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Impact Study of the Extension Activities Conducted by the Science Education Department, College of Education, Central Mindanao University, Maramag, Bukidnon, Philippines

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Abstract: : One of the primary functions of Central Mindanao University is to offer extension services to the community and its stakeholders. The institution is committed to its mission of promoting holistic development among individuals and communities through the provision of exceptional services in education, research, outreach, and productivity. Several centers and colleges have established extension programs, initiatives, and activities that align with their areas of expertise. These endeavors aim to empower stakeholders and contribute to the overall mission of the university. The training program had the primary objective of providing educators with the essential knowledge, skills, and attitudes required to effectively incorporate pedagogical practices into their subject matter expertise. By means of practical workshops and experiential activities, educators acquired the necessary pedagogical content knowledge (PCK) to effectively design and deliver captivating and purposeful learning encounters for their students.

The training encompassed three fundamental domains: pedagogical knowledge, content knowledge, and technological knowledge. Educators have devised methodologies to effectively incorporate technology into their mathematics pedagogy, thereby augmenting student involvement and comprehension. In addition, the program enhanced their proficiency in mathematical concepts, allowing them to effectively deliver lessons with clarity and skillfully address students' inquiries.

Following the completion of the training program, educators reported a notable enhancement in their self-assurance, which subsequently contributed to the cultivation of a favorable atmosphere for learning. They developed an increased proficiency in addressing students' misconceptions, offering explanations, and assisting them in navigating typical obstacles encountered in the field of mathematics. The training program fostered a growth mindset, promoting the ongoing development of professional skills and a dedication to remaining knowledgeable about evidence-based practices.

Keywords: *Impact Study, Knowledge, Attitudes & Values, Skills, Extension Program, Program Evaluation.*

INTRODUCTION

Central Mindanao University (CMU) assumes four primary functions, namely education, research, production, and extension. A university on Mindanao Island has been actively providing and expanding its extension programs throughout the region. Higher education institutions, such as CMU, bear a societal obligation to foster the exchange of knowledge, skills, technology, and guidance while also serving as conduits for the transmission of knowledge, skills, and guidance. According to the Institute of Forestry (n.d.), self-reliance is fostered through the recognition of needs and the acquisition of knowledge, leading to the alteration of attitudes and behaviors. CMU (2023) delineated extension programs in the fields of the humanities, sciences, and education. The institution prioritizes research and extension activities to foster the holistic development of its community and stakeholders.

Extension is a primary area of emphasis for State University Colleges (SUCs), as it plays a crucial role in the advancement of knowledge through instructional and research endeavors. According to Holland, Jones, and Kardan [1], the implementation of participatory extension strategies has been found to enhance the efficacy of various development programs while also fostering sustainability and facilitating social transformation. The execution of the extension program is of utmost importance. According to the research conducted on the Effectiveness and Impact of the Community Extension Program of a Higher Education Institution in the Philippines, it was found that the resolution of community issues cannot be solely entrusted to local government officials or residents. Instead, the active participation of the knowledge-based sector and the academic community is necessary to provide a scientific diagnosis of the problems occurring within the community. According to the regulations set forth by the Commission on Higher Education (CHED), State Universities and Colleges (SUCs) are mandated to actively participate in community service initiatives and educational endeavors. According to CHED Memo 52 of 2016, the Commission has recently commenced efforts to redirect extension initiatives. In addition, State Universities and Colleges (SUCs) are required to respond to the community's needs for growth and progress as stipulated in the provisions of Republic Act 7722. According to Lauzon [2], the implementation of an extension project serves to enhance communities by means of nonformal education, with the

objective of equipping individuals with the necessary resources to enhance their own capabilities through sustainable endeavors.

Higher education plays a crucial role in the dissemination of knowledge, skills, attitudes, and practices, with the aim of enhancing the quality of life for various stakeholders. Consequently, educational establishments exhibit a strong inclination to disseminate the expertise of their academic staff through extension initiatives, which are undertaken in direct response to research discoveries and the requirements of stakeholders. In the context of meeting the expectations and requirements of various stakeholders, extension initiatives Central Mindanao University has consistently implemented extension programs that are timely, relevant, and focused on achieving and pursuing excellence in Research Development and Extension. The study was carried out in accordance with the research extension and development objectives set at the national, regional, and institutional levels. The effectiveness of program implementation is influenced by various factors, including the institutional thrust, which encompasses the stated vision, mission, goals, and objectives, as well as the administrative procedures [3].

In the implementation of the Research, Development, and Extension (RDE) endeavors, faculty members from various colleges within the university are engaging in collaborative and cooperative efforts with Local Government Units (LGUs), non-profit organizations, and other affiliated entities. The technical specialists were academic members of the University who implemented extension programs supported by internal or external organizations. Professors from multiple colleges collaborated, taking into consideration the requisite level of knowledge necessary for the investigation. The university has employed a multidisciplinary approach for the purposes of research and extension. The notion pertains to the collective collaboration aimed at formulating a comprehensive extension program that serves the interests of the entire community. According to Redfearn, Parsons, and Drewnoski [4], it is imperative to consider the necessary resources for addressing community issues in a project that involves multiple disciplines. Consistent with its dedication, Carnegie Mellon University (CMU) has undertaken numerous community engagements in various barangays, offices, and schools. The aforementioned engagements encompass a range of activities, such as technology transfer, livelihood programs incorporating skills training, company development, and commercialization, among others. However, an assessment of the program's impact on its beneficiaries has not been conducted thus far. The objective of this study was to assess the recipients of the extension programs and activities offered by the CMU College of Education.

THEORETICAL FRAMEWORK

The study is grounded on the theory of change. The concept of change involves predefining the potential outcomes of actions, both in the short and long term, while also identifying the contextual factors that may hinder their success [5]. The rationale for implementing a modification is to facilitate the assessment of the impact of pedagogical content knowledge (PCK) training on teachers' pedagogical content knowledge, socio-economic status, and teaching skills.

METHODOLOGY

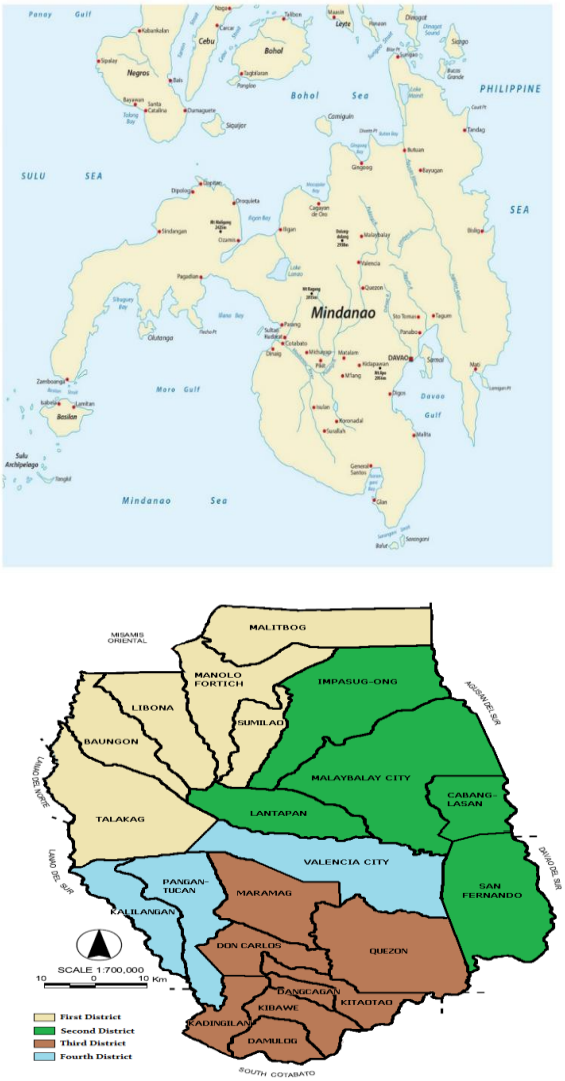
- **Research Design**

The study employed a descriptive research design in order to elucidate the characteristics of the participants. Descriptive statistics, including frequency counts and percentages, were employed to analyze the data, as well as to examine the characteristics of the participants. The study employed a 5-point Likert Scale to assess the influence of the extension project and associated activities on the development of knowledge, skills, and values among participants who received capacity-building training, attended seminars, and engaged in activities facilitated by the College of Education. A survey questionnaire was prepared to facilitate the collection of primary data from the participants.

- **Locale of the Study**

Bukidnon is a province situated in the Northern Mindanao region of the Philippines. It is characterized by its landlocked geographical location, positioned at the central region of the island of Mindanao. The aforementioned location is connected to the southern region of Davao and the northern region of Misamis Oriental on the island. The topography of the area is primarily characterized by a gently undulating tableland covered in grass, with an average elevation of 915 meters. The topography is characterized by a combination of low plains, undulating uplands, and steep canyons and valleys. The location is situated within the latitudinal range of 7'25' to 8'38' north and the longitudinal range of 124'16' east. The geographical area is distinguished by its mountainous topography, which is frequently regarded as unsuitable for agricultural purposes. The Bukidnon region is characterized by its undulating agricultural terrain, which serves as the residence of both indigenous communities and small-scale farmers. It is worth noting that this area exhibits a significant prevalence of poverty, ranking among the highest in the region. Bukidnon is a province located within the administrative region known as Region 10. The region offers a wide array of resources and potential opportunities for diversifying income streams. This location is renowned for hosting the largest pineapple plantation in the world.

The City of Valencia is situated centrally on the Island of Mindanao. The area under consideration is situated in the central region of the Province of Bukidnon, encompassing a total land area of 63,126 hectares. Out of this, 35,321.74 hectares, accounting for approximately 55.95% of the total area, are designated as agricultural land suitable for crop cultivation. In the urban setting, various crops such as rice, corn, sugarcane, and other industrial crops are cultivated (Phil Atlas, 2015). This study was conducted at Valencia, Bukidnon. A map of the locale study locale is shown in figure 1



1. Map of the Philippines and Bukidnon showing the locale of the study

RESULTS AND DISCUSSION

The study comprised a sample size of 31 participants. The participants in the study consist of 96.3% individuals who are currently employed within the Department of Education. The study's sample size of 31 participants is considered to be adequate for representing the target population, enabling the derivation of valuable insights and conclusions. Although it is generally preferable to have larger sample sizes in order to achieve higher statistical power, it is important to note that smaller samples can still produce meaningful findings, particularly in qualitative research or when the target population is restricted [6].

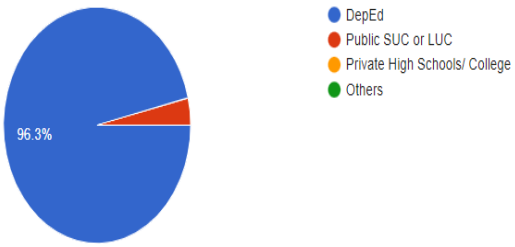


Figure 2. Profile of participants in terms of employment

The study's pertinence to the education sector is evidenced by the fact that 96.3% of participants in the Department of Education are employed. The substantial presence of educators employed within the Department of Education enhances the generalizability of the research findings to a substantial segment of the education labor force. This aspect of the study contributes to its external validity, indicating that the findings have the potential to be applied to a wider population of teachers or education professionals within the department [7].

Moreover, the clustering of individuals within the Department of Education provides valuable perspectives on the policies, practices, and obstacles encountered by the department. The aforementioned findings possess significant potential in assisting policymakers and administrators in making well-informed decisions aimed at enhancing the comprehensive education system [8].

The practical significance of the study is indicated by a substantial proportion of respondents who are employed in the Department of Education. This implies that the chosen research topic is relevant and meaningful to educators, aligning with their professional responsibilities and practical experiences. Consequently, the findings of the research can provide valuable insights for the formulation of strategies and interventions that have a direct influence on the professional growth and overall welfare of teachers within the department [9].

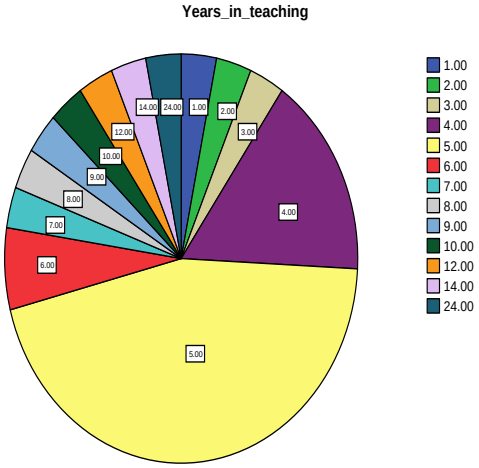


Figure 3. Profile of participants in terms of years of employment

The participants in the study had the opportunity to fulfill their professional duties at the educational institution where they were employed for a range of time periods, spanning from one year to a maximum of 24 years. The diverse range of years of service exhibited by the participants in their respective educational institutions serves as a testament to the enduring commitment and steadfastness of the teaching personnel. According to a study conducted by Rivkin, Hanushek, and Kain [10], there is evidence to suggest that proficient educators play a substantial role in enhancing students' scholastic accomplishments and overall performance within educational institutions. The extended duration of service exhibited by these educators suggests that they have established robust connections with students, colleagues, and the community, thereby potentially enhancing the educational milieu.

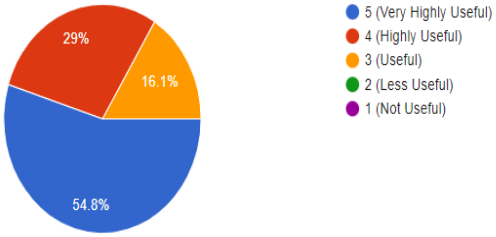


Figure 4. Responses of the participants in terms of the usefulness of the training.

The respondents' favorable evaluation of the training, expressed as a "very highly useful" rating, indicates their positive perception of the training's efficacy and its influence on their professional growth. The ratings received serve as a reliable measure of the training's effectiveness in fulfilling the expectations and requirements of the participants, as well as its capacity to impart valuable knowledge and skills [11].

Based on the research conducted by Garet [11], it has been observed that professional development programs that are effective in nature tend to elicit favorable responses from participants. These responses indicate that the training is perceived as valuable and applicable to their teaching methodologies. A high rating indicates that the training program has effectively addressed the specific concerns of the participants and has successfully improved their comprehension of the subject matter or instructional strategies.

The favorable assessment of the training's efficacy by the participants can be ascribed to a multitude of factors. For example, the training program may have prioritized the acquisition of practical knowledge and skills through experiential learning opportunities. This approach would have allowed participants to promptly implement their newly acquired knowledge and skills in their teaching practices [12]. Practical experiences of this nature often elicit positive responses from educators and contribute to the perceived efficacy of the training.

Furthermore, the training may have placed a significant emphasis on the integration of technology, a practice that is frequently esteemed by educators due to its perceived ability to enhance instructional methodologies and foster increased student involvement [13]. Teachers are more inclined to evaluate training as highly useful when they perceive it to be relevant to their specific classroom needs.

In addition, the proficiency and credentials of the instructors overseeing the program are pivotal factors in assessing its efficacy. The significance of trainers' content knowledge and pedagogical expertise in improving the caliber of teacher training programs is underscored in a study conducted by Hill, Ball, and Schilling [14]. The perceived usefulness of training is more likely to be high when trainers demonstrate a comprehensive understanding of the subject matter and employ effective instructional strategies.

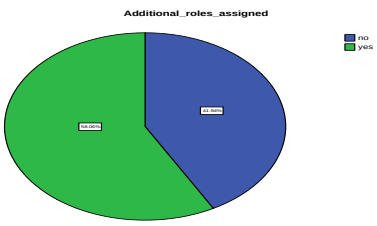


Figure 5. Number of participants given additional roles after the training

A total of 58% of the participants (n=18) indicated that they were assigned supplementary responsibilities subsequent to their enrollment in the training program. The act of assigning supplementary responsibilities to participants subsequent to their completion of the mathematics pedagogical content knowledge (PCK) training signifies the acknowledgment of their enhanced proficiency and aptitude in the field of mathematics education. According to Hill, Ball, and Schilling (2008), the implementation of math pedagogical content knowledge (PCK) training as part of professional development programs has been shown to be effective in improving teachers' understanding and instructional skills in the subject. As a result, teachers experience heightened levels of confidence and competence in their ability to teach mathematics.

Hill, Ball, and Schilling (2008) assert that pedagogical content knowledge (PCK) plays a crucial role in the effectiveness of teaching. This knowledge encompasses the understanding of how to effectively present mathematical concepts to students, thereby promoting their learning. Upon completion of professional development in pedagogical content knowledge (PCK), educators acquire a heightened comprehension of diverse instructional methodologies, enabling them to actively involve students in the learning process and cater to their individualized requirements.

According to Garet [11], when teachers exhibit enhanced competence in the application of research-based practices and novel strategies, school administrators and leaders are more inclined to delegate them with supplementary duties. These encompass various responsibilities, such as providing guidance and support to mentees, designing educational programs, and facilitating workshops to enhance the professional growth of fellow educators.

In addition, it has been found that teachers who participate in Pedagogical Content Knowledge (PCK) training are more proficient in providing assistance and mentorship to their peers in enhancing their pedagogical approaches [15]. Educators have the capacity to exchange their expertise, personal encounters, and effective pedagogical approaches, thereby fostering a cooperative and scholarly environment for professional development within the educational institution.

The allocation of supplementary responsibilities to participants can also be interpreted as a recognition of their dedication to professional development and ongoing enhancement. Teachers exhibit a growth mindset and a propensity to surpass their typical teaching duties when they actively pursue training opportunities and invest in their professional development [16].

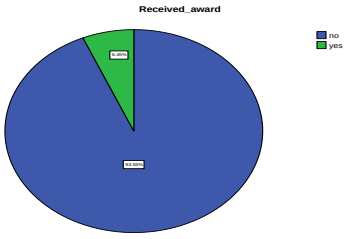


Figure 6. Number of participants who received an award after the training

Two participants got honors after enrolling in the course, which emphasizes the training's considerable influence on their professional development and recognition in the educational community. Such acknowledgment may result from participants' improved teaching techniques, enhanced student results, or contributions to the general performance of the school [11].

The math PCK training is an example of an effective professional development program that frequently results in better teaching techniques and more teacher effectiveness. Teachers are more likely to design engaging and fruitful learning experiences for their students as they put the knowledge and abilities they learned from the training into practice in their classrooms [17]. Higher student accomplishment as a result of effective classroom modifications can bring about acknowledgment for the instructors' efforts.

Additionally, after receiving training, teachers who exhibit outstanding progress in their pedagogical content knowledge (PCK) may serve as role models for their peers and motivate others to enhance their teaching methods [18]. The accomplishments of these two participants may have inspired other participants to take advantage of professional development opportunities and strive for teaching excellence.

Additionally, the fact that these two participants were honored with awards can be seen as confirmation of the training program's efficacy. The program's quality and applicability are reflected in how the training affected their teaching methods and the subsequent recognition they gained. This endorsement can attest to the training's capacity to promote the real development of educators [14].

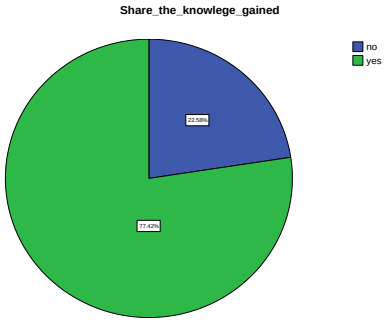


Figure 7. Participants who shared their knowledge learned during the training

The manner in which PCK training participants shared the information they learned shows their dedication to professional collaboration and their readiness to make a positive impact on the larger teaching community. Since it encourages a culture of ongoing learning and progress among educators, information sharing is a crucial component of good professional development [11].

effective professional development programs enable participants to put the knowledge and skills they have learned in the classroom to use before sharing their experiences with other colleagues. Teachers can encourage others to embrace research-based methods and cutting-edge teaching techniques by sharing their knowledge and achievements.

Furthermore, when educators share their expertise, it might result in a general expansion of the teaching profession. According to a study by McMillan and Schumacher [10], peer collaboration is important and has a favorable influence on instructional strategies. Teachers can learn from one another and improve their teaching techniques and student outcomes by exchanging best practices and productive instructional strategies.

Sharing the information learned during PCK training can help create a welcoming and cooperative learning atmosphere at the school. Collaboration and open communication among instructors foster a climate of trust, respect, and a shared dedication to student success [13].

Sharing knowledge obtained through professional development is also consistent with instructional leadership standards. Teachers who actively share their knowledge with their peers exhibit leadership qualities and help the school community as a whole advance professionally [17].

How did the training help you as a math teacher?

Effective math education is crucial for fostering students' analytical and problem-solving skills, enabling them to succeed academically and in their future careers. The following are the respondents answer on how the training helped them:

Enhancing TPCK:

The training significantly contributed to my development and improvement in my TPCK areas, which encompass the intersection of pedagogical knowledge, content knowledge, and technological knowledge. Through practical workshops and hands-on activities, I learned how to effectively integrate technology into my math instruction. I had some prior experience with technology integration, but the training refined my approach, particularly in creating video lessons that were timely and relevant to my students' need.

Boosting Confidence:

As a result, my confidence as a Mathematics teacher soared, knowing that I could deliver meaningful learning experiences to my students. I became more adept at addressing typical misunderstandings, providing clarifications, and offering guidance when my students faced common difficulties in mathematics. The training instilled in me a growth mindset, fostering ongoing professional expertise, and a commitment to staying informed about research-based practices in mathematics education.

Mastery of Subject Matter:

The training also allowed me to deepen my mastery of the subject matter. I gained insights into various teaching strategies that I could apply to cater to diverse learners' needs. Moreover, it equipped me with the capacity to deal with my students' unique challenges in comprehending mathematical concepts.

Widening Teaching Strategies:

Expanding the use of technology in my classroom widened my understanding of teaching strategies, enabling me to engage my learners effectively. I noticed a marked improvement in

the way I delivered lessons and facilitated discussions. With technology as a valuable tool, I could present complex topics in a more accessible manner, making learning a positive and transformative experience for my students.

A Continuous Quest for Knowledge and Techniques:

While the training had a tremendous impact on my teaching and professional growth, I acknowledge that there is always room for improvement. As an educator, I am committed to continuous learning and seeking additional training opportunities. This mindset reflects the enthusiasm of my colleagues as well; we collectively feel that the training has been incredibly useful, and we are eager to participate in further programs that can enhance our teaching practices.

Benefits for Learners:

The training not only helped us as teachers but also had a profound impact on our students. The integration of technology, problem-solving, critical thinking, and effective assessment strategies resulted in better learning outcomes for the learners. The simplified explanations of complex topics made the learning process more engaging and enjoyable. Students became more active participants in the learning journey, leading to increased interest and understanding of Mathematics.

What can you suggest for the next trainingng?

The role of mathematics educators in shaping the future of students is unparalleled. As the landscape of education evolves, it is imperative to equip teachers with the necessary skills to effectively utilize technology-based instruction and implement innovative teaching strategies. The following are the topics they wish to be included for the training:

Regular and Sustained Training:

Teachers express the need for regular and sustained training to ensure continuous improvement in their instructional practices. Regular training sessions allow educators to stay updated with the latest developments in educational technology, pedagogical techniques, and subject matter knowledge.

Technology-Based Instruction:

technology to enhance student learning experiences. Such training should introduce teachers to educational software, interactive simulations, mathematical modeling tools, and online resources that support student engagement. Educators need to understand how to effectively integrate technology into their lessons to create dynamic and interactive learning environments.

Practical Applications and Activities:

Teachers emphasize the value of practical applications and activities during training. Hands-on experiences enable them to understand the implementation of new strategies and techniques better. Integrating practical applications allows teachers to witness the impact of technology and new teaching methods firsthand.

Extended Training Duration:

Many teachers advocate for longer training durations to delve deeper into the subjects and acquire a comprehensive understanding of new concepts. Extended training sessions provide ample time for educators to grasp complex topics and hone their skills.

Tailored Strategies for Adult Learners:

Teachers who work with adult learners request specialized training that caters to the unique needs of this demographic. The training should address instructional approaches that are suitable for adult learners, including strategies to enhance motivation and create a supportive learning environment.

Follow-Up and Coaching Opportunities:

Teachers find post-training follow-up sessions and coaching opportunities highly beneficial. Follow-up sessions offer a chance for reflection, clarification, and sharing of experiences. Coaching allows teachers to receive personalized guidance and support in implementing new strategies effectively.

CONCLUSION AND RECOMMENDATION

The development of pupils' mathematical understanding and the development of a passion for the subject are greatly influenced by math professors. Teachers need specialized training that emphasizes technology-based instruction, real-world applications, and adult learners-specific learning methodologies in order to improve mathematics education. For educators to stay up to date with best practices and adjust to the changing needs of their students, continuous growth through regular and sustained training, paired with follow-up sessions and coaching, is imperative. Educational institutions can create a supportive environment that empowers teachers and, in turn, improves the standard of mathematics education for future generations by addressing the needs of teachers for longer training duration, more practical applications, and increased focus on technology integration.

On the basis of the findings of this study, it is advised that the MS Mathematics Education faculty and students include technology-based instruction, practical application and activities in mathematics, tailored strategies for the different types of learners, and follow-up and coaching over a longer period of time in their next extension activity.

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