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Banking the Jargon as an Intervention to Enhance Conceptual Understanding of Grade 9 Science-Earth and Space

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ABSTRACT. The purpose of the study was to examine the effectiveness of Banking the jargon as an intervention to enhance conceptual understanding of grade 9 Science- Earth and Space in learners' academic performance. The study used a quasi-experimental design with an equal number of participants in the experimental and control groups. There were 32 participants from each of the two groups, who were all grade 9 learners with a diversity of learning styles. Students in the control group received instruction without the intervention, while students in the experimental group underwent this intervention. The data obtained from both groups were analyzed using Paired Samples t-test and One-Way ANOVA. The use of Paired Samples t-test revealed that both methods significantly increased the mastery of the students in grade 9 Science- Earth and Space. The use of ANOVA in the post-test results showed a significant difference between the groups in favor of the experimental group. The learners in the experimental group performed better than the learners in the control group in understanding the concepts taught in the three modules of grade 9 Science –Earth and Space. This implies that the intervention was effective. This result is fortified by the results of the interview of ten (10) participants. Their responses were analyzed using thematic analysis. Findings revealed that students have varied experiences in accomplishing and learning from the material. Further, all ten participants agreed that the intervention had helped them by widening their vocabulary which led to an easier understanding of the concepts taught.

Keywords: Academic performance, ANOVA, content-specific, pre-test, post-test, vocabulary

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INTRODUCTION

Learners tagged science as a difficult school subject, and sometimes this made them feel indifferent towards the subject. Knowing how crucial science was to students and in the community's life worried the researcher as a science teacher. Science provides ways of systematically making sense of the world around us by developing scientific inquiry skills, specifically objectivity, curiosity, honesty, and critical thinking (University of the Philippines National Institute for Science and Mathematics Education Development (UPNISMED), 2011). For years, teachers have been learning, unlearning, and re-learning different strategies and approaches to make science concepts easy, fun, and meaningful to learners. Despite all the efforts made by the teachers, learning science concepts remains very challenging. In fact, in the Philippines, it is one of those countries noted to have low levels of science literacy for many years (Martin et al., 2004). This pattern was confirmed in the National Achievement Test (NAT) results for the previous years and when the Philippines joined the assessment for Program for International Student Assessment (PISA) 2018, whose results found that Filipino 15-year-olds scored at the bottom of the ranking among 78 countries and territories (Organization for Economic Cooperation and Development (OECD), 2019a, 2019b). Compared to their performance on the Trends in International Mathematics and Science Study (TIMSS), another international test assessment, Filipino students followed the same pattern. Filipino fourth-graders who participated in the TIMSS 2019 cycle also came in last among the 58 participating nations, suggesting that the vast majority of Filipino students" show limited understanding of scientific concepts and knowledge of fundamental scientific facts" (Mullis et al., 2020).

There are a lot of factors that affect the teaching and learning of science concepts in general. One of the reasons pointed include the low academic performance in science due to the language barrier. The language the students are expected to learn in many content areas, such as mathematics and science, can be challenging because most vocabulary terms in these areas are low-frequency, technical words that only appear in content-specific contexts (Hedrick et al., 2008; Taboada and Rutherford, 2001). Science is taught in English which poses a big challenge to our learners since they are learning science in a second language instead of their home language (Van Laere et al., 2014). As Tucker (1999) pointed out, individuals quickly develop cognitive skills and master content material that is taught in a familiar language. It makes sense that in the Philippines, specifically in the researcher's locality, where English is a second language (ESL), learners find it difficult and overwhelming to learn science concepts.

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"Banking the jargon" was conducted to enhance conceptual understanding of Grade 9 section Earth and Space. In this intervention, the learners made a word bank that helped them remember and understand scientific terms and connect with prior knowledge and the new content they learned. A word bank is a list of words created by the teachers or learners that relates to the core content and academic

material the learner is learning. It can be used as a review prior to reading, as an assessment of what the learners are learning in comprehension by having the learners categorize their words, and in writing by having the learners use the words in sentences and paragraphs (Electronic Learning Community (ELC), 2011). In this intervention, a word bank was used to help the learners remember science-specialized vocabulary or jargon by writing its translation in two languages, their mother tongue and Filipino, if available, its definition and example or illustration. Language and vocabulary are crucial to literary and academic success for all learners (Biemiller, 2006; Nagy and Townsend, 2012), and while academic vocabulary is essential for all learners, it is especially essential for the academic success of English Language Learners (Shanahan and Beck, 2006; Snow, 2009). The large amount of complex academic vocabulary associated with science is the cause of significant challenges to the academic learning of science concepts of English Language Learners (Shanahan and Beck, 2006; Snow and Uccelli, 2009). Unsurprisingly, the students at the school, who are also ELLs, feel overwhelmed by the volume of new vocabulary they meet and feel like they are learning a foreign language. More often than not, they laugh at it because they have a hard time pronouncing the words. They can rarely interact throughout the discussion and have trouble understanding what they are reading. Of course, students need help understanding the questions written in English during exams. They expressed surprise when the teachers translated the questions into Filipino or their local dialect during the post-assessment conversation, saying, "Oh!" It means just that. When asked why they performed poorly on the test during the learner-teacher conference that the teacher often holds after each quarter, the learners' most frequent response is that they needed to grasp the terminology and questions presented in English.

For this reason, the teacher-researcher implemented this academic intervention as Keiffer et al. (2009) found in their study that; increasing the academic vocabulary proficiency of ELLs increases their understanding of content concepts. The intervention was crafted after the conduct of the Learner-Teacher Conference after the second quarter assessments. After gathering enough data that supported this intervention, the teacher designed the form used by the learners and eventually sought the permission of the school head by submitting the Action Plan for the intervention.

This intervention was rooted in Dewey's Theory of Constructivism (1963), which states that building on existing information allows us to create new knowledge. If there is a gap between prior knowledge and the new content being learned, an individual cannot make the connections to learn the new content presented. The learners have a gap between their prior academic vocabulary knowledge and the specialized scientific terms or content language, in general, that is taught in school, thus creating a barrier to their learning.

The study assessed the effectiveness of the intervention conducted to improve the conceptual understanding of learners in Grade 9 Science Earth and Space. Specifically, it aimed to determine the level of performance of the experimental and control group in the pre-test, assess if the intervention increased the level of performance of learners, test whether there is a significant difference between the experimental group and control group performances, gather learners' experiences in making the word banks, and determine how does the intervention help the learners in understanding the concepts of Grade 9 Science-Earth and Space.

METHODOLOGY

The study utilized an explanatory mixed-method research design involving different processes, such as collecting, analyzing, and interpreting quantitative and qualitative data in a single study (Creswell and Clark, 2011).

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Participants

The participants of this action research were the 64 regular learners of Grade 9- Humility and Grade 9- Respect at Mati National Comprehensive High School (MNCHS) in the City of Mati, Davao Oriental, Philippines. These two sections have the lowest mean percentage scores in the first and second-quarter assessments in the classes the teacher handled. The experimental group was the 32 regular learners of Grade 9- Humility, while the 32 regular learners of Grade 9- Respect were the control group. From the experimental group, 10 learners were interviewed for the qualitative analysis, (Dukes, 1984; Creswell, 2007). Data gathered from the learners were treated with full confidentiality.

Data Gathering

To get the baseline, both learners from the experimental group and control group took the pre-test before the start of the third quarter modules discussion. Questions in the pre-test were taken from the analyzed test questions of the school in the previous years. Mean percentages of the pre-test were used as the study's baseline and used to answer question number one (1) of this research. After the pre-test, respondents underwent orientation to be guided on the things to be done in the implementation of the intervention. After the orientation, learners in the experimental group underwent the intervention.

Both the experimental group and the control group received the same classroom instruction except for making a word bank which the experimental group only did. The pre-test was identical to the post-test that was given at the end of the third-quarter module discussion. The pre and post-test results were used to measure learners' learning during the unit and to help determine whether the conduct of intervention affected learners' achievement. The Paired Sample T-test was used to determine the significant difference between pre and post-tests for each group to answer question number two (2) of this research. To answer question number three (3), which is to determine the significant difference between the experimental and the control group using the post-tests, a One-Way Analysis of Variance (ANOVA) was used. flowchart below simplifies the whole process of this action research.

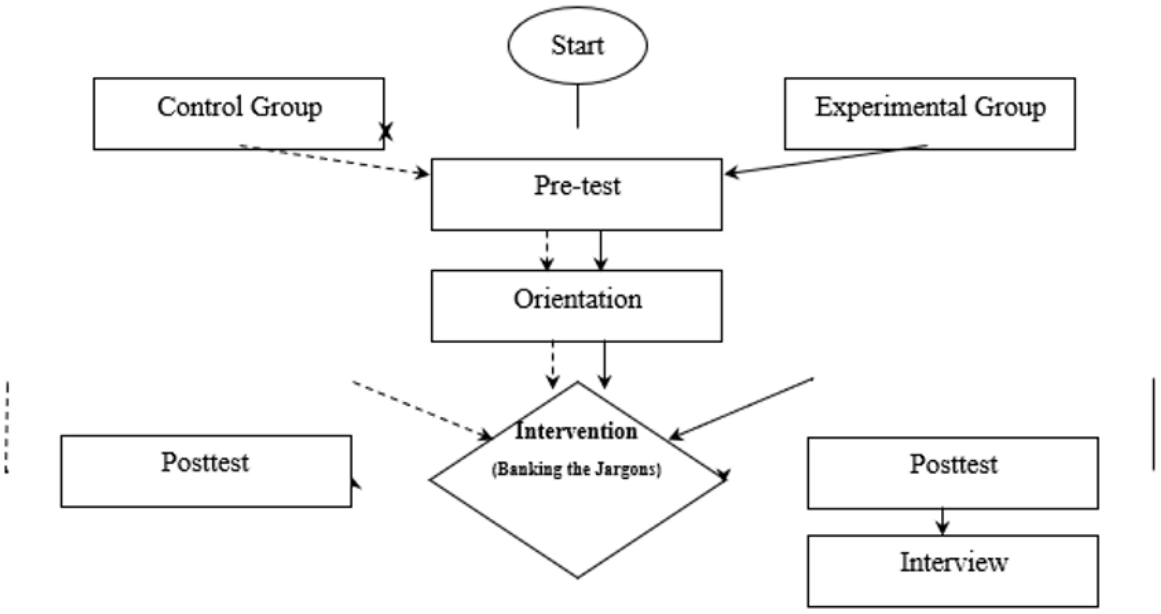
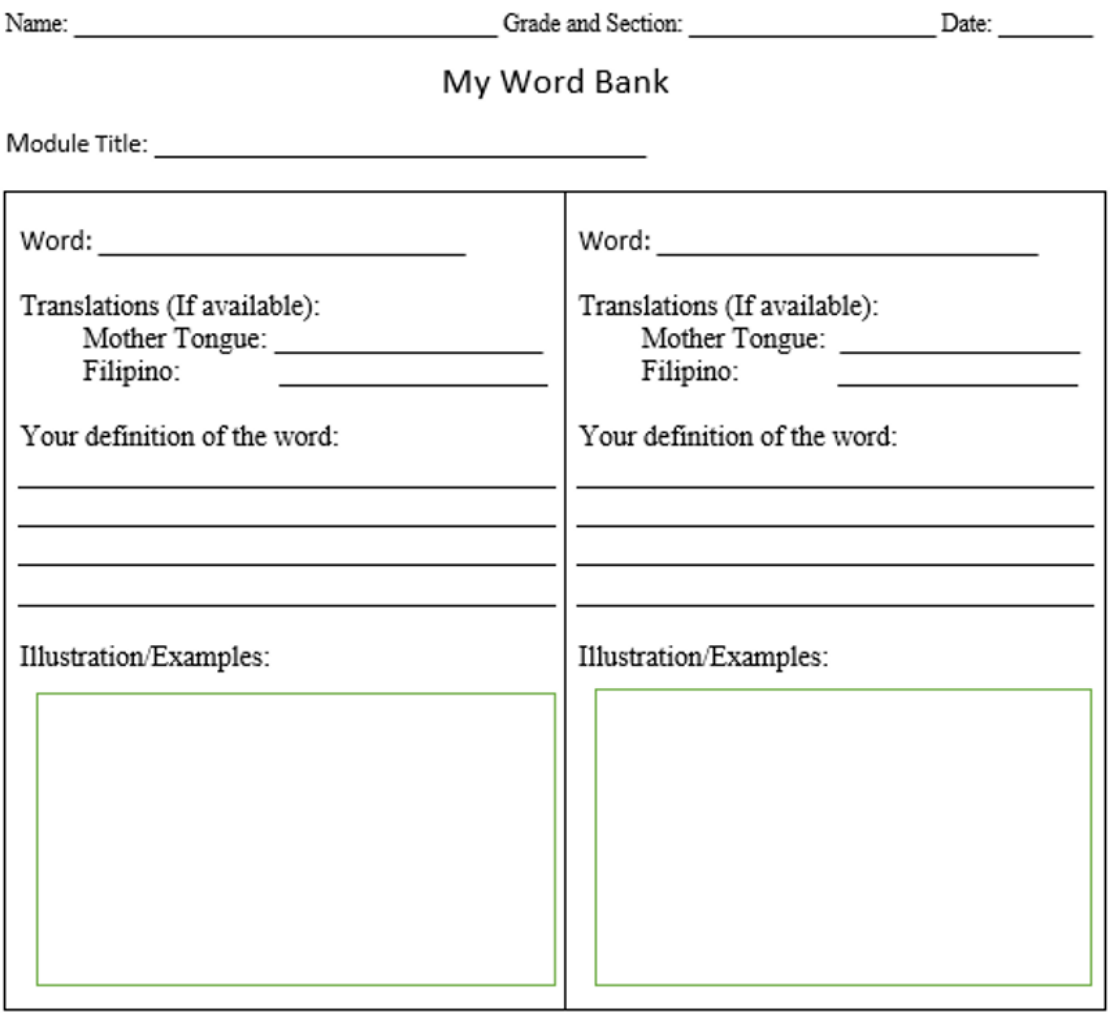


Figure 1. Flow chart of gathering data in the study.

For the qualitative part of the research, questions four (4) and five (5), 10 learners from the experimental group were interviewed. Learners were asked to share their experiences in making word banks to answer question number 4 and asked if word banks have helped them understand the concepts in Grade 9 Science- Earth and Space and in what way they have helped them to answer question number 5. Learners that were interviewed were selected through drawing lots. The responses of the learners were categorized into themes. Data from the learners' feedback helped the researcher determine the learners' experiences in making word banks and how it helped them understand the concepts of Grade 9 Science- Earth and Space. It also acted as a participatory tool in allowing adjustments in the future implementation of this intervention.

Materials

The material used in the intervention is a teacher-designed word bank. It was distributed to the learners where they wrote the "jargon" with its Filipino and mother tongue translation, if available, its definition, and example/or illustration of the word. The form is shown next. During the daily sessions, learners jot down words that are specialized to science or jargon in the form, where they also write the translations in Filipino and their mother tongue if available. Learners also provided examples or illustrations of the jargon. The Word Banks were collected and compiled every week. At first, the learners were guided in filling up the forms, corrections were made if needed, and eventually, full responsibility was given to the learners. The word banks were compiled in a folder that learners could use when they needed it.


Name: _____ Grade and Section: _____ Date: _____

My Word Bank

Module Title: _____

Word: _____	Word: _____
Translations (If available): Mother Tongue: _____ Filipino: _____	Translations (If available): Mother Tongue: _____ Filipino: _____
Your definition of the word: _____ _____ _____ _____	Your definition of the word: _____ _____ _____ _____
Illustration/Examples:	Illustration/Examples:

Figure 2. Word bank format used in the intervention.

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RESULTS AND DISCUSSION

Performance Level of Experimental group and Control Group in Pre-test and Post-test

Table 1 presents the pre-test and post-test results of the two groups in the Grade 9 Science- Earth and Space. The experimental group has a mean of 8.44 in the pre-test, and the control group has a mean of 7.69. The experimental group has a higher mean score than the control group in both the pre-test and post-test. It can also be seen that both the experimental and control group have increased their mean score in the post-test, with a difference of 12.8 in the experimental group and 5.69 in the control group in their pre-test and post-test. The following discussions will explain if the increase in the post-test is significant, especially with the experimental group who underwent the intervention.

Table 1. Pre-test and post-test achievement of learners.

		Pre-test		Post-test	
Groups	**N**	**Mean**	**SD**	**Mean**	**SD**
Control	32	7.69	1.93	13.38	3.41
Experimental	32	8.44	2.53	21.24	3.71

Difference Between Pre-test and Post-Test Scores of Experimental Group

Table 2 presents the significant difference between the pre-test and post-test results of learners who were subjected to the intervention. As can be seen, a *p*-value of 0.00 is less than the level of significance ($\alpha = 0.05$), which indicates that there is a significant difference between the pre-test and post-test results of the experimental group. Further, the mean of the post-test is higher than the pre-test by 12.8. Thus, there is strong evidence that the intervention "Banking the Jargons" improved the performance of the learners. The outcome is in line with Silvan et al. (2019) findings in their study on enhancing Garde 9 High School Students' Performance in Science Through Intervention, which found that carrying out interventions helps students absorb topics more effectively. Additionally, science terms and concepts can be linked to previous knowledge by enhancing science-related jargon and providing vocabulary education (Young, 2015). Word knowledge enables students to understand the concepts described in the text, make connections between the meanings of the passages they are reading, and ascertain the connections between what is being read and heard and what the student already knows. According to Cromley et al. (2016), students with a greater vocabulary knowledge demonstrate greater comprehension of science texts, which results in an understanding of the science ideas taught by the teachers.

Table 2. The results of the paired-sample t-test of the experimental group.

Test	**Count (N)**	**Mean**	**Standard Deviation**	***t*-scores**	***P*-value**
Pre-test	32	8.44	2.53	16.06	0.000
Posttest	32	21.24	3.71		

Difference Between Pre-test and Post-Test Scores of Control Group

Table 3 presents the significant difference between the pre-test and post-test results of learners in the control group. As can be seen, a p-value of 0.00 is less than the significance level (α = 0.05), indicating a significant difference between the pre-test and post-test results of the control group. The outcome demonstrates that even without the intervention, students in the control group could achieve a certain level of academic development and progress toward achievingtheir personal or institutional goals (Kazazoglu, 2013). Other variables may have contributed to this improvement. The economic circumstances in which pupils find themselves are one of thecrucial elements influencing their academic success. Their study and homeworkroutines, time management techniques, physical and mental health, and family relationships (Munoz and Portez 2001).

Table 3. The results of paired-samples t-test of control group.

Test	Count (N)	Mean	Standard Deviation	*t*-scores	*P*-value
Pre-test	32	7.69	1.93	9.54	0.000
Posttest	32	13.38	3.41		

Difference Between Control and Experimental Groups in Post-test

Table 4 shows that there was a significant difference in the post-test scores between the learners in the experimental group and the learners in the control group ($F_{1,61} = 75.01$, $p<.05$). Since the mean score of the experimental group in the post-test (21.24) is higher than the mean score of the control group (13.38), it can be said that the students in the experimental group have performed better in the post-test than the learners in the control group who were not subjected to making word banks. This also implies that the "Intervention" effectively improves learners' conceptual understanding by improving their knowledge and retention of science-specialized vocabulary.

The results of the paired samples t-test in the experimental group indicated that there was a significant increase in the mean scores between the pre-test and post-test. The

Table 4. One-Way ANOVA to compare the post-test scores between the experimental group and the control group.

Source	SS	*df*	MS	F	*P*
Corrected Model	1024.98[a]	2	512.49	40.20	0.000
Intercept	1144.800	1	1144.80	89.79	0.000
Pre-test	8.960	1	8.96	0.70	0.405
Group	956.380	1	956.38	75.01	0.000
Error	777.758	61	12.75		
Total	21089.000	64			
Corrected Total	1802.734	63			

*Significant at 0.05 level

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positive result is further enforced using ANCOVA, which shows that the experimental group has performed better than the control group in the Grade 9 Science Earth and Space post-test. From the presented results, it is worthwhile to assume that the intervention enhanced their scientific vocabulary and helped them understand concepts of the third quarter modules on Earth and Space. Therefore, it can be inferred that the intervention "Banking the Jargon" is very helpful in understanding and remembering scientific terms, leading to understanding the concepts discussed in Grade 9 Science- Earth and Space modules. This finding supports the findings of Marzano and Pickering (2005) that the "strongest action" teachers can take to provide students with the background knowledge necessary to access content taught in school is teaching them content-specific words (i.e., academic vocabulary and the claim of De Guzman (2005) who emphasizes that vocabulary knowledge is a prerequisite and a causative factor in comprehension. Further, the result of this action research confirms the conclusion of Biemiller (2006), Nagy and Townsend (2012) that language and vocabulary are crucial to literacy and academic success for all learners, and the statement of Shanahan and Beck (2006) and Snow (2009) that while academic vocabulary is crucial for all learners, it is especially crucial for the academic success of English Language Learner students.

The positive results presented earlier were astounding, however, the quantitative nature of the study is limited only to knowing the significant effect of the intervention. It does not reveal the learners' experiences, which are necessary for building meaningful lifelong learning. In order to better comprehend and examine the significant experiences of the learners, which are essential to the success of the conducted intervention, I have therefore chosen to pursue the qualitative aspect of this research. Ten (10) students were asked to respond to questions about their experiences in creating the word bank and whether and how it helped them comprehend the ideas in grade 9 science—Earth and Space—in order to achieve this goal. The next table shows the themes for the first question: What are your experiences in making word banks?

Table 5. Emergent themes based on the analysis of responses in Question 4. What are your experiences in making the word banks?

Themes	Sample response of respondent SE18	Translated response
Accomplishing the word bank	"Hassle siya usahay pero lingaw. Hassle kay usahay lisod mangita ug translation sa mga words unya daghan pa me usahay buhatonon sa ubang subjects, pero lingaw siya kay magtinabangay man me sa akong mga classmates sa pag answer."	Accomplishing the word bank sometimes is a hassle because it is difficult to find the meaning and translations of the jargon, especially when we have a lot of things to accomplish with the other subjects, but it is fun because we work with our classmates in answering it.
Learning from the material	"Daghan ko'g natuna-an na mga bag-ong words ug dali na lang nako masabtan ug mahinumduman ang mga words labi na ug ma translate sa bisaya u tagalog. Dali nlang pud ko makasabot sa discussion sa klase pag gamiton tong mga words na naa sa word bank."	I have learned a lot of new words, and I can easily understand and remember the words, especially if they are translated into mother tongue or in Filipino. It is also easier for me to understand the discussion especially if it involves words that are found in the word banks.

Personal view about the material	"Ganahan ko ani na activity kay makatabang siya sa akoa maski usahay maglisod ko gamay." "Lingaw siya himoon, ganahan ko kay mag drawing drawing tapos mag komparahay me sa among drawing tapos magkinataw-anay me, pero ang nindot kay magtinabangay man me sa akong mga classmates mao na lingaw kaayo."	I like the activity (material) because it helped a lot even if sometimes, I am having slight difficulty in accomplishing it. It is fun to accomplish. I like it because I got to draw, and we compare our work and laugh at it. Moreover, what is good about it is that we work together and have fun together.

Based on table 5, using the word bank provided the participants with different learning experiences. These learning experiences were expected because this intervention was designed to help learners understand and remember scientific terms that will eventually help them understand the concepts of Grade 9 Science-Earth and Space. It is important to note that these learning experiences have helped the learners to enhance their conceptual understanding and mastery of the concepts discussed, as revealed in the result of the study that there is a significant difference between the pre-test and post-test results. Hence, the intervention, "Banking the Jargons" has served its purpose. By knowing that the learners have positive views about the material was also overwhelming. The material was useful and enjoyed by the students as they review the terms in it together with their classmates. That positive feeling can also be a factor in its

Table 6. Emergent themes based on the analysis of responses in Question 5. How does the intervention, "Banking the Jargon" help learners in uderstanding the concepts of Grade 9 Science-Earth and Space.

Themes	Sample response of respondent SCE 10	Translated response
Widens one's vocabulary and corrects misconceptions	"Opo nakatabang kaayo ang word bank sa ako kay mas daghan na ko nasabtan na scientific terms unya mas dali nako mahinumduman ang mga words ky na translate man sa bisaya o tagalog unya naa pa jud mga examples. Mas nakasabot nako sa meaning sa mga words sa science kay usahay lahi man gud iyang meaning sa uban na subject kintahay sa English mao na usahay makalibog"	Yes, it is helpful. Using word banks, I have learned a lot of scientific terms and it is easier for me to understand and remember the words because it is translated to mother tongue or in Filipino and examples are given. I can now distinguish the scientific meaning of the word from its layman's meaning and its uses in other subjects such as in English.
Improves learning	"O, nkatabang jud siya kay mas dali na nako masabtan ang ipang discuss nimo mam sa klase nato sa science ky nakasabot nman ko sa mga words. So dali rako kasabot sa atong lesson. Usahay pud pagmalibog ko motan-aw ko sa iyang meaning sa word bank. Pag-abot sa test maka-answer me kay mahinunduman man namo ang mga words unya mas nakasabot me sa questions.	Yes, it is helpful. It is easier for me to understand the discussion in science because I already understand the words (scientific terms). And at times when I get confused, I simply look into the word bank to see the meaning of the words used. During examinations it helped me to answer the questions because I remembered the words and it helped me to understand the questions.

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success as noted by Hagenauer and Hascher (2014) that positive emotions, including enjoyment, led to higher student achievement. Therefore, since the learners enjoyed what they were doing, they easily accomplished their tasks in a fun and enjoyable way.

After knowing their experiences, participants were asked the second question: "Have word banks helped you in understanding the concepts in Grade 9 Science- Earth and Space? If yes, how?" to deepen the discussion. This question was asked to determine if the learners perceived the material (word bank) as helpful or useful to them. The response of the learners was overwhelming, it was a unanimous "YES" and when asked how, their answers were analyzed thematically which is presented in table 6.

Based on Table 6, it can be inferred that the intervention, "Banking the Jargons" has helped the learners in the experimental group in understanding the concepts of Grade 9 Science-Earth and Space by widening their scientific vocabularies and making it more meaningful to them by translating it to their own language. This finding supports the idea of Keiffer et al. (2009) that increasing the academic vocabulary proficiency of English-language learners (ELL) increases their understanding of content concepts and the idea of Tucker (1999) that individuals easily develop cognitive skills and master content material that is taught in a familiar language.

CONCLUSION

In the light of the findings of the study, it is concluded that the intervention, "Banking the Jargon", is effective in enhancing the conceptual understanding of Grade 9 Science-Earth and Space. Both the quantitative and qualitative findings can strongly support the conclusion. Thus, teachers having trouble with the language barrier in teaching science concepts and letting the learners master the concepts taught, can make use of word banks as an intervention. This study bridges the gap among learners in the teaching-learning process.

However, when employing this intervention, the teacher must be available to guide the students, especially at the start, and gradually release the full responsibility to them when they have fully understood the process. It must also be strategized so that the learners will not feel it is an additional burden for them. Teachers must be creative and sensitive to the needs of the learners in employing this intervention. Doing so will make the activity enjoyable and beneficial for the learners. If done with great consideration, this intervention will help bridge the gap and improve the learners' understanding and mastery of science concepts.

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