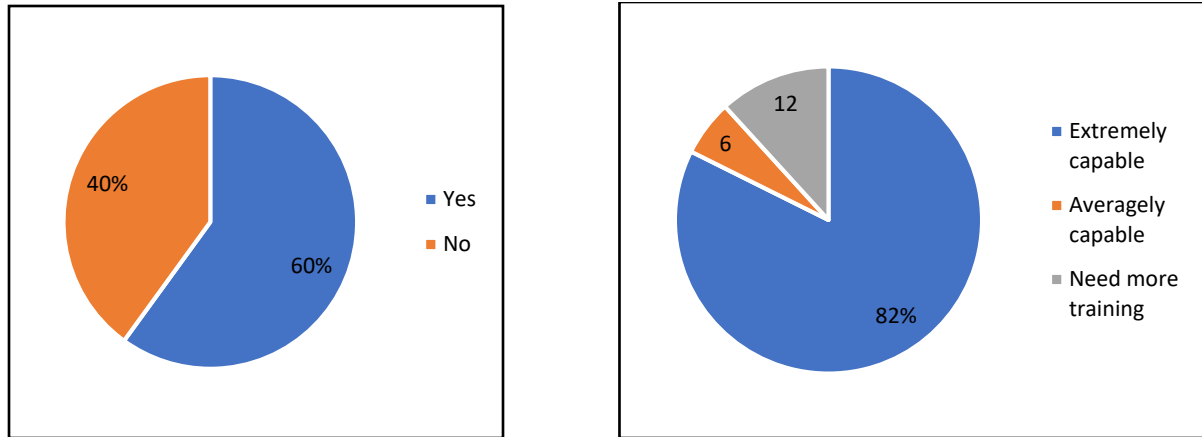


Figure 8: Mathematics and science teachers' level and capability of assigning mathematics and science kits

### 3.3. Teachers' level of using mathematics and science kits is based on gender and school location

the findings illustrated that male teachers used science kits more than female teachers at a percentage of 65% compared to counterparts who use those kits at an average of 56%. On the other side, based on the school's geographical location, the findings showed that most schools in rural areas used more mathematics and science kits at an average of 73% compared with the schools in the urban area, which used these kits at an average of 53%.

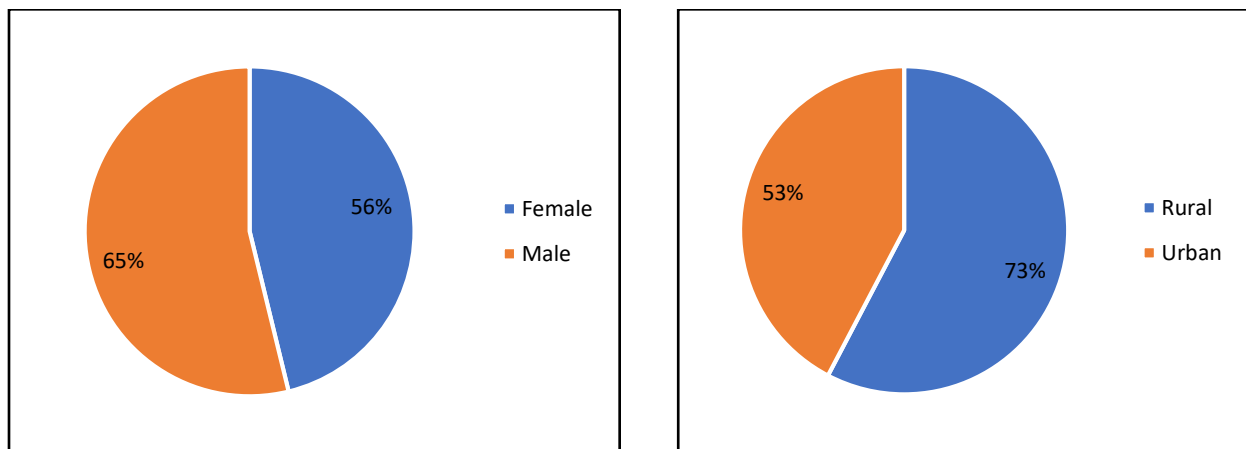


Figure 9: Teachers' level of using math and science kits by gender and school location

### 3.2.4. Teachers' Level of Using Formative Assessment Tools

The results obtained from the classroom observation assessing the incorporation of modernized formative assessment tools in mathematics and science classrooms indicate a notable adoption rate, with 77% of teachers utilizing these tools as part of their instructional strategies. However, 23% of

teachers did not use these tools. Notably, 40% of teachers incorporated Plickers, 33% utilized voting cards, and 27% employed show-me boards as part of their teaching methodologies.

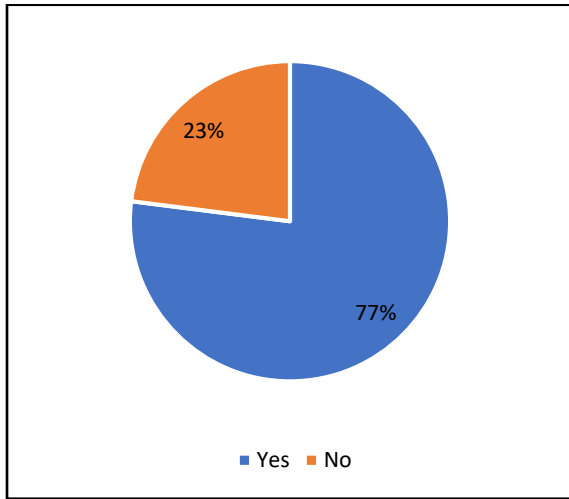
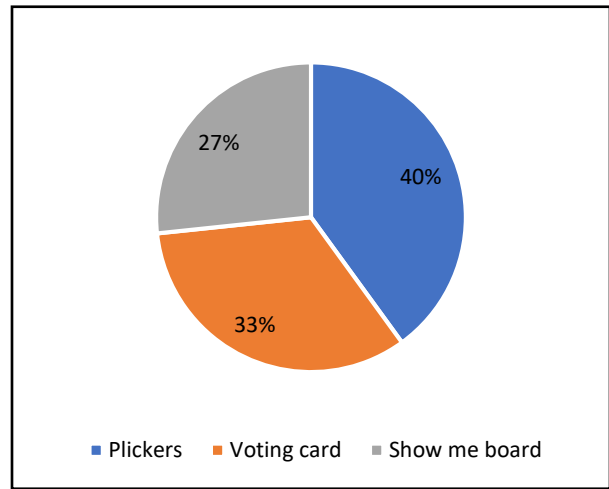


Figure 10: Mathematics and science teachers' level of using modernized formative assessment tools



Formative assessment tools used by mathematics and science teachers

### 3.4. Teachers' level of Using Formative Assessment Tools Based on Gender and School location,

The findings indicate that, on average, 69% of male teachers and 67% of female teachers incorporated these modern tools into their instructional practices. On the other side, according to the geographical location of the school, the findings illustrated that teachers in the rural area used the provided modernized tools at a percentage of 64% while in urban used these tools at a percentage of 66%

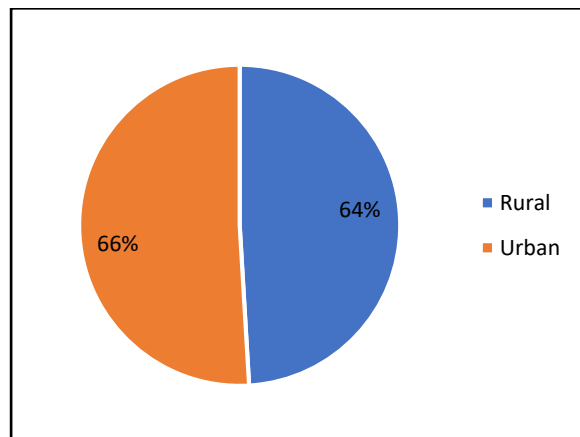
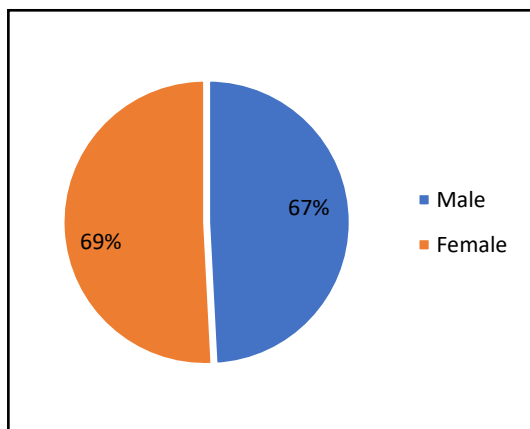


Figure 11: Teachers level of using formative assessment tools by gender and school location



*“I support my colleagues in different CPD sessions every Wednesday where we discuss the challenges of teaching mathematics and find the solution together as a team.” Teacher A*

*As a mentor, I try to collaborate with my colleagues, particularly those whom we teach a similar lesson (Mathematics). For example, if there is someone who has a problem teaching some concepts, I try to intervene as much as I can. Also, during the CPD (Continuous Professional Development) session that occurs on Wednesday afternoon, we, the scientific teachers, sit together and discuss how to improve our teaching methodology. Teacher F*

when asked to highlights some examples of successful mentoring experiences one SSL said:

Some examples of Successful mentoring experiences where SSLs witness positive changes in their colleague's teaching approach or student outcomes

*I mentored a fellow teacher who was initially hesitant to integrate technology into the classroom. Through collaborative planning and training sessions, we explored various educational apps and online resources. The colleague embraced technology, and this shift positively impacted student engagement, making lessons more interactive*

*My colleagues are aware of improved lesson plan of 5Es (Engage, explore, Explain, Elaborate and Evaluate). Use of ICT is improved for both teacher and learners at our school, Nowadays, learners are engaged in the lessons. Said Another teacher*

*After different CPD sessions, teacher develops engaging lessons that utilize technology and other innovative pedagogies*

## **Theme 2: School Subject Leaders’ Role in Ensuring Effective Use and Sustainability of Provided Materials**

In their responses, school subject leaders who participated in this study indicated how they facilitate teacher training sessions by effectively using provided materials and incorporating best practices and innovative teaching methods. Some said they regularly monitor the use of provided classroom materials through peer classroom observations, feedback, and teacher discussions.

*“I ensure effective utilization of teaching materials by establishing clear guidelines and expectations within the department. This includes communicating the importance of proper care and usage, specifying storage protocols, and outlining responsibilities for maintaining shared resources.” Said teacher F*

*“I conduct regular CPD sessions to familiarize colleagues with new teaching materials and resources. This involves hands-on demonstrations, usage tips, and encouraging open discussions to address challenges. Ongoing CPD ensures that everyone is well-equipped to utilize materials effectively.”* Teacher D said

*I regularly check in with colleagues to gauge how the materials are used, gather feedback on their effectiveness, and address any concerns. This allows for continuous improvement and adjustments based on real-time experiences.* Teacher K

Some teachers said that in their schools, the weekly reports on the use of provided materials are done by the school IT department, which reports about the use of ICT tools like projectors, and the lab assistant reports about the use of science kits.

*Teaching materials received in our school are efficiently utilized through lesson preparation, delivering lessons by using a laptop and projector, and in the evaluation phase by using plickers and voting cards. The fact is the weekly reports from school IT and Lab assistants about using projectors and related devices in teaching and learning in most classes where electricity is available.* Said teacher J

*I can affirm that the teaching materials received in our school are efficiently utilized. The fact is that there are weekly reports from laboratory assistants about the use of projectors in most classes where no electricity is available.* Teacher G

### **Theme 3: Challenges encountered by School Subject leaders and how they overcome them**

School Subject Leaders (SSLs) expressed the challenges they face in playing this pivotal role in guiding and supporting other teachers to enhance the quality of teaching Mathematics and Science within their respective subject areas. In the discussion, we will delve into the common challenges faced by School Subject Leaders and explore strategies they employ to overcome these hurdles, ensuring effective leadership and sustained improvement in the teaching and learning process.

*Keeping up with rapid technological advancements posed a challenge in my role.*

*As a subject leader and mentor, one of the challenges I faced is managing a demanding workload and time constraints. I lack enough time for organizing meeting session because of full timetable.*

**Table 1: Perceived school subject leaders' challenges and solutions used to overcome them**

Challenges	Frequency	Some provide solutions by SSLs to overcome the challenges
Keeping up with rapid technological advancements	1	<i>I engaged in continuous professional development focused on technology integration to address this. I also facilitated workshops for colleagues to enhance their digital literacy, fostering a culture of adaptability and innovation within the department.</i>
Managing a demanding workload and time constraints	5	<i>To overcome this, I implemented effective time management strategies, prioritized tasks, and delegated responsibilities when appropriate. Additionally, I encouraged a culture of collaboration among team members to share the workload and support each other. Additionally, I encouraged a culture of collaboration among team members to share the workload and support each other.</i>
Dealing with diverse teaching styles among colleagues	4	<i>I addressed this by promoting professional development sessions, emphasizing best practices, and encouraging peer mentoring. This approach allowed teachers to learn from each other and adapt effective strategies to their individual teaching styles.</i>
Lack of electricity in some classrooms	9	<i>For electricity, there is no solution; we just report to the school leaders.</i>
Lack of network connection,	11	<i>"No sustainable solution, but sometimes I used my own internet..." "... taking the extra time, use of offline course, working in groups."</i>
Classrooms that are not appropriate for projections (walls that are not white)	3	<i>"... I consistently reported it to the school leaders..."  "... I sometimes move my students to the smart room when it is not occupied."</i>
Overcrowded class	4	
Some teachers are uninterested in the CPD program and want new teaching approaches. There is a conflict of interest	3	<i>"... by trying to approach them, there is some improvement."  "I try to be not discouraged in explaining the usefulness of peer learning and inviting them to observe my lesson. This gave a positive change."</i>

Although the SSLs who participated in this study avowed various difficulties, most are committed to fostering collaborative learning communities among science/mathematics teachers by creating platforms for professional exchange, collaboration, and shared learning experiences.

## Discussion of Findings

This finding suggests a strong inclination among educators in these fields to incorporate the 5Es model into their teaching methodologies. The 5Es model, encompassing stages such as Engagement, Exploration, Explanation, Elaboration, and Evaluation, is known for its effectiveness in promoting active learning and student engagement. The high adoption rate across both subjects signifies a positive trend towards employing inquiry-based and interactive teaching methods, fostering a deeper understanding of mathematical and scientific concepts among students. The results indicate that trained math and science teachers embrace the 5Es model in teaching at 84%.

Interestingly, when examining the results based on gender, a subtle but noteworthy distinction emerges. Male teachers demonstrated a utilization rate of 92% for the 5Es instructional model, while their female counterparts exhibited a slightly higher rate of 94%. While the difference is minimal, it indicates a general alignment in teaching strategies between male and female educators. This consistency may stem from shared professional development opportunities, a common understanding of effective pedagogy, or institutional support for integrating the 5Es model. The results underscore the universality of the 5Es model in mathematics and science education, transcending gender differences among teachers and reinforcing its broad acceptance as a valuable teaching framework.

Based on the school's geographical location a noteworthy distinction emerges when considering the geographical location of schools, revealing that teachers in rural areas exhibit a higher adoption rate of the 5Es model at 95%. In comparison, their urban counterparts show a slightly lower rate of 91%. This discrepancy may be influenced by factors such as resource availability, class size, or pedagogical priorities specific to each setting.

The findings suggest that the 5Es model enjoys widespread popularity in both rural and urban educational contexts, albeit with a subtle variation, emphasizing the flexibility and effectiveness of this instructional approach across diverse teaching environments. The results obtained on using 5Es highlight that a portion of mathematics and science teachers may require additional support, training, or resources to integrate that innovative pedagogy into their teaching methodologies fully. Overall, observations suggest that most teachers understand the importance of the Elaborate phase in promoting deeper understanding and real-world application, but there's room for improvement in providing further explanations and utilizing scenarios uniformly. The obtained results align with those

of Bahtaji (2021), who highlights that using 5Es increases students' engagement in a lesson. In addition, Ahmad et al. (2018) showed that all phases of 5Es provide ample space for students' hands-on practices of the learning contents.

As indicated by the 81% usage rate, the observed prevalence of technology integration aligns with the broader trend in contemporary education towards leveraging modernized tools for more effective and interactive instruction. The results imply a positive momentum towards modernizing teaching practices in mathematics and science. Nonetheless, attention should be given to the 19% who have not yet incorporated projectors and computers into their teaching, as addressing potential barriers or providing targeted professional development could further enhance the overall technological integration among educators. This insight underscores the importance of ongoing support and professional development initiatives to ensure that all teachers can harness the benefits of modern tools for student learning and engagement in mathematics and science classrooms.

The findings underscore the evolving landscape of formative assessment practices in mathematics and science education, emphasizing the need for ongoing support and professional development to ensure all educators can effectively integrate these tools into their teaching methodologies, ultimately enhancing the learning experience for students. These results highlight educators' diverse strategies to measure student understanding and facilitate real-time feedback. The prevalence of Plickers, voting cards, and show-me boards indicates a recognition of the value of interactive and technology-enhanced assessment tools in teaching mathematics and science. However, the variations in usage percentages suggest that teachers may choose tools based on individual preferences, classroom dynamics, or available resources. This insight underscores the importance of acknowledging and supporting the diverse array of formative assessment tools that cater to educators' unique needs and preferences in mathematics and science classrooms. It was supported by Nkundabakura et al. (2023), who illustrated the use of modern tools and innovative teaching and learning methods to improve the educational process.

These findings underscore the importance of ongoing professional development opportunities to enhance teachers' skills and comfort levels using scripted lessons and mathematics and science kits. Although more than half of teachers, 59%, have indicated a good level of utilizing scripted lessons, there is still a journey to support 41% of teachers who indicated that they have difficulties using scripted lessons. Ensuring that all educators have the necessary training and support is crucial for maximizing the benefits of interactive learning, hands-on and experiential learning approaches facilitated by these

mathematics and science kits, and the resources embedded in scripted lessons like animations and simulations. This was in agreement with Larsen (2018), who explained that using science kits motivates learners and increases students' engagement in the lesson.

## Conclusions

The findings of this study shed light on the positive impact of training and instructional tools provided by the Rwanda Quality Basic Education for Human Capital Development (RQBEHCD) Project, Sub-Component 1.2. As the findings indicate, a good percentage of trained teachers effectively utilize the materials they have received, like computers and projectors, science kits, and formative assessment tools. In addition, the findings indicated that many teachers are proficient in preparing and delivering 5E-based lessons in their respective subjects. This is indeed a commendable stride towards enhancing the quality of mathematics and science education. However, the study also highlights areas that demand attention and improvement, particularly in scripted lessons, where the usage percentage is 59%, and science kits, where the usage percentage is 60%. As far as the continuous professional support to math and science teachers by the project, sub-component 1.2 is concerned, the study recommends reinforcing the CPD program within the schools by empowering and equipping the school subjects' leaders with the necessary skills to support their peer teachers.

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