

Innovating For a Better Tomorrow Through the Development and Validation of Science Activity Workbook in Grade 8 Physics

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Abstract: *Anchored on Constructivism Theory, this research aimed to determine the acceptability of the proposed Science Activity Workbook in Grade 8 Physics in boosting students' engagement in the lesson. The Science Activity Workbook focused on enriching the student's understanding of Physical processes and concepts in real-life activities using the available resources and materials. Using the quasi-experimental research design, eighteen (18) Science Teachers and nine (9) Science experts tested the acceptability of the Science activity workbook in Grade 8 Physics. Fifty (50) students in a private high school answered the pretest and posttest. The workbook was assessed as highly acceptable by the respondents based on the following variables: Introduction, objectives, content, application, evaluation, clarity, presentation, and usefulness. Since students can easily understand the application of Physics concepts if they can directly observe the processes, the proposed workbook hoped to meet the needs of the students for more effective and productive learning. Many Science teachers believe that Science workbooks are relevant to holistic learning thus, this study will be relevant for remedial classes as supplementary material for mastering the lessons, specifically in areas where most students are to fail. It is a significant aspect of teaching and learning processes as it will provide training in scientific areas and supply information to help the students gain attention and interest in manipulating the available resources.*

Keywords: development and validation, Science Activity Workbook, Grade 8 Physics, Constructivism Theory

Introduction

Education is a process of teaching and learning, especially in a school, academy, college, or university. It is all about teaching, learning, and practicing skills and knowledge. It also means helping other people learn what to do and how to do things. It is where the learners improve their skills, gain new knowledge, and inculcate in their minds the importance of learning. It is an armor to fight the changes and struggles in their lives as they grow old. ^[1]

Physics is a natural science since it explains the matter, its motion, behavior, and related entities of energy and force. It is one of the fundamental scientific disciplines that play an important role in understanding how the world around us, how behaves from simple can openers, light bulbs, and cell phones. All of these are relevant in understanding how things interact with one another, how we apply forces in every action we made, how important electricity is in human life, and how these living organisms evolve for them to adapt to the discoveries in Physics. ^[2] Physics is taught in the fourth year of high school in the old curriculum until the Philippines followed the new K-12 curriculum enabling the new graduates of senior high to work locally or even abroad right after their graduation rites. But for those who are going to enroll in college, the senior high will serve as their preparation for higher learning.

At the same time, teaching Science is a spiral. Physics is taught not at the fourth-year level in high school but as early as Grade 3. ^[3]

Based on Jerome Bruner's Constructivism theory the proposed Science Activity Workbook in Grade 8 Physics will enable the students to construct new ideas or concepts based on existing knowledge. This theory allows the learners to explore their skills beyond the usual setup which is the class discussion. Students will also improve their reasoning and writing skills since there are follow-up questions given to them after observing and performing the activity. Lastly, students work in a group so they can develop camaraderie, patience, cooperation and understanding among the members. Bruner also pointed out three stages of intellectual development. The first stage is "enactive" where students begin to develop understanding through active manipulation or involvement. In this stage, the students have the chance to play and experience with the materials to understand the concept. The second stage is "iconic", this time students are capable of making images of the materials and no longer need to manipulate them directly. Lastly "symbolic" in which students can use their abstract ideas to represent the work. For example, students are given a task to explain the concept of force. The student must go through all of these stages to master a certain idea. It is more effective than just reading, writing, and imagining the process happening in the lesson being taught to them. ^[4]

Constructivism is best for understanding in terms of how learners use information, resources, and help from others to build and improve their critical thinking skills. It enables learners to construct knowledge, whether this construction reflects objective realities or the construction perceived to sharpen one's cognitive development for acquiring higher intellectual skills. Constructivism is a learning theory that holds that knowledge is best gained through a process of reflection and active construction in the mind. ^[5] The scope of the study contains all topics taught in Physics 8 based on the K-12 curriculum guide. The topics that will be selected are force, Newton's Law of motion, circular motion, work, power, energy, sound, light, heat, and electricity. The chronological

arrangement of these activities is based on the sequence of the topic given in the curriculum guide for Physics 8. On the other hand, this study is limited only to eighteen (18) Science Teachers and nine (9) Science experts to test the acceptability of the Science activity workbook in Grade 8 Physics. The performance of the 50 students in selected private schools in Pasay to identify the result of the pretest and post-test administered to them.

The main purpose of the study is to identify the level of acceptability of Science Activity Workbook in Grade 8 Physics. Specifically, the study sought to answer the following:

1. What is the level of the inadequacy of instructional materials in Physics?
2. Based on the findings, what instructional materials may be proposed?
3. How acceptable is the science activity workbook as assessed by experts and science teachers in terms of:
 - 3.1 Introduction;
 - 3.2 Objectives;
 - 3.3 Content;
 - 3.4 Application;
 - 3.5 Evaluation;
 - 3.6 Clarity;
 - 3.7 Presentation and
 - 3.8 Usefulness?
4. Is there a significant difference in the assessment of the two groups of respondents on the forecited variables?
5. How do the learners perform in the pretest and posttest before and after using developed and validated science activity workbook?

Methodology

This study used the descriptive method of research. Descriptive research describes data and characteristics about the population and data of the study. Survey questionnaires were used to determine the acceptability of the Science Activity Workbook in Grade 8 Physics. It also designs to depict the participants in an accurate way. Descriptive research methods are used to describe the situation given.^[6]

Likewise, this study utilized a quasi-experiment design. It is used because participants cannot be randomly selected or randomly assigned to groups. This method is most appropriate to determine a cause-and-effect relationship even when the limitation as to who or what we could study.^[7] A quasi-experimental design is used to assess the performance of the Grade 8 students after exposing to the Science Activity Workbook in Grade 8 Physics

To determine the acceptability of the Science Activity Workbook purposive sampling was used because it targets a particular group of people which were Science experts and Science teachers that have the qualification and can contribute to this study. The study also involves a population of 50 Grade 8 students, composed of two (2) sections. Each section consists of 25 students paired according to their level of academic performance. They served as respondents in the experimental group and control group.

Survey Questionnaires were given to the Science teachers and Science experts as respondents to assess the level of acceptability of the developed Science Activity Workbook in Grade 8 Physics and a pretest and post-test that consists of fifty (50) multiple-choice items. A pretest was administered before the utilization of the developed Science Activity Workbook in Grade 8 Physics while a post-test was given after using the learning material. The results were recorded and evaluated to find out if any significant difference existed from the results of the pretest. The post-test results of the students were compared to the pretest result. The pretest and post-test were validated by the school principal of the researcher.

Responses were collected and used T test for an independent sample to compare groups that are formed by matching or computing single performance on the pretest and post-test on two different treatments.

Result and Discussion

The objective of this study is to determine the acceptability of the Science Activity Workbook in Grade 8 Physics. The following table displays the descriptive analysis of the responses of the respondents.

Table 1: Assessment as to the level of inadequacy of Instructional materials in Physics

Instructional Materials	Science Experts		Science Teachers		Composite		RANK
	WM	VI	WM	VI	WM	VI	
	1. Activity Sheets	2.22	LI	2.33	LI	2.28	

2. Books	1.17	A	1.67	A	1.42	A	6
3. Laboratory Manual	2.06	A	2.44	LI	2.25	LI	5
4. PowerPoint Presentation	2.11	LI	2.56	LI	2.35	LI	4
5. Science Activity Workbook	3.66	I	3.78	I	3.72	I	1
6. Worktext	2.67	MI	2.22	LI	2.45	LI	2

Scale	Equivalent	Verbal Interpretation	Symbol
5	4.20-5.00	Highly Inadequate	HI
4	3.40-4.19	Inadequate	I
3	2.60-3.39	Moderately Inadequate	MI
2	1.80-2.59	Less Inadequate	LI
1	1.00-1.79	Adequate	A

Table 1 depicts the level of inadequacy of instructional materials in Physics. As revealed, Science Activity Workbook got the highest level of inadequacy with a weighted mean of 3.72 or verbally interpreted as inadequate. Then it followed by Worktext got a mean of 2.67 or verbally interpreted as less inadequate. Also, the PowerPoint presentation got 2.35 or was verbally interpreted as less inadequate. Activity sheets got the 4th rank with a weighted mean of 2.28 or were verbally interpreted as less inadequate. The laboratory manual got a weighted mean of 2.25 or was verbally interpreted as less inadequate. Lastly, books got a weighted mean of 1.42 or were verbally interpreted as adequate.

As shown in Table 1, Science Activity Workbook can be developed for teaching Grade 8 Physics. The main objective of the study was to make instructional material that will aid the Grade 8 students. Science Activity Workbook is a student's guide work activity containing concepts, instructions, and exercises related to a particular subject. It helps the student to easily understand the concept/ topic. Science Activity Workbook is composed of 5 parts, namely the introduction, objectives, concept/ discussion exercises, and experiments.

The findings in the results emerged private primary teacher training lacked adequate facilities and learning resources. The status of instructional materials, equipment, and facilities is inadequate, obsolete, dilapidated, and unsuitable for preparing competent teachers. This state of affairs raises concern about the quality of teachers from emerging private primary teacher training colleges serving in the school system. The proliferation of training institutions in such conditions is a manifestation of the ineffectiveness or near-total collapse of the systems of monitoring and regulation of teacher training institutions. Although the situation might improve, inadequate instructional materials and resources in teaching and learning prevent these institutions from contributing to the production of up-to-date and specialized knowledge for their trainees.^[8]

Table 2: Assessment as to Introduction

CRITERIA	Science Experts		Science Teachers		Composite	
	WM	VI	WM	VI	WM	VI
1. Introduction gives a clear overview of the subject matter.	4.11	A	4.22	HA	4.17	A
2. Introduction prepares the students mentally for the subject matter.	4.3	HA	4.33	HA	4.32	HA
3. Introduction motivates the students to go with the lesson.	4	A	3.89	A	3.95	A
4. Introduction gets the interest of the learners.	4.11	A	3.94	A	4.03	A
5. Introduction is brief and concise	4	A	4.22	HA	4.11	A
Overall Weighted Mean	4.1	A	4.11	A	4.12	A

Overall, the level of acceptability as to introduction has a weighted mean of 4.12 or acceptable.

In Table 2, criteria number 2 states that “Introduction prepares the students mentally for the subject matter” got a verbal interpretation of Highly Acceptable, while the rest of the criteria have the verbal interpretation as Acceptable. The results of the study showed efforts must be undertaken to decongest the Basic Education Curriculum and make learning more enjoyable for young learners. They will be integrating science topics into other subjects to make the new curriculum more child friendly. The new curriculum focuses on oral fluency in the first grade. In this way, learners will realize that science is not a difficult subject instead it is an enjoyable and child-friendly subject.^[9]

Table 3: Assessment as to Objectives

CRITERIA	Science Experts		Science Teachers		Composite	
	WM	VI	WM	VI	WM	VI
	1. Objectives are based on the curriculum guide in Physics 8.	4.56	HA	4.56	HA	4.56
2. Objectives are specific.	4.56	HA	4.39	HA	4.48	HA
3. Objectives are clearly stated	4.67	HA	4.83	HA	4.75	HA
4. Objectives are attainable	4.78	HA	4.61	HA	4.7	HA
5. Objectives are time bound	4.56	HA	4.27	HA	4.42	HA
Overall Weighted Mean	4.63	HA	4.53	HA	4.58	HA

Overall, the level of acceptability as to the objective has a weighted mean of 4.58, or highly acceptable.

Strengthening the effectiveness of the learning objective and capabilities of the teachers were the highest contributing factors that make teaching Science more interesting and motivating. The result is similar in the teaching of science in Mexico Elementary Schools and is also effective for both pupils and teachers based on the increased pupils’ proficiency level.^[10]

Table 4: Assessment of Content

CRITERIA	Science Experts		Science Teachers		Composite	
	WM	VI	WM	VI	WM	VI
	1. Contents are parallel with the objectives.	4.67	HA	4.33	HA	4.5
2. Contents have adequate information to support the concept presented.	4.78	HA	4.61	HA	4.7	HA
3. Contents are based on the learning competencies.	4.56	HA	4.61	HA	4.59	HA
4. Contents provide adequate information.	4.67	HA	4.39	HA	4.53	HA
5. Contents are interesting and self-motivating	4.67	HA	4.28	HA	4.48	HA
Overall Weighted Mean	4.67	HA	4.44	HA	4.56	HA

Overall, the level of acceptability as to content has a weighted mean of 4.56 or highly acceptable.

The development of the workbook is integrating the material of Science and the English language. To make learning input as comprehensible as possible, the teacher should present information and content clearly and easily to understand considering the level of the learner's comprehension. The focus of the teaching should be inspired by the content to be learned helps help to identify the language skills required to learn the content and the reasoning abilities needed to improve^[11]

Table 5: Assessment as to Application

CRITERIA	Science Experts		Science Teachers		Composite	
	WM	VI	WM	VI	WM	VI

1. Application ensures the interest of the students in learning Science.	4.44	HA	4.44	HA	4.44	HA
2. Application develops critical thinking for the learners.	4.44	HA	4.44	HA	4.44	HA
3. Application helps the learners to become resourceful	4.44	HA	4.39	HA	4.42	HA
4. Application improves learner's leadership skills	4.44	HA	4.5	HA	4.47	HA
5. Application encourages the learners to actively participate in the learning activities.	4.56	HA	4.5	HA	4.53	HA
Overall Weighted Mean	4.46	HA	4.45	HA	4.46	HA

Overall, the level of acceptability as to application has a weighted mean of 4.46 or highly acceptable.

The finding of this study suggested that teachers must pursue opportunities to build their understanding of how students with varied interests, abilities, and experiences can be stimulated, molded, controlled, and guided. Students may be able to make sense clearly of scientific ideas. This idea can be linked to real-life situations. Furthermore, science teachers must have the chance to conduct research in regard to science teaching and learning.^[12]

Table 6: Assessment as to Evaluation

CRITERIA	Science Experts		Science Teachers		Composite	
	WM	VI	WM	VI	WM	VI
	1. The evaluation is congruent with the objectives.	4.67	HA	4.66	HA	4.67
2. The evaluation assesses the learning gained.	4.67	HA	4.61	HA	4.64	HA
3. The evaluation develops capabilities for continuous learning.	4.44	HA	4.33	HA	4.39	HA
4. The evaluation is clear to the purpose of the study.	4.33	HA	4.27	HA	4.3	HA
5. The evaluation gives opportunities to the learner to continue their learning.	4.67	HA	4.44	HA	4.56	HA
Overall Weighted Mean	4.56	HA	4.46	HA	4.51	HA

Overall, the level of acceptability as to evaluation has a weighted mean of 4.51 or highly acceptable.

The result of these findings is like one study which showed that many secondary schools surveyed in the Ebonyi state of Nigeria agreed that the use of instructional materials develops scientific attitudes such as patience, honesty, skepticism, and accuracy in students toward the learning of chemistry. Practical works and evaluation serve as an extension of the student's knowledge which sometimes confirms or disabuses the current idea. The function of the instructional materials develops interest and good attitude among the students.^[13]

Table 7: Assessment as to Clarity

CRITERIA	Science Experts		Science Teachers		Composite	
	WM	VI	WM	VI	WM	VI
	1. The directions are suited to the level of the learners.	4.56	HA	4.72	HA	4.64
2. The directions are easy to understand.	4.67	HA	4.72	HA	4.7	HA
3. Science terminologies in the activities are	4.33	HA	4.39	HA	4.36	HA
4. Questions are clearly structured.	4.44	HA	4.56	HA	4.5	HA
5. The instructions help the slow learner to achieve more.	4.67	HA	4.28	HA	4.48	HA

Overall Weighted Mean	4.53	HA	4.53	HA	4.54	HA
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Overall, the level of acceptability as to application has a weighted mean of 4.54 or highly acceptable.

The result pointed out that a positive aspect of the workbooks is the inclusion of writing activities from all three progressive-writing levels such as sentence, paragraph, and text. The use of writing activities at each of these three levels provides students with the opportunity not only to improve their writing skills of lower levels but also to develop higher-level writing skills. The students cannot clearly understand what kinds of texts they are expected to write; therefore, these activities do not successfully serve their purpose.^[14]

Table 8: Assessment as to Presentation

CRITERIA	Science Experts		Science Teachers		Composite	
	WM	VI	WM	VI	WM	VI
	1. The presentation is clear and uses correct grammar.	4.33	HA	4.33	HA	4.33
2. The presentation of instructions in the activities is clear and comprehensive.	4.33	HA	4.33	HA	4.33	HA
3. The presentation used sufficient familiar vocabulary to ensure learning.	4.11	A	4	A	4.06	A
4. The structure, style, and format are appropriate to the target level of the learner.	4.11	A	4.22	HA	4.17	A
5. Illustrations and photographs are properly labeled.	3.67	MA	4.22	HA	3.95	A
Overall Weighted Mean	4.11	A	4.22	HA	4.17	A

Overall, the level of acceptability as to presentation has a weighted mean of 4.18 or acceptable.

The result of this assessment confirmed that the workbooks can be used to provide learners with opportunities to practice their learning accords. Based on the researchers' study, they pointed out that workbooks best represent a practice curriculum tool. The workbook can be used to track the progress of earners and provide extra support where necessary. It was important to take into consideration that the topics presented in the workbook are aligned to the curriculum tool so that in an educational system where there is widespread learner failure, a set of strong and well-aligned curriculum elements holds great potential to support teachers in improving learning outcomes.^[15]

Table 9: Assessment as to Usefulness

CRITERIA	Science Experts		Science Teachers		Composite	
	WM	VI	WM	VI	WM	VI
	1. The workbook guides the students in verifying and applying Physics concepts.	4.44	HA	4.72	HA	4.58
2. The workbook develops students' learning.	4.67	HA	4.5	HA	4.59	HA
3. The workbook develops students' higher order of critical thinking.	4.44	HA	4.33	HA	4.39	HA
4. The workbook is a good instructional material in the absence of textbooks	4.33	HA	4.39	HA	4.36	HA
5. The workbook motivates the students to study	4.44	HA	4.27	HA	4.36	HA
Overall Weighted Mean	4.46	HA	4.44	HA	4.46	HA

Overall, the level of acceptability as to usefulness has a weighted mean of 4.46, or highly acceptable.

These findings explain that the importance and usefulness of the instructional materials enhanced and motivated the students. It improves academic achievement in education at the higher secondary level. Teaching style using activity-based learning attract students play a positive role in student motivation and improve academic learning. The main purpose of using activity-based workbooks in teaching and learning is to concertize students' learning and achieve set goals of education.^[16]

Table 10: Significant Differences of Respondents' Assessment in Terms of Acceptability of Science Activity Workbook in Grade 8 Physics

CRITERIA	Science Experts		Science Teachers		Computed		Decision	Interpretation
	WM	SD	WM	SD	t-value	p-value		
1. Introduction	4.10	0.62	4.11	0.53	0.049	0.961	Failed to Reject	NS
2. Objectives	4.63	0.25	4.53	0.41	0.591	0.56	Failed to Reject	NS
3. Content	4.67	0.28	4.44	0.42	-1.426	0.66	Failed to Reject	NS
4. Application	4.46	0.41	4.46	0.48	-0.059	0.954	Failed to Reject	NS
5. Evaluation	4.56	0.37	4.46	0.36	-0.595	0.557	Failed to Reject	NS
6. Clarity	4.53	0.41	4.53	0.36	0.000	1.00	Failed to Reject	NS
7. Presentation	4.11	0.51	4.22	0.46	0.567	0.576	Failed to Reject	NS
8. Usefulness	4.46	0.24	4.44	0.40	-0.153	0.88	Failed to Reject	NS

(p-value) = 0.05 NS= Not Significant α

Table 10 discloses the difference in assessments of the Science experts and Science teachers in the developed Science Activity Workbook in Grade 8 Physics. As it was revealed, the variables such as introduction with a p-value of 0.961 ($p=0.961$), objective ($p=0.56$), content ($p=0.66$), application ($p=0.954$), evaluation ($p=0.557$), clarity ($p=1.00$), presentation ($p=0.576$) and usefulness ($p=0.88$), each with p-value higher than 0.05 level of significance which result to non-rejection of the null hypothesis. Therefore, the two groups of respondents have no significant difference in their assessment of the level of acceptability of the Science Activity Workbook in Grade 8 Physics in terms of introduction, objective, content, application, evaluation, clarity, presentation, and usefulness.

Table 11: Comparison of the Pretest and Post-test Results of the two groups.

Group	Mean Score	MPS	Descriptive Equivalent	p-value	Decision	Interpretation
Experimental	29.39	58.78	Average	0 ($t=-4.124$)	Rejected	Significant
Control	23.16	46.32	Average			

Table 11 displays the comparison of the experimental group and the control group in the post test. The results show that the experimental group got a posttest mean score of 29.39 while the control group got 23.16. The experimental group's post test score is higher by 6.23 than the control group.

In addition, the computed p-value of 0.000 expresses that the difference is significant at 0.05 level. The data presented shows that the experimental group improved higher than the control group in Grade 8 Physics after using the Science Activity Workbook. There is a significant difference in the performance of the students in the pretest and post-test.

Conclusion and Recommendations

Generally, Science Activity Workbook was inadequate instructional materials in Physics. The Science Activity Workbook in Grade 8 Physics was designed and developed to improve the performance of the students in Grade 8 Physics. It was assessed as highly acceptable by the Science experts and Science teachers which means that the standard criteria are met as shown by the good result of the students' respondents and was found to be effective instructional material in the teaching and learning process. In addition, it was assessed as highly acceptable by the Science experts and Science teacher respondents which means that the two groups of respondents agreed on a high acceptability level of the Science Activity Workbook in Grade 8 Physics in the following variables: objective, content, application, evaluation, clarity and usefulness. On the other hand introduction and presentation were verbally interpreted as acceptable and the performance of the students improved after using the Science Activity Workbook in Grade 8 Physics. Students became interested in the learning topics in Grade 8 Physics using Science Activity Workbook. Follow-up research on the study is recommended to corroborate the results.

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