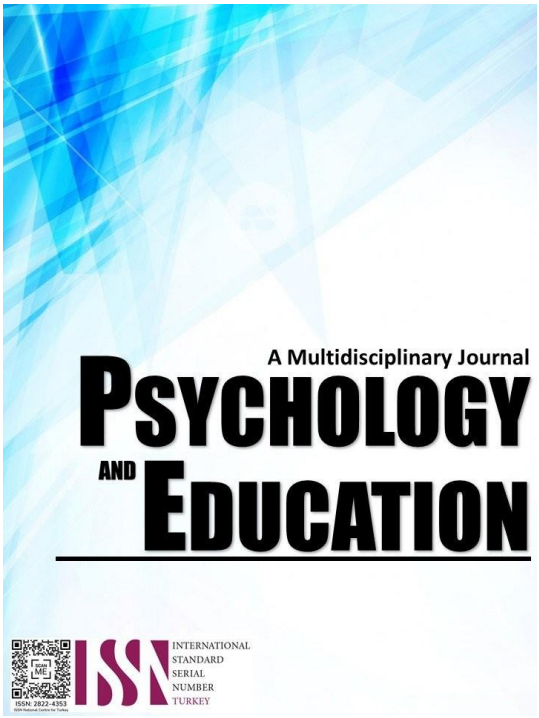
EFFECTIVENESS OF DEVELOPED INTERACTIVE eBOOKS IN ENHANCING THE LEARNERS' READING COMPREHENSION IN SCIENCE



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Research Article

Effectiveness of Developed Interactive eBooks in Enhancing the Learners' Reading Comprehension in Science

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Abstract

The study aimed to determine the effectiveness of interactive eBooks in enhancing reading comprehension in science among grade 6 learners. The study utilized a quasi-experimental design with a pretest-posttest group. The sample consisted of 56 grade 6 learners randomly assigned to the experimental (eBook) and control (Modular) groups. The experimental group received instruction on interactive eBooks, while the control group received instruction using science learning modules. Both groups were pretested and post-tested using a researcher-made test. The data were analyzed using descriptive and inferential statistics. The results of the study revealed that the (eBook Group) has higher posttest scores where 5 or 17.9% of the respondents scored excellent, 17 or 60.7% scored above average, and 0 or none of the respondents scored poorly during the posttest compared to the Modular Group were 12 or 42.9% of the respondents scored in average level and 5 or 17.8% of the respondents scored above average. These indicate that the use of interactive eBooks in science lessons positively affected the reading comprehension of grade 6 learners. The results also showed a significant difference in the post-test scores between the two groups, with the eBook group having higher scores. This study's findings suggest that using interactive eBooks in teaching science lessons is an effective way to enhance the reading comprehension of grade 6 learners. The use of interactive eBooks can be a valuable tool for teachers in designing and delivering engaging and practical science lessons.

Keywords: *interactive learning, technology-based instruction, developed interactive e-book, reading comprehension*

Introduction

The pandemic has had an impact on the Philippine educational system, particularly learners' reading comprehension abilities and the gradual increase of face-to-face instruction after the pandemic showed a depressing truth. Many learners have struggled to acquire fundamental abilities and skills including writing, reading, and simple arithmetic operations.

The Department of Education has taken a proactive approach in addressing the issue of reading comprehension among learners in the Philippines after the pandemic. By providing various learning materials, online programs, teacher training, and reading assessments. However, such initiatives were not enough based on the recent results of national assessments for student learning (DepEd Order 173, s. 2021). The overall results of the national assessments revealed the following results, there were many early grade learners struggling to meet the learning standards in early language literacy and numeracy and the low achievement levels in English, Math and Science appeared to be caused by gaps in learners' reading comprehension. This means that there were many low performing learners who could not comprehend (read and understand) Math and Science word problems that were written in English. Hence, they were unable to demonstrate their knowledge in these content areas.

In order to address the aforementioned gaps, there was a need to strengthen the reading and comprehension proficiency of every learner and to nurture a culture of reading which a requisite skill in all content areas. Here in Region X, the Regional office has developed the learning recovery plan dubbed as Rx ADOBE: Road to Learning Recovery which addressed two critical goals to effectively execute remedial measures and build the learners resilience for the future and to identify learning gaps and learning needs. The Regional Office also maintained to implement in the entire region their flagship program, the Project CNR (Care for NorMin Readers) which envisioned to lessen if not totally take out from the scene, the frustration readers who were found in all grade levels. But sad to say the closures of schools during pandemic caused disruptions to the program and projects of the DepEd resulting to learning losses and gaps to the school children and these relative losses were severe to the point that the reading and comprehension proficiency of the learners were affected.

In Ubaldo D. Laya Memorial Central School, there was an increased on the number of Non-Readers and Struggling Readers and an increased on the numbers of readers who were Frustration based on their Reading Comprehension for school year 2022-2023. On Grade six level alone, the number of struggling readers was 41 out of 128 learners or 32% of the total population of the grade six learners. And during the 1st quarter examination for this school year, the Science subject was one of the subjects that has a lower Mean Percentage Score (MPS) level.

It was for these reasons that the researcher developed an interactive eBooks as learning materials and as an aide to enhance and remediate the reading comprehension in science of the Grade Six learners in Ubaldo D. Laya Memorial Central School and the goal of this research was to determine whether or not the developed eBooks were effective in accomplishing literacy goals in science that include different learning activities and reading comprehensions as well as investigating their effectiveness in stimulating student motivation to read.

In DepEd Order No. 42, s. 2016, entitled "Policy Guidelines on Daily Lesson Preparation for the K to 12 Basic Education Program," included provisions on the use of varied learning materials and teaching techniques in the classroom. Specifically, the order mandated that teachers should use a variety of learning resources, such as textbooks, supplementary materials, technology-based resources, and other educational resources that were appropriate for the learners' needs and learning styles. It also encouraged the use of different teaching strategies and techniques, such as inquiry-based learning, cooperative learning, problem-based learning, and differentiated instruction.

Moreover, DepEd Order No. 42, s. 2017, entitled "Policy Guidelines on the Implementation of Multi-Factored Assessment Tool," emphasized the use of varied assessment tools and techniques to ensure that student learning was assessed holistically. The order encouraged the use of formative assessments, performance tasks, and other authentic assessments that went beyond traditional paper-and-pencil tests.

Overall, these orders reflect the importance of using varied learning materials and teaching techniques in the classroom to ensure that students' diverse learning needs and styles were addressed and that they were able to achieve their full potential.

Since developing technology skills was so important, educators must learn how to take advantage of the options offered by technology-based learning materials such as eBooks (Wright et al., 2018). Research suggested the incorporation of online eBooks can support those struggling with difficulty in reading (Ciampa, 2016) by improving the reading comprehension of struggling readers. Because children today were tuned into the electronic world, transitioning from paper-based reading to eBooks may stimulate an interest in reading that promotes literacy activities, and, consequently, eBook reading could be an effective way to improve children's literacy skills (Wright, et al., 2018).

Research Questions

This study aimed to assess the effectiveness of the Interactive E-book: An Interactive Reading Materials to enhance the comprehension level in science to the select Grade 6 learners of Ubaldo D. Laya Memorial Central School, SY 2022-2023. Specifically, this study sought to answer the following questions.

1. What are the pretest scores of the learners in the Modular Group and the eBook group?
2. What are the posttest scores of the learners in the Modular Group and the eBook group?
3. Is there a significant difference between the pretest scores of the learners in the Modular Group and the eBook Group?
4. Is there a significant difference between the posttest scores of the learners in the Modular Group and the E-Book Group?
5. What seminar-workshop can be designed based on the findings of the study?

Methodology

This section presents the research methods used in this study. It also discusses the research design, research environment, respondents, sampling procedures, research instruments and their validity, data gathering procedures, and statistical treatment of the data.

Research Design

The research design used in this study was the quasi-experimental method. The respondents were given a pretest to measure their prior knowledge and to establish equality between groups. Then the researcher conducted the lesson using the Modular Approach of teaching and the used of eBook in teaching science concepts. After the implementation, posttest was given to the respondents to measure the effectiveness of the developed interactive eBook.

The respondents of this study were the 56 Grade six learners of Ubaldo D. Laya Memorial Central School which were composed of two sections in grade six, Section Rizal and Del Pilar, the learners of these sections were arranged heterogeneously. The Modular Group was composed of 28 learners from Grade VI Del Pilar and the eBook Group was also composed of 28 learners from Grade VI Rizal.

Participants

The respondents of this study were the 56 Grade six learners of Ubaldo D. Laya Memorial Central School which were composed of two sections in grade six, Section Rizal and Del Pilar. The researcher used cluster sampling in determining the sections, the Modular Group was composed of 28 learners from Grade VI Del Pilar and the eBook Group was also composed of 28 learners from Grade VI Rizal.

Pre-Test was administered to both groups in order to measure their prior knowledge about the characteristics and classification of vertebrates and invertebrates. The identification of the Modular Group and the eBook Group was done through drew lots. The name of the section that was drawn out first was the eBook Group and the other one was the Modular Group. The eBook Group was section Rizal and the Modular Group was section Del Pilar.

Table 1. *UDLMCS Grade VI Respondents*

Grade 6 Enrollees			
Name of Sections	*Male*	*Female*	*Total*
Grade VI-Rizal	18	10	28
Grade VI-Del Pilar	17	11	28
Total	35	21	56

Instruments

There were two sets of researcher-made questionnaires used in this study, the pretest and posttest questionnaires based on a Table of Specification corresponding to the objectives from the DepEd K-12 Science Curriculum Guide for Teachers. An item analysis was done to check the reliability of the questionnaires. After the implementation, a researcher-made posttest questionnaire was used to measure the comprehension of the respondents to the science concepts being introduced with the used of the modular approach and interactive eBook. In the posttest, the questions from the pretest were shuffled to create a variation from the pretest questionnaire.

• Development of the Lesson Plans

There were two (2) sets of lesson plans (Appendix D) in the conduct of the study. The contents of the lesson plans were taken from DepEd K-12 Curriculum Guide for Teachers Science VI and from the DepEd Learning Modules-2nd Quarter Science Week 5 & 6. The objectives were the same but only differ on the presentation and discussion of abstract ideas.

• Preparation of the TOS

After making the lesson plans, the researcher prepared a 40-item teacher-made achievement test. The test questions were based from the DepEd K-12 Curriculum Guide for Teachers Science VI and from the DepEd Learning Modules-2nd Quarter Science Week 5 & 6.

• Development of the Pretest and Posttest

The researcher prepared a 40-item test and conducted a pilot testing to thirty-eight (38) learners who were learners of Grade VI-Bonifacio to validate the questionnaires. The result in Appendix J showed the item analysis for the 40 self-constructed items and their corresponding discrimination and difficulty index.

• Item Analysis

An item analysis was prepared after the conduct of the pilot testing to validate the teacher-made test. The result in Appendix J showed the item analysis for the 40-item teacher-constructed items and their corresponding discrimination and difficulty index.

The discrimination index measured how good or not good the test item when the respondents were grouped into two groups. Results displays that some of the constructed items have at least fair remarks which signified that those items were correctly discriminated between the upper level and lower-level group of learners in the test. Items with poor remarks were modified/revised or deleted.

• Panel of Experts

To standardized the developed Interactive eBook, it went through an evaluation by a panel of experts: eighteen (18) science teachers of Ubaldo D. Laya Memorial Central School. Each of the eighteen experts was provided with a rubric (Appendix K) containing criterion indicators written as declarative statements about the developed Interactive eBook's content validity, aesthetics quality, readability, and suitability in the classroom.

The researcher used qualitative analysis in the process of evaluating the developed interactive eBooks. The panel of experts evaluated the developed interactive eBooks using an adapted and revised rubric based on its content validity, aesthetics quality, readability, and suitability in the classroom. Each response will be assigned as follows:

4 = excellent 3 = very satisfactory

2 = satisfactory 1 = needs improvement

The panel of experts provided answers to the following open-ended questions to the rubric.

1. What can you say about the use of interactive eBook in teaching the Characteristics and Classification of Vertebrates and Invertebrates in Science?
2. Did you understand the concept presented? Why? Why not?
3. Which do you like better in presenting the lessons– through the use of printed modules or through the use of "Interactive eBooks? Why?
4. Did the developed interactive eBook help you appreciate science? Why?
5. Did the developed interactive eBook enhance your learning in science? How?

Recommendations:

1. Accepted as:
2. For revision/improvement:

To understand the overall rating, the following distributions of scores, with the corresponding descriptions, were used:

1.51	- 4.00	Excellent
2.51	– 3.50	Very Good
1.51	- 2.50	Good
1,00	- 1.50	Needs Improvement

Qualitative comments and suggestions from the experts (Appendix L) were taken into the account for the revision of some errors and corrections. After the face validation, the corrected Interactive eBook was used to the ebook group for the presentation and discussion of the lesson.

Procedure

The following were the steps which were carried out upon gathering the pertinent data of the study:

The researcher sent out letters to the Schools Division Superintendent (SDS) of Iligan City to conduct the research after the recommendation of the Dean of the Graduate School, St. Peter's College, Iligan City. After the approval by the SDS, the letter was forwarded to the school principal of Ubaldo D. Laya Memorial Central School.

When the permission was secured, the researcher gathered the prior knowledge of the learners about the subject matter by administering the pretest. The pretest was administered to both groups of learners. The pretest was given to the respondents a week before the conduct of the study. The researcher administered the pretest to measure the prior knowledge of the respondents about the topic. Confidentially of their identity and answers were secured observing the Ethics of Research.

Then, the researcher produced copies of the DepEd Learning Modules in Science VI-2nd Quarter, Week 5 and 6 and gave those copies to the learners of Grade VI-Del Pilar (Modular Group). The learning modules contain science concepts and activities about the characteristics and classification of vertebrates and invertebrates. Module 5, which is about the characteristics and classification of vertebrates while Module 6, which is about the characteristics and classification of invertebrates.

After the face validation of the panel of experts, the corrected Interactive eBook was used to the eBook Group for the presentation of the lesson. The learners accessed the Interactive eBook offline using their cellphones by installing the Kotobee Reader to their mobile phones. The researcher also displayed the Interactive eBook to the television inside the classroom using laptop connected with HDMI to the television for the whole class to see. The learners individually answered the interactive activities inside the eBook.

After one (1) week of the implementation of the developed Interactive eBook, a posttest was given to measure the academic performance in science of the eBook Group. Confidentiality or their identity and answers was assured observing the Ethics of Research. After the implementation, the researcher conducted a posttest to the respondents using the same comprehensive questions but were shuffled to measure if the interactive eBook was effective in enhancing the comprehension level of the respondents in science. The pretest and posttest scores were recorded, tallied, and consolidated the correct responses for each correct item. Then the researcher analyzed the data and interpreted on the research study.

The researcher used the Learning and Recovery Continuity Plan (LRCP) time in conducting the study. The school allotted 80 minutes each day to conduct the LRCP, 40 minutes in the morning and 40 minutes in the afternoon. The researcher utilized the LRCP time in conducting the study. The researcher devoted a week in each section, the study was implemented to the respondents in 2 weeks during the 2nd quarter.

Statistical Treatment

The analysis of the sample data involved employing several statistical tools: firstly, frequency and percentage were utilized to elucidate the distribution of pretest and posttest scores among the respondents, providing a comprehensive overview of performance trends. Secondly, the Mann-Whitney U Test was applied to ascertain the paired differences between pretest and posttest scores, offering deeper insights into the variations and potential impacts of the intervention or treatment on the respondents' outcomes.

Results and Discussion

This section focuses on the presentation, analysis, and interpretation of data. It presents the data gathered, the results of the statistical analysis done, and the interpretation of findings. These are presented in tables following the sequence of the specific research problem regarding the effectiveness of the interactive eBook in enhancing the comprehension of Grade 6 learners in science.

Problem 1: What are the pretest scores of the learners in the Modular Group and the eBook group?

Table 2. *Pretest Scores of the Modular Group*

Score Range	*Frequency Count*	*Percentage (%)*	*Description*
1 – 8	6	21.4	Poor
9 – 16	21	75.0	Below Average
17 – 24	1	3.6	Average
25 – 32	0	0	Above Average
33 - 40	0	0	Excellent
Total	28	100.0	

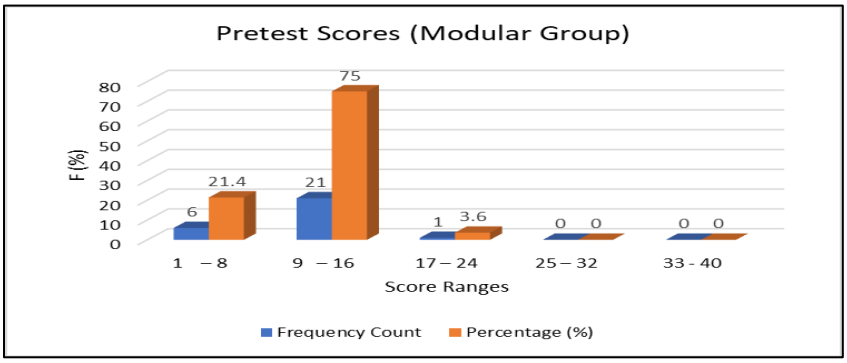

Figure 1. *Pretest Scores of the Modular Group*

Table 2 (figure 1) presents the pretest scores of the Modular Group. As shown in the table, most of the respondents in the Modular Group got scored below average during the pretest.

There were 21 or 75% of the respondents from the Modular Group who have pretest scores ranges from 9-16 which were in the below average scores and 0 or none in the Modular Group got an excellent score. These results implied that the respondents have poor performance prior to the implementation of Modular Approach and using interactive eBook in teaching science concepts.

Mayer (2019) discusses the importance of prior knowledge in learning in his book "Learning and Instruction: Theory into Practice". Mayer emphasizes the importance of prior knowledge in the learning process. According to Mayer, prior knowledge plays a crucial role in helping learners make sense of new information and in facilitating the acquisition of new knowledge. He argues that educators need to take into account learners' prior knowledge and build upon it in order to effectively teach new concepts and skills.

Research done by Bransford, Brown, and Cocking (2000) shown that learners' prior knowledge can significantly affect their learning outcomes. Learners who have more extensive prior knowledge on a particular topic tend to learn new information more easily and effectively than those who have limited prior knowledge. This is because learners with more extensive prior knowledge are better able to connect new information to what they already know, which helps them to understand and remember new information more effectively.

Therefore, educators need to take into account learners' prior knowledge when designing instruction. They need to build on learners' prior knowledge and help them to connect new information to what they already know to enhance their understanding to the new lesson or concepts being presented, to transfer what they have learned to new situations, to improve classroom performance, to achieve effective learning.

Table 3. *Pretest Scores of the eBook Group*

Score Range	*Frequency Count*	*Percentage (%)*	*Description*
1 – 8	0	0	Poor
9 – 16	16	57.1	Below Average
17 – 24	12	42.9	Average
25 – 32	0	0	Above Average
33 - 40	0	0	Excellent
Total	28	100.0	

Table 3 (figure 2) displays the pretest scores of the eBook group. As shown in the table, the respondents in the eBook Group got scored between below average and average during the pretest. There were 16 or 57.1% of the respondents from the eBook Group who have pretest scores ranges from 9-16 which were in the below average scores and 12 or 42.9% who have pretest scores ranges from 17-24 which were in the average score level. These results implied that the respondents in the eBook group have a little background knowledge or ideas about the topic compared to the modular group. Majority of the respondents in the Modular Group scored below average because they do not have a concrete idea or prior knowledge about the Characteristics and Classification of Vertebrates and Invertebrates compared to the respondents in the eBook Group.

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Research Article

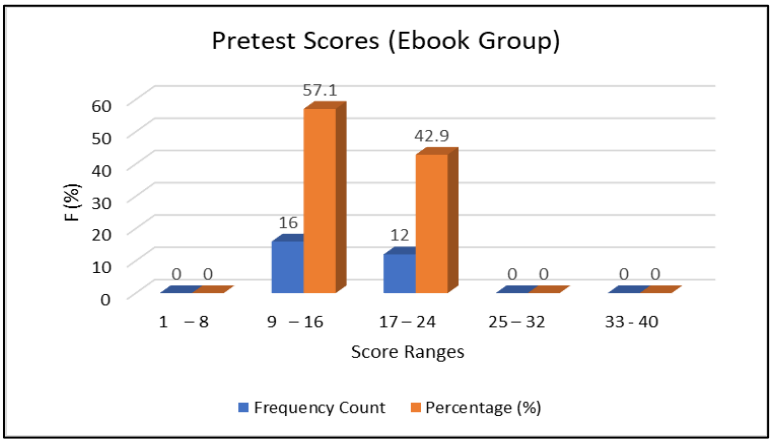

Figure 2. *Pretest Scores of the eBook Group*

Schema Theory, developed by Anderson (2019), expands the meaning of schema to include the importance of general knowledge and concept understanding in reading comprehension, specifying that most reading difficulties can be traced to insufficient prior. When readers' schemata do not provide sufficient understanding of the incoming text, problems comprehending the text exist (Rumelhart, 1982). According to schema theory, a reader's prior knowledge, experiences, concepts, and vocabulary significantly influence reading comprehension (Little & Box, 2018).

In the context of learning science, schema theory suggests that learners bring pre-existing knowledge and experiences to the learning process, and that this prior knowledge shapes how they perceive and interpret new scientific concepts. When learners encounter new scientific information, they try to integrate it into their existing schemas, and may modify their schemas if the new information conflicts with their prior knowledge. (Little & Box, 2018)

Also, in the study "Seeing deep structure from the interactions of surface features" by Chi and VanLehn (2017) looked at how learners use their past knowledge to spot deep structures in new information. For learners to successfully grasp new concepts, prior knowledge was essential. When learners have prior knowledge, they may draw connections between it and new knowledge, understand new ideas, and combine new knowledge with what they already know.

According to research, learners who have greater background in a given field are better able to comprehend and retain new material in that field. Additionally, prior knowledge enables learners to recognize the key components of new ideas and to distinguish them from supporting details. The fundamental structures that underlie a given concept are more likely to be the attention of learners with greater prior knowledge than its outward manifestations.

Moreover, prior knowledge can also help learners to anticipate and predict new information, which could aid in comprehension and retention. When learners have a strong understanding of a particular topic, they can anticipate what would come next and were more likely to remember it. Therefore, building on learners' prior knowledge and helping them connect new information to what they already know is essential for effective learning and is a key component of good teaching practice of a teacher that would contribute to teachers' performance, improve learners' performance as well as the performance of the school.

Problem 2: What are the posttest scores of the learners in the Modular Group and the eBook group?

Table 4. *Posttest Scores of the Modular Group*

Score Range	*Frequency Count*	*Percentage (%)*	*Description*
1 – 8	0	0	Poor
9 – 16	11	39.3	Below Average
17 – 24	12	42.9	Average
25 – 32	5	17.8	Above Average
33 - 40	0	0	Excellent
Total	28	100.0	

Table 4 (figure 3) displays the posttest scores of the Modular Group. As shown in the table, there were 12 or 42.9% of the respondents scored in average level and 5 or 17.8% of the respondents scored above average. Results displayed that there were increased in the posttest scores of the respondents compared to their pretest scores which manifested that those respondents performed average during the posttest. The respondents in the Modular Group performed average during the posttest because the respondents now have the acquired ideas and concepts on the topic based on their readings of the modules.

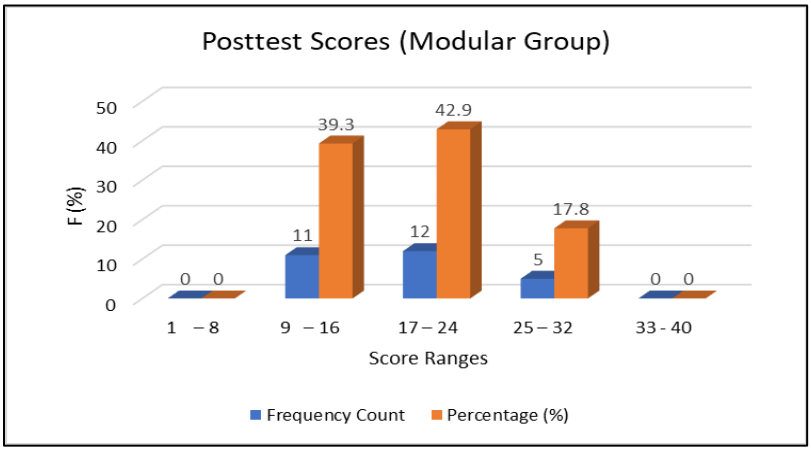

Figure 3. *Posttest Scores of the Modular Group*

In the article "Modularizing instruction for student-centered learning.", Lockwood (2017) discussed the benefits of modular instruction for promoting student-centered learning, including increased flexibility and personalized learning. The modular approach involved breaking down the course material into smaller, more manageable units, each with its own set of learning objectives and assessments. Numerous advantages of this strategy included increased adaptability, improved assessment, and enhanced retention for both teachers and students.

Lockwood emphasized that one of the primary advantages of the modular approach was its flexibility. By dividing course content into smaller units, learners can progress at their own pace and focus on specific topics that interest them, this flexibility accommodates individual learning styles. The modular approach also offers improved assessment. By assessing learners at the end of each module, educators can provide immediate feedback on their progress and help them identify areas where they need additional support or guidance.

The modular strategy offers numerous advantages, but it also has certain drawbacks. The narrow concentration on particular themes, which might not give learners a comprehensive comprehension of the subject matter, was one potential drawback. The modular method may also restrict student-teacher or peer connection, which could lead to a decrease in engagement and teamwork.

Table 5. *Posttest Scores of the eBook Group*

Score Range	*Frequency Count*	*Percentage (%)*	*Description*
1 – 8	0	0	Poor
9 – 16	0	0	Below Average
17 – 24	6	21.4	Average
25 – 32	17	60.7	Above Average
33 - 40	5	17.9	Excellent
Total	28	100.0	

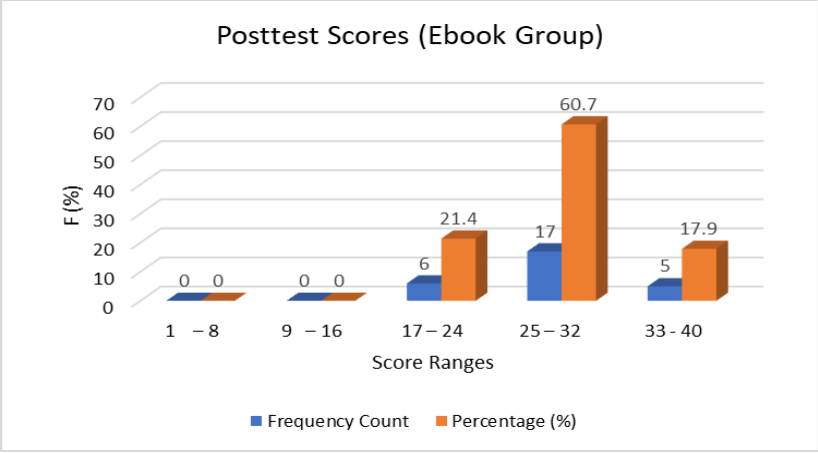

Figure 4. *Posttest Scores of the eBook Group*

Table 5 (figure 4) displays the posttest scores of the eBook group. As shown in the table, there were 5 or 17.9% of the respondents

scored excellent, 17 or 60.7% of the respondents scored above average and 0 or none of the respondents scored poor during the posttest. Results displayed that there were great increased in the posttest scores of the respondents compared to their pretest scores which manifested in the scores of the majority of the respondents who got above average during the posttest.

The respondents in the eBook group performed above average after the implementation of the interactive eBook because the respondents have already a concrete concepts and ideas about the topics through the help of the various activities they performed while using the interactive eBook.

Vygotsky emphasized in his Cognitive load theory that the amount of mental effort, or cognitive load, required to process information during learning was a key factor in determining the effectiveness of learning. Through the use of interactive eBook, the respondents in this study become active participants, not passive, in the learning process. The eBook provided the learners to be autonomous in their literacy learning. Through their interactions with symbols and their meaning and various learning activities learners developed their own strategies to increase their knowledge. Thus, when learners solved problems on the learning activities in the eBook, their motivation increased.

Problem 3: Is there a significant difference on the pretest scores of the learners between the Modular Group and the eBook Group?

Table 6 presents the difference between the pretest scores of the Modular Group and eBook Group. The data revealed that the pretest scores of eBook group had a significant difference between the pretest scores of the modular group. Thus, the null hypothesis, which states that there is no significant difference between the pretest scores of the modular group and eBook group, was rejected.

Table 6. *Difference' Pretest Scores of the Modular and E-Book Groups*

		Statistic	*p*	*Mean Difference*	*Effect Size*
Pretest (E-Book)	Pretest (Modular)	155	<0.001	-5.00	0.606

*Note: 1 – Mann-Whitney U Test ** - p < 0.01 *** - p < 0.001 ns – p > 0.05 * - p < 0.05*

According to research conducted by Hsieh and Cho (2017), eBooks can significantly improve students' academic performance and engagement compared to traditional textbooks. The study found that students who used eBook had higher test scores and were more engaged in their learning than those who used traditional textbooks. eBooks were found to be particularly effective in teaching complex concepts, as they provided interactive and multimedia content that helped students better understand the material.

Another study conducted by Zohoorian and Nourizadeh (2018) found that eBooks can increase students' motivation and interest in learning. The study found that students who used eBooks were more likely to be interested in the subject matter and were more motivated to learn compared to those who used traditional textbooks. eBooks were also found to be more effective in promoting self-directed learning, as students had access to interactive features such as quizzes and self-assessment tools.

Furthermore, a study by Lin and Lin (2017) found that eBooks can improve students' reading comprehension and information retention. The study found that students who used eBooks had better reading comprehension and retention rates compared to those who used traditional textbooks. eBooks were found to be particularly effective in providing visual aids and multimedia content that helped students better understand and remember the material.

Problem 4: Is there a significant difference on the posttest scores of the learners between the Modular Group and the eBook Group?

Table 7. *Difference' Posttest Scores of the Modular and eBook Groups*

		Statistic	*p*	*Mean Difference*	*Effect Size*
Posttest (Ebook)	Posttest (Modular)	54.0	<0.001	-11.0	0.862

*Note: 1 – Mann-Whitney U Test ** - p < 0.01 *** - p < 0.001 ns – p > 0.05 * - p < 0.05*

Table 7 presents the difference between the posttest scores of the modular group and eBook group. The data revealed that the posttest scores of eBook group had a significant difference between the posttest scores of the modular group. Thus, the null hypothesis, which stated that there was no significant difference between the posttest scores of the modular group and eBook group, was rejected.

According to Ramey (2017), the effective use of technology in teaching has changed the classroom, and it has created more educational options. Both the teacher and the leaner have benefited from this type of teaching strategy. The teachers have learned how to integrate educational technology into their classrooms, and it motivated the learners to learn more.

Short (2020) also stated that the youth of today were surrounded by computers, the Internet, mobile devices and other tech products, which could capture their attention. This indicates that learners that live in the 21st century were attracted more to technology. By using this eBook strategy, the learners would be able to improve their reading comprehension as it could be done with teacher guiding the learners in reading.

Martinez-Estrada and Conaway (2017) piloted an eBook project for one semester at the Tecnologio de Monterrey, a university with an enrollment of over 90,000 students on 33 campuses. Each student and professor were given a Kindle eBook to use during the spring semester of 2017. At the end of the semester, all participants were given a survey regarding the eBook project. Eighty-eight percent of the professors indicated that they believed that the eBook positively influenced the teaching and learning process. Sixty-six percent of students indicated that the eBook had a positive impact on the classroom experience. Eighty-five percent of the students indicated that they read more with the eBook than without the eBook (Martinez-Estrada & Conaway, 2017). Overall, Martinez-Estrada (2017) and his team of researchers found the eBook project to be successful and have decided to continue using eBooks in the future. Without a doubt, technology has impacted education. In the same way, interactive eBooks may impact the reading classroom.

Problem 5: What seminar-workshop can be designed based on the findings of the study?

Table 8. *Action Plan*

"Create, Innovate, Share: A Seminar-Workshop on eBook Making					
Date	July 2023-August 2023				
Vision	To empower educators to harness the power of technology and digital media to enhance their teaching and learning practices, and to create engaging and interactive learning materials that cater to diverse student needs and interests. Through this seminar-workshop, we aim to equip teachers with the knowledge and skills needed to create and publish their own eBooks, and to integrate them into their curriculum and instruction. Our goal is to foster a culture of innovation, collaboration, and lifelong learning among teachers, and to inspire them to use eBooks as a means of promoting student engagement, critical thinking, and creativity in the classroom and beyond.				
Prepared by:	Jane B. Playda				
Key Action Steps/ Strategies to Achieve Objective	Persons Responsible	Resources/Budget Needed	Time Frame	Threats /Potential Barriers	Indicators of Success
Introduce eBooks: Formats and Software	All Teachers Speaker	MOOE 1000	July 2023	1. Technical difficulties 2. Participants may have limited prior knowledge or experience with eBook creation and editing 3. Participants may be resistant to adopting new technologies or changing their existing teaching practices	100% of the teacher-participants have increased understanding of eBook formats and software.
Design an eBook: Formatting, Styling and Lay-out	All Teachers Speaker	MOOE 5000	July 2023	Participants may have limited technical skills or experience with designing eBooks, which may make it difficult for them to understand the technical concepts and tools related to formatting, styling, and layout	100% of the participants should be able to demonstrate their creativity in the design of their eBooks, using innovative and engaging design elements and techniques.
Craft Lesson Plan for eBook Creation	All Teachers Speaker	MOOE 1000	July 2023	Participants may not have a strong understanding of curriculum standards, which can make it difficult for them to align their lesson plans with the relevant standards. Inadequate training on the principles of effective lesson planning	100% of the teacher-participant should be able to make a well-structured lesson plan which would align to the curriculum standards and with effective use of instructional strategies.
Write an eBook: Content Creation and Organization	All Teachers Speaker	MOOE 3000	July-August 2023	Participants may have limited time to create content for their eBooks, which can lead to rushed or incomplete content that does not effectively support the learning objectives. Inadequate follow-up support	100% of the teacher-participant should be able to create an eBook with clarity and coherence of content and with effective use of multimedia elements, with appropriate use of citations and

					reference, with consistency and coherence of style which can create engagement and capture the interest of readers and lastly with relevance and alignment with the learning objectives.

Conclusion

Based on the findings of the study, before the lesson was taught to the respondents, they do not have prior knowledge about the topic. Thus, the null hypothesis which states there is no significant difference between the pretest scores of the Modular Group and the eBook group is rejected. This was supported by the Theory of Information – Processing Theory by Miller (as cited in Huitt, 2018) that the human brain was like a computer that processes information which was stored as memory. In order for the learners to learn a certain topic, teachers must provide them with learning experiences that are done in varied ways. Therefore, the learner shaped his or her knowledge by remembering, memorizing, practicing, performing and others. Thus, it was essential to store the knowledge of Vertebrates and Invertebrates in the long-term memory so that the child can relate to the interdependence of other Science skills.

In addition, the respondents showed a significant improvement in their posttest scores in both Modular and eBooks groups. In as much as the respondents achieved improvement in comprehending Science concepts based on their pretest and posttest scores both in the Modular and eBook Groups, respondents who were taught science concepts using eBook performed better than those who were taught using the Learning Modules. Furthermore, Vygotsky's Scaffolding Theory (as cited in Kressly, 2017) emphasized that both technologies assisted learning and modular learning allowed teacher to level and structure the content to have it within the child's zone of proximal development. A teacher might provide scaffolding by, first, giving the learners detailed guides to carry out experiments and activities, then given them brief outlines that might be useful for structuring experiments and activities, and finally, asking them to set-up experiments and learning activities entirely on their own.

In general, the respondents registered an improvement in comprehending science concepts using the developed interactive eBook which contribute positively in improving the learning of the learners. Moreover, Dale's Cone of Experience (as cited in Kovalchick and Dawson, 2018) posits that teaching and learning experiences have certain levels. Perceptual learning styles were sensory bases; the more sensory channels possible in interacting with a resource, the better the chance that many learners can learn from it.

In the light of the findings and conclusions, the following recommendations are enumerated. (1) The Department of Education (DepEd) must embrace the use of interactive eBooks as a powerful tool for teaching and learning. Interactive eBooks have the potential to revolutionize traditional classroom instruction by providing engaging and dynamic learning experiences. Furthermore, interactive eBooks offer the flexibility of anytime, anywhere access, allowing students to study at their own pace and review materials as needed. The DepEd can consider partnering with reputable educational technology companies to develop and implement interactive eBooks aligned with the curriculum, ensuring that they are accessible to all students. This integration of technology into the classroom can enhance student engagement, foster critical thinking skills, and ultimately lead to more effective teaching and learning outcomes. (2) The school administrators may help the teachers perform their essential duties and roles as educators by providing Information and Communication Technology (ICT) resources in such a way accessible and accountable for teachers' teaching purposes in the classroom. The learners are more motivated to learn with their teacher who uses an intervention to their teaching that could match the learner's field of interest with technologies. (3) Teachers should possess the full understanding on the feature of technology. ICT integration is not only beneficial to learners, but even more to teachers as educators are being dealt with a wide range of pedagogies to implement these for classroom practices and applications. Seminar-workshop with the use of ICT may be conducted to extend teachers way of teaching to improve and enhance their teaching performance in order to create an effective teaching-learning environment in classroom. Urbano (2021) concluded that teachers ought to have been inspiring the learners in possessing their own learning and ought to have been taking the position as facilitators to develop a sense of interdependence. (4) The future researchers may set this study as gauge for further similar studies to conduct along the line of Science through ICT, particularly with the use of eBook and should extend from this field of reference to other subjects, as well as the need to extend research to other Technology or Web-Based teaching and learning tool.

References

Anderson, R. C. (2017). The notion of schemata and the educational enterprise: General discussion of the conference. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), Schooling and the acquisition of knowledge (pp. 415-431). Hillsdale, NJ: Erlbaum.

Ayele, A. G. (2019). The Effectiveness of Electronic Books in Enhancing Students' Reading Comprehension. International Journal of Education and Literacy Studies.

Ben-Chaim, D., Keret, D., & Ilany, B. (2017). Effects of feedback on self-regulation, motivation, and achievement in middle-school science. The Journal of Educational Research,

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2020). How people learn: Brain, mind, experience, and school. National Academy Press.

Bus, A. G., Takacs, Z. K., & Kegel, C. A. T. (2015). Affordances and limitations of electronic storybooks for young children's emergent literacy.

Bus, A.G., De Jong, M.T., & Verhallen, M. (2012). CD-ROM talking books: A way to enhance early literacy? In M.C. McKenna, L.D. Labbo, R.D. Kieffer, & D. Reinking (Eds.), International handbook of literacy and technology, Volume II (pgs. 129-144). Erlbaum.

Casiano, M. (2017). Teaching Computer in the Secondary and Tertiary Level. Rex Box Store, Inc. Quezon City, Philippines.

Ciampa, K. (2016). Reading in the digital age: using electronic books as a teaching tool for beginning readers. Canadian Journal of Learning And Technology.

Chong, P.F., Lim, Y.P. & Ling, S.W. (2019). On the design preferences for ebooks. IETE Technical Review.

Cook, D. B., & Klipfel, M. (2018). How do our students learn? An outline of a cognitive psychological model for information literacy instruction. Reference & User Services Quarterly.

Coyle, K. (2018). Managing technology. The Journal of Academic Librarianship.

Delgado, P., & Vargas, C. (2018). E-books, learning and memory: A preliminary study. Computers in Human Behavior, 87, 296-303. This study investigated the effects of reading ebooks and printed books on learning and memory, and found that participants had better memory recall of printed books than ebooks.

Drennan, G., & Moll, I. (2018). A conceptual understanding of how educational technology coaches help teachers integrate ipad affordances into their teaching period. The Electronic Journal of e-Learning.

Department of Education. (2021). DepEd Order No. 173, s. 2021: Guidelines on the Implementation of the Basic Education Learning Continuity Plan for School Year 2021-2022 in Light of the COVID-19 Pandemic.

Department of Education. (2016). DepEd Order No. 42, s. 2016: Policy Guidelines on Daily Lesson Preparation for the K to 12 Basic Education Program.

Department of Education. (2017). DepEd Order No. 42, s. 2017: Policy Guidelines on the Implementation of the Multi-Factored Assessment Tool for Grade 1 to 10.

Department of Education. (2016). DepEd Order No. 42, s. 2016: Policy Guidelines on the National Reading Program.

de Jong, M. T., & Bus, A. G. (2012). Quality of book-reading matters for emergent readers: An experiment with the same book in a regular or electronic format. Journal of Educational Psychology.

de Jong, M. T., & Bus, A. G. (2012). The efficacy of electronic books in fostering kindergarten children's emergent story understanding. Reading Research Quarterly.

Dinçer, S., & Doğanay, A. (2017). The effects of multiple-pedagogical agents on learners' academic success, motivation, and cognitive load. Computers and Education.

Domingo, M. G., & Garganté, A. B. (2016). Exploring the use of educational technology in primary education: Teachers perception of mobile technology learning impacts and applications use in the classroom. Computers in Human Behavior.

Gupta, R., & Gupta, S. (2016). Pedagogical uses of e-books: A review. Education and Information Technologies.

Hirsch, J. A., & Mazerolle, S. M. (2020). Schema theory and cognitive neuroscience: An integrative approach. Frontiers in Human Neuroscience.

Hsiao, K. L., & Chen, C. C. (2015). How do we inspire children to learn with e-readers? Library Hi Tech.

Hsieh, P.-H., & Cho, V. (2017). Investigating the effectiveness of using digital stories in teaching vocabulary in EFL classrooms. Computers & Education.

Huang, Y., Liang, T., Su, Y., & Chen, N. (2012). Empowering personalized learning with an interactive e-book learning system for elementary school students. Educational Technology Research & Development, 60(4), 703-722. doi:10.1007/s11423-012-9237-6

Huitt, W. (2018) The Information Processing Approach to Cognition. Educational Psychology Interactive. Valdosta, GA: Valdosta State University.

Jones, T., & Brown, C. (2017). Reading engagement: A comparison between e-books and traditional print books in an elementary classroom. International Journal of Instruction.

Kao, G. Y. M., Tsai, C. C., Liu, C. Y., & Yang, C. H. (2016). The effects of high/low interactive electronic storybooks on elementary school students' reading motivation, story comprehension and chromatics concepts. Computers and Education.

Kaynar, N., Sadik, O., & Boichuk, E. (2020). Technology in early childhood education: Electronic books for improving students' literacy skills. Tech Trends.

Korat, O. (2016). Reading electronic books as a support for vocabulary, story comprehension and word reading in kindergarten and first grade. Computers & Education.

Kovalchick, A., & Dawson, K. (2018). Cone of experience. In R. A. Reiser & J. V. Dempsey (Eds.), Trends and issues in instructional design and technology (2nd ed., pp. 139-150). Pearson.

Larson, L. C. (2016). Digital readers: The next chapter in e-book reading and response. Reading Teacher.

Lin, C.-H. & Lin, Y.-C. (2017). Exploring the Acceptance and Effects of E-Books on Academic Performance: A Study of College Students in Taiwan. The Asia-Pacific Education Researcher.

Lockwood, F. (2017). Modularizing instruction for student-centered learning: A case study in undergraduate information literacy instruction using open educational resources. Journal of Academic Librarianship.

Martinez-Estrada, P., & Conaway, R. N. (2017). EBooks: The next step in educational innovation. Business Communication Quarterly.

Massy, W. F., & Wilger, A. K. (2017). Technology's contribution to higher education productivity. New Directions For Higher Education.

Mayer, R. E. (2018). Cognitive theory of multimedia learning. In R. E. Mayer (Ed.), The Cambridge Handbook of Multimedia Learning (2nd ed., pp. 43-71). Cambridge University Press. This book chapter discusses the cognitive processes involved in multimedia learning, including the role of working memory and long-term memory.

Maynard, S. (2016). The impact of e-Books on young children's reading habits. Publishing Research Quarterly.

McHugh, J. (2018). "Connecting to the 21st-century student." Edutopia. N.p., 09 Sept. 2005. Web. 08Dec. 2013.

McLean, K. C., & Lilgendahl, J. P. (2019). Personal schema theory. In K. C. McLean & M. Syed (Eds.), The Oxford handbook of identity development (pp. 198-213). Oxford University Press.

Moody, W.D., Daniel, D.B., & Baker, C.A. (2020). E-books or textbooks: Students prefer textbooks. Computers & Education.

Prensky, M. (2018) Digital natives, digital immigrants. On the Horizon. 9(6), 1-6.

Prensky, M. (2018) Digital natives, digital immigrants, part II: Do they really think differently? On the Horizon.

Pressley, M. (2000). What should comprehension instruction be the instruction of? In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), Handbook of Reading Research, Volume III (pp. 545-561). Erlbaum.

Rahman, M. M., & Ahmed, M. (2020). The Effectiveness of Using E-Books in the Classroom: A Systematic Review. Journal of Education and Practice.

Riffell, S. K. (2016). Pedagogical uses of electronic books. Journal of Adolescent & Adult Literacy.

Salmon, G. (2013). E-moderating: The key to teaching and learning online. Routledge.

Sweller, J. (2019). The use of visual and auditory modes in instructional materials. Educational Psychology Review.

Weber, C. L., & Cavanaugh, T. W. (2016). Promoting reading: Using eBooks with gifted and advanced readers. Gifted Child Today.

Weng, C. Y., Chen, Y. L., & Huang, Y. M. (2019). Pedagogical uses of e-books in higher education: A literature review. Australasian Journal of Educational Technology.

Wong, S. L., & Hodson, D. (2010). More than equipment, less than ideal: Teachers' views about inquiry-based science education. Research in Science Education..

Wright, M., Hoolohan, C., & Hedberg, J. (2018). Student perceptions of using mobile devices for learning in higher education – A literature review. In D. Hernández-Leo, T. Ley, R. Klamma, & A. Harrer (Eds.), Scaling up learning for sustained impact. Proceedings of the 8th European Conference on Technology Enhanced Learning (EC-TEL 2013) (pp. 515-518). Springer.

Zhang, J., & Duke, N. K. (2018). The effectiveness of electronic books for promoting literacy at the preschool level: A review of research. Educational Research Review.

Zohoorian, Z., & Nourizadeh, R. (2018). E-book vs. print book: Student preferences and the impact of emotion, motivation, and learning outcomes. Computers & Education.

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