Community-Based Learning (CBL) Activity Packet: Pathway in Enhancing Scientific Literacy of Grade 9 Students

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Abstract

In the Philippines and around the globe, the call for educational reforms and advancement stresses the need for a scientifically literate population ready for the challenges of working in the twenty-first century. Accordingly, this study aims to investigate the effect of the community–based learning activity packet in enhancing the three domains of knowledge of scientific literacy among grade 9 students of Palahanan Integrated National High School. Based on the results of the study, it was found that there is a significant difference between the pretest and post-test scores in the scientific literacy test of the respondents exposed to the community–based learning activity packet in terms of the three domains of knowledge of scientific literacy. Thus, it is concluded that this hypothesis is not supported by evidence. With this, the following recommendations are recommended: (1) teachers may enhance the community–based learning activity packet by providing more contextualized locale conditions, (2) teachers may also consider incorporating additional reflection and group work activities specifically designed for the improvement of the epistemic knowledge of the students, (3) teachers may also consider the use community – based learning to other areas of scientific literacy like scientific competencies and attitudes, and (4) future researchers may try to use community – based learning in elementary or senior high school in nurturing students interests in science. The development of scientific literacy among students is important, as it holds immense significance not only within the bounds of academic endeavor but also in the real world.

Keywords: community – based learning activity packet, domains of knowledge, scientific literacy

1. Introduction

One approach for understanding the world is through science. It is an institution, a product, and a method that allows individuals to use information to accomplish desired results and to contribute to the creation of new knowledge. In addition, the need for scientifically literate individuals ready for the challenges of the twenty-first century workforce is emphasized in the need for educational reforms and advancement both here in the Philippines and around the globe. Scientific literacy is a crucial skill that students must possess in today's world (Muliastrini, 2020). It is a fundamental ability required to thrive in an ever more competitive society (Kahler et al, 2020).

Scientific literacy is more than just comprehending scientific concepts, it also involves knowing scientific methodologies and applying scientific knowledge to everyday situations (Haerani, 2020). Science literacy also refers to the capacity to understand and utilize scientific knowledge in practical, everyday scenarios (DeBoer, 2000). Furthermore, students must possess scientific literacy in order to comprehend, recognize, clarify, and apply scientific discoveries for the purpose of resolving challenges encountered in modern society (Budiarti & Tanta, 2021).

One way to enhance scientific literacy is by engaging students in learning activities that extend beyond cognitive capacities. Community-Based Learning (CBL) is a teaching strategy that connects theoretical knowledge with practical application in the real world. CBL fosters students' scholastic acquisition and civic growth by concurrently tackling tangible societal issues, community necessities, and communal interests (Gustavus Adolphus College, 2019). CBL fosters a sense of affiliation and attachment to one's community among students. Simultaneously, it compels individuals to cultivate a diverse set of cognitive and scholarly abilities to comprehend and address the problems they face in their daily existence. Community schools are closing the gap between knowledge and action and between what students must learn and what they can offer by purposefully relating academic standards to the actual reality of their communities.

Today, curriculum writers, administrators, and instructors are making crucial efforts to maintain the Philippine standards of education. However, the academic performance of students in the country remains low. The latest findings from the Program for International Student Assessment (PISA) reveal that students in the Philippines continue to rank among the lowest globally in terms of their proficiency in math, reading, and science. The newest test scores indicate that there has been no major progress in the country's academic performance since 2018. Despite the extensive efforts made by the education department to implement reforms and make preparations after a poor performance in PISA 2018, less than 25% of Filipino students who participated in the test in 2022 achieved the minimum level of proficiency in math, reading, and science, as indicated by the PISA results.

However, recognizing science education's role in improving scientific literacy, as described by Norris and Phillips (2003) suggests that students should be engaged in learning that goes beyond cognitive abilities. This includes incorporating socio-scientific issues (SSI), which helps develop a broader literacy dimension and leads to more knowledgeable citizens.

SSIs pertain to social issues that are connected to science. SSI also emphasizes the importance of presenting students with real-life situations to help them understand and address the social aspects of scientific issues. Through the provision of an authentic experience, students will acquire a more profound comprehension of the subject matter and cultivate abilities that may be applied outside the confines of the educational setting (Sadler, 2011). A teaching technique that is relevant when integrating SSI is Community based learning. CBL is a teaching strategy that establishes a connection between academic concepts and their practical implementation in the real world. This teaching technique is founded on the belief that the most significant learning occurs when individuals have hands-on experiences that are supplemented by direction, contextual information, fundamental knowledge, and intellectual analysis. The inclusion of students' insightful information and ideas, derived from personal observation and social interaction, enhances the depth of the learning experience for individuals and enriches the course content.

One such method for giving students real-world context is the creation of science educational materials. One crucial reason for this strategy is that instructional resources can assist teachers in adopting integrated science learning and students in studying science in a comprehensive and genuine manner. The various forms of instructional materials include textbooks, worksheets, workbooks, modules, learning packets, worktexts, and manuals (Selga, 2013).

An example of instructional material that can be used for learning is the Learning Activity Packet (LAP). A learning activity packet is a self-contained educational unit created to enhance the process of teaching and learning. Furthermore, it incorporates a wide variety of activities that stimulate multiple senses. In addition, the packet may contain a diverse range of activities, including games, discussions, movies, records, filmstrips, graphs, puzzles, political cartoons, charts, research themes, attitude surveys, picture interpretation, maps, songs, application techniques, problem solving, and other related activities. Galos (2022) outlines the five fundamental components of learning activity packets as follows: behavioral objective, concepts, learning activities, pre and post self-evaluation, and quest or self-initiated learning.

Furthermore, the Municipal Environment and Natural Resources Office (MENRO), of the Local Government Unit of San Juan, Batangas, identified the municipality's existing top four environmental challenges and issues. The first issue is the presence of microplastics in marine organisms due to water pollution, whereas the second issue encompasses inadequate waste segregation and disposal, the third one will be deforestation, and lastly climate change. To address the impact of these problems, they are actively cultivating positive relationships with all members of the community and collaborating with various institutions to promote knowledge of sustainable development. With the socio-scientific issues that the municipality of San Juan, Batangas is currently facing, this study seeks to develop a community-based learning activity packet that will give students a more authentic learning experience and increase their awareness of the following issues that they may encounter in the community, and which could contribute to the development of their scientific literacy. This educational innovation can increase students' interest in science, enable them to relate their science education to other disciplines, and improve their comprehension of science as well as their capacity for civic responsibility.

2. Literature review

2.1. Learning Packet

The Learner's Packet is an upgraded iteration of the Detailed Lesson Plan or Daily Lesson Log. These materials are in both digital and physical formats and provide comprehensive coverage of specific lessons in various subjects. They primarily consist of supplementary references and activities designed to facilitate the achievement of the objectives outlined in the Most Essential Learning Competencies (Ramirez, 2022).

Self-paced learning material refers to a structured set of instructions that are created to help learners effectively acquire a specific body of knowledge or learn a particular method. By integrating with various modalities, learners can proficiently acquire extensive knowledge or effectively navigate complex processes. It can exist in either digital or paper format. In the pre-digital era, the learning activity packet (LAP) served as a paper-based form of self-paced learning material. The self-paced learning material empowers learners to acquire knowledge autonomously, hence fostering their motivation to persist in their learning endeavors (Cooper & Maile, 2018).

2.2. Community Based Learning

According to Melaville (2006), community-based learning refers to a set of practices designed to engage students in high-quality educational experiences. The concepts encompass academically oriented community service, civic education, environmental education, place-based learning, service learning, and work-based learning. Each of these strategies has its own supporters and professionals, as well as a unique history and set of accomplishments. Each technique, when considered separately, provides a unique perspective and important resources for the educational and information acquisition process.

2.3. Scientific Literacy

As stated by NCREL (2003), students need to possess scientific literacy, which refers to their knowledge and understanding of science concepts and processes, in order to actively participate in the digital era society. Students have the ability to inquire, obtain, or ascertain solutions to queries that arise from their everyday experiences. Furthermore, they possess the capacity to articulate, elucidate, and forecast natural occurrences. Students should possess the ability to comprehend scientific articles in the popular media and actively participate in societal discussions regarding the credibility of their conclusions. Furthermore, students have the ability to recognize scientific concerns, whether they are on a local or national scale, and offer scientific and technological knowledge. Students have the ability to evaluate the quality of scientific knowledge based on the sources and procedures utilized to generate it. In addition, it is important for students to possess the ability to articulate and assess arguments grounded in facts, as well as to generate a suitable summary of the discussion.

2.4. Theoretical Framework

This study is based on the experiential learning theory. Experiential Learning Theory (ELT) is founded on the empirical investigations carried out by Dewey, Lewin, and Piaget. ELT is a holistic and flexible learning approach that integrates experience, perception, cognition, and behavior. The experiential learning model delineates a cyclical pattern of learning encounters. According to Kolb (1984), learning is the act of creating knowledge by transforming experiences. Experiential learning is one of the most impactful methods of learning.

The experiential learning process consists of four steps: Experience, Reflect, Think, and Act. These steps are repeated numerous times in every encounter and experience.

This viewpoint is reflected in the context-based science learning. Context-based learning focuses on real-world circumstances and emphasizes interdisciplinary linkages. It uses scientific applications as a starting point to build scientific concepts. Hence, context-based learning stimulates students to utilize their cognitive and metacognitive abilities, fosters their motivation to study, and promotes their scientific literacy (Bennett & Holman, 2002).

Community-based learning is a teaching and learning approach that offers a setting for developing academic and work-related abilities. CBL promotes the acquisition of knowledge and the cultivation of civic engagement in students, while simultaneously tackling practical problems, meeting the requirements of the community, and catering to their interests.

Community-based learning (CBL) also connects classroom learning with real-world experiences within local communities. It gained prominence in promoting scientific literacy among students by offering hands-on opportunities to apply scientific concepts in practical settings. Incorporating community-based learning into science education not only enhances students' scientific literacy but also empowers them to become active participants in addressing real-world scientific challenges.

Scientific literacy holds significant importance in both academic and practical contexts. Acquiring scientific literacy abilities has become a primary objective in education during the 21st century. Scientific literacy, as defined by the PISA framework, encompasses three key competencies: the capacity to elucidate scientific phenomena, conduct scientific assessment and inquiry, and comprehend scientific data and evidence (NRC, 2012). These competencies require three domains of knowledge: content, procedural, and epistemic knowledge. Content knowledge is the knowledge of facts, concepts and ideas, and theories pertaining to various domains of science which involves simple recall of information and locating simple information from a table. Procedural knowledge is the use and application of conceptual knowledge to explain or describe a phenomenon. It includes selecting procedures and performing them, organizing, presenting, and interpreting data. Meanwhile, epistemic knowledge refers to the knowledge of constructs and defining features that are important to the knowledge building process. It includes understanding of the focus of the problem, observation, analyzing, synthesizing, evaluating, justifying data, and designing a plan to solve a problem. Therefore, it is essential for educators to create interactive learning settings in all comprehensive learning situations. This is because it was proved that learning in such environments is more effective and easier for students (Baratè et al., 2019; Turgut & Yakar, 2020).

3. Methodology

The study employed a descriptive - developmental research design to determine whether community-based learning activity packets develop the scientific literacy of the students. The respondents of the study are fifty (50) grade nine (9) students from a heterogenous section of Palahanan Integrated National High School in San Juan, Batangas. A survey questionnaire is given to initially identify the respondent's profile and their perceived socio scientific issue knowledge. Then the respondents are given a pre-test and then exposed to the use of the community-based learning activity packets. Afterwards, then a post-test was conducted.

The study employed a cluster random sampling methodology. The study also utilized different instruments to gather the data needed to answer the research problems. These include an expert validation tool for the content and format of community-based learning packet, a pre – post-test assessment and a survey questionnaire on socio scientific issue knowledge of the students. The pre – post – test consist of forty-five (45) items, which include topics related to biodiversity. The pre – post-test seeks to investigate whether the community-based learning activity packet develops the scientific literacy of the students.

For the content validation, the researcher seek assistance from one head teacher, one master teacher, and four teachers from Palahanan Integrated National Highschool. The revised instruments are submitted and checked by the panellists including the researcher's adviser, subject specialist, statistician, and technical editor. All their corrections and recommendations will be incorporated on the final copy of the instruments.

The instruments of the study undergo both internal and external validation. The researcher seek permission from the Division Office of Batangas Province and to the school principal of Palahanan Integrated National High School for conduct of the study. Then the research questionnaire and the crafted community-based learning activity packet will be given to the head teacher, master teacher and several teachers of Palahanan Integrated National High School for external validation. All their comments and suggestions are incorporated into the research to make the questionnaire as well as the learning activity packet more valid and reliable.

After the validation of experts, the research questionnaire undergoes content validity testing to assess if the questions are valid for the learners. According to Polit and Beck the SCVI that is at least 0.83 is acceptable if there are at least six experts. After the test of validity, the researcher seeks for the permission of the panel for the implementation of the research. After the content's validity and approval, a pretest will be the chosen 50 students from Grade 9 will be subjected to the study.

The researcher took into account the various stages of community-based learning when developing the activity packet. The first is to study the background information in the community context and explore the community area to collect information through interviews with the Local Government Unit of San Juan, Batangas. Also, the researcher will seek the help of the Municipal Environmental and Natural Resources Office of San Juan, Batangas to gather enough information about the existing socio scientific issues and environmental problems in the locality. Secondly, it is to analyse all available resources in the community to provide an authentic experience to the learners. The next step is to design the community-based learning activity packet with various parts, which include concepts; behavioural objectives; learning activities; pre-, self- and post-evaluation; and quest or self-initiated learning. After designing the community-based learning activity packet the next step is to organize the learning experience of the learners, followed by taking off the lesson or exposing the learning through varied community- based learning activities and making the students reflect on their learning experience, and lastly the evaluation or assessment of what the students have learned.

Afterwards, the implementation of the study was administered, and the students are exposed to the use of the community-based learning activity packets. For a period of three weeks as prescribed by the curriculum guide crafted by the Department of Education a community-based learning activity packet are used to enhance the teaching and learning process and the scientific literacy of the students. Community based learning activities are incorporated during instruction to provide a more authentic learning experience to the students. After the implementation, a post – test was administered to find out the development of students' scientific literacy. Lastly, a statistical treatment was done to test the hypothesis of the study.

The collected data undergo several statistical measures and tools to assist the researcher in presenting, evaluating, and interpreting the data. The scientific literacy of students is compared before and after the implementation of the community-based learning activity packet using Mean, SD, Frequency, and Percentage. A t-test was employed to determine the statistical significance of the difference between the pre and post test scores of students with respect to their scientific literacy.

4. Findings and Discussion

Table 1

Profile of the Respondents According to Age

Age	f	%
14 years old	33	66.0
15 years old	15	30.0
16 years old	2	4.0
TOTAL	**50**	**100.0**

Table 1 presents the profile of the respondents in terms of their age. There are 50 respondents, 66% (33) are in the age of 14 years old. Another 30% (15) whose age is at 15 years old and 4% (2) whose age is at

16 years old. Students aged 14-19, sometimes face distractions from various extracurricular activities. If they lack enthusiasm in science, this poses a challenge for the teacher. Numerous secondary science teachers have been cognizant of these issues and have responded appropriately. The teachers were aware that in order for the students to be engaged in the subject's future, they would require high-quality resources to facilitate their learning. Some of the suggested and put into practice approaches include utilizing high-quality reference materials to enhance the development of mathematical skills and problem-solving abilities, engaging students by posing thought-provoking questions, fostering confidence through hands-on experimentation, making science lessons meaningful and intellectually stimulating, combating boredom through active learning, promoting independent inquiry, and expanding cognitive abilities through the acquisition of scientific vocabulary (Galos, 2022)..

Table 2

Profile of the Respondents According to Sex

Sex	f	%
Male	16	32.0
Female	34	68.0
TOTAL	**50**	**100.0**

Table 2 provides a summary of respondent's sex distribution. The majority of the participants were female students, comprising of 68% (34) in total while male students are accounted for only 32% (16).

Identifying the sex distribution of learners is crucial when developing a learning material for students. Gender differences in cognitive, emotional, and social development have been well-documented in the literature (Halpern, 2012). By taking these differences into account, educators and developers can create learning materials that are more effective and engaging for both boys and girls.

Table 3

Respondents' Perceived Socio – Scientific Issue Knowledge

Statements	Mean	SD	Verbal Interpretation
1. I am aware of some socio scientific issues present in my community area.	3.70	0.46	Exceptional
2. I can easily identify those socio scientific issues in my community (e.g., deforestation, pollution, and climate change).	3.82	0.39	Exceptional
3. I can comfortably describe socio scientific issues exist in my area.	3.56	0.50	Exceptional
4. I am well informed about the causes and effects of socio scientific issues in my community.	3.76	0.48	Exceptional
5. I regularly seek information about socio scientific issues in my community area.	3.44	0.50	Solid Understanding
6. I actively participate in group discussion in mitigating some effects of those socio scientific issues in my area.	3.50	0.51	Exceptional
7. I consistently practice engaging myself in seeking solutions to those socio scientific issues.	3.74	0.44	Exceptional
8. I am well informed as well as my family members about socio scientific issues related to our local community.	3.72	0.45	Exceptional
9. I am very good at collecting information about those socio scientific issues present in my community.	3.68	0.47	Exceptional
10. I consistently participate and support environmental advocacy in our local community about socio scientific issues.	3.62	0.49	Exceptional
Overall	**3.65**	**0.47**	Exceptional

Legend: 3.50-4.00 (Exceptional); 2.50-3.49 (Solid understanding); 1.50-2.49 (Basic understanding); 1.00-1.49 (Limited knowledge)

Table 3 presents the respondents perceived level of socio scientific issue knowledge. It is shown in statement number two that the respondents can easily identify and recognize different socio scientific issues present in their community with a mean score of 3.82 (SD= 0.39). However, in statement five stating the respondents regularly seek information about socio scientific issues in the community had the lowest mean of 3.44 (SD=0.50). Altogether, the following statements garnered an overall mean of 3.65 (SD=0.47) with verbal interpretation of exceptional which manifests that the respondents have an exceptional socio scientific issue knowledge within their respective communities.

Although it was found out that the students have exceptional socio scientific issues knowledge, table 3 reveals that the students seek information about different socio scientific issues that exist in the community. To address this issue, the researcher incorporated community-based learning activities into the packet. These include interviews and campaigns, which serve as supplementary activities enabling students to have a deeper understanding of their community and the different socio – scientific issues they might encounter. In doing this, the researcher accompanied and endorsed the students to the barangay office to ask permission to conduct the campaign and exhibit their campaign materials about preserving the ecosystem and protecting the environment. This presents a valuable opportunity to enrich the learning experience of the students by integrating different socio-scientific issues into the community-based learning activity packet. These issues are identified through an interview to the Municipal Environmental and Natural Resources Office of the Local Government Unit of San Juan, Batangas. By doing so, students gain a more comprehensive understanding of community challenges and are empowered to seek solutions based on their encounters with these issues.

This is supported by the study of Pouliot (2008) suggesting that studying Socio Scidaily is an effective way to promote Scientific Literacy. This type of literacy encourages young people to engage with science in practical ways, enhance their ability to evaluate information they encounter daily, make informed decisions about controversial sociotechnical issues, and actively participate in debates and discussions related to these issues.

Table 4

Summary of the Pretest Scores of the Respondents in Scientific Literacy Test in Terms of Content, Procedural and Epistemic Knowledge.

Rating	Content Knowledge		Procedural Knowledge		Epistemic Knowledge		Verbal Interpretation
	f	%	f	%	f	%	
74% and below	4	8.00	0	0.00	1	2.00	Beginning
75 – 79%	14	28.00	7	14.00	27	54.00	Developing
80 – 84%	25	48.00	14	28.00	22	44.00	Approaching Proficiency
85 – 89%	7	14.00	22	44.00	0	0.00	Proficient
90% and above	0	0.00	7	14.00	0	0.00	Advanced
TOTAL	**50**	**100.0**	**50**	**100.0**	**50**	**100.0**	

Table 4 displayed the summary of the pre-test scores of the respondents in scientific literacy test in terms of content, procedural and epistemic knowledge. It reveals that in terms of content knowledge 48% (25) achieved a rating between 80% and 84%, categorized as Approaching Proficiency. Conversely, 8% (4) scored 74% or below, signifying a Beginning level. The majority of students are situated at the Approaching Proficiency level, indicating they have fundamental knowledge, skills, and core understanding that requires minimal teacher guidance and some peer support. This suggests that most respondents are capable of simple recall of information about topics related to biodiversity prior to the exposure of the community-based learning activity packet. Conversely, a small percentage of students are at the Beginning level, suggesting that students struggle with understanding and recalling information about biodiversity due to inadequate acquisition or development of prerequisite knowledge and skills.

The study conducted by Irdalisa (2020) provides support for the notion that students' comprehension of material concepts is closely linked to their content knowledge. The pre-test score of 57.5 for content knowledge was lower than the post-test score prior to the deployment of the guided inquiry paradigm. Furthermore, according to Suryawati et al. (2014), Content Knowledge encompasses concepts, theories, ideas, frameworks, evidence-based knowledge, practices, and methodologies for the advancement of knowledge. It implies that the instructor must possess a comprehensive and profound understanding of their teaching content. Understanding the content is crucial as it dictates the specific approaches required for each domain (Koehler et al., 2013).

Table 4 also outlines the pre-test scores reflecting the scientific literacy of respondents concerning procedural knowledge. Among the respondents, 44% (22) achieved a rating between 80% and 84%, indicating a Proficient level of procedural knowledge. Conversely, 14% (7) attained a score between 75% and 79%, suggesting a Developing level of procedural knowledge. This developing level implies that the respondents have a minimum knowledge and skills and core understanding of procedural knowledge. Respondents can utilize and apply their knowledge in selecting and performing different procedures about biodiversity but may require assistance when executing tasks. Moreover, individuals at the proficient level have established fundamental knowledge, skills, and a core understanding, which students can apply and transfer effectively and independently in authentic performance tasks such as performing procedures related to population density and biodiversity.

A study conducted by Canobi (2009) indicated that enhancing procedural knowledge can facilitate enhancements in conceptual knowledge. Similarly, procedural knowledge is defined as the capacity to sequentially follow steps in order to achieve a goal or solve difficulties.

Table 4 also presents the pretest scores reflecting respondents' levels of scientific literacy regarding epistemic knowledge. Out of the respondents, 54% (27) achieved a score between 75% and 79%, indicating a developing level of epistemic knowledge. Conversely, only 2% (1) reached a score indicating a beginning level, suggesting that the students struggle in terms of their epistemic knowledge in relation to topics related to biodiversity. Most respondents demonstrated a developmental level of epistemic knowledge, signifying a foundational understanding. Respondents at this stage can analyze, synthesize, evaluate, justify data, and devise problem-solving strategies but may require guidance when engaging in authentic tasks like reflection and designing a plan to solve a problem related to biodiversity.

Zetterqvist and Bach's (2023) study reveals that there is a lack of understanding in epistemic knowledge. The study found that individuals tend to prioritize scientific phenomena (content knowledge) or the method itself (procedural knowledge) rather than focusing on epistemic knowledge. One plausible explanation is that epistemic knowledge requires a high level of intellectual effort; another argument is that epistemic knowledge is still eclipsed primarily by content knowledge and secondarily by procedural knowledge. Students' engagement with the epistemic parts of science, whether as content or procedural knowledge, implies the need for instructors to clearly differentiate between these distinct components of scientific knowledge.

Table 5

Summary of the Post Test Scores of the Respondents in Scientific Literacy Test in Terms of Content, Procedural and Epistemic Knowledge.

Rating	Content Knowledge		Procedural Knowledge		Epistemic Knowledge		Verbal Interpretation
	f	%	f	%	f	%	
74% and below	0	0.00	0	0.00	0	0.00	Beginning
75 – 79%	0	0.00	0	0.00	0	0.00	Developing
80 – 84%	6	12.0	2	4.0	11	12.00	Approaching Proficiency
85 – 89%	21	42.00	2	4.0	36	72.00	Proficient
90% and above	23	46.00	46	82.00	3	6.00	Advanced
TOTAL	**50**	**100.0**	**50**	**100.0**	**50**	**100.0**	

Table 5 illustrates the summary of the post-test scores of the respondents in scientific literacy test in terms of content, procedural and epistemic knowledge. It revealed that in terms of content knowledge 46% (23) achieved a rating of 90% or higher, indicating an Advanced level of content knowledge. Conversely, 12% (6) attained a score between 80% and 84%, categorized as Approaching Proficiency. This suggests that following the implementation of the community-based learning activity packet, a majority of students have surpassed the core requirements in terms content knowledge and can seamlessly apply them across various tasks related to biodiversity. However, some respondents remain at the Approaching Proficiency level, signifying they have developed fundamental knowledge and skills in conceptual understanding about biodiversity but still require guidance from teachers and assistance from peers.

The study conducted by Klosterman and Sadler (2010) found similar results, which examined the influence of utilizing a curriculum centered around socio-scientific issues (SSI) on the development of science topic knowledge. The students' content knowledge was assessed using a standards-aligned content knowledge exam (distal assessment) and a curriculum-aligned exam (proximal assessment). The results showed a substantial difference between the pre-test and post-test scores of the participants. The study's findings, which include both proximal and distal assessments, provide significant evidence to support the effectiveness of using SSI as contexts for science teaching. Furthermore, this study offers evidence to endorse the utilization of SSI as a framework to augment science subject knowledge.

Table 5 also presents the post-test scores reflecting respondents' scientific literacy in procedural knowledge. Among the 50 respondents, 82% (46) achieved a rating of 90% or higher, indicating an Advanced level. Additionally, the remaining respondents attained ratings between 80 – 84% and 85 - 89%, categorized as Approaching Proficiency and Proficient, respectively. This suggests that the majority of respondents have exceeded the core requirements in procedural knowledge, demonstrating their ability to effectively utilize and apply procedural knowledge to explain and execute procedures related to biodiversity. Moreover, they can select and executing various procedures, as well as organizing, presenting, and interpreting data. Conversely, students categorized as Approaching Proficiency have developed foundational knowledge and skills in procedural knowledge with support and guidance from teachers and peers. Meanwhile, those classified as Proficient have established fundamental knowledge and skills independently, enabling them to transfer their understanding effectively through authentic performance tasks.

Acquiring procedural knowledge and scientific research abilities is essential for an individual to achieve scientific literacy. Procedural knowledge refers to the specific tools, methods, and processes employed in scientific study. By engaging in problem-solving activities, students enhance their procedural knowledge, abilities, and conceptual understanding. Effective organization of learning activities is crucial in the teaching/education process to facilitate the development and reinforcement of conceptual and procedural knowledge (Šorgo & Ploj Virtič, 2020).

Table 5 also shows the post-test scores indicating respondents' scientific literacy in epistemic knowledge. Among the 50 respondents, 72% (32) achieved a rating between 85% and 89%, qualifying them as Proficient. Additionally, only 6% (3) attained a score of 90% or higher, indicating an Advanced level of epistemic knowledge. This suggests that most respondents have reached a proficient level of epistemic knowledge. Those classified as Proficient have developed fundamental knowledge and skills, as well as a core understanding of epistemic knowledge, allowing them to autonomously transfer their understanding through authentic performance tasks like reflection and journal writing. Conversely, respondents at the Advanced level have surpassed the core requirements for epistemic knowledge, demonstrating their ability to analyse, synthesize, evaluate, justify data, and design solutions for various problems with ease. This indicates a high level of proficiency and competence in epistemic knowledge.

The study conducted by Khishfe and Abd-El-Khalick (2002) provides support for the idea that when students engage in explicit reflection on a topic, they can develop their own standards and criteria for knowledge. This, in turn, enhances their understanding of how knowledge is acquired and encourages them to participate more effectively in inquiry and discussion. By participating in more advanced discussions regarding knowledge and beliefs, students may have gained a deeper comprehension of how collaborative conversations contribute to the development of scientific theories.

Table 6

Summary of Acceptability of Community- Based Learning Activity Packet

Format	Mean	SD	Verbal Interpretation
1. Content	4.00	0.00	Very Acceptable
2. Format	3.84	0.09	Very Acceptable
3.Presentation and Organization	3.91	0.20	Very Acceptable
4. Accuracy and Up-to-datedness	3.94	0.13	Very Acceptable
5. Community – Based Components	3.88	0.29	Very Acceptable
Overall	3.91	0.05	***Very Acceptable***

Legend: 3.50-4.00 (Very Satisfactory/ Acceptable); 2.50-3.49 (Satisfactory/Acceptable); 1.50-2.49 (Needs Improvement); 1.00-1.49 (Not Satisfactory/ Acceptable).

Table 6 revealed the perceived acceptability of the community – based learning activity packet as to content evaluated for content validity. Validators rated the community - based learning activity packet in terms of content very acceptable with an overall mean score of 4.00, (SD = 0.00). This means that the experts perceived the content to be appropriate for the target learners. In addition, the community - based learning activity packet is aligned with the DepEd Most Essential Learning Competencies (MELCs) which are the learning competencies that were deemed to be the most essential in the achievement of content and performance standards. Likewise, the time frame allotment for the achievement of a specific objective is suitable for the learners since the allotted time for the activities in the community - based learning activity packet is aligned with the DepEd budget of work.

Table 6 also presents a summary of the perceived acceptability of the community-based learning activity packet, focusing on format. The ratings provided by experts indicate a very acceptable rating, with an overall mean score of 3.84 (SD=0.09). This suggests that experts found the format of the community-based learning activity packet to be highly acceptable for the intended learners. In terms of print format, the researcher opted for Arial font style with a font size of 11, known for its readability and ease on the eyes, thus ensuring comfort for students during reading sessions. Regarding illustrations, the researcher incorporated various visuals and graphic organizers into the learning packet. These elements are known to enhance learning outcomes and facilitate knowledge retention. Moreover, the illustrations were carefully selected to be simple, recognizable, and accompanied by clear labels and captions. Realistic colours were used to ensure relevance, while maintaining an attractive and appealing layout to engage the target audience effectively. Design and layout considerations were also considered, ensuring that the community-based learning packet is visually appealing yet straightforward. This approach aims to maintain the reader's focus without unnecessary distractions. To ensure durability, the printed community-based learning packets were soft-bound properly, enhancing their longevity for repeated use. Addressing concerns related to size and weight, the packets were printed on A4 sized bond paper with a thickness ranging from 70 to 80 gsm, providing a balance between portability and durability. This choice aimed to optimize the practicality and usability of the learning materials.

Table 6 also illustrates the perceived acceptability of the community – based learning activity packet as to presentation and organization. It shows that in terms of presentation and organization, the learning activity packet attained a mean score of 3.91 (SD=0.20) with a verbal interpretation of very acceptable. It implies that the material is suited for the students' level of understanding. To enhance engagement and captivate readers, the researcher infused the community-based learning packet with relatable narratives. By crafting stories set within their local environment, the researcher ensured that the content was not only relevant but also personally meaningful to the readers. These narratives were carefully designed to draw parallels with the students' everyday lives, fostering a deeper connection to the material and igniting their interest in learning. Aside from stories, to address the vocabulary level of the respondents, the researcher also prepared vocabulary building activities for the target students. In topic three, activity one, the researcher presents a list of eight words pertaining to the concept of water pollution. From this selection, students engage in multifaceted tasks such as defining the words, utilizing them in sentences, identifying synonyms or antonyms, or even enacting their meanings. By interacting with these words in diverse ways, students not only expand their vocabulary but also deepen their understanding of the topic.

Table 6 also illustrates the perceived acceptability of community – based learning activity packet as to accuracy and up-to-datedness. The CBL activity packet attained a mean score of 3.94 (SD=0.13) with a verbal interpretation of very acceptable. Accuracy and up-to-datedness is one of the important aspects of a learning material which contributes to effective learning outcomes. It is crucial that the information provided in the materials is accurate, reliable, and up to date to ensure that the students will be equipped with the most current and relevant knowledge in the subject matter. In crafting the community-based learning activity packet, the researcher meticulously curated current information and details sourced from recent materials and articles, ensuring the content remains relevant and up-to-date.

Table 6 also illustrates the perceived acceptability of community – based learning activity packet as to community – based material, it reveals that three out of ten statements attained a mean score of 4.00 (SD= 0.00) while the remaining seven statements attained a mean score of 3.83 (SD=0.41) and altogether they can be described with a verbal interpretation of very acceptable.

In this study, the developed learning activity packet utilized community-based learning by integrating activities that immerse students in various social issues prevalent within their communities. These activities not only afford students firsthand experience with real-world challenges but also instil in them a profound understanding of their capacity to effect positive change and foster robust community partnerships.

Table 7

Significant Difference in the Pre-test and Post tests Scores in Scientific Literacy Test of the Respondents Exposed to Community Based Learning Activity Packet

Scientific Literacy	**PRE-TEST**		**POST TEST**		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Content Knowledge	8.76	1.62	12.20	1.43	-12.28	49	.000
Procedural Knowledge	10.78	2.01	14.06	1.24	-11.54	49	.000
Epistemic Knowledge	8.28	0.81	11.20	1.12	-22.39	49	.000
OVERALL	27.82	3.08	37.46	2.48	-22.02	49	.000

Legend: Sig. (2-tailed) ≤ .05 (significant); Sig. (2-tailed) >.05 (not significant)

Table 7 illustrates the test of difference between the pretest and post test scores of the respondents' scientific literacy as to three types of knowledge: content; procedural; and epistemic. The summary of values reveals a significant difference between the pretest and post test scores of the respondents after implementation and the use of community-based learning packet which was statistically significant at the 0.05 confidence level. The results also show an improved scientific literacy of the respondents based on the comparison of their pre and post-test in the terms of content, procedural and epistemic knowledge.

Table 7 also illustrates a significant difference between the pre-test and post-test scores of students' scientific literacy in terms of content knowledge. Specifically, the pre-test yielded a mean score of 8.76 (SD=1.62), whereas the post-test recorded a mean score of 12.20 (SD=1.43), indicating a substantial increase. This significant difference suggests a significant improvement in content knowledge among the respondents from the beginning to the end of the implementation. Since the developed community - based learning packet connects the classroom content to the socio scientific issues and experiences it provides relevance to the real-world context. This helps students to understand practical application of academic concepts and deeper understanding of factual information and ideas related to science that foster deeper engagement.

Mashman and Porter (2013) emphasized that students must possess a profound comprehension of material concepts as a crucial aspect of acquiring effective content knowledge. The research involved analysing fundamental science skills, developing concept maps, designing learning experiences, and formulating assessments based on scientific concepts and competencies. These activities were believed to have enhanced content knowledge.

Table 7 also illustrates the significant difference between the pre-test and post-test scores of students' scientific literacy in terms of procedural knowledge. Specifically, the pre-test attained a mean score of 10.78 (SD=2.01), whereas the post-test yielded a mean score of 14.06 (SD=1.24), indicating a substantial increase in their procedural knowledge. This significant difference suggests a significant improvement in procedural knowledge among the respondents from the beginning to the end of the implementation. Since the developed community – based learning activity packet provide experiential learning activities that challenges the students to follow and execute different procedures as well as organize, present and interpret data they are likely to develop procedural knowledge. For example, topic three, activity three, students are presented with an engaging task of interviewing three distinct individuals within their barangay to explore the multifaceted impacts of water pollution on households, health, environment, and economy. This activity serves as a compelling opportunity for students to apply their understanding in practical contexts, prompting them to organize their thoughts effectively and execute various procedures to address real-world challenges. By engaging in such hands-on experiences, students are challenged to navigate complex issues, thereby fostering the development of procedural knowledge.

Furthermore, the acquisition of procedural knowledge and scientific research abilities is essential for an individual's scientific literacy (Aiman & Hasyda, 2020). Procedural knowledge refers to the instruments, methods, and processes employed in scientific inquiry. Effective organization of activities is crucial in the teaching and learning process to facilitate the development and reinforcement of conceptual and procedural knowledge (Šorgo & Ploj Virtič, 2020). The design of these methods and procedures should encompass a range of scientific techniques, allowing students to gain a deeper comprehension of the fundamental principles of science.

Table 7 also revealed a contrast between the pre-test and post-test results concerning students' scientific literacy regarding epistemic knowledge. Specifically, the pre-test recorded an average mean score of 8.28 (SD=0.81), while the post-test exhibited a mean score of 11.20 (SD=1.12), indicating a considerable enhancement in the student's epistemic knowledge. Since the developed community – based learning activity packet integrates activities fostering sense of civic responsibility and social awareness among students leading to deeper understanding of their role as responsible citizen and agents of change it will challenge the students to build their understanding about the different problem in their community and encourage them to develop and design a plan to solve real life situation problems leading to enhance epistemic knowledge. For instance, the developed community – based learning activity packet incorporates activities where in the students will going to write a reflection and share their personal experiences, thoughts and emotions related to the complex challenges in their community leading enhance knowledge of construct or building understanding through exploration, reflection and interaction that is transferable to real – life situations.

This result is additionally reinforced by Yang et.al (2018) research, which suggests that learning experience plays a vital role in the formation of epistemic cognition and beliefs. Two instructional design recommendations can be derived from the positive connections seen between learner characteristics and the comprehension of epistemic information in the field of science. Initially, it is imperative for science teachers to offer students the chance to actively participate in scientific investigation and debate in order to enhance their genuine involvement in the scientific process. Furthermore, since the enterprise factor was found to have a significant correlation with all learner factors, it is possible that teaching students about the process of scientific knowledge development in a scientific community or enterprise could improve their interest, self-efficacy, and overall learning experiences in the field of science.

5. Conclusion

Based on the result of this study, it is concluded that there is a significant difference between the pre - test and post test scores of the respondent's scientific literacy as they are exposed to the use of community – based learning activity packet. Furthermore, based on the findings and conclusions of the study, the following are the recommendations are hereby suggested:

Although the community – based learning activity packet was found out to be very acceptable, it was noteworthy that community – based components have the lowest mean score. Teachers may improve integration of the community – based learning activity packet by providing more contextualized locale conditions in the community and integrate more community-based learning activities that will immerse the students in various social issues in the community. Teachers may also provide activities wherein the students will be encouraged to join different organizations in the community to become more involved in community projects. Despite the community – based learning activity packet's potential to enhance scientific literacy across the three domains of knowledge, the post test result revealed epistemic knowledge has the lowest mean score. To address this, teachers may consider incorporating additional reflection activities and group work specifically designed to enhance the epistemic knowledge of the students. In addition, since the study found out that community – based learning found to be effective in developing the three domains of knowledge of scientific literacy, they may consider other areas of scientific literacy like scientific attitudes and scientific competencies and future researcher also may try to use community – based learning in elementary or in senior high school science curriculum in nurturing the interest of students in learning science.

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