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Research Article

Task-based Supplementary Instructional Materials in Learning Grade 10 Chemistry

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ABSTRACT

This study aimed to develop and evaluate task-based supplementary instructional materials in learning Grade 10 Chemistry in selected junior high schools in District I of the Schools Division Office of Marikina City during the school year 2021 - 2022.

This study utilized the descriptive method of research with the questionnaire as the data gathering instrument. The sources of data were the ten (10) experts and twenty (20) high school Science teachers from the Schools Division Office of Marikina City, who served as the evaluators of the developed task-based supplementary instructional materials. Five criteria, namely: instructional design and organization of material, instructional quality, assessment, format, and presentation were used to determine the acceptability of the developed task-based supplementary instructional materials. The statistical tools used in this study were weighted mean and t-test.

The significant findings of the study based on the questions raised are both the Science teachers and the Science experts evaluated the developed task-based supplementary instructional materials as very satisfactory in terms of instructional design and organization of material, instructional quality, assessment, format, and presentation and there was no significant difference between the evaluations of Science teachers and Science experts on the developed task-based supplementary instructional materials based on instructional design and organization of material, instructional quality, assessment, format, and presentation.

Keywords*: Chemistry, Learning, Teaching*

Introduction

Man continuously thinks about how phenomena occur in the environment and constantly devises means to improve ways of living. Changes in the world today are inevitable and take place through Science. Unquestionably, as mentioned by Viens (2019), the foundation of modern-day technological breakthroughs is Science and its applications.

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At present, every learner must understand the basic concepts of Science. Learning Science develops problem-solving skills, strengthens awareness about the technology, suggests ways to conserve natural resources, and instils survival skills. Learners must be provided with engaging experiences to be informed and participative citizens who can make judgments and decisions regarding applications of scientific knowledge that may have social, health, or environmental impacts (Arrieta, Dancel, & Agbisit, 2020).

In the K to 12 curriculum, Science as a discipline is introduced as early as kindergarten. It aims to develop scientific literacy among learners. The K to 12 Science curriculum is learner-centered and inquiry-based, emphasizing the use of evidence in constructing explanations (DepEd, 2016). Concepts and skills in Life Sciences, Physics, Chemistry, and Earth Sciences are presented with increasing levels of complexity from one grade level to another in spiral progression, thus paving the way to a deeper understanding of core concepts.

Traditionally, Science lessons are taught through vocabulary. Definition of scientific terms and information are often memorized. This practice contributed to conceptual development however, in this model of instruction, words are often presented in isolation, and students are tested on the words alone, without application to concepts (Naderi & Fazilatfar, 2020).

New trends in teaching Science emerged. According to Yannier, et.al. (2021), learners should be provided with active problem-solving conferences, hands-on activities, and meaningful real-life performance tasks. Thus, the K to 12 Science curriculum is facilitated using multi/interdisciplinary approach, Science-technology-society approach, contextual learning, problem/issue-based learning, and inquiry-based approach (DepEd, 2016). The approaches are based on sound educational pedagogies namely, constructivism, social cognition learning model, learning style theory, and brain-based learning.

Learners today are curious. They are interested to learn many concepts in Science and other disciplines. Alongside, learners are hooked to electronic gadgets, computer games, internet surfing, and social media (Dillon, 2021). It is a great challenge for Science teachers to employ teaching strategies that divert and sustain their interest in learning Science. Studies found that most of the learners are dependent on electronic gadgets in which its abuse can lead to poor grades (Rashid, et.al, 2021).

Science education facilities can also affect students' performance in learning Science (Malik & Rizvi, 2018). The lack of Science education facilities is reflected in the poor quality of basic Science and Mathematics education seen by the low achievement scores of Filipino students on various tests. In the survey conducted by Trends in International Mathematics and Science Study (TIMSS) in 2019, the Philippines ranked lowest among the participating countries. The study revealed that students show limited understanding of scientific concepts and limited knowledge of foundational Science facts.

Verma (2019) claims that the learning experience that takes place inside the classroom is the key factor that determines the achievement of learning. One way in which teachers can improve learners' experience is by involving them in wide-ranging learning resources (Kelly, 2019). Teachers often utilize instructional materials as a primary learning resource. Laboratory manuals, workbooks, learning modules, models, audio-visual materials, and computer-assisted instructional programs are proven effective in modifying learners' behavior and facilitating the effective acquisition of knowledge and skills.

Supplemental resources are an additional benefit for students. These can motivate them on a particular topic. These are not just intended to facilitate exploratory or supplemental learning. Teachers can add supplemental resources to assist students who may need corrective action to succeed (Nordengren, 2022). When used effectively, these resources help students get involved, engaged, and connected with the content of the learning area.

According to Pappas (2020), a learning module is a form of tutoring that allows students to use a self-contained package of learning activities. These activities guide the learner to know or be able to do something. The

learning module also contains activities designed to help learners understand a particular lesson. It instructs students to practice or rehearse the information. Exercises are carried out as the activity progresses from easy to difficult that enables students to master the concept (Weselby, 2021). In this way, the placement of the exercises formalizes the level of difficulty that the learner can perform.

Amid the public health emergency caused by COVID 19, the Department of Education (DepEd) needs to provide quality, accessible, relevant, and liberating education. In response to this emergency, the DepEd has developed a Basic Education Learning Continuity Plan to ensure that learning opportunities are safely provided to learners through a variety of learning opportunities. DepEd Order No. 18, s. 2020 instructed Schools Division Offices to develop, create, and provide learning resources urgently and necessarily. A policy that establishes guidelines that will enable DepEd to provide learning resources in the implementation of the BE-LCP and guidelines on the release, utilization, and liquidation of support funds for the printing and delivery of self-learning modules and other resources is stated in the said order.

In Sto. Niño National High School, Science teachers produced sixteen (16) learning activity sheets that will be used to enhance learners' understanding of the concepts taught in the following areas – Life, Chemical, Physical, and Earth Sciences in spiral progression. There are three (3) Science teachers who were selected to develop self-learning modules to facilitate the Most Essential Learning Competencies (MELCS) to be utilized by the learners in the division. With the availability of these self-learning modules and learning activity sheets, nine (9) percent of Grade 10 learners have failed marks in Science in the fourth quarter of the school year 2020-2021, when concepts about stoichiometry and properties of gases were taught.

Hence, it is the main purpose of this study to develop supplementary instructional materials which could help learners to improve their understanding of Science specifically on Chemistry. The researcher observed that most students are not interested in learning Chemistry. It is very frustrating for Chemistry teachers to see their learners not finding the relevance of chemical processes which manufacture usable products that people use every day. In the study conducted by Kousa, Kavonius, and Aksela (2018), the results showed negative attitudes of students toward the subject were due to inadequate teachers' approach to the material, and poor non-formal instructional materials. In the light of the foregoing facts, the researcher decided to develop task-based supplementary instructional materials that could address learners' difficulties in mastering skills needed to fully understand lessons in Chemistry.

The researcher believes that task-based learning is an effective approach in teaching Chemistry. Loveless (2022) cited that in the teaching process of task-based learning, students are often placed in complex situations. According to the Marlborough School (2020), the students should analyze the problem by themselves and learn the necessary knowledge to solve problems. And sometimes, they need cooperative groups to solve the problem. Teachers take real-life tasks and problems as teaching materials to stimulate students to think. In this learning model, students learn in complex situations and teachers cultivate their interest in learning and initiative in learning (Kelly, 2020).

Thus, learning is more attainable when learners are engaged in tasks that teach them the concept and its applications in real life. Moreover, the utilization of task-based instructional materials is an effective tool in meeting the needs of learners and mastering their learning competencies.

Methods

This study utilized the descriptive method of research to achieve its main objective, to develop and evaluate task-based supplementary instructional materials as aids to learners having difficulties in mastering skills needed to fully understand lessons in Chemistry. Just like qualitative research, descriptive research aims to gather data without any manipulation of the research context. Thus, the study was descriptive since it described, recorded, analyzed, and interpreted the evaluations of the two groups of respondents on the developed instructional

materials in terms of the given criteria: instructional design and organization of material, instructional quality, assessment, format, and presentation, and the significant difference between the evaluations of the two groups of respondents.

The sources of data were the ten (10) experts and twenty (20) high school Science teachers.

The first group of respondents consisted of the experts composed of Master Teachers, Head Teachers, and Subject Coordinators knowledgeable in Science pedagogy and instruction. Experts chosen have at least five (5) years of experience in teaching Science in high school and have finished their Master's degree. The second group of respondents were the high school Science teachers who were employed permanently in their respective schools. The two groups of respondents evaluated the developed task-based supplementary instructional materials in terms of the given criteria. The respondents were selected using purposive sampling. Purposive sampling is a sampling technique in which the researcher relies on his or her judgment when choosing members of the population to participate in the study (Crossman, 2020).

Reference materials such as learning modules, workbooks, textbooks, unpublished materials like theses and dissertations, journal articles, and the internet helped the researcher in the development of the study.

The researcher adapted the evaluation tool for print learning resources from the Department of Education - Alternative Delivery Mode Learning Resource Standards. The validation tool was modified, and some criterion items were retained since these are suitable to sevaluate the developed task-based supplementary instructional materials. The evaluation questionnaire was administered to collect the evaluations of the two groups of respondents on the developed task-based supplementary instructional materials in terms of the given criteria: instructional design and organization of material, instructional quality, assessment, format, and presentation.

To be able to conduct the study and gather relevant information, the researcher obtained a curriculum guide that contains the most essential learning competencies in Grade 10 Chemistry which is taught in the fourth quarter of the School Year. Then, the researcher designed and developed the task-based supplementary instructional materials based on the most essential learning competencies in Grade 10 Chemistry. The topics developed as modules which were derived from the Most Essential Learning Competencies in Science specifically in Chemistry are: (1) Balancing Chemical Equations, (2) Chemical Reactions, (3) Kinetic Molecular Theory of Gases, (4) Volume, Pressure, and Temperature Relationship, and (5) Biomolecules.

After the completion of the supplementary instructional materials, the researcher secured permission from the Schools Division Superintendent and the School Heads of the selected high schools in District I of the said Division for the study to take place.

The developed task-based supplementary instructional materials were evaluated by the two groups of respondents: experts and high school Science teachers. To determine the acceptability of the developed task-based supplementary instructional materials, an open-ended questionnaire was administered and retrieved online through Google Forms.

Results and Discussion

Table 1. Summary of Respondents' Evaluations on the Developed Task-Based Supplementary Instructional Materials in Learning Grade 10 Chemistry

Criterion Items	Respondents			
	Teachers		Experts	
	OWM	VI	OWM	VI
a. Instructional Design and Organization of Material	3.59	VS	3.86	VS
b. Instructional Quality	3.58	VS	3.68	VS
c. Assessment	3.58	VS	3.7	VS
d. Format	3.64	VS	3.82	VS

Criterion Items	Respondents			
	Teachers		Experts	
	OWM	VI	OWM	VI
e. Presentation	3.55	VS	3.76	VS
Grand Weighted Mean	**3.59**	**VS**	**3.76**	**VS**

Note: OWM – Overall Weighted Mean

Similar to the study of Sagloria (2020), both her Science teachers and the expert respondents Strongly Agree with the indicators for each part/component of the developed learning resource package since her study and the present study adapted the evaluation tool for print learning resources from the DepEd – Alternative Delivery Mode Learning Resource Standards. But the present study modified the tool, and some criterion items were retained since these are suitable to evaluate the developed task-based supplementary instructional materials. Also, other studies mentioned in every criterion had desirable results from their respective two groups of respondents which are very similar to the evaluations of the two groups of respondents in the present study.

Table 2. Summary of Test of Difference in the Evaluation of the Two Groups of Respondents on the Developed Task-Based Supplementary Instructional Materials in Learning Grade 10 Chemistry

	Teachers		MT's		$t_{computed}$ Value	Decision	Interpretation
	OWM	s	OWM	s			
a. Instructional Design and Organization of Material	3.59	0.40	3.86	0.37	1.78	Fail to Reject the H_0	Not Significant
b. Instructional Quality	3.58	0.28	3.68	0.24	0.96	Fail to Reject the H_0	Not Significant
c. Assessment	3.58	0.29	3.70	0.21	1.93	Fail to Reject the H_0	Not Significant
d. Format	3.64	0.21	3.82	0.35	1.77	Fail to Reject the H_0	Not Significant
e. Presentation	3.55	0.26	3.76	0.31	1.95	Fail to Reject the H_0	Not Significant

Note: a = 5% Critical z Value = 1.96

The table reflects that the evaluations of teachers and expert respondents on the developed task-based supplementary instructional materials in learning grade 10 Chemistry concerning instructional design and organization of material, instructional quality, assessment, format, and presentation do not indicate significant differences as shown in the respective computed t values which are below the critical t value. This concludes that the respondents' evaluations are the same.

This means that both groups of respondents have the same evaluation of the developed task-based supplementary instructional materials in learning Grade 10 Chemistry in terms of instructional design and organization of material, instructional quality, assessment, format, and presentation. It is worth noting that the developed task-based supplementary instructional materials can be effective and is appropriate to the target learners.

Hereunder are comments and suggestions offered by the two groups of respondents on the developed task-based supplementary instructional materials in learning grade 10 Chemistry.

Comments. The following are the positive comments given by the respondents on the developed task-based supplementary instructional materials.

a. The content is consistent with topics / skills found in the DepEd Learning Competencies intended for the learning area and grade level.
b. The different parts of the learning material are well organized. The lessons are arranged in proper sequence based on the level of difficulty of the topic.
c. The objectives and the guide questions measure the desired knowledge and skills.
d. The procedure is complete and easy to follow. The procedure in each activity is presented in a manner which could be easily understood by the students.
e. The learning materials provide necessary information on the concept to be learned.
f. The activities are relevant to real world experiences in measuring the student's commitment to learning.
g. The learning materials are eye-catching and interesting.
h. The learning materials are timely and will surely aid online and modular students in learning the concepts.
i. The developed learning materials should be given as alternative learning resources for teachers and students.

Suggestions. The following are the suggestions given by the respondents on the developed task-based supplementary instructional materials.

a. Illustrations and pictures showing the procedure can be added to guide the students in accomplishing the activity.
b. The learning materials should offer activities that use materials that are readily available at home to support independent and distance learning.
c. The developed materials can be digitized to be utilized by online students.

Conclusion

Based on the results of the study, the researcher therefore concludes that: the developed task-based supplementary instructional materials satisfy the criterion items for print learning resource; the developed task-based supplementary instructional materials are deemed acceptable to the Science teachers and Science experts; and the developed task-based supplementary instructional materials are acceptable based on the given comments and suggestions of the two groups of respondents.

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