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Ethno-Learning Resources in Teaching Biology for Promoting Sustainability Education: A District-Wide Science Problem

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ABSTRACT

Sustainable development is dependent on the social, cultural, and environmental setting. Authentic learning materials should be designed with real-world applicability outside of the classroom. This study aimed to investigate the locally available ethno-learning resources for teaching biology to promote sustainable development education in the district of Esperanza, particularly in Esperanza Districts I and II. The study employed a descriptive-quantitative approach emphasizing a descriptive research design where the data gathered from the teacher-respondents was recorded and described descriptively. A complete enumeration has been utilized in the study to procure all the teachers in the said locale. Microsoft Excel was used to analyze teacher-respondents' data and create graphs and tables. Books, modules, supplementary reading materials, laboratory apparatuses, and laptops are both districts' main instructional learning resources, while speakers, projectors, and TVs are the least technology-based. The most common problems encountered by science teachers are the inadequate number of books, the inadequate number of projectors and computers, and other technology-based resources. Also, indigenous resources, realia, and replicas under localized learning materials are the most effectively used by teachers in teaching science. Future studies should highlight the importance of localized and contextualized materials in teaching science, create more locally available materials, compare learning materials locally and internationally, and use other relevant methods to ensure the availability of learning resources.

INTRODUCTION

The development of a sustainable society is one of the global objectives for the future. A sustainable society is one that has undergone sustainable development to achieve sustainability. The concept of sustainable development is highly dependent on the social, cultural, and environmental setting (Jeronen *et al.*, 2016). Accordingly, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" is how sustainability is defined. This definition highlights the long-term aspect of the concept of sustainability and introduces the ethical principle of achieving equity between the present and future generations. As it exclusively focuses on human needs or desires, it makes no explicit mention of the natural world. But the report makes it plain that these "needs" also include protecting the environment (Kopnina, 2012; Jeronen *et al.*, 2016).

For students to learn and develop competence in a wide range of life skills, many strategies and procedures are developed and practiced at school. Resource management is the process of organizing and managing learning resources and materials. Utilizing resources is also essential for the students' successful learning because it strengthens their ability to think critically and inspires them (Saro *et al.*, 2022).

According to a study on the science games in the UK's national curriculum, including games and activities during

discussions helps students stay focused and engaged for a long time. Learning resources, on the other hand, are any teaching tools having instructional functions or content that are utilized for formal or informal teaching, regardless of whether they are locally developed or procured. Both printed and digital documents are included (Ghazali-Mohammed, 2016).

In today's era, in order to improve students' knowledge, abilities, and attitudes toward their studies, science teachers struggle to provide lectures that are interesting, relevant to students' lives, tie them to their community or location, and include local culture as an integral part of the curriculum. In the Philippines, the implementation of the K-12 curriculum led to several educational system reforms that improved students' overall and global competitiveness in scientific education on a national level (Bello *et al.*, 2023). The Philippine Republic Act 10533, also known as "The Enhanced Basic Education Act of 2013," states that "the curriculum shall use the spiral progression approach to ensure mastery of knowledge and skills after each level," which is the same as the executing policy, which states that "the curriculum shall be contextualized and global and shall be flexible enough to enable and allow schools to be localized and indigenous and enhance the quality of education" (Rule II, Curriculum Section, 10.10.2).

Apparently, Revington S. (2015) further explains that authentic learning resources are "real-life learning"

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because they inspire students to make things that are beneficial to their community and the wider globe. By setting up motivating challenges for students, a teacher can encourage and provide the essential preparation, criteria, resources, and support to assure their success. From this vantage point, the teacher is seen as a facilitator rather than a dictator. Like how this method of learning involves all the senses, it enables students to arrive at a meaningful, useful, and shared outcome. They are real-world initiatives that give the students a chance to interact directly in a practical setting. Additionally, authentic learning materials are created with the intention of interacting with a society or a community that is visiting the student community. A project should be designed with real-world applicability outside of the four walls of the classroom in mind (Saro *et al.*, 2022).

According to Mapaderun and Oni (2002), having access to a variety of learning resources and having enough facilities makes teaching and learning more successful. Conversely, if a school's facilities are inadequate, it will have a detrimental impact on the students' academic performance. Careful planning must be considered to create a productive learning environment in the classroom. Makulu (2004) observes that the strategies used by teachers now may not be effective in the future due to the significant changes in our environment in relation to the ongoing changes in science, of which biology is a discipline. The study of biology is challenging for many students. The challenges of learning science are a result of both the nature of science and the reaching techniques used. Students experience several learning issues and lose interest in learning biology when the design and learning settings are prioritized over their interests and expectations (Yuzbasilioglu and Atav, 2004; Saro *et al.*, 2022).

In the 21st-century educational system, particularly in distant learning, technology that allows instant access to knowledge has advanced quickly. As a result, the adoption of technological innovation in the educational environment is constantly evolving in accordance with the needs of the departments of education around the world. During the distance education era, the hybrid educational approach which combines traditional teaching methods with modern learning strategies was employed (Kazu *et al.*, 2022).

The purpose of this study was to promote locally available learning resources for teaching biology. Furthermore, the study would help science teachers greatly innovate other ways to make their teaching instruction more effective and interactive for students to promote sustainable development education. Utilizing available learning resources locally, which are explicitly convenient and appropriate in the classroom setting, and on top of that, the use of contextualization in teaching, particularly in science, lets the students perceive the real things around them. The students could highly develop more skills and enhance their ability to transfer skills from one context to another; these would also help them critically think and continuously obtain new knowledge and skills.

Research Questions

The study goals were to investigate the locally available ethno-learning resources for teaching biology and promoting sustainable development education in the district of Esperanza, particularly in Esperanza Districts I and II. Specifically, the following research questions aim to answer the following:

1. What are the available ethno-learning resources utilized by the teachers in teaching biology?
2. What are the challenges, such as the issues and problems encountered by the science teachers in utilizing the instructional learning materials?
3. What are the most convenient and effective ethno-learning resources for teaching biology in the said districts?
4. What instructional development model could be recommended and implemented in teaching biology?

LITERATURE REVIEW

The terms "materials, ideas, beliefs, and technologies in a given culture or environment that are drawn from the past and present cultural practices and traditions of learners" and "ethno-science" are interchangeable. These developed from mystical, supernatural, and mythical realities as well as ongoing environmental acculturation (Ugwuanyi, 2015; Saro *et al.*, 2022).

According to Romero (2010), ethno-science refers to the knowledge that is indigenous to groups of people, including their languages, philosophies, technology, and cultures. Teaching and Learning Using Locally Available Resources (TALULAR) aims to foster meaningful communication, improve information retention, and give students first-hand or direct contact with the social and physical realities of their surroundings. It promotes involvement, especially if the learners are allowed to handle the materials. Additionally, it promotes environmental sustainability by encouraging litter reduction, recycling, and reuse. Types of locally accessible resources: (1) Human resources are persons who, aside from the classroom teacher, aid in the learning process. Teachers may also work with others who can assist in facilitating a particular activity. For instance, lab technicians who can help the students with the lab activity. In addition, the students are already familiar with how to use the lab equipment for the next lab activity. (2) Plant Resources: mostly plant parts that can be utilized as specimens for the experiment, such as leaves, flowers, and fruits. (3) Resources for Animals: Fish, worms, frogs, and chickens are common dissecting animals available for hands-on experiments. (4) Material Resources: This category includes items like visual aids, literature, cell structures, and skeletal structures. (5) Non-Material Resources: These resources include individual expertise, life lessons, and teaching methods. (6) Additional Resources a) Realia are actual items that are employed as teaching and learning aids. presenting a real leaf, a stone, an insect, or a frog, for instance, but it depends on the subject. b) Models and photographs are real-world representations that can be utilized as teaching

and learning tools (Saro *et al.*, 2022).

Salihu (2012) claimed in his research that certain teaching aids and materials work best in secondary schools since learners there are most inquisitive at that age and stage about the items in each setting. As a result, they will benefit greatly from resources like physical characteristics, skeletal structures with labels, DNA structures, and living things. The teaching of science nowadays also ignores the culturally oriented approach that improves teaching and learning and instead places a heavy emphasis on content and the use of conventional methods. Poor performance and a potential lack of interest in science were the results of science teachers' disregard for a culturally relevant teaching strategy (Ugwuanyi, 2015).

Through the process of contextualized module-based learning, instructional strategies and approaches that are essential to the subject, such as biology, were used to help the students relate to it. In order to make academic information more meaningful to students' lives and experiences, contextualization is the technique of introducing applicable and significant factors into presentations and discussions of that topic (Department of Education, 2016). A setting that is more expansive in terms of student motivation can be created with the aid of contextualization. Students' fear of science is diminished when it is relevant and real to them, and they begin to comprehend its importance (Wang, Sun, & Wickersham, 2017; Bello *et al.*, 2023).

According to research by Hamdunah *et al.* (2016), contextualized learning modules offer summaries of the instruction, concepts, and material as well as details on how students learn. The instructional material is also used to assist, encourage, enhance, promote, and create teaching and learning activities in order to enhance and enable the most effective procedures and processes of educational instruction (Herrera & Dio, 2016).

The teaching of ethno-science in secondary schools was explained by several studies that were also conducted in the Philippines. The strategies used in the patterning biology class can help the teachers' learning strand develop. The Mahabadi (2013) study found that teachers desire all their students to learn. The teaching strategies used in scientific classrooms have made it possible for the instructional selection process, which they will refer to as "instructional selection" here. the development of educational settings where only a chosen subset of students can succeed. More students will succeed in any science course code, and some students will study additional science, like biology, if teachers are aware of the many learning styles that kids bring to a science classroom (Nwagbo *et al.*, 2012).

Okeke (2022) asserts that integrating culturally relevant activities into science curricula would help students learn from both their culture and their science lessons, which would boost their academic performance and interest in pure science (biology, physics, and chemistry).

The study of biology is challenging for many students.

The challenges of learning science are influenced by both the nature of science and the techniques of instruction. Additionally, if the design and learning settings are prioritized over the interests and expectations of the students, various learning issues are triggered, and students' interest in biology decreases. It has been mentioned how much a student's relationship to their learning environment affects their academic progress.

The ways that learning occurs best are reflected in their teaching philosophies. It is stated that students' attitudes about biology and its study are significantly influenced by how they perceive their learning environment (Den Brok, Telli *et al.*, 2009).

Adeyem (2010) argues that education is the only path to becoming a tool for fostering economic development since it includes the experiences that allow people to grow and realize their potential. Okete (2007) went on to say that many people will gain and develop the knowledge, abilities, and even attitudes they need to live successfully through education. And this is the main justification for why so many contemporary nations value investing in education. An investigation into the impact of biology teaching and learning resources on students' academic achievement was carried out in secondary schools in Kenya (Saro *et al.*, 2022). They learned that while there were resources available, they were insufficient for teaching biology. The texts were readily available and suitable, however there were not as many videos available that accompanied the lessons. Teachers employed the accessible learning tools in their courses since they were aware of how crucial they were to students' learning. Students can learn and be taught effectively when teachers use computers and other ICT tools. Finally, a shortage of resources affects the pupils' performance (Wanjiku, 2009).

Studies about ethno-science were recently conducted in the Philippines, where they hurt the learning process in all secondary schools. The growth of the teachers' learning strand can be aided by the observed behaviors and the modeling behavior of biology classes. Teachers want all their students to learn. The usage of teaching methodologies in science classrooms has led to a situation known as instructional selection, whereby we are creating learning settings in which only a chosen group of students may achieve (Tandi *et al.*, 2016; Saro 2022).

Saro *et al.* (2022) claim that their school has simpler access to reading material, lab tools, modules, worksheets, and computers. Additionally, employing books and actual photographs when teaching biology is more successful. This proved that science teachers are more creative in their search for community-based teaching resources. The findings demonstrated that literature, locally created materials, and authentic objects and images were beneficial in the field of teaching biology. The development of teaching materials based on actual photographs taken in the real environment is encouraged by the researchers in order to gain a deeper understanding of the biological learning skills.

METHODOLOGY

Research Design

The study employed a descriptive-quantitative approach with an emphasis on a descriptive research design where the data gathered from the teacher-respondents was recorded and described descriptively. The descriptive statistics were utilized to analyze the data that were gathered in the study. Furthermore, the goal of this research design was to concentrate primarily on how public-school science teachers view the underlying principles of having well-diversified learning resources in biology in the context of education. The variables can be measured typically on instruments, and in that way, the number of data points will be analyzed using statistical procedures (Creswell, 2008).

Population and Respondents of the Study

The research respondents of the study were from the districts of Esperanza 1 and 2 in the schools' division of Agusan del Sur. In the district of Esperanza I, there are four (4) secondary schools; in Esperanza District II, there are (4) four secondary schools. The study employed a complete enumeration technique that procured all the science teachers in the said districts. There are 34 teachers who are teaching science subjects, particularly biology.

Research Instruments

The study utilized a descriptive survey questionnaire for the science teacher respondents. The researchers adopted the questionnaire for the study of Saro, J., Dayupay, A. M., and Aloyon, G. C. (2022), yet they modified the questionnaire based on the main goal and objectives of the study. Furthermore, the researchers prepared two types of questionnaires: the checklist and the survey questionnaire given to the teachers involved in the study. The study's questionnaire was validated by experts. Also, it has been divided into two parts to gather information and evaluate the learning resources for teaching biology. Part 1, the checklist form, contained lists of the ethno-learning resources that are certainly available and utilized by the science teachers and the problems encountered by the teacher-respondents utilizing those learning and teaching resources. For part 2, the survey questionnaire contains related questions to evaluate and validate the effectiveness of the learning resources in teaching biology.

Data Gathering Procedure

The researchers had secured the approval of the Schools Division Superintendent (SDS) to conduct the study in the two selected districts in the Division of Agusan del Sur, which are Esperanza Districts I and II. The researchers also provided a letter to the public school district in charge (PSDI) in both districts 1 and 2 of Esperanza. After which, the researchers prepared a survey-checklist attendance form for the eight schools in the two districts. The researchers provided an assurance to the science teacher-respondents that their responses would remain anonymous and treated with strict confidentiality. Also,

the researchers explained to the involved respondents the main goal and objectives of the study. Lastly, the retrieval of the questionnaires was done right after the science teacher-respondents completed answering the said research questionnaire. The responses of the science teachers were tallied and encoded properly.

Research Ethical Considerations

Research ethics, in general, relates to both ethical and unethical methods used in a particular study. Neuman argued in 2014 that in order to meet ethical standards, researchers must strike a balance between the rights of their research participants and the advancement of science. A researcher must assess potential benefits, such as improved decision-making, greater comprehension of social life, or aiding research participants, against potential disadvantages, such as a loss of dignity, self-respect, privacy, or democratic freedoms (Neuman, 2014).

The researcher would tabulate and analyze the data for statistical analysis after retrieving the questionnaire. The entire study process would adhere to ethical norms. The researcher had time to consult experts in research and any friends who are knowledgeable about research in order to avoid plagiarism. Additionally, the researchers would delete the data they have gathered from their end after the study is finished and the results are in.

Statistical Treatment

Microsoft Excel was utilized by the researchers in computing and tabulating the frequency and percentage of the data gathered from the teacher-respondents. Also, constructing the graphs for the interpretation of the findings of the study.

RESULTS AND DISCUSSIONS

The study has been carried out, with the data collected as needed. These data discussed the answer to the study about the ethno-learning resources in teaching biology for promoting sustainable development education. The following are the research questions that need to be answered: (1) What are the available ethno-learning resources utilized by the teachers in teaching biology? (2) What are the challenges, such as the issues and problems encountered by the science teachers in utilizing the instructional learning materials? (3) What are the most convenient and effective ethno-learning resources for teaching biology in the said districts? (4) What instructional development model could be recommended and implemented in teaching biology? It has also coincided with the data interpretation, analysis, and discussion of the findings.

Figure 1 shows a summary of the available ethno-learning resources utilized by science teachers in teaching biology in the districts of Esperanza 1 and 2 in the school division of Agusan del Sur. The findings showed that the locally available learning resources are books, modules, magazines, supplementary reading materials, laptops, TVs, laboratory apparatus, speakers, and projectors.

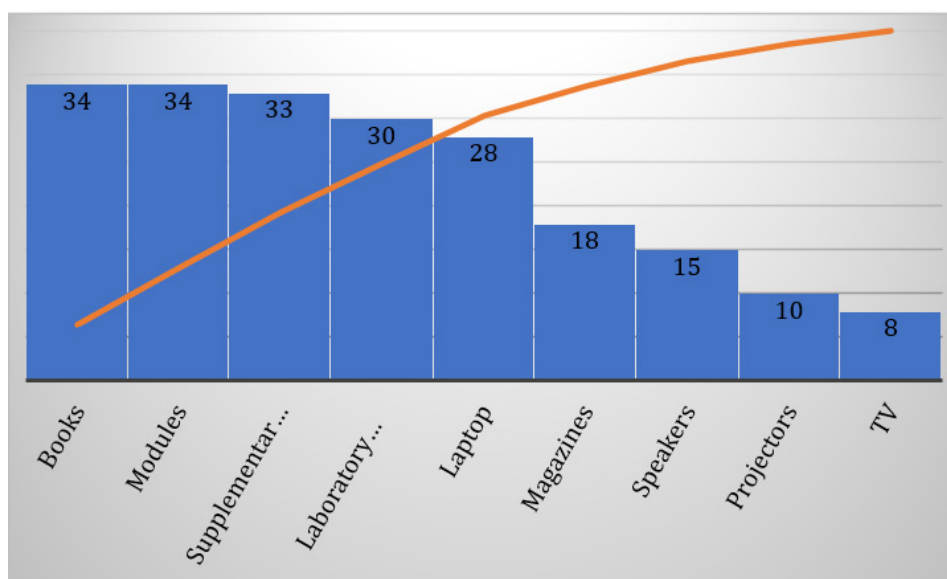


Figure 1: The Available Ethno-Learning Resources Utilized by Science Teachers in Teaching Biology

The results implied that most of the science teacher-respondents answered that the books and modules are the most convenient and available learning resources in teaching biology. The books and modules had the highest percentage of 100% (34), the supplementary reading materials had 97.05% (33), the laboratory apparatuses got 88.25% (30), laptops (82.35%, 28), magazines (52.94%, 18), and speakers, projectors, and TVs had the lowest percentage based on the results gathered.

The study of Saro *et al.* (2022) revealed that textbooks, books, and laboratory tools are the sources of science teachers' activity. Since students could study anywhere, including their homes, using books, they were the most efficient learning tools and had the highest study percentage. As a result, this shows that most science

teachers feel more comfortable using books than other supplemental materials.

Tandi (2016) revealed that textbooks are essential to the daily task of teaching and learning biology and become even more significant during times of transition. Additionally, it clarifies that books may be advantageous tools for the teaching and learning process. In other words, books and other reading materials are appropriate for both school-related issues and students' learning processes.

Bringas (2014) supported the findings and reminded teachers that using teaching strategies can improve a variety of topic areas. The improvement of the students' academic performance would require the use of resources like books and other supplemental materials. Additionally, it should be grounded in the utilization of experiences

Table 1: Issues and Problems Encountered by the Science Teachers in Utilizing the Instructional Learning Materials

Issues and Problems	Frequency (n)	Percentage (%)
Inadequate number of books	34	100
Inadequate number of laboratory apparatuses	22	64.71
Inadequate number of projectors	34	100
Inadequate number of instructional models (moon, cell structures, body systems, etc.)	26	76.47
Inadequate numbers of computers and other technological devices	34	100
Old visual aids	34	100
Obsolete books	29	85.29
No electricity	2	5.88
Total	34	100

Legend: TPS (34); statistically interpreted using frequency and percentage

and materials that are meaningful to the students' daily lives and are readily available in their neighborhood.

Table 1 shows the issues and problems encountered by the science teachers in utilizing the instructional learning materials in the districts of Esperanza 1 and 2 in the division of Agusan del Sur. The results implied that

most of the science teacher respondents responded that the inadequate number of books, inadequate number of projectors, inadequate numbers of computers and other technological devices, and old visual aids were the most common issues and problems encountered by the science teachers, which had a 100% (34). The obsolete

books had 29 responses with 85.59%, the inadequate number of instructional models (moon, cell structures, body systems, etc.) got (76.47%, 56), and the inadequate number of laboratory apparatuses (22, 64.71%). Lastly, the lowest percentage based on the table's result is "no electricity," which had a percentage of 2 (5.88%). This means that in both districts, electricity could be used in the teaching and learning process.

The data presents that the science teacher-respondents' most common issue and problem encountered was the inadequate number of books, inadequate number of projectors, inadequate numbers of computers and other technological devices, and old visual aids. On Figure 1, it has been presented that books are the most locally available resources utilized by the science teachers, yet in Table 1, books are also the common issues faced by the teachers, particularly in Esperanza Districts 1 and 2. This implies that though books have been shown to be

successful in enhancing students' reading and speaking abilities, they must have a high value for the teaching and learning process (Johnson, 2002). It emerges from this that secondary schools in Kenya examined the impact of the use of biology teaching and learning tools on students' academic achievement, which is consistent with the Wanjiku (2013) study. It reveals that the students were greatly impacted by the use of instructional materials, including books, additional reading materials, and modules. Learning resources are crucial since they help students' learning processes and can consequently considerably raise student accomplishment (Revington, 2015).

A range of instructional learning tools are needed to convey teachings more effectively, especially when students are involved in an interactive activity in a classroom setting. Teachers would specifically enhance their course materials to encourage students to actively participate in class (Suprapti *et al.*, 2018).

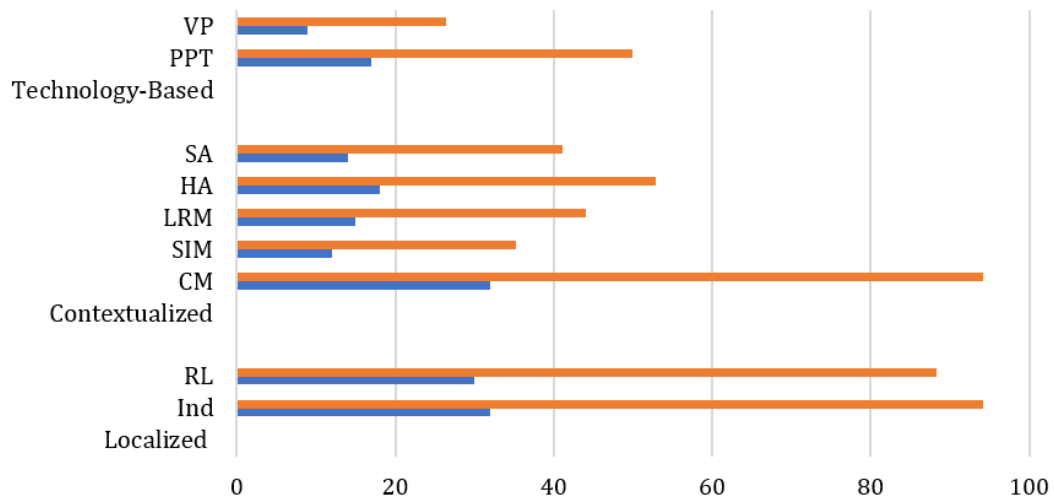


Figure 2: Most Convenient and Effective Ethno-Learning Resources for Teaching Biology in Both Districts of Esperanza

Legend: Localized Learning Resources; Ind (Indigenous Resources), RL (Realia and Replica); Contextualized Learning Resources; CM (Contextualized Modules), SIM (Strategy Intervention Materials), LRM (Learning Resources Materials), HA (Hands-on Activity), SA (Science Apparatuses); Technology-based Learning Resources; PPT (Power-Point Presentation), VP (Video Presentation)

Figure 2 illustrates the validated ethno-learning resources utilized by the science teacher-respondents in teaching biology, particularly in the districts of Esperanza 1 and 2 in the division of Agusan del Sur. There are three categories of learning resources: localized learning resources, contextualized learning resources, and technology-based learning resources.

The localized learning resources include indigenous resources (32, 94.11%) and realia-replica resources (30, 88.23%). This means that the science teacher utilized localized learning resources in teaching biology. The contextualized learning resources had 5 sub-types, which are the contextualized modules (32, 94.11%), hands-on activities (18, 52.94%), the learning resources materials (15, 44.11%), the science apparatuses (14, 41.17%), and the strategy intervention materials (12, 35.29%). Based

on the findings, the contextualized modules had generally utilized by the science teachers which got the highest percentage among the other sub-types. The technology-based learning resources had a PowerPoint presentation (17, 50%) and a video presentation (9, 26.47%), which means that the teacher-respondents are not able to use the video presentation as a way of teaching biology. This might be the problem of a lack of learning resources at school and the connectivity issue.

Contextualized learning is designed to create a setting that fosters greater learning effectiveness, as shown by improved retention and completion rates. The study also found a review where all skill accomplishment results were positive, showing that low-skilled students can learn more successfully. One of the respondents claimed that localized teaching resources require local resources like flora and other supplemental items. By giving students genuine or realistic resources, like as plants and animals, they are exposed to a more appropriate setting, making learning more effective. The same is true for the use of microscopy to see tiny living specimen samples during the learning process (Saro *et al.*, 2022).

Ballesteros (2014) found that students who get localized and contextualized education outperform their peers academically. This finding is consistent with previous research on the benefits of localized and contextualized science activities for boosting students' academic performance. Contextualized learning modules, according to a research

by Hamdunah *et al.* (2016), offer summaries of the instruction, concepts, and material as well as details on how students learn. The instructional material is also used to assist, encourage, enhance, promote, and create teaching and learning activities in order to enhance and enable the most effective procedures and processes of

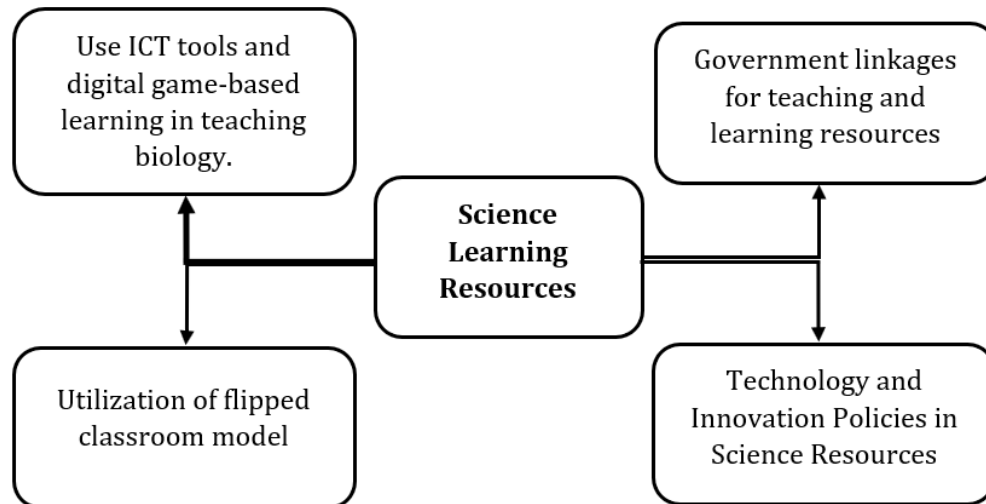


Figure 3: Instructional Development Model in Science Learning Resources

educational instruction (Herrera & Dio, 2016).

Figure 3 presents the instructional development model for science learning resources. It focused on the learning resources in teaching science and its interrelated components, such as government linkages for teaching and learning resources, technology and innovation policies in science resources, the utilization of the flipped classroom model, and the utilization of ICT tools and digital game-based learning in teaching biology. The four components of the above model could help the science teachers promote locally available learning resources with technology-based resources under them. Furthermore, the study findings could also be the basis for creating worksheets on biology subjects such as biodiversity and ecosystems, but the actual worksheets should be localized and contextualized.

Onasanya (2004) indicates that having locally and contextually relevant learning resources in teaching science, particularly biology, could promote students' interest in life science and care for insects, fish, and animals. Hence, students would also become much more involved in classroom learning because realia rule out distortions in students' knowledge and provides them with opportunities for "hand-on" interactions and experiences as well.

Danio (2012) explained that having indigenous resources is efficient because it is not costly and consumes less energy. Also, it has more advantages when utilized in the classroom setting. Lastly, the indigenous learning materials are not harmful and are naturally non-polluting.

CONCLUSION

Based on the findings of the study, books, modules,

supplementary reading materials, laboratory apparatuses, and laptops are more readily available learning resources in both districts. The books and modules are the main instructional learning resources utilized by science teachers in terms of availability, utilization, and even effectiveness in teaching biology. The most lacking or limited learning materials are the speakers, projectors, and TVs. These are the least technology-based resources in the said districts, yet these materials are greatly important nowadays since video presentations are also ways to get the attention of the learners in learning science.

Nonetheless, the most common problems encountered by science teachers are the inadequate number of books, the inadequate number of projectors and computers, and other technology-based resources. Also, indigenous resources, realia, and replicas under localized learning materials are the most effectively used by teachers in teaching science, such as biology. These studies' findings showed that using the mentioned learning materials would make the discussion and teaching interactive and motivate students' interests.

RECOMMENDATIONS

The authors of the study recommended that future researchers come up with a study that highlights the importance of having localized and contextualized materials in teaching science. Also, the authors recommended creating more locally available materials or contextualized worksheets for teaching science subjects. Lastly, the authors recommended that future studies compare the learning materials used by the science teachers locally to the learning materials used by the teachers internationally, or even check other relevant

methods that highlight the availability of learning resources in teaching science.

Statement of Conflict of Interest

The authors declared and validated that there were no potential conflicts of interest with respect to the research, authorship, and/or publication of this paper.

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