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Research Article

Trailblazing Innovation Transformation Through Assistive Approaches for Inclusive Science Education

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ABSTRACT

This study investigated the level of innovation in assistive technology (AT) among science teachers in inclusive classrooms, focusing on resource allocation and implementation, collaboration measures, technological training, personal professional approach, and adaptability. Utilizing a mixed-methods approach, data were gathered from 36 science teachers through surveys and interviews. The results revealed a high level of innovation overall, with specific strengths and areas for improvement identified.

Teachers However, innovated resource allocation and implementation to meet various student requirements. collaboration measures indicated average level of innovation, highlighting the need for systematic teacher collaboration and best practice exchange. The high rating of technological training shows science teachers' proactive professional development to improve AT skills. Teachers' innovative personal professional approach focused on lifelong learning and creative problem-solving to achieve inclusion. Teachers' adaptability to modify tools and create low-tech solutions for students also scored high, highlighting teachers' ability to modify existing tools and develop low-tech solutions to address specific student needs. The study identified key themes, including resource limitations, technological barriers, administrative and knowledge gaps, and student-centered challenges, that influence teachers' innovative use of AT. Based on these findings, a comprehensive training workshop, STEAM AID, was proposed to equip teachers with the skills and knowledge needed to overcome these challenges and foster an inclusive learning environment.

Keywords: *Assistive technology, Inclusive education, Innovation, Science teachers*

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Introduction

Innovation in education has become critical for addressing the diverse challenges faced by learners today. Traditional methods have often proven insufficient, leading to disengagement and underachievement (Stand Together, 2024). Innovation in education involves introducing new elements to enhance learning, requiring fresh perspectives and a constant drive for improvement (The Global College, 2023). This approach fosters creativity, problem-solving, and adaptability, encouraging inquiry and exploration in schools (Kalyani & Rajasekaran, 2018; Sherly, 2023). Innovative pedagogical practices not only ignite students' passion for learning but also equip them with the skills necessary to succeed in modern society (Sherly, 2023).

Teachers foster innovation by generating new ideas through research and collaboration. Those who demonstrate creativity, collaboration, communication, and reflective practice are essential to nurturing innovative classrooms (Allmon, n.d.; Livingston et al., 2023; Lynch, 2018). In science education, these traits are especially important, as they help students acquire and apply scientific skills, promoting technological innovation and problem-solving (Udu, 2018).

Inclusive science education poses additional challenges, particularly in adapting instruction and resources for students with special needs. Teachers often face obstacles such as inadequate training, limited materials, and a lack of collaboration between science and special education professionals, which can hinder the success of students with disabilities (Pujaningsih et al., 2021). However, teachers continue to find creative solutions, utilizing physical materials and alternative methods to engage all learners (Pujaningsih et al., 2021). Adaptability is key, with research showing that flexible teachers positively impact student progress and are better equipped to handle challenges (Collie et al., 2018, 2020; Martin et al., 2018). Inclusive classrooms demand resourceful, compassionate teachers who are well-prepared to meet diverse needs (Gulzar, 2021; Ramos, 2023).

Innovation and adaptability are vital in inclusive science education, where teachers must engage all students and develop their problem-solving skills (Burns et al., 2019; Collie et al., 2020; Pujaningsih et al., 2021). Teachers' professional development is transitioning from traditional models to personalized approaches, allowing educators to guide their own learning and focus on their specific goals and challenges (Green, 2023). While large-group professional development remains necessary to impart institutional standards (Goodwin et al., 2019), personalized learning is more effective in addressing individual teacher needs (Canlé, 2020).

In inclusive classrooms, especially in science education, the adaptation of new technologies such as assistive technology (AT) is essential for ensuring students with disabilities can fully participate. AT helps overcome learning barriers and promotes inclusion (Batanero et al., 2022; Zwarych, n.d.). Successful AT projects have enhanced independence for students with cognitive disabilities, and innovative tools in science labs, such as microscope slide scanners for visually impaired students, enrich learning experiences (Gómez et al., 2017; Korozi et al., 2018). However, barriers such as high costs, insufficient training, and teacher attitudes can limit AT's effectiveness (Adams et al., 2017; Byrd & León, 2017; Holstein et al., 2017).

Inclusive science education is particularly important for addressing disparities in access to STEM (Science, Technology, Engineering, and Mathematics) opportunities for marginalized groups, including students with special needs. These students face significant barriers in science education, resulting in lower participation rates in advanced courses and careers (Johnson & Schneiderwind, 2020; Kolonich et al., 2018; National Center for Science and Engineering Statistics, 2023). In countries like the Philippines, these challenges are exacerbated by inadequate infrastructure and support (Mina, 2013; Technical Education and Skills Development Authority, 2020), making innovation and inclusion in education even more critical (Rogayan et al., 2021).

To address these challenges, this study specifically aimed to identify the level of innovation in AT among inclusion junior high school science teachers in seven junior high schools in

a school district in Rizal, Philippines, during the School Year 2023–2024 in terms of: (a) allocation and implementation of resources; (b) collaboration measures; (c) technological training; (d) personal professional approach; and (e) adaptation, and to develop a competency development tool for AT for inclusion science teachers based on the findings of the study.

Methods Research Design

This study employed a mixed-method research design, specifically a sequential explanatory design. This design integrated both quantitative and qualitative methodologies to generate nuanced and comprehensive conclusions (Clark, 2019). Initially, quantitative data were collected and analyzed through a Likert Scale Survey, providing a broad understanding of the research issue. Subsequently, qualitative data were gathered through semi-structured interviews to enhance and elaborate on the quantitative findings.

The explanatory sequential design was particularly suitable for investigating the level of innovation in assistive technology (AT) among science teachers in inclusive classrooms. This approach allowed for the identification of a cohort of teachers exhibiting a high level of innovation based on their survey responses. These teachers were invited to participate in semi-structured interviews aimed at exploring the strategies they employed to utilize AT in fostering a more inclusive educational environment for students with special educational needs.

The qualitative data collected from these interviews served as a foundation for developing a competency development tool, aimed at enhancing science teachers' capabilities to improve educational settings for their students.

Sample and Sampling Design

The study's sample comprised junior high school science teachers in 7 junior high schools in a school district in Rizal, Philippines, during the 2023-2024 school year, selected based on specific criteria: they had to be full-time employees at one of the seven public junior high schools and have at least one student with special educational needs (SPED) in their roster. Purposive sampling was employed to enhance the study's rigor and ensure the sample aligned with the research aims. This method enabled the identification of teachers who completed a Likert Scale Survey on their level of innovation in AT. From this initial group, science teachers exhibiting the highest levels of innovation were invited for semi structured interviews, with their insights informing the development of a competency development tool based on their best practices and innovative strategies.

Context and Participants

Initially, the study focused on four public junior high schools in a school district in Rizal. However, during data collection, the researcher identified a low number of science teachers teaching inclusive classes. To enhance the study's outcomes, a request was made to the Division Office of Rizal to include three additional schools.

During the 2023-2024 school year, full-time science teachers in these schools who had at least one SPED student were invited to participate in the initial data collection phase. Verification of the teachers' eligibility was conducted by the subject area leader in their respective schools. Teachers without SPED students in their rosters were excluded from the data-gathering process. For the second phase, science teachers demonstrating the highest levels of innovation in AT based on their Likert Scale Survey responses were selected for semi-structured interviews. This two-phase approach ensured that the data gathered for developing a competency development tool was grounded in effective practices and innovative techniques employed by these teachers in inclusive science classrooms, thereby validating the knowledge through their firsthand experiences.

Research Instrument

In the initial data collection phase, the researcher designed a Likert Scale Survey to evaluate the level of innovation in AT among science teachers in inclusive classrooms, focusing on aspects such as resource allocation, collaboration measures, technological training, professional approach, and adaptation. The

survey targeted science teachers in public junior high schools in a school district in Rizal, Philippines and consisted of two sections. Section I gathered demographic information about participants, including grade level, years of teaching experience, and level of knowledge of AT. Section II featured a modified Likert Scale with seven items assessing various categories, using a 4-point scale ranging from "Always" to "Never," allowing participants to indicate the frequency of statements regarding their use of AT in their classrooms.

Additionally, an interview guide was developed based on survey responses and relevant literature. To ensure the validity of the survey instrument, both face and content validity assessments were conducted. Four experienced teachers and subject matter experts reviewed the survey items for clarity and relevance, providing feedback that resulted in necessary revisions. After approval from the validators, a pilot study was conducted with a different set of junior high school science teachers, yielding a Cronbach's Alpha of $\alpha = 0.82$, indicating high internal consistency and suggesting that the items effectively measured the intended constructs.

Data Gathering Procedure

The data collection process began with obtaining consent from the Schools Division Superintendent of Rizal and the principals of the seven public junior high schools in Rizal. This consent was crucial for conducting the study and involving science teachers in inclusive classrooms. The first phase of the study involved developing a Likert Scale survey to assess the level of innovation in AT among these teachers, personal approach, and focusing on resource allocation, collaboration measures, technical training, adaptation. The survey underwent face and content validation by teacher validators and a statistician to ensure its relevance and adequacy. After making necessary revisions based on the feedback, the survey was distributed to all junior high school science teachers teaching in inclusive classes across the participating schools. The completed surveys were then analyzed using descriptive statistics.

In the second phase, an interview guide was created based on the survey responses. This guide was validated and revised accordingly. Science teachers with the highest mean scores on the survey were selected for semi-structured interviews to delve deeper into their practices and the factors influencing their innovation in AT. The interviews were recorded and transcribed for analysis using thematic analysis, specifically the Braun and Clarke method. This qualitative phase aimed to explain the quantitative findings by exploring the underlying reasons for high and low survey scores, along with the challenges faced by teachers. The insights gained from the interviews informed the development of a competency development tool for AT, tailored for science teachers in inclusive classrooms. While the quantitative data highlighted general areas needing improvement, the qualitative data provided detailed examples of effective practices, ultimately enhancing the competency of science teachers in utilizing AT.

Data Analysis

In the quantitative phase of this study, a survey was administered to inclusion science teachers to evaluate their level of innovation in utilizing AT in the classroom. The survey encompassed various aspects such as resource allocation, collaboration measures, technological training, personal professional approaches, and adaptation, with responses collected via a Likert scale. The data analysis involved calculating frequencies and means, allowing for visual representation of response distributions through frequency tables. This analysis helped identify specific items where teachers reported either positive or negative experiences, with Table 1 categorizing respondents' levels of innovation in AT based on mean scores. Following this quantitative analysis, a qualitative phase was implemented to gain deeper insights into the survey findings.

Table 1. Mean and Level of Innovation

Mean	Level of Innovation
3.25 and above	Transformational
2.50 - 3.24	High
1.75 - 2.49	Average
1.00 - 1.74	Low

The qualitative data collection utilized Braun and Clarke's Thematic Analysis to investigate the innovative practices of science teachers in using AT within inclusive classrooms. Semi-structured interviews were conducted with science teachers selected for their high scores on the Likert scale, focusing on resource allocation, technological training, personal approaches, and adaptation. The interviews were designed to encourage open expression of thoughts, experiences, and strategies for overcoming challenges related to AT use. Each interview was audio-recorded and transcribed for accuracy. The analysis followed Braun and Clarke's six-phase process, beginning with familiarization with the data and the generation of initial codes to identify relevant features. The researcher then collated these codes into potential themes, reviewing and refining them for coherence. Themes were defined and named, revealing insights into enhancing student learning, fostering a collaborative learning environment, addressing diverse student needs, and professional support. The final report interconnected these themes into a cohesive narrative, illustrating how teachers' innovative practices with AT enriched the classroom experience for students with special needs. This systematic approach provided valuable insights into the characteristics and strategies of highly innovative science teachers in inclusive settings.

Result and Discussion

Level of innovation in AT of inclusion junior high school science teachers in 7 junior high schools in a school district in Rizal, Philippines during School Year 2023-2024 in terms of allocation and implementation of resources, collaboration measures, technological training, personal professional approach, and adaptation

Table 2. Mean of Each Component Based on the Result of the Survey

Components	Mean	Interpretation
Allocation and Implementation of Resources	2.69	High
Collaboration Measures	2.46	Average
Technological Training	2.52	High
Personal Professional Approach	2.86	High
Adaptability	2.66	High

Allocation and implementation of resources

The survey results indicated a high level of innovation among science teachers in using AT, with an overall mean score of 2.69 categorized as "High." Teachers demonstrated resourcefulness in finding instructional materials for students with special needs, often seeking new AT tools despite limited resources. For example, Teacher "Hydrogen" creatively used everyday materials like cardboard boxes for lab equipment, while Teacher "Beryllium" employed high-contrast visuals and large print materials to support visually impaired students.

However, the study also revealed a nationwide shortage of specialized teaching materials and technology, making it difficult for public schools to fully meet the needs of students with disabilities. Teacher "Beryllium" noted delays in resource requests, often leading to mismatches with students' evolving needs. This challenge underscores the importance of adaptability in utilizing available materials.

While teachers aligned with Udu's (2018) perspective on engaging science education, many struggled to secure funding for assistive technology (AT), with some, like Teacher "Nitrogen," purchasing low-tech AT out of pocket due to a lack of involvement in budget decisions. Additionally, teachers reported only moderate confidence in troubleshooting and maintaining AT equipment, likely due to limited access to essential tools, which could hinder effective science instruction.

To address these gaps, comprehensive training on AT tools is crucial to help science teachers enhance integration into instruction, improve troubleshooting skills, and create more inclusive learning experiences.

Collaboration measures

The overall mean score for collaboration measures was 2.46, indicating an average level of innovation in sharing knowledge and working together on AT integration. Most teachers actively participated in professional learning communities (PLCs) or online forums to exchange best practices and support AT use in science classrooms. For example, Teacher "Neon" shared that her department collaborated to develop interactive science kits for students with special needs and held regular meetings for lesson planning and innovative teaching strategies. In contrast, Teacher "Fluorine" noted a lack of formal meetings at her school but valued casual discussions on alternative teaching approaches and peer tutoring benefits. Teacher "Oxygen" emphasized that collaboration inspired her to develop unique strategies for including students with special needs, as discussions with colleagues provided new perspectives.

Despite this engagement, teachers demonstrated only an average level of innovation in initiating collaborative projects, contributing to online resources, and advocating for administrative support to strengthen AT-related teamwork. They also showed limited efforts in seeking partnerships with specialists to explore new AT options. While science teachers are willing to share knowledge and improve AT use in inclusive classrooms, there is room for growth in proactively fostering creativity and strengthening collaboration.

Technological Training

Science teachers demonstrated a high level of participation in professional development programs focused on the technological aspects of AT, with an average score of 2.52. This reflects their strong enthusiasm for AT-related training and their commitment to enhancing their technological skills.

The survey revealed that many teachers actively sought additional training beyond what their schools provided, demonstrating a proactive approach to staying informed about technological advancements. They also showed eagerness to acquire new skills through school-based AT training and felt confident in seeking technical support when needed. Some teachers even took independent initiatives to deepen their understanding. For instance, Teacher "Nitrogen" conducted her own research to support students with special needs due to limited resources, while Teacher "Beryllium" attended technology-related seminars at her own expense to improve her teaching methods.

Despite these positive efforts, areas for improvement were identified. Teachers showed only an average level of innovation in proposing topics for future AT training and actively engaging in discussions during sessions. This suggests a need for more collaborative, research-driven training environments where teachers feel empowered to contribute ideas and participate more actively. Schools can further support professional development by fostering interactive learning spaces that encourage discussion, inquiry, and shared expertise, ultimately leading to more effective AT implementation in science classrooms.

Personal Professional Approach

Science teachers demonstrated a strong commitment to innovation and the use of AT in inclusive science education, with an overall mean score of 2.86 which falls in the "High" category. The findings highlighted several positive aspects of their personal professional approach to AT, including viewing limitations as opportunities for creative solutions, seeking ways to integrate AT for accessibility and engagement, experimenting with AT tools, and embracing lifelong learning.

Teachers were also committed to ensuring equitable access to the science curriculum and adapting existing resources to create inclusive learning environments.

Teacher "Beryllium" emphasized the importance of creativity when AT was unavailable, using differentiated instruction and alternative materials to support students with special needs. Teacher "Helium" also viewed limited AT resources as an opportunity to find alternative solutions for student needs. Teacher Boron took initiative in researching ways to help students understand lessons, despite challenges with trial and error, and felt rewarded when students succeeded. Teacher "Carbon"'s approaches led to increased class engagement and collaboration among students.

Overall, the findings portray science teachers as not only committed to using AT but also passionate about integrating it in innovative and inclusive ways to help all students reach their full potential.

Adaptability

Data showed that science teachers adapt and implement AT in their classrooms, with an overall mean score of 2.66, which falls within the "High" category. This indicates that teachers emphasize resourcefulness and adaptability in meeting the diverse needs of students in science education. The findings reveal that teachers demonstrate a high level of innovation by effectively adapting lessons and assessments to maximize the impact of AT for all learners, showcasing their flexibility and commitment to inclusive learning. Their ability to quickly develop low-tech solutions using readily available materials highlights their resourcefulness in finding alternative approaches when faced with limitations.

Additionally, teachers are constantly seeking ways to enhance their use of AT, fostering dynamic and innovative learning environments. They believe that effective AT use goes beyond simply applying pre-made tools, requiring a creative combination of existing resources and innovative adaptations. Teachers also encourage students to participate in the adaptation process, reinforcing the idea that adapting AT is a vital skill for creating inclusive learning experiences.

Interviews with the teachers provided real-life examples of these adaptive practices. For instance, Teacher "Hydrogen" recalled using cardboards and plastic bottles as alternatives when laboratory tools were unavailable. She also modified worksheets and visual aids to ensure that they were accessible and easier to understand, particularly for students with special needs. Her focus on hands-on exercises and legible visual aids ensured active student participation. Overall, these practices reflect the strong commitment of science teachers to fostering student-centered, inclusive learning environments that make science education accessible to all.

Competency development tool for assistive technology for inclusion science teachers based on the results of the study

The findings of this study highlight both the innovative efforts and persistent challenges faced by science teachers in integrating AT in inclusive classrooms. While many teachers demonstrate creativity in resource allocation, collaboration, and adaptation, the study also reveals gaps in technical training, administrative support, and equitable access to AT resources. These challenges suggest that, despite teachers' willingness to innovate, a more structured approach is necessary to ensure consistent and effective AT integration across classrooms.

To address these gaps, a competency development tool designed specifically for science teachers in inclusive settings is essential. A training workshop titled "STEAM AID: Science Teachers Empowered with Assistive Methods for Accessible and Inclusive Delivery" was developed based on findings from the survey and semi structured interviews to enhance inclusion science teachers' competencies and innovation in assistive approaches for students with special needs. The decision to implement a training workshop was driven by empirical findings that identified several challenges faced by teachers, including limited resources, technology barriers, administrative and knowledge gaps, and student-centered challenges. These challenges underscore the need

for improved educational equity and effectiveness in inclusive science classrooms.

The workshop provides an immersive environment where inclusion science teachers can acquire essential skills and knowledge for innovating and utilizing AT effectively. Focused sessions target specific challenges, such as resourcefulness, adaptability, proactive problem-solving, and student-centered design. Teachers can develop a comprehensive set of strategies to enhance their proficiency in integrating AT into their teaching practices.

Additionally, the workshop fosters a collaborative, interactive learning environment that encourages peer learning and knowledge exchange. This aligns with the study's goal of promoting collaboration and bridging gaps in administrative and educational knowledge. Teachers can share their most effective practices, experiences, and solutions to common challenges in inclusive classrooms. The practical and immersive approach also allows teachers to actively engage with AT, exploring its applications and building confidence in using these tools to create inclusive learning environments.

The "STEAM AID" workshop is designed to empower science teachers, promote collaboration, and provide practical experience in integrating AT. It equips them with the skills, knowledge, and resources necessary to create inclusive and equitable learning experiences for all students.

Moreover, the STEAM AID Training Workshop is a comprehensive two-week program designed to help inclusion science teachers enhance their competencies in using AT to create inclusive learning environments. The training combines various methods such as workshops, seminars, modules, and online courses to accommodate teachers at different levels of innovation. These methods also ensure that the training is accessible and engaging, addressing the specific challenges teachers face when integrating AT in their classrooms. The workshop is grounded in the findings of a study that identified several key areas where teachers need support: resourcefulness, adaptability, proactive problem-solving, student-centered design, collaboration, educational equity, technology use, outcome assessment, and funding acquisition.

One of the core components of the workshop is the Resourcefulness and Creativity Module, which empowers teachers to think creatively and find innovative solutions, even with limited resources. This module introduces strategies for effectively reusing materials and developing simple technologies, while

also showcasing real-life examples of successful innovations in AT. This helps teachers, especially those in resource-constrained schools, foster creativity in finding practical solutions to technological challenges.

The Adaptability to Technological Barriers Workshop addresses another common issue faced by inclusion science teachers—limited access to technology. The workshop provides skills to help teachers overcome technological challenges such as poor internet connectivity and low-tech environments by teaching them to use low-tech alternatives and offline resources. This adaptability is crucial for teachers working in environments where access to advanced technologies is not always guaranteed.

To further enhance teachers' problem-solving skills, the Proactive Problem-Solving Program emphasizes the importance of independently recognizing and resolving resource and knowledge gaps. This program teaches science teachers to conduct independent research, solicit resources effectively, and build strong support networks. By developing these skills, teachers can ensure that their classrooms are well equipped, and their students have enriched learning experiences.

The Student-Centered Design Course is another essential element of the workshop, focused on designing and implementing AT that directly addresses the needs of students with special needs. This course guides teachers through the process of assessing student learning challenges, designing appropriate solutions, and implementing inclusive instructional methods. This ensures that AT is customized to each student's unique needs, fostering a more inclusive and supportive learning environment where all students can thrive.

In terms of promoting fairness, the Educational Equity Training provides teachers with strategies to ensure that all students, regardless of ability, have equal access to learning resources and effective instructional practices. This training covers the use of visual aids, interactive exercises, and assessment tools to simplify complex concepts, ensuring that students with special needs can engage with the curriculum and succeed academically.

Collaboration is also a central theme of the workshop. The Collaboration Workshop emphasizes the importance of teamwork and ongoing professional development. By promoting collaboration among teachers, the workshop encourages the sharing of best practices and innovative ideas, which creates a more supportive and dynamic teaching environment. This peer learning approach ensures that teachers continue to grow professionally, benefiting from each other's experiences and insights.

The Assistive Technology Integration Seminar focuses on providing teachers with hands-on experience in using and incorporating AT into their lessons. Teachers learn practical techniques for integrating various AT tools into their classroom activities and receive ongoing support to ensure that they can effectively apply these tools in real-world settings. This practical training is essential for helping teachers feel confident and competent in their use of AT.

To measure the impact of AT on student learning, the Outcome-Based Assessment Mechanism introduces tools for evaluating how well AT is contributing to student outcomes. This component emphasizes the use of feedback mechanisms and data-driven improvements to ensure that the AT being used is making a meaningful difference in student learning.

Additionally, the workshop includes a Funding and Resource Guide, which offers practical advice on how to secure funding for AT. Teachers learn strategies for incorporating budget considerations into their planning, applying for financial support, and writing grant proposals. Securing adequate funding is critical for the long-term sustainability of AT in classrooms, and this guide helps teachers gain the financial resources they need.

One of the unique features of the STEAM AID workshop is its flexibility in accommodating teachers with different levels of innovation in AT use. The training is tailored to teachers' specific needs based on their scores from the crafted STEAM AID survey, which assesses their competencies in using assistive technology. Teachers focus on their three lowest-scoring areas during the two-week workshop, ensuring their professional development is targeted and efficient. For example, a teacher who scores low in resourcefulness, funding management, and outcome-based assessment will attend sessions specifically designed to improve these areas. This focused approach allows teachers to concentrate on the areas where they need the most improvement, leading to more significant professional growth.

Throughout the two-week program, teachers also work on a final project that showcases the skills and knowledge they've gained. This project serves as a practical application of their learning and provides tangible evidence of their improved competencies. The flexible structure of the workshop allows teachers to focus on their specific needs while still collaborating with peers and developing a comprehensive skill set in using AT.

Overall, the STEAM AID workshop is designed to provide teachers with a personalized, practical, and collaborative learning experience. By focusing on key areas such as resourcefulness, adaptability, and student-centered design, and by offering flexible, tailored sessions, the workshop ensures that teachers are well-equipped to integrate AT into their classrooms. This, in turn, helps create more inclusive and equitable learning environments where all students, especially those with special needs, can succeed.

Conclusion

The data presented in this study offers significant knowledge on the level of innovation in AT among science teachers in inclusive classrooms in a school district in Rizal, Philippines. The conclusions of the study are as follows:

1. The analysis of survey responses indicated a significant degree of innovation in various aspects, such as resource allocation and implementation, collaboration measures, technical training, personal professional approach, and adaptation. Science teachers exhibit creativity and originality in overcoming constraints related to resources and technology, actively pursue opportunities for collaboration, participate in continuous technological education, and embrace a proactive approach to problem-solving and adjustment in the inclusive classroom.

   Given the evident innovation among science teachers, educational institutions may establish formalized support systems to sustain and enhance these innovative efforts. Policymakers can develop incentive programs, such as grants or awards, to recognize and encourage teachers who effectively integrate AT. Additionally, school administrators may facilitate structured mentorship programs, pairing experienced AT users with those seeking to enhance their skills.
2. Although there were favorable results, numerous challenges were found, including limited resources, technological obstacles, administrative deficiencies, student-centered issues, and the need to improve educational equity and effectiveness. Nevertheless, science teachers demonstrate dedication and creativity in overcoming these challenges, showcasing their commitment to providing equal opportunities for all students to get an education.

   To address these barriers, educational stakeholders may advocate for increased funding and resource allocation for AT integration. Schools and districts may establish clearer administrative policies that streamline the procurement and maintenance of AT tools. Additionally, policies that prioritize accessibility—such as inclusive curriculum design and teacher workload management—should be implemented to ensure that teachers have adequate time and support to effectively integrate AT in their classrooms.
3. Creating a competency development tool in the form of a training workshop is seen as a viable method to tackle these difficulties. These seminars would offer science teachers organized and immersive learning opportunities, making it easier for them to gain the necessary skills, methods, and knowledge that are customized to their specific needs. Workshops, by their collaborative character, facilitate peer learning, information sharing, and professional networking. This, in turn, enhances science teachers' capacity to effectively integrate AT and create inclusive and effective learning environments.

   To ensure the long-term success of training initiatives, professional development programs can integrate AT-focused workshops into teacher training curriculum. Schools may collaborate with government agencies and private organizations to provide accessible, high-quality AT training opportunities. Furthermore, policies can encourage the establishment of professional learning communities where teachers can continuously share best practices and receive ongoing support for AT implementation.

   By addressing these implications, policymakers, school administrators, and teachers can work collectively to enhance the use of AT in inclusive science education, ultimately fostering a more equitable learning environment for all students.

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