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Designing an innovative teaching device for the secondary education

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A B S T R A C T

The study determine the utilization and effectiveness of the research-based innovative teaching devices in the Schools Division of Camarines Norte to provide an inventory of available research-based innovative teaching devices developed in the Division as to physical component, special features and mechanics of its utilization; determine the degree of utilization of the said teaching devices as assessed by the teachers along functionality, flexibility, support to teaching, technical considerations, and engagement and interactions of the user; determine the extent of effectiveness of the said teaching devices as assessed by the jurors as to scope, delivery of instruction, appropriateness of the content, and layout and presentation; and determine the experiences and challenges in the utilization of the said teaching devices. The developed research-based innovative teaching devices utilized by the teachers were moderately functional, flexible, supported teaching, considered technical aspects, and ensured the engagement and interaction of the user to a moderate extent only. Along with scope, delivery of instruction, and appropriateness of the content, layout, and presentation, the teaching devices were found to be effective to a moderate extent; thus, their effectiveness moderately contributes to the enhancement of the competencies, skills, and abilities of the students. The inclusion of learning activities suited to the learners that could be utilized by the teachers and students is being suggested. Enhancement training and the allocation of funds to sustain the implementation of the study are necessary to motivate teachers to do research and innovation.

RESUME

O estudo determina a utilização e a eficácia dos dispositivos de ensino inovadores baseados em pesquisa na Divisão de Escolas de Camarines Norte para fornecer um inventário dos dispositivos de ensino inovadores baseados em pesquisa disponíveis desenvolvidos no Divisão quanto ao componente físico, características especiais e mecânica de sua utilização; determinar o grau de utilização dos referidos dispositivos de ensino, conforme avaliado pelos professores ao longo da funcionalidade, flexibilidade, apoio ao ensino, e, considerações técnicas, e engajamento e interações do usuário; determinar a extensão da eficácia dos referidos dispositivos de ensino, conforme avaliado pelos jurados quanto ao escopo, entrega de instrução, e, adequação do conteúdo, layout e apresentação; e determinar as experiências e desafios na utilização dos referidos dispositivos de ensino. Os dispositivos de ensino inovadores desenvolvidos e baseados em pesquisa utilizados pelos professores foram moderadamente funcionais, flexíveis, apoiados no ensino, considerados aspectos técnicos, e, e assegurou o engajamento e a interação do usuário apenas de forma moderada. Juntamente com o escopo, a entrega de instrução e a adequação do conteúdo, layout e apresentação, os dispositivos de ensino foram considerados eficazes em uma extensão moderada; assim, a, sua eficácia contribui moderadamente para o aprimoramento das competências, habilidades e habilidades dos alunos. Sugere-se a inclusão de atividades de aprendizagem adequadas aos aprendizes que possam ser utilizadas pelos professores e alunos. A capacitação e a alocação de recursos para sustentar a implementação do estudo são necessárias para motivar os professores a fazer pesquisa e inovação.

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Introduction

Teaching is an inspiring profession with both rewards and challenges. The teaching profession is one that is continually evolving in terms of both content and methodology, which makes it an interesting job for those who teach in elementary and secondary schools. Instructors are crucial in shaping and assisting students to become useful members of society (Villa, 2015). Improving learning creativity and connecting concepts to the local learning environment both depend on the improvisation of resources. There are impacts when educators employ instructional materials in their teaching.

Using instructional resources improves teaching and learning processes in many cases. However, most public secondary schools lacked physical resources and supplies, including textbooks and media resources (Wagura, 2015). Lack of instructional resources makes teaching difficult because students require the abstract concepts in the curriculum to be made real and concrete. When using a range of instructional material and engaging in active learning, students develop more positive attitudes.

Innovative teaching devices that are research-based can be made out of materials present in the community or in the environment (Armagosa, 2016). Education of today requires expertise in the development and utilization of innovative teaching devices that could cater to the needs of diverse learners. One of the innovations today is the utilization of different technologies in the teaching and learning process. Learning with technology is very crucial in today's school. It is considered to be a critical part of a child's education. Advances in technology influence how people share, create, and develop information and students and teachers need to be highly skilled in their use of information and communication technologies.

Meaningful development of technology-based knowledge and skills is important for all students, to avoid a phenomenon known as the "second-level digital divide", whereby people have drastically differentiated skills, which in turn influence how people participate in society (Ghavifekr, Rosdy, 2015). The integration of technology in education is important to keep pace with society and prepare students for their roles in society (Salavati, 2016). It increases the motivation and engagement of learners, caters to different learning styles, and improves learning outcomes (Eseyel, Ifenthaler, Ge, Miller, 2014). The important role that technology plays in education allows teachers to design meaningful learning experiences that utilize technology (Hong Kwek, 2007).

Access to high-quality education remains a major hurdle in developing nations. Several initiatives, such as the use of multimedia technology, have been examined in an effort to provide access to the great majority of developing-country citizens. In order to examine how multimedia technologies have proven to be a viable strategy for bridging the gap in the provision of unrestricted access to high-quality education and improved student performance, this paper offers a systematic review of various multimedia tools in the teaching and learning processes. The identification of frequently used multimedia resources to aid in the use of

multimedia in education for teaching and learning. Multimedia elements including audio, video, animation, and 3-D were discovered to be present in the existing tools in addition to text and images. While most multimedia solutions used for teaching and learning aim to address the pedagogical content of the topic of interest and the user audience, the technologies and components integrated into their development are largely responsible for the success of the various multimedia tools used on the different target groups and subjects (Abdulrahaman et al., 2020).

Learning with generation has emerged as critical in today's schools. Governments, education systems, researchers, school administrators, teachers, and parents consider that technology is an essential component of a child's education. When discussing technology in education, the term 'integration' is frequently used. The idea of incorporating technology into the curriculum arose from a worry that we might have been teaching about and how to utilize technology without addressing how students can apply technology-related information and skills. The significant role that technology plays in education allows teachers to create relevant learning experiences that use technology. Teachers have long explored the tools and resources that can best assist student learning activities. However, technological advancements and increased accessibility have made the possibilities appear practically limitless (Eady, Lockyer, 2013).

A multimedia software program is a progressive presentation of a combination of media such as sound, graphic, text and animation. The development of such applications enables education system through manner of way of improving information sharing technique and at the same time have an impact on human beings to expect creatively. The computer science department at Universiti Teknologi MARA (UiTM) Negeri Sembilan has developed three multimedia applications, Greenfoot, Visualization makes Array Easy (VAE), and e-Tajweed, for educational purposes. These applications engage students by allowing them to visualize concepts, behavior, and operation, improving their understanding and performance in assessments (Osman, Ramli, Mohd Taib, 2017).

The use of ICT in the classroom has become essential for teaching students how to operate in the information age. Studying the difficulties to using ICT in education may help educators overcome these barriers and become successful technology adopters in the future. This meta-analysis of the literature demonstrates that instructors want to include ICT into science teaching but face obstacles such as a lack of confidence, competence, and resource access. Teachers require ICT resources, professional development, enough time, and technical help to increase their ICT integration. The inclusion of all components raises the probability of successful integration (Bingimlas, 2009).

Interest organizations such as teachers, schools, and education ministries are advocating for the use of digital technologies in science teaching. Yet, improvements in

teaching and the introduction of new skills require considerable testing and adjustment to ensure successful and long-lasting application and learning success. Creating and implementing an easily configurable teaching unit that covered all parts of 3D printing, from computer-aided modeling to cutting, printing, and post-processing, as part of the program's learning material. The initial instructional approach, developed with the cooperation of a small group of students, was modified to meet the needs of larger groups and entire 9th grade classrooms. This innovative teaching approach can be effectively applied to improve the existing teaching tool. It can be useful specifically in the current trend of innovative biology teaching, and on the other hand, its validity is supported by the outcomes, which suggest that this teaching approach can greatly improve students' motivation and learning success related to computer-aided modeling and the 3D printing process. Therefore, this teaching-revised concept presented was based on feedback from students and can be used as a proven method of teaching material in schools (Bonorden, Papenbrock, 2022).

The current approach to learning is the process of teaching students with the skills or abilities needed in an innovative educational setting. Learning English needs technique and creativity so that students can compose narrative texts. Digital storytelling is one approach of teaching narrative writing that can help high school students enhance their writing skills when constructing narrative texts. By using digital storytelling, the students can mastery some aspect in English (Shasqia, 2020).

Higher education is changing, and a new normal is forming. Students' expectations are considerably higher, and teachers must keep up with technological advancements while also working to boost student participation in classrooms (presentation or virtual). Students understand that adopting new learning tools and methods can improve classroom efficiency while also increasing enthusiasm to learn. In terms of activity preferences, ninety-one and ninety-nine percent (91.99%) of students prefer interactive activities over traditional ones. In this context, the professor has researched a number of methods, strategies, and tools in recent years and designed a new and innovative paradigm based on gamification. This technique, known as TechTeach, explores a variety of popular concepts and interactive tools for teaching computer science. It was developed for use in a B-Learning setting. The paradigm employs flipped classrooms, Bring Your Own Device (BYOD), gamification, soft skills training, quizzes, and surveys to boost student engagement and deliver the greatest possible learning environment. Due to the pandemic, COVID-19 educators have brought new teaching techniques that can alleviate the obstacles that are being faced during online classes. With the new teaching approach that has been developed, it was also brought up as part of the new norm, making it helpful in the face-to-face setting. TechTeach has been improved to better adapt to the new manner of teaching (0–100% online). Thanks to TechTeach, the classroom is less of a boring place; it's a place to learn and have fun, regardless of physical fitness (Portela, 2020).

Taking innovation in teaching and learning beyond isolated short-term projects is one of the holy grails of educational technology research, strewn with the residue of a never-ending stream of comparative research that finds no substantial difference between innovative technologies and techniques and traditional teaching. Meanwhile, the rapidly growing Bring Your Own Device (BYOD) movement threatens to overburden education professionals and researchers attempting to replicate present processes on mobile devices. There are some studies that show that there are still few well-developed theoretical frameworks for supporting creative pedagogy through BYOD. The framework has been used in a variety of educational contexts and scales, including brief workshops, complete courses, and multinational joint initiatives. To support creative pedagogy through BYOD, include modeling collaborative practices through the creation of communities of practice for teachers to explore the capabilities of mobile devices for new ways of learning for students, collaborative redesign programs in response to changes in the concepts of learning and teaching, and collaboration with ICT services for infrastructure development on campus (Cochrane et al., 2014).

In the Division of Camarines Norte, teachers from different fields of specialization developed innovative teaching devices presently utilized in the field which generally aim to enhance the performance of the learners and to contribute to the implementation of the K to 12 curriculum. It provides an inventory and profile the available research-based innovative teaching devices developed in the Division as to physical component, special features and mechanics of its utilization. Determine the degree of utilization of the said teaching devices as assessed by the teachers along functionality, flexibility, support to teaching, technical considerations, and engagement and interactions of the user. Determine the extent of effectiveness of the said teaching devices as assessed by the jurors as to scope, delivery of instruction, appropriateness of the content, and layout and presentation; and present the experiences and challenges in the utilization of the said teaching devices.

The studies conducted in the Division of Camarines Norte provide localized insights into innovative teaching approaches tailored to the specific needs of secondary education students. These approaches, which expand from computer-helped games to multi-useful studying equipment, display a guarantee to gain knowledge by design and strategy that integrates era for customized solutions. On the opposite side, the associated literature presents a broader examination of tutorial technology and pedagogy and underscores the important function of multimedia integration, ICT usage, and creative pedagogy in addressing academic problems on an extensive scale. Both units of research concentrate on the significance of technology and revolutionary teaching in boosting educational results, but they differ in phrases of their extent and the level of the analysis.

For example, studies on Computer-Assisted Game in Teaching Secondary Mathematics (Argamosa, 2016) and A Multimedia Software Program for Educational Purposes (Osman, Ramli, Mohd Taib, 2017) highlight the utilization of multimedia technology to engage students

and improve understanding. Similarly, research on Multi-Visual Learning Board for Intermediate Learners (Caceres, 2014) and Multi-functional Teaching Cabinet emphasizes the importance of adaptable teaching tools catering to diverse learning needs. Through these comparisons, educators and policymakers can glean valuable insights into effective strategies for enhancing teaching and learning in secondary education, bridging the gap between localized approaches and broader educational trends.

A common theme across both localized studies and broader literature is the integration of multimedia elements into teaching methods. Whether via computer-assisted gaming practices or multimedia applications, such learning models prioritize using multimedia as part of teaching aids in keeping students engaged and enhancing understanding. Moreover, according to the report by Aisami, 2015 visuals were described as strong equipment in the learning process and performance enhancement. However, approximately two-thirds of all learners are visual learners. All localized reports and related literature show visual aids or a combination of information and interactive multimedia to be advantageous in assisting learners in understanding information. As a result, teachers are advised to adopt these methods where possible to ensure they meet all the learners' needs.

Methodology

This study utilized Descriptive and Evaluative methods of research. There were two groups of respondents in this study: the identified ten (10) teacher-innovators of the research-based innovative teaching devices in the Division of Camarines Norte and fifty two (52) teachers who utilized the said innovative teaching devices.

The data gathering methodology involved utilizing both surveys and individual interviews with participants to explore their experiences with innovative teaching methods. Surveys were employed to collect quantitative data, offering insights into respondents' overall usage and perceptions of these techniques on a broader scale. On the other hand, individual interviews provided qualitative data, allowing for a deeper exploration of participants' individual experiences, perspectives, challenges, and recommendations regarding the adoption of innovative teaching practices. By combining these methods, a thorough understanding of the effectiveness and implications of innovative teaching approaches in education was achieved.

Table 1.
Respondents

Innovations	Teacher-Innovator	Teachers who Utilized the Innovations
All-In-One Library	1	8
Computer-Assisted Game in Teaching Integers for Grade 7 Mathematics Students	1	3
Multifunctional Instructional Device in Teaching Secondary Mathematics	1	11
Image Projector Prototype	1	2
Multifunctional Teaching Cabinet	1	2
Multipurpose Teaching Device	1	3
Multi-visual learning board for intermediate learners	1	3
Manga - Inspired Comics in Teaching AP	1	3
Mathematical games and puzzles	1	8
Enhancement Module in Mathematics Aired in Local TV	1	9
Total	9	52

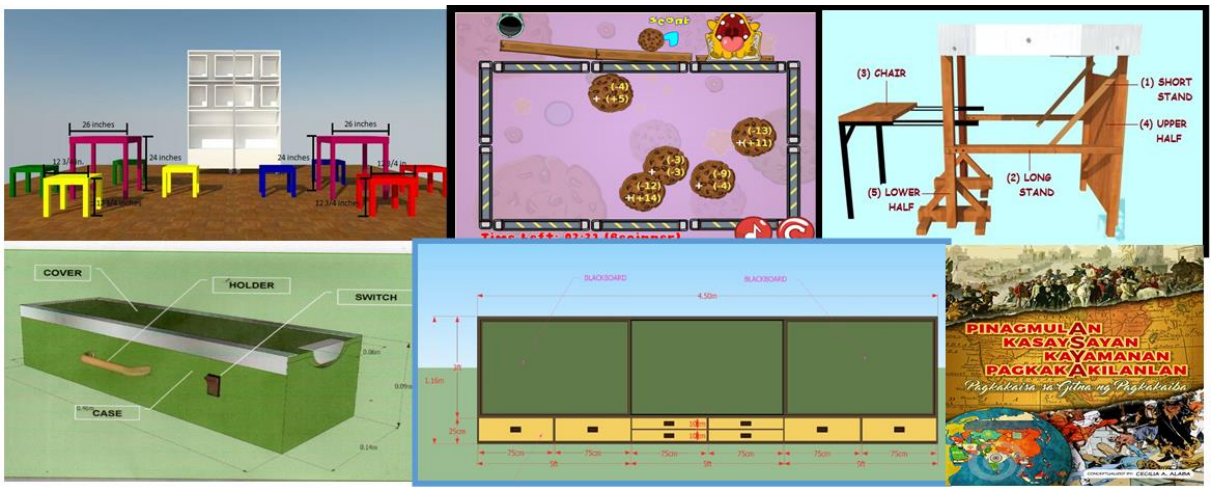
Results and discussions

Figure 1 shows the Researched-based Innovative Teaching Devices. For the All-In-One-Library presents the mobile library cabinet designed to respond to a recognized priority need of the learner and the need for new ideas to improve children's reading comprehension. It can be folded and can be locked to maximize space inside the classroom (James, 2017). At the back of it is a magnetic whiteboard that offers a smooth writing platform with several purposes. It is developmentally appropriate for pupils with reading difficulties and incomprehension.

Computer-Assisted Game in Teaching Secondary Mathematics (Argamosa, 2016) presents the “Feeding Mathy: Integers of Life Challenge” game. It has a game interface, problem set, information and progress support, programming language, database, and other software application. This can be utilized to facilitate alternative strategies in teaching the basic concept of integer operation to Grade 7 Mathematics students.

Figure 1.

Researched-based Innovative Teaching Devices



Multi-functional Instructional Device (Morada, 2014) in Teaching Secondary Mathematics was developed using multifunctional instruction devices that include a teacher's table with a built-in chair, podium, mini-table, drawing table, easel, and wooden chair. This is developed to enhance learning and remedy the least mastered skill of the students and can be utilized anytime at any given Mathematics lesson and can be transformed depending on the lessons and specific functions of the device.

Image Projector Prototype (Auro, 2014) has a computer-aided design that shows the IPP with connecting wires for the color camera and LED lamp put inside the gooseneck. The base of the camera and the LED lamp were put inside the case which is made of an aluminium bar. It can be transferred from one classroom to another because of its simplicity and the size of the device.

Multi-functional Teaching Cabinet can be seen as a simple square structure but looking closely at the unassuming structure when it will be opened reveals a cabinet with different partitions. These can be used for different purposes according to the preference of the teacher. The multi-functional device has multiple uses in the classroom. There is a manual prepared by the innovator to serve as a guide on how to use the device.

Multipurpose Teaching Device is the equipment or apparatus that could easily assist/aid the teacher in the delivery of various lessons in grade 7 science. The durability and affordability were considered for learning competencies, sample activities, and assembling guide. It can be transferred from one class to another.

Multi-Visual Learning Board for Intermediate Learners (Caceres, 2014) includes design into a multi-purpose teaching structure like a reading board, whiteboard, numeracy board, and writing board ready for use to develop different learning skills with organize things and materials for teaching and it maximizes space in the classroom with the built-in designed drawers.

Manga-Inspired Comics are intervention materials developed based on the least mastered skills in Grade 7 Araling Panlipunan focusing on the concept of "Timog at Kanlurang Asya Transisyonal at Makabagong Panahon (Ika-16 hanggang ika-20 siglo)." It caters to diverse learners and is deemed necessary to enhance the performance and competency of the students about concepts.

Mathematics Games and Puzzles for Grade 3 Pupils (Panol, 2012) consist of multiple intelligence s techniques with the use of games in puzzles for mathematics instruction. This can be integrated into any part of the lesson in mathematics for grade 3 pupils.

Enhancement Module in Mathematics Aired in Local TV was used by the fourth year and other students who subscribed to local cable TV providers in the town of Jose Panganiban. It focused on the second grading learning competencies.

For the degree of utilization of the innovative teaching device, table 2 presents the summary of functionality, flexibility, support to teaching, technical considerations, and engagement and interaction of the user. As can be gleaned from the table, the degree of utilization of the innovative teaching devices along with teaching support attained a grand mean of 4.45 interpreted as "moderately utilized". Technical considerations with a grand mean of 4.41 interpreted as "moderately utilized". Functionality with a grand mean of 4.37 is interpreted as "moderately utilized". Next is the indicator engagement and interaction of the user with a grand mean of 4.26 interpreted as "moderately utilized" while flexibility attained a grand mean of 3.78 interpreted as "moderately utilized".

Table 2.

Summary of the Degree of Utilization of the Teaching Innovation

Criteria	Grand Mean	Verbal Interpretation
1. Support to Teaching	4.45	Moderately Utilized
2. Technical considerations	4.41	Moderately Utilized
3. Functionality	4.37	Moderately Utilized
4. Engagement and interaction of the user	4.26	Moderately Utilized
5. Flexibility	3.78	Moderately Utilized
Total Grand Mean	4.25	Moderately Utilized

The findings revealed that the degree of utilization of the innovative teaching devices in the Division of Camarines Norte, along with functionality, flexibility, support for teaching, technical considerations, and engagement and interaction of the user, got a total grand mean of 4.25, interpreted as "moderately utilized". This means that the innovative teaching devices were utilized by the target users to a moderate extent only; thus, the innovative teaching devices were moderately functional, flexible, supported teaching, considered technical aspects, and ensured the engagement and interaction of the user to a moderate extent only.

Innovative teaching devices are essential to effective instruction. The teacher should know how to prepare and use teaching devices and other instructional materials and should

recognize their value in fostering good instruction (Ebron, 2014). The greatest value of the instructional aids lies in their appeal to students' senses and perceptions. Their ability to attract and hold students attention and interest, and their ability to develop an understanding of the material to be learned help the students learn faster, save instructional time, and understand the relationships between different concepts or ideas.

A good instructional aid should promote certain desirable results. It should stimulate interest, command attention, be easily understood, and promote a positive reaction on the part of the student. An instructional aid should be complete, have an explanation on a label, and be as simple as possible. In the development of teaching innovations, teachers should keep in mind that they have to consider the needs and interests of their learners.

The development of teaching innovation devices depends on their availability, feasibility, cost, and, most importantly, their consideration of the learning needs of the students. The number of students in a class and the existing facilities are other considerations. Often, teachers must improvise and adapt to the existing circumstances in order to incorporate quality instructional aids or devices. The researcher recommends that the teachers' innovative teaching device be adopted by the Camarines Norte Division.

Table 3.

Summary of the Extent of Effectiveness of the Teaching Innovation

Criteria	Grand Mean	Verbal Interpretation
1. Appropriateness of the content	4.25	Moderately Effective
2. Delivery of Instruction	4.21	Moderately Effective
3. Lay-out and Presentation	4.42	Moderately Effective
4. Scope	4.42	Moderately Effective
Grand Total	4.33	Moderately Effective

Table 3 presents a summary of the extent of effectiveness of the innovative teaching devices in terms of scope, delivery of instruction, appropriateness of the content, layout, and presentation. As can be seen from the table, extent of effectiveness along scope attained a grand mean of 4.42, interpreted as "moderately effective", delivery and instruction, got a grand mean of 4.21, interpreted as "moderately effective". Layout and presentation got a grand mean of 4.42, interpreted as "moderately effective". The extent of effectiveness of the innovative teaching devices got a total grand mean of 4.33, interpreted as "moderately effective".

The findings revealed that the innovative teaching devices along scope, delivery of instruction, appropriateness of the content, layout and presentation were found to be effective to a moderate extent only, thus its effectiveness moderately contributes to the enhancement of the competencies, skills and abilities of the students.

Table 4 presents the experiences and challenges in the utilization of the innovative teaching devices in the Division of Camarines Norte. As can be seen from the table, the

experiences encountered by the teachers who actually utilized the innovative teaching devices were students were very participative and active in the teaching and learning process given the fact that they manipulated the devices. One of the respondent teachers said “masaya sa loob ng classroom habang nilalaro nila ang computer-assisted game tungkol sa Math”, (Students were happy inside the classroom while we discuss and play the computer assisted game about Mathematics concepts). Another teacher said, “mas nagiging madali para sa mga estudyante and lesson at na mamanage ko ng maayos ang oras sa pagtuturo”, (it is easy for the students to understand the lessons and teachers can manage the instructional time properly). Another said, “tumaas ang performance ng mga bata sa dinsiscuss na topic”, (it enhances the performance of the students in Mathematics).

Table 4.

Experiences and Challenges in the Utilization of the Innovative Teaching Devices

Experiences/Challenges Encountered	Frequencies
Experiences:	
Students were very participative and active in the teaching and learning	52
process.	52
It helps teachers manage instructional time.	52
Enhances performance of the students	
Challenges:	
Technical-know-how of the teachers in the operation of the devices	21
Limited copy of the intervention materials	11
Limited number of the innovative teaching device (only 1)	21
Budget Allocation for Reproduction of IM	20
Budget Allocation for the provision of the teaching devices	5

Challenges encountered by the teachers were the technical know-how of the teachers in the operation of the devices, limited or inadequate copies of the intervention materials, a limited number of innovative teaching devices (only 1), budget allocation for reproduction of intervention materials, and budget allocation for the provision of the teaching devices.

Teachers who utilized the innovative teaching devices did not have enough technical know-how in terms of the operation of the devices; though it was explained to them, they are still not fully aware of the efficient utilization of the devices. There were also challenges in terms of the availability of the devices; there was only one (1) innovative teaching device in the school. There were also challenges in terms of the provision of enough copies of intervention materials and mathematical games and puzzles, so the IM was utilized by only a limited number of students.

Teachers faced challenges in the utilization of innovative teaching devices. It’s a reality that in the implementation of the curriculum, there were so many problems met by administrators, teachers, students, and parents, among others. One of which is the lack of

learning and instructional materials, taking into consideration the changes in the strands and core competencies of the subjects being offered. With these realities, schools were encouraged to localize the curriculum to respond to their teaching-learning needs; enrich it without sacrificing the established content and performance standards and competencies to make the curriculum responsive to their needs.

Since there is limited available learning and instructional material, both teachers and students have difficulty in the delivery of the lesson and, more so, in mastering the learning competencies. As such, it is a disheartening fact that, at the end of the school year, students may not be able to master the learning competencies. With these, as a teacher, one has to be innovative and creative so that the needs of the learners are met.

Instructional material provides direction for the teacher to properly deliver his lessons to his students in their daily search for understanding and verification and is essential to effective instruction. They should know how to prepare and use instructional aids and recognize their value in fostering good instruction. It should cater to diverse learners and promote certain desirable results, stimulate interest, command attention, be easily understood, and promote a positive reaction on the part of the student. It should be complete, have an explanation of a label, and be as simple as possible. With these, teachers should be creative and innovative enough to address the lack of appropriate instructional materials to effectively deliver the lessons or concepts they are teaching (Komendat, 2010).

It is on these points that the researcher recommended that the innovator present his innovation in the school community. Upon knowing the importance of the innovative teaching devices, stakeholders can understand and decide on the allocation of funds for the provision of the innovative teaching devices for the utilization of their children. Teacher-innovators should also conduct enhancement training for teachers so that they are fully aware of how they can properly utilize the teaching devices.

Conclusions

The researcher presented the procurement process for acquiring goods, projects, and services at the Bicol University Polangui Campus. This proves that the University has a step-by-step flow of the transactions, but upon conducting a series of interviews and discussions, it was found out that there are issues and problems surrounding the process. From the issues and problems obtained, the researchers proposed a system framework to support compliance checking in the procurement process at the University. This paper also includes the data requirement, which is essential in supporting the data of the system and a key factor in presenting the data visualization of the documents. Furthermore, an algorithm was also included to assist in verifying the uploaded documents that will be used in the data presentation.

The study concluded that, the teachers in the Camarines Norte Schools Division use the developed innovative teaching devices; The said devices were moderately functional, flexible, supported teaching, considered technical aspects, and ensured the engagement and interaction of the user to a moderate extent only; The research-based innovative teaching devices, along with their scope, delivery of instruction, appropriateness of the content, layout, and presentation, were found to be effective to a moderate extent only; thus, their effectiveness moderately contributes to the enhancement of the competencies, skills, and abilities of the students; Teachers faced challenges in the utilization of the said devices as to technical know-how, availability, and their drive to teach with technology.

In order to make use of the research-based innovative teaching devices created by the teachers, it should be adopted in the Camarines Norte Schools Division. The inclusion of learning activities suited to the learners that could be utilized by the teachers and students to effectively utilize them is being suggested. Modifications of the said teaching devices to make them more functional are also recommended. Enhancement training for teachers on how to utilize the said teaching devices should be conducted. Further, the allocation of funds to sustain the implementation of research-based innovative teaching devices is necessary to motivate teachers to do research and innovation.

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