2018

Development and Validation of Science Instructional Materials (ScIMs) Using Games in Grade 8 Force, Motion, and Energy

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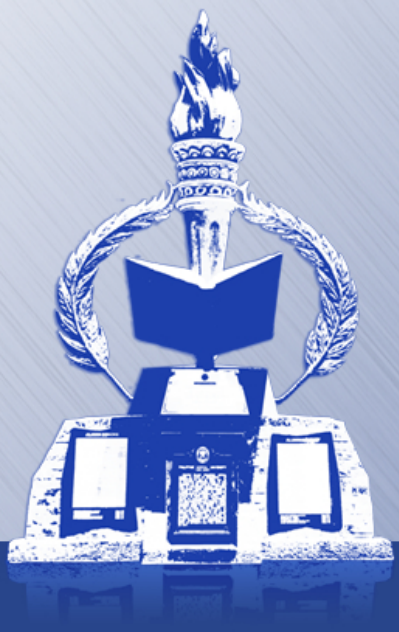

PHILIPPINE NORMAL UNIVERSITY
The National Center for Teacher Education

DEVELOPMENT AND VALIDATION OF SCIENCE INSTRUCTIONAL MATERIALS (ScIMs) USING GAMES IN GRADE 8 FORCE, MOTION, AND ENERGY

A THESIS
Presented to
Faculty of Graduate Studies and Teacher
Education Research in Indigenous Peoples Education
Philippine Normal University
North Luzon
Aurora, Alicia, Isabela

In Partial Fulfillment
of the Requirements for the Degree
MASTER OF ARTS IN EDUCATION
With specialization in Science Education

MARJORY L. LARGO

2018

PHILIPPINE NORMAL UNIVERSITY
The National Center for Teacher Education

CERTIFICATION OF APPROVAL

The thesis attached hereto, titled **DEVELOPMENT AND VALIDATION OF SCIENCE INSTRUCTIONAL MATERIALS (SclMs) USING GAMES IN GRADE8 FORCE, MOTION AND ENERGY** prepared and submitted by MARJORY L. LARGO in partial fulfillment of the requirements for the degree **MASTER OF ARTS IN EDUCATION** with specialization in **Science Education**, is hereby recommended for oral examination.

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ACKNOWLEDGEMENT

The author would like to express her deepest gratitude and appreciation to the special people who unselfishly contributed their knowledge, time and effort that made this piece of humble work successful:

To God Almighty for His unfailing love and outpouring blessings;

To her research adviser Dr. Marie Grace S. Cabansag, for her intellectual advices, assiduous encouragement and diligent help to check and improve this research;

To her statistician, Prof. Roldan S. Cardona, for his willingness to give information and patience in answering the researcher's inquires;

To Ma'am Agnes Palaruan, Ma'am Susana Quidasol and Ma'am Lirio G. Ariate for lending their priceless time and effort in evaluating her developed ScIMs used in this study;

To the Oral Defense Committee, Prof. Jesus D. Gonzales, Prof. Roldan S. Cardona, and Dr. Marissa R. Guiab, for their valuable comments and suggestions for the enhancement of this study;

To Ma'am Eddielyn L. Martinez and Sir Julius G. Sagario, for the patience in conducting the ScIMs in their respective class;

To Ma'am Madelyn M. Tolentino and Ma'am Janet G. Corpuz, for the dedication in checking the initial manuscript and the ScIMs, encouragement, guidance and support;

To Prof. Josie Jordan D. Gineta-Rosete, for patiently editing the text of the study;

To the faculty and staff of Cauayan City National High School, especially to the principal Sir John R. Mina, Department Head Sir Sanny Boy T. Quidasol, Sir Rommel Hero A. Saladino, and Sir Elvis Franciso L. Labiano, for the encouragement, unending support and sympathy to the researcher;

To Ma'am Jewelyn Macailao and her husband, for helping the researcher in similarity index of this humble work;

To her ever supportive friend Jasmin Fe P. Gardiola, for companionship and everything;

To her friends and ates/kuyas especially to Geraldine F. Sagario, Miriam Arconcel, Kristina Fontanilla, Donnalyn Lilagan, Cristal Torres, Aisie Bete and Jandy Danzalan for their assistance, support and friendship;

To her/tita Arnold, Alfredo, Eduardo and Mary Jane for their unending help and assistance;

To her siblings John Mark, Mary Joy and Angelica, for guidance and support;

To her parents and grandparents Mama Mercy, Papa Joey, Papang Manuel and Nanay Memeng for their provisions throughout the years as she followed her dreams;

To her support boy best friend, Randolf Caesar, as a source of inspiration, encouragement, love, and unending support behind sleepless nights and early mornings;

For the people whose names are not mentioned but whose support and help are recognized, her endless thanks and appreciation.

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Abstract

Development and validation of game-based Science Instructional Materials (ScIMs) in grade eight (8) Forces, Motion, and Energy was the main objective of this study to support teachers in dealing with learners' varied learning styles. The researcher followed the method of instrumentation in developing the ScIMs using games. The influence of game theory, cultural learning and use of science process skills were the underpinning within the development of the learning activities to stimulate academic performance. There were 15 game-based ScIMs developed that were validated by experts teaching Science. The ratings obtained were treated statistically and yielded an acceptable Cronbach alpha coefficient. The ScIMs were also subjected to first and final try-outs among grade 8 students and obtained significant difference in the pre-test and posttest scores, as measured by the t-test of dependent means. Based on the gathered results the game-based ScIMs are fit for use in grade 8 Science classes. The researcher proposes that the developed and validated ScIMs using games may be used as supplementary instructional materials in teaching grade eight Forces, Motion, and Energy. Also it may further support teachers in providing new perspective of a pedagogical approach with Filipino cultural context.

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Abstrak

Ang pagbuo at balidasyon ng mga Science Instructional Materials (ScIMs) na nakabatay sa mga laro sa Puwersa, Paggalaw, at Enerhiya na para sa ikawalong baitang sa sekondarya ang pangunahing layunin ng pag-aaral na ito. Ang pagsusuring ito ay bilang tulong at suporta sa pagtuturo ng mga mag-aaral na may iba't-ibang estilo sa pagkatuto. Ang metodo ng instrumentasyon ang ginamit na pamaraan para sa pagbuo at balidasyon ng (ScIMs). Ang impluwensiya ng teorya ng laro, pag-aaral ng kultura at paggamit ng proseso ng agham ay nagsilbing tema ng (ScIMs) para mapaunlad ang kakayahang pang-akademiko ng mga mag-aaral. Mayroon labing limang (ScIMs) na nakabatay sa laro ang nabuo na sumailalim sa balidasyon ng mga ekspertong guro sa pagtuturo ng agham. Batay sa natipong mga resulta, ang mga rating na nakuha ay ginagamit sa istatistika at nagbigay ng isang katanggap-tanggap na Cronbach Alpha Coefficient. Ang ScIMs ay napailalim din sa una at huling pagsubok sa mga mag-aaral sa ikawalong baitang sa sekondary at nagkaroon ng makabuluhang pagkakaiba sa pre-test at posttest iskor, na sinukat ng t-test of dependent means. Sa nakalap na mga resulta ang ScIMs na batay sa laro ay angkop para magamit sa mga mag-aaral ng ikawalong baitang sa sekondarya. Ipinanunukala ng mananaliksik na ang binuo at napatunayan na mga ScIMs gamit ang mga laro ay maaaring gamitin bilang mga pandagdag na kagamitang pagtuturo sa ikawalong baitang sa sekondary ng Agham. Maaari rin nitong suportahan ang mga guro sa pagbibigay ng bagong pananaw sa pagtuturo sa konteksto ng kultura ng Pilipino.

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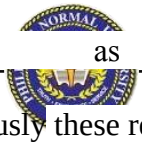
CHAPTER 1

THE PROBLEM AND LITERATURE REVIEW

Background of the Study

Physics as a field of Science is a necessary part of the academic system and exciting intellectual journey that stimulates and expands learners' frontiers of data regarding environment. Historically, minors begin their formal study of Physical Science in the middle school. They most frequently progress within the sequence of Biology, Chemistry, and eventually Physics. If they continue their study of science, Physics is wide thought of to be the foremost academically challenging. Even after instruction students usually consider that physics is hugely troublesome and incomprehensible to a majority of the population. The roots of this situation lie not solely within the subject's demanding subject matter as a presumed "hard science," however additionally in consequence of the abstract nature of Physics (Hookway, 2013). Angell, Guttersrud, Henriksen, and Isnes (2004) probed the views of high school students and Physics academics concerning Physics. They found that students realize Physics hard as a result of their need to affect totally different representations like experiments, formulas and calculations, graphs, and abstract explanations at an equivalent time. Former Physics students bear in



mind Physics as their "worst subject" and nearly continuously these recollections embody pictures of an instructor and associated experiments in an exceeding laboratory (Knight, 2004). The existing state of the Philippines in Science education mainly in the fundamental education level, lags behind other countries within the world. Within the Third International Mathematics and Science Study (TIMSS), once it joined in 1999 and 2003 severally (Orleans, 2007), the Philippines ranked third and fourth. Several Filipino students have improved recognition for their high level of accomplishments in the International Science and Engineering Fair, Robotics Competition, and Physics Olympiad. Moreover, there are reports of scholars in rural areas marking abundant over the international mean within the case of the Third/Trends in International Mathematics and Science Study (TIMSS) or a seventy fifth mastery level within the case of the National Achievement Test (NAT) as explained by Brawner (2011). However, the accomplishments of some students are shaded by the consistently poor performance of Filipino students in international assessment studies and national assessment studies. Studies show that Filipino students have low retention of ideas, have restricted reasoning and analytical skills, and poor communication skills (UP NISMED, 2004). Limited classrooms, laboratories,instructional materials, and administrative support are several factors identified by educators and researchers that impede the performance of students in Physics (DOST-SEI, 2006). Furthermore, teachers' educational insufficiencies and poor collaboration

with physics specialists might result to innovative educational strategies within the absence of educational devices in the schoolroom. Consequently, ineffective teaching and learning processes manifest themselves ensuing to poor transfer of knowledge and skills to students (Orleans, 2007). Educational system in the secondary level in the Philippines confirms that instructional materials used are textbook-based as unconcealed within the inventory of instructional materials in the country. This shows that students neither get exposed to varied modes of learning nor manipulate an array of materials to enrich learning experiences. Therefore, the effectiveness of learning mainly depends on the knowledge, ability and skills of teachers (Orleans, 2007). As an important tool in the teaching and learning process, instructional materials boost students' memory and understanding. It serves as a principal source of content in science, present specific views about the nature of scientific practices, and show how scientific knowledge is established. In addition, it can also support the influence of teachers on how to teach science more practical.

Abdullahhi (2010) asserts that, instructional materials are tools locally made or imported that facilitate learners' learning. Moreover, Obanga (2005) view them as material things which are used to impact and build exceptional enrichment of the intellect.

Nevertheless, instructional materials would not totally reach its potential without the necessary elements for successful utilization both by the teacher and the learner. Cronbach (2009) justifies the necessary elements of behavior that provides the base for learning consisting of all the objects, persons, and symbols in the learning environment. More importantly, the use of instructional materials can appeal to the individual attention by creating interest goal which will facilitate the learner to be personally engaged in the process of learning. Panes (2013) in her study regarding the difficulties of high school students in solving

Physics revealed that students lacked mathematical skills that which are required in solving worded problems. As a result, they might not translate unknown factors into mathematical expression and formulate mathematical equation that expresses the relation of the variables. Moreover, what students found most difficult in solving worded problems involve quadratic and exponential equations. Eventually, the result also showed that students have increasing difficulties because the level of queries likewise expands as they deal with more complex worded problems. As a result, students have problems in understanding advanced ideas. Moreover, within the study of what makes Physics tough, Ornek, Robinson, and

Haugan (2008) discovered that student-related factors, like not studying more, and lack of interest have the foremost influence on students' success in Physics.

This scenario has become one of the propellers for the major reforms done in education for the Philippines. The government, through the Department of Education, led a significant reform through K-12 Basic Education Program that acknowledges many theories in teaching and learning. One of these theories is constructivism which is described as knowledge made within the mind of the learner supported or reflected in one's experiences. Constructivism is basically a theory focused on observation and scientific study concerning how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. In the classroom, the constructivist view of learning can point towards variety of different teaching practices and methods. Within the most general sense, it always means that encouraging students to use active techniques like experiments and real-world problem solving to create additional knowledge and to reflect on a discourse concerning what they are doing and the way they are understanding is dynamical. The teacher makes certain she understands the students' preexistent conceptions, and guides the activity to address them and build on them. Therefore, despite whether or not there is an objective reality, it is the individual who constructs his/her own reality through his/her experiences and interaction with the environment. As an individual experience something new, he/she filters this information through mental structures (schemata) that incorporate schema, beliefs and preconceptions to form sense of the knowledge (Prince & Felder, 2006).

One approach to delivery of learning based on constructivism is inquiry-based by Scherr (2003). In Physics education, this approach may be a laboratory-based, step by-step, in-depth introduction to the Physical Sciences that offers students direct experiences with the method of Science. It is expressly designed to develop scientific reasoning skills and supply observation relating scientific ideas, representations, and models to real-world phenomena. Wong et al. (2011), emphasize that effective implementation of inquiry-based curriculum materials and instruction will enhance students' conceptual understanding, reasoning abilities and interest towards learning Science. The inquiry approach is a lot of centered and learning content as a way to develop information-processing and problem-solving skills. The system is a lot of student centered, with the teacher as facilitator of learning. There is more emphasis on "how we come back to know" and fewer on "what we all know." Moreover, students are more engaged in the construction of information through active involvement. The more interested and engaged students are by a subject or project, the better it will be for them to construct in-depth knowledge of it. Learning becomes nearly easy once one thing fascinates students and reflects their interests and goals.

In addition, inquiry-based science challenges students' thinking by involving them in work scientifically oriented queries wherever they learn to convey priority to proof, assess explanations within the lightweight of different explanations and learn to communicate and justify their decisions. These are tendencies required to promote and justify their decisions. In short, scientific inquiry needs the employment of proof, logic, and imagination in developing explanations concerning the natural world" (Newman, 2004). Another approach in education wherever students are

actively involved in the learning is the theory of games. It is a branch of decision theory concerned with the interdependent decision. The subjects of game theory are situations, where the result for a player does not depend upon his/her own choices, but conjointly on the behavior of other players. Game theory deals with problems during which every player's strategy depends on what the other players do (Hotz, 2006).

Games methodically give the learners with new and varied learning environments that meet his or her own learning style. Active learning through the utilization of play has shown a positive impact with learners by allowing them to actively participate during a learning project rather than passively taking note of lectures or looking at videos with

educator's distribution games as pre-tests and post-tests, reviews, and while preparing assignments (Annetta, 2008). When K-12 learners are learning to play games, they are in fact learning a new skill or language that is defined above than ancient reading and writing through multiple interactions as well as pictures, text, diagrams, symbols, and movement (Gee, 2007). These multiple interactions need correct interpretations for the learner to master the game resulting in out of the box thinking and risk taking which are based on active learning.

Active learning principles concentrate on games requiring players to use their time in passive learning and reflective thinking that generates information from this sort of

learning through instant feedback and therefore the chance to work out extra game solutions (Gee, 2007). An active learning strategy are often outlined as an attractive activity that requires the learner to perform an academic action. The teacher can be sure that each learner participated within the active learning experiences based on information from the game application tool employed in the learning process. On the other hand, active learning strategies could be individual or cluster work. The learning strategies ought to be organized during a constructive manner to ensure effective ways of involving learners in the learning process. Active learning strategies may additionally embody however not restricted to group action activities, peer and self-critiques of work and role taking part (Miller, Chang, Wang, Beier, & Klisch, 2011).

There are many advantages to games and simulations in learning. Academic games and simulations are found to be effective in motivating students to be told (Ke, 2008; Papastergiou, 2009; Tüzün, YilmazSoylu, Karakus, Inal, & Kizilkaya, 2009), and games that encourage exploration is also significantly participative of learners (Kinzie & Joseph, 2008). Gaming these days is employed during a type of organizations to coaching people the way to solve real-life issues that are usually found in emergency responses, military operations, and medical activities. Therefore, the impact of gaming even for adults may have a broad-based intent to the learner. By going through a gaming exercise, the

learner could gain associate experience of realism "what it may be, however not associate absolute within the real-world."

The gaming constructive experience may provide the learner eventually the way to visualize a platform of what readiness appears like through the gaming lenses. The learner can have a stronger idea on the sorts of skills and knowledge that one would wish to solve problems. The learner will further learn the processes in detail. The learner can master skills associated with certain jobs and therefore the use of tools applicable to certain jobs in education, health, and therefore the military as specific examples (Vos & Denessen, 2011). The "Minute to Win It" games provided such an activity wherein students were motivated to undertake them; the games are unit intriguing however need no athletic or high mental skills. The games additionally gave students authority in developing the principles for the games and a way of relativeness to the information they collected. Students were ready to develop responsibility and independence in data collecting, and use self-managing and observation skills through the "Minute to Win It" games. The lessons related to every game, as well as students seeing their pre- and post-test scores, gave students the chance to envision progress and improvement. Additionally, games in the classroom support criteria that emphasizes mastery, progress and improvement (so that students can return to price learning for its own sake). Also, classroom activities, especially gamification, should embody novelty, challenge, variety, and diversity" (Azedo, 2012). The "Minute to Win it" games not solely give variety, challenge and diversity, but they furnish students a way of agency in knowing wherever the information they collected came from.

In the Philippines, native games refer to Filipino indigenous games. Such games utilized in education can fall to the present trend in education that highlights two-way flow of learning and culture. As UNESCO stressed, education ought to be world in perspective; however, localized in approach to bring important effects on sustainability. Learning in step with cultural background may promote property and preservation of indigenous knowledge (Morales, 2014).

Aikenhead (2001) reported that society methods or cultural integration provides opportunities for students to be told Western Science content schooled within the context of native community's traditions. Students' cultural views influence construct data; whereas cultural background influences psychological feature vogue and motivation (Morales, 2014). Cultural context of education associated with cultural background offer an understanding of why students react in a very specific manner to learning material or learning setting. With the varied culture of the Philippines, it is favorable for each student to contextually relate to materials and for academics to integrate culture in physics games.

Conceptual Framework

The present situation of education needs to accommodate amendments to usher learners to a world of speedy change in technology, increasing interconnection, and new forms employment that are not focused on mastering or committal to memory (Winthrop, 2016). Learners' engagement and understanding of the content is

given more importance in today's education in favor of the spoonfeeding the facts and knowledge. Hence, using lecture technique is inadequate in teaching

science. Several researchers have planned advanced ideas and techniques to assist academics to cope with success with the issues (Kaptan, 2012). Learner-centered approaches to teaching and schooling need corroboratory policies for making ready effective educators. Moving from creative constructivist philosophy, scientific discipline and philosophy to the characterization of creative person teaching and learning environments presents a challenge. Constructivist philosophy does not dictate how one ought to teach but it will influence the teacher to treat every learner as an individual in his/her own, to consider diversity of perspective, and to acknowledge that the learner's behavior could be a direct reflection of his / her life experiences. Bandura (1977, 1986, 1995, 1997 as cited in Vincentas, 2012). Consequently, the Basic Education Curriculum, popularly known K-12 program, is anchored on constructivist approach. This approach holds that learning is an active process of constructing rather than acquiring knowledge

and that instruction is a process of supporting that construction rather than acquiring and communicating knowledge. Constructivists view learning as something that concerns experiences of learners that allows them to readily and willingly learn. Since instruction could be a method of supporting construction, it should be structured so it may be simply understood by the learner since it is designed to facilitate

extrapolation and or fill within the gaps of learning. Similar to this approach is the Inquiry-based learning which is a pedagogical approach incorporating a range of teaching approaches that involve stimulating learning to explore educational content by posting, work and responsive queries or problems, thereby prods learners in constructing new knowledge and understandings. Teachers who use these approaches act as facilitators of learning (Weiner, 2013). Inquiry-based teaching focuses on moving students beyond general curiosity into the realms of critical thinking and understanding. The teacher should encourage students to raise questions and support them through the investigation process, understanding how to start and the way to structure an inquiry activity. According to Conelle (2014), students learn through reasoning and doing, through asking questions, carrying out experiments, weighing up proof and considering alternative hypotheses. They have to use evidence-based reasoning and creative problem-solving to reach a conclusion, that they have to defend or present. Moreover, their curiosity and also the skills of scientific inquiry gets enhanced.

A promising platform for promoting inquiry-based learning is game environments. Game-based learning environments are used for a variety of domains, as well as negotiation skills, languages and policy argumentation. Devising effective ways for guiding inquiry-based learning in game environments requires an understanding of students' inquiry strategies (Durlach, 2009).

The millennials grew up in an electronics-filled and progressively on-line and socially-networked world. They became accustomed in enjoying games, exploring gadgets or electronic devices that were not processed to aid learning. The classroom becomes a boring environment to them without the use of teaching strategies that accommodate their passion for games. Learning becomes more satisfying if their passion and interests are addressed within the classroom particularly when dealing with difficult lessons like those in Physics. Physics has invariably been considered a hard and boring field of Science (Korur & Eryılmaz, 2012). This common perception about Physics however can be turned into positive wherever pedagogies and classroom activities come into play. When learning is directed towards enjoyable and fascinating activities like games then the students' interest will increase (Lavonen, 2007). In addition, Moursund (2007) says games offer wonderful surroundings to explore concepts of procedure thinking. The fact that games are available both in a non-computerized type and in a very computerized form helps to form these excellent learning surroundings. A contemporary education prepares students to be productive and accountable citizen. Playing games has been and continues to be a way of recreation among children. Centuries before radios, televisions, cell phones, computers, and game consoles, children contend hide-and-go-seek and tag. With the emerging technology, children are taking part in hand-held games on airplanes and taking part in games on their cell phones at

restaurants. When educational games students play, students can expand their knowledge of a subject, broaden their understanding of a historical event or culture, or become stronger at a specific talent ("Applying instructional Games" 694 as cited in McCauley, 2011).

According to Martin, Justine, and Ewing (2011) games have a positive impact on learning are as follows:

1. help establish a sense of self;
2. compelling;
3. engages a child in a virtual world;
4. builds social relationships;
5. incorporates problem solving;
6. decision-making;
7. encourages participation in learning communities; and
8. develops multiple intelligence skills.

Though, it has many advantages games turn out an excessive amount of aggressiveness that will cause unmanageable room. These drawbacks may be reduced through structured activities and acceptable process to bring out the specified learning outcomes which will be derived from games.

In the light of these findings and conclusions, as a strategy in teaching Science, the present study purported to craft lessons in Physics through games specially in the areas of forces and motion; work and energy; heat and temperature; electricity; and light and sound.

This study used the Input-Process-Output Model of developing Science Instructional Materials (ScIMs). The input components for the Science Instructional Materials (ScIMs) was taken from the K to 12 Curriculum Guide for Science, budget of work in Grade eight, textbooks in Science Grade eight, learning modules, and laboratory manuals. The developed learning material was mainly based on the criteria and guidelines in constructing the instructional materials as established by the Department of Education.

The process component was divided into three stages, the ScIMs preparation, ScIMs development and the ScIMs validation.

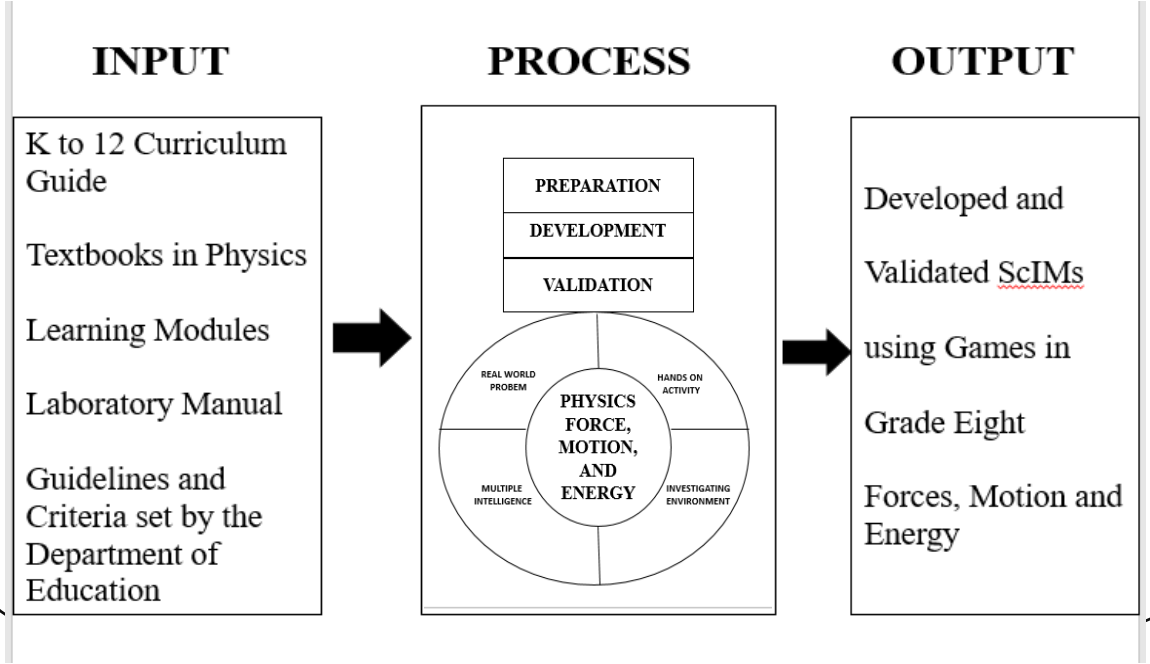


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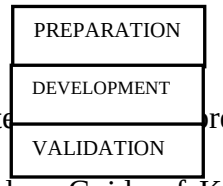
Figure 1.1

Research Paradigm



The Science Instructional Mate reparation includes the selection the content based from the Curriculum Guide of K to 12 in Grade Eight. ScIMs velopement stage deals with the actual writing and production of the material.

Proofreading and editing with the evaluation of the adviser and the initial rev of the ScIMs were included. The validation stage was done through the first second pilot testing of the

edited ScIMs to the respondents. After each pilot test was conducted, the ScIMs were subjected to validation by three (3) selected experts. The revision was based on the suggestions of the experts based from their evaluation on the ScIMs. The developed

and validated ScIMs using Force, Motion and Energy was the output of the study.

Statement of Purpose

This study is directed towards the development and validation of Science Instructional Materials (ScIMs) using games in Grade 8 Force, Motion and Energy aligned with the structure of the Basic Education Curriculum of K to 12.

Specifically, this study aimed to:

1. develop and validate ScIMs on Force, Motion and Energy for students in Grade 8 of the Basic Education Curriculum;
2. establish validity of the Science Instructional Materials (ScIMs)
3. revise Science Instructional Materials (ScIMs) based on

the evaluations.

Significance of the Study

The developed ScIMs could be a great support to the following:

Students. The Science Instructional Materials (ScIMs) may help the students to understand better the topics or even master the concepts in Physics while they are enjoying the activities. It may also boost students interest and involvement in the learning process and they become more responsible of their own learning, inquiry, multiple

intelligences skills and to be responsible members of the community. It also serves to promote awareness on the different games in the Philippines.

Teachers. It may inspire the teachers to create their own instructional materials or module that caters diverse learners to provide more challenging, effective and efficient teaching learning environment.

Administrators. The result of the study may inspire the school administrators to employ appropriate materials that may serve as help to the teaching-learning process to increase students' performance. It also serves as an opportunity to support in constructing differentiated instructional materials for varied learners.

Curriculum Planners. The result of the study may serve as a realization that they need to review and revise the curriculum that coincide with the objectives of the educational system in the country to produce globally competitive and holistic learners.

Parents. The results of the study will help the parents of the respondents feel secured because there are strategies and innovations in teaching that will greatly help their children. It may guide them as to how parental support and consistent follow ups are essential and important in the development of their children as well.

Future Researchers. The findings of this study will serve as a reference material and guide for future researchers to create and validate their own instructional materials.

Definition of Terms

Bicycle Dynamo. Are actually magnetos and produce alternating current.

Buko Race. This game used a coconut fruit and a back pack that the students will carry up the stairs.

Bowling. The game or activity back pack a player to rolls or throws a bowling ball towards a target.

Coconut Ride. It is where the carpet ride originated. This game used coconut leaves to transfer one student from one place to another, by the help of other student pulling the base of the coconut leaves.

Dancing Dried Leaves. This is a game that showcase the vibration of sound through medium.

Egg Drop. A Minute to win it game that shows the relationship of mass, force and the change in objects motion that uses egg, plate, and glass.

Filipino Traditional Games or "Mga Laro ng Lahi". These are games that Filipino children invented (but some are adopted as well) played usually by using native materials/instruments or without the need of anything but the players themselves.**Game.** It is a physical or mental competition conducted according to rules with the participants in direct opposition to each other.

Lover's Carry. This is a game where a partner carries his/ her partner to transport from one court to another.

Prism. This is a game that uses a prism to produce rainbow colors.

Riddle. This is a question or statement intentionally phrased so as to require ingenuity in ascertaining its answer or meaning, typically presented as a game.

Science Instructional Materials (ScIMs). These are instructional materials used to stimulate the activities of students and maximize their level of understanding (Dy, 2014)

Simple Electric Set Up. This is a game that uses load, connecting wire, battery to light up the bulb.

Sparkling Stone. This game uses two identical stones to produce fire.

Steam Boat. It is a steam-driven vessel, especially a small one or one used on inland waters.

String Telephone. A tin can telephone is a type of acoustic (non-electrical) speech-transmitting device made up of two tin cans, paper cups or similarly shaped items attached to either end of a taut string or wire. People only had limited string.

Tumbang Preso or Presohan. This is a native game of the Philippines that is a favorite of Filipino children. The word **tumba** means "to fall" and **preso** means

"prisoner." This game highlights how to make the can fall to its side and retrieve the thrown slipper before the "it" stands the can back up.

CHAPTER 2

METHODS

This chapter presents the method of research, research designs, research locale, sampling and participants, research instruments and the statistical tool used in the treatment of data.

Research Method

The researcher made use of descriptive research that is mainly concerned with describing the nature or condition and the degree in the detail of the present situation.

This method is used to describe the nature of a situation as it exists at the time of the study and to explore the cause/s of a particular phenomenon (Fraenkel &Wallen, 2007). The aim of descriptive research is to obtain an accurate profile of the people, events and situations. With this research type, it is essential that the researcher already have a clear view of picture of phenomena being investigated before the data collection procedure is carried out.

The researcher used this kind of research to obtain first hand data from the respondents so as to formulate rational and sound conclusions and recommendations of the study. The descriptive approach is quick and practical in terms of the financial aspect. In addition, this method of research is advantageous due to its flexibility, which can use either qualitative or quantitative data or both, giving the researcher greater options in selecting the instrument for data gathering.

Research Design

The development and validation of the ScIMs includes three stages:

1. Preparation - selecting the content of the ScIMs, designing instructional activities.
2. Development - writing the ScIMs, proofreading, editing and reproduction of the ScIMs, evaluation of the ScIMs by the adviser, first revision of the ScIMs.
3. Validation - first pilot testing, first validation by experts, second revision of the ScIMs, second pilot testing, second validation by experts, third revision of the ScIMs, score and final revision of the ScIMs.

PHASE I PREPARATION	PHASE II DEVELOPMENT	PHASE III VALIDATION

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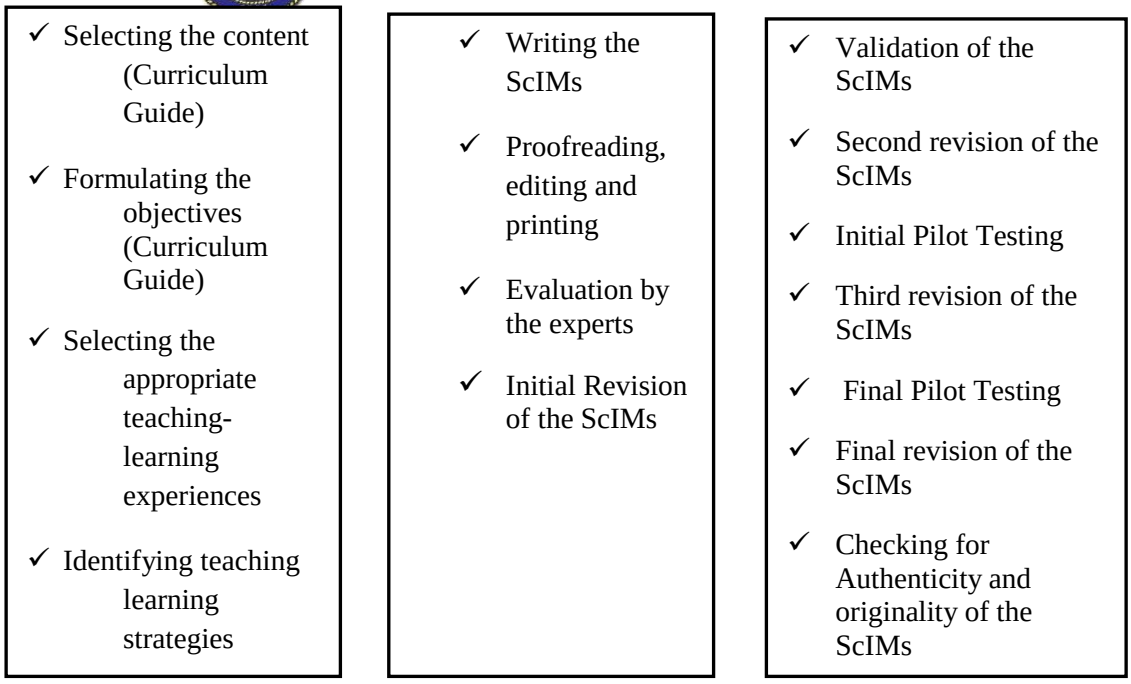


Figure 2.1
ScIMs Development and Validation Flow Chart

Research Locale

The study was conducted at Cauayan City National High School located in Brgy. Turayong, Cauayan City, Isabela, offering Basic Education Curriculum (BEC), Science and Technology Engineering Curriculum (STEC), Special Program in the Arts and Design (SPAD) and Special Program for Sports (SPS). It envisions to produce graduates who are God-fearing, academically competent, self-propelling, and nature-loving individuals living a productive and meaningful life. Further, it is committed to provide equitable access to excellent instruction among all learners in order for them to become value oriented, functionally literate and globally competitive individuals.

Sampling and Participants

The grade eight students of Cauayan City National High School, for the school year 2017-2018 were the participants of the study, who were chosen through cluster sampling. There were nineteen (19) heterogeneous sections with 40 students in each class. Grade 8 – Garnet consisting of 40 students were the participants during the first pilot testing while the students of grade 8 – Diamond, also consisting of 40 students, were involved in the final pilot testing of the Science Instructional Materials (ScIMs).

Instrument

Checklist.

This was utilized to measure things or information required.

Procedure

This part consists of assessment/pretesting phase, development phase validation phase and ethical considerations.

Assessment/pretesting phase.

This phase involved planning, organizing and putting into order the content, objectives, teaching learning experiences, teaching strategies and instructional activities, with the help of teachers teaching science subjects at Cauayan City National High School in Cauayan City, Isabela.

Selecting the content.

The content of the developed ScIMs was based on the standard curriculum guide provided by the Department of Education and the prescribed topics under Science Grade 8.

The topics included in the Science Instructional Materials (ScIMs) for the first quarter were as follows:

Module 1: Forces and Motion

Module 2: Work and Energy

Module 3: Heat and Temperature

Module 4: Electricity

Module 5: Light and Sound

Formulating the objectives of the learning modules.

Every activity begins with a goal such as in programs of instructions, course and even trainings which are broken down into specific goals or learning. The objectives are brief statements on what the students will achieve after completing the tasks. Such precise and articulated learning objectives are important because they

provide learners with a clear picture of the learning objectives to direct teachers' choice on the instructional activities and guide their own assessment strategies as a teacher.

Table 2.1

Module Objectives and ScIMs Games

MODULE	LEARNING COMPETENCIES	GAMES
1. FORCES AND MOTION • Newton's First Law • Newton's Second Law • Newton's Third Law	• Investigate the relationship between the amount of force applied and the mass of the object to the amount of change in the object's motion Infer that when a body exerts a force on another, an equal amount of force is exerted back on it. • Demonstrate how a body responds to changes in motion**.**	• **Egg Drop** • **Coconut Riddle** • **Tumbang Preso**
2. WORK AND ENERGY	• Identify situations in which work is done and which no work is done	• **Buko Race**

	Describe how work is related to power and energy • Differentiate potential and kinetic energy • Relate speed and position of object to the amount of energy possessed by a body	• • **Lover's Cary** • **Bowling**
3. HEAT AND TEMPERATURE	• Differentiate heat and temperature and its effects on the body	• **Riddle** • **Steam Boat** • **Sparkling** • **Stone**
4. ELECTRICITY	• Infer the relationship between current and charge • Differentiate electrical power and electrical energy Explain the functions of circuit	• **Simple** • **Electric Set Up** • **Bicycle Dynamo**

	Breakers, Fuses, Earthing, double insulation, and other safety devices in the home	
5. SOUND AND LIGHT	• Infer how the movement of particles of an object affects the speed of sound through it Explain the hierarchy of colors in relation to energy	• **String on the Telephone** • **Prism Dancing Dried Leaves**

Selecting the teaching –learning experiences.

The selection of teaching learning experiences using games considered the impact to learners' understanding of the intended lesson. The game-based activities were influenced by real-world situations, environment, and multiple intelligences.

Identifying teaching-learning strategies.

Experiences within the level of abilities and interest were considered as well as the hands on activities incorporating real world situations that promote the enhancement of multiple intelligences. To guarantee the attainment of each ScIMs, the

conditions of learning must be applicable to the selected use of the games. The use of games as instructional strategy, sprang from the theoretical backgrounds of inquiry-based and constructivist approach where the K to 12 Curriculum has been anchored. The learners are the active participants of the learning and were considered as the center of the curriculum. It followed differentiated activities for diverse learners.

Development phase.

This stage was considered the heart of the study. The preparation of the Science Instructional Materials (ScIMs) was focused in this stage.

Writing the Science Instructional Materials (ScIMs).

This was the major part of the development and validation of the Science Instructional Materials (ScIMs). The criteria set by the Department of Education Material Council and the UNESCO guidelines in developing the instructional materials were used in the study. Guidelines covered the objectives, content, organization, materials and resources and effectivity in writing the ScIMs.

The suggestions and comments from the experts, and the adviser were considered in the development of the ScIMs. The style adopted for the learning module was patterned from the existing Science learning materials for K to 12 Grade 8. The content of the learning modules is considered distinctive because it is game-based that promotes the Filipino culture.

Proofreading, editing and printing the ScIMs.

The Science Instructional Materials (ScIMs) were exposed to grammar and spelling checks both by computer program operations and by an English critic. The tasks were done per module with the assistance of advisers, co-teachers and practitioners teaching Science. The printing of the ScIMs were done after editing the text, graphics, formatting and lay outing for better outcome. The experts guaranteed that the Science Instructional Materials (ScIMs) are clear, consistent and correct in terms of features, elements and component. Each set of module was presented to the experts using the evaluation tool (see Appendices.)

Evaluations of the materials by the adviser.

The developed instructional materials were presented to the thesis adviser for comments and suggestions before the evaluation by the experts who are Science teacher practitioners.

Initial revision of the instructional materials.

The integration of the suggestions and comments of the adviser and teacher practitioners was performed before the ScIMs were reprinted for the experts' validation.

Validation phase.

This stage was undertaken to validate the instruments for content validity, organization and readability.

Validation of the ScIMs.

The revised ScIMs were returned to the experts for validation. The validation process was conducted by the experts in many phases corresponding to the five modules with three (3) games each. Content validity represents the test essence to measure the intended lessons and areas. (Sevilla, et al 1988 as cited in Agorilla). The suitability of the ScIMs to the subjects and the objectives were analyzed and agreed through the assistance of the experts in the field. The ScIMs were subjected to validation using Expert's Assessment Checklist. This checklist was developed based on several theses such as that of Salvador (2005), Rivera (2011) and Agorilla (2015). The criteria set by the writers of these theses were found to be applicable so they were adopted. Objectives contain the clarity of statement, attainability, and measurability in terms of knowledge, process, understanding and performance which are the highlight of the criteria of assessment procedures in the K to 12 Curriculum.

For the sequence, the criteria included the clarity and conciseness of instructions, proper organization of the lesson, progression and depth of knowledge, provisions of adequate questions, problems and relevance to the objectives.

The effectivity of ScIMs was focused on the promotion of active learning and motivation for the students.

The following was used to describe the ratings.

Mean Rating	Verbal Description
$\geq$ 0.9	Excellent
$\geq$ 0.8	Good
$\geq$ 0.7	Acceptable
$\geq$ 0.6	Questionable
$\geq$ 0.5	Poor
$\geq$ 0.4	Unacceptable

The Intraclass Correlation Coefficient using Cronbach Alpha was utilized to determine the internal consistency of the reliability of the experts' responses. A rank above 0.7 Cronbach Alpha Coefficient is the ideal score.

Second revision of the ScIMs.

The experts' suggestions and recommendations were applied in the revision of the ScIMs. Revisions were made to follow experts' observations regarding the format of the ScIMs.

Initial pilot testing.

The developed ScIMs were administered to the Grade 8 students of Section Garnet under the Basic Education Curriculum of Cauayan City National High School

with forty (40) students during the First Quarter of the School Year 2017-2018. The ScIMs were used by the grade 8 teachers in Science who have been teaching the topics for more than five (5) years and are in the position of Teacher III. Initial pilot testing included the administration of Pre Test prior to the actual use of the ScIMs. A Post-test was given to determine whether there exists an improvement on the students' understanding of the lessons.

Third revision of the ScIMs.

The ScIMs were revised after the initial pilot testing considering the comments and suggestions of the teachers who utilized the module as well as the observation of the researcher during the conduct of the lesson in the third revision of the ScIMs.

Final pilot testing.

The final pilot testing was performed by an equally qualified science teacher teaching the topics included in the ScIMs. The set of the students where the final pilot testing was conducted comparable to the set of students where the first pilot

conducted. After the conduct of each learning module the posttest was likewise performed similar to what the first try out.

Figure 2.2

The Teacher Conducting the Final Pilot Testing

Final revision of the learning modules.

The final stage in developing the ScIMs is the final revision. The researcher observed and took down notes of her observation in the conduct of the learning module. These observations together with the feedback of the teachers as well as how the students behave in the conduct of the game-based lessons were integrated in the revision of the ScIMs. Problems that were encountered by the students during the second pilot testing were used as bases for further revisions on the learning materials. Results on the use of ScIMs comparing the test scores between pre-test and post-test

were subjected to standard statistical treatment. A sample of the validated learning module is found on the Appendices.

Checking for the authenticity and originality of the ScIMs.

The developed ScIMs shall be subjected for Authenticity and Originality test after final oral defense.

Statistical Treatment

1. t-test Dependent – This is also referred to as the paired t-test or paired-samples t-test that compares the means that of two connected groups to see whether or not there is a statistically vital distinction between these means.
2. Cronbach Alpha Coefficient – In the study, this was used to determine the internal consistency of the responses gathered.

2.

Ethical Considerations

Ethical considerations in research with students occur at all stages of the research process. They ought to be thought of as an ongoing and reflexive part of the research process throughout the lifetime of a research project and not even as the primary hurdle to be overcome. The researcher considered the following ethical principles: respect for autonomy, no maleficence, beneficence, justice, and fidelity to the interactions and

relationships between students and teachers, specifically teacher to student (i.e., however teachers act with and relate to students), student to teacher/learning setting (i.e., however students act with and relate to teachers), and student to student (i.e., however students ELEMENTARY moral CLIMATE INDEX seventy-five act with and relate to different students) (Brown & Krager, 1985; field marshal, 1984, 1985; Schulte et al., 2002). Respect for autonomy involves permitting someone to act independently. The researcher did not force the teacher in conducting the research. No maleficence refers to doing no harm to others most especially in the learners. The students are not harmed during the conduct of the study. Learners enjoy the activities because they have prior knowledge in playing the games. Beneficence means that benefiting others; justice involves treating others fairly; and fidelity means that being devoted and trustworthy. Respect for persons lies at the center of those principles. To create the ESECI School Ethical Climate Index (SECI) which was developed for middle and high schools (Schulte et al., 2002) was adopted.

CHAPTER 3

RESULTS AND DISCUSSION

This sections presents, interpret and analyses the data gathered for the attainment of the following purposes:

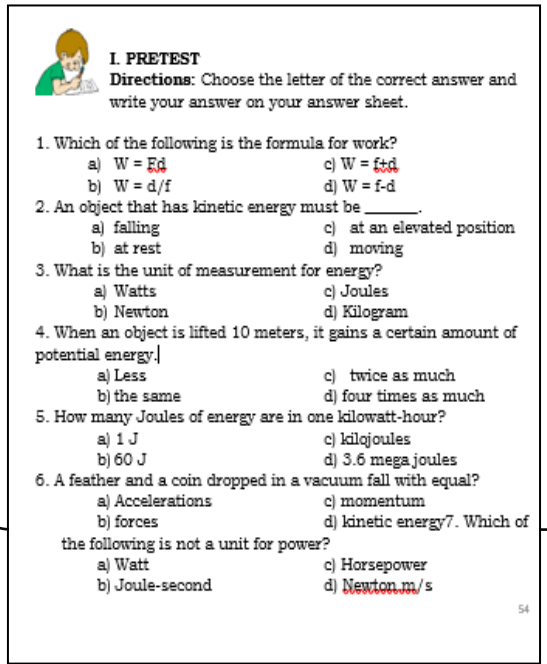
1. develop a ScIMs in Science and Technology for students in Grade 8 of the Basic Education Curriculum;

2. establish validity and reliability of the Science Instructional Materials (ScIMs); and

3. revise Science Instructional Materials (ScIMs) based on the evaluations.

Science Instructional Materials (ScIMs) Developmentof Science

The use of Science Instructional Materials (ScIMs) is one treatment to improve students' performance. In drafting the Science Instructional Materials (ScIMs) the following parts were included. The first part consists of preface, and pretest. The preface provides meaningful lessons in higher order thinking skills. Pretest identify the existing knowledge of the learners (see the on the next page).



I. PRETEST
Directions: Choose the letter of the correct answer and write your answer on your answer sheet.

1. Which of the following is the formula for work?
   a) W = Fd c) W = f+d
   b) W = d/f d) W = f-d
2. An object that has kinetic energy must be _____.
   a) falling c) at an elevated position
   b) at rest d) moving
3. What is the unit of measurement for energy?
   a) Watts c) Joules
   b) Newton d) Kilogram
4. When an object is lifted 10 meters, it gains a certain amount of potential energy.
   a) Less c) twice as much
   b) the same d) four times as much
5. How many Joules of energy are in one kilowatt-hour?
   a) 1 J c) kilojoules
   b) 60 J d) 3.6 mega joules
6. A feather and a coin dropped in a vacuum fall with equal?
   a) Accelerations c) momentum
   b) forces d) kinetic energy7. Which of the following is not a unit for power?
   a) Watt c) Horsepower
   b) Joule-second d) Newton.m/s

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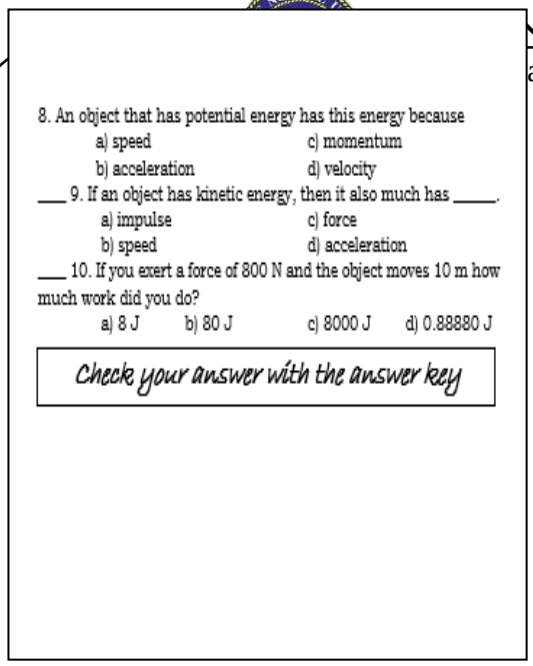

8. An object that has potential energy has this energy because
a) speed c) momentum
b) acceleration d) velocity
___ 9. If an object has kinetic energy, then it also much has ____.
a) impulse c) force
b) speed d) acceleration
___ 10. If you exert a force of 800 N and the object moves 10 m how much work did you do?
a) 8 J b) 80 J c) 8000 J d) 0.88880 J

Check your answer with the answer key

Second part has the overview of the topics and its focus points. The overview allows the learners to identify what is inside of the module and the topics as well.

The third part comprises the games that consisted of mechanics on what to do before, during, and after the game. This is mainly the highlights of the ScIMs. In addition, it consists of guide questions for processing and the enrichment activities (see figure 3.2).

Game

EGG DROP INERTIA
Objectives:
After playing this game, you should be able to

- demonstrate how a body responds to change in motion;
- Investigate the relationship between the amount of force applied and the mass of the object to the amount of change in the object's motion
- explain Newton's first law or law of inertia;
- relate Newton's first law in real life situations

Materials:

10 raw eggs,10 glass filled with water

10 stainless plate

Figure 3.2

ScIMs Egg Drop Game

Lastly, the fourth part contains the life lessons that applies the concept in real life, and the post test that determine whether there exists change in the performance of the learners.

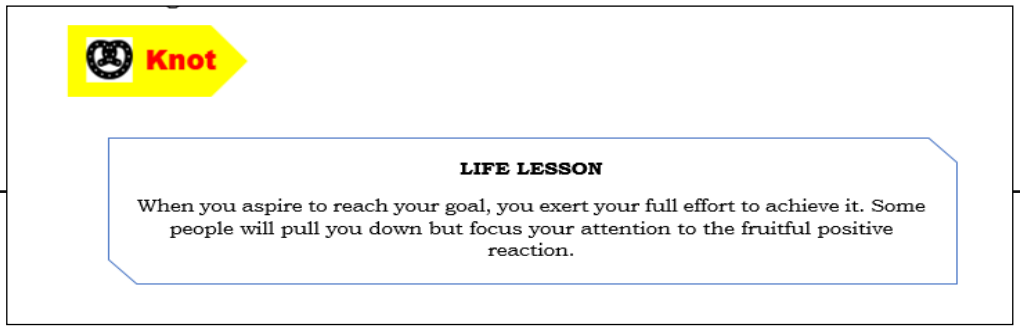

Figure 3.3

ScIMs Life Lesson

Table 2.1 shows the matrix of topics using games in the entire quarter Module one (1) which presented the lesson on Laws of Motion. The First Law or Law of Inertia made used of the game Egg Drop that focused on the ability of objects to stay at rest and resist

change on its motion while at rest. The Second Law or Law of Acceleration was presented through the game Coconut Ride. It demonstrated that when a body exerts a force on another object, an equal amount of force is exerted back on it. The Third Law or Law of Interaction highlighted the game *Tumbang Preso* or *Presohan* that demonstrate how a body responds to change in motion upon acted by unbalanced forces.

Table 3.1

Matrix of Topics Using Game

MODULE	GAMES
1. FORCES AND MOTION • Newton's First Law • Newton's Second Law • Newton's Third Law	**Egg Drop** **Coconut Ride** **Tumbang Preso**
2. WORK AND ENERGY • Mechanical Work • Work, Power and Machines • Work and Mechanical Energy	**Buko Race** **Lover's Carry** **Bowling**
3. HEAT AND TEMPERATURE • Heat and Temperature • Heat Energy • Effects of Heat	**Riddle** **Sparkling Stone** **Steam Boat**
` **4. ELECTRICITY** • Eletricsl Quantities • Ohm's Law	**Simple Electric Set Up** **Salt Solution**

• Equivalent Resistance • Electric Power and Electrical Energy M	**Bicycle Dynamo** and Alternative Energy
5. SOUND AND LIGHT • Work and Mechanical Energy • Effects of Sound • Visible Light	**String on the Telephone** **Dancing Dried Leaves** **Prism**

Module two (2) presented the lesson on Work and Energy. The first topic was Mechanical Work; the game *buko* race was used to present the lesson. It explained and relate the concepts of work, power and energy in real life. The second lesson was Work, Power and Machines that made use of the game Lover's Carry explaining the

relationship of power and energy and the kinetic and potential energy of objects to the amount of energy possessed by a body. Work and Mechanical Energy was the third topic on module two (2) that made use of the game Bowling Ball. It demonstrated the difference between potential and kinetic energy.

MODULE 2 **Work and Energy**

Overview

A construction worker holding one end of a heavy board, a soldier guarding the Rizal Monument, an inspector watching canned goods go by moving belt, or a secretary typing letters and communications are said to be doing work. Whatever its meaning in daily life, work has a very precise meaning in Physics.

This module will help you find the answer to such questions as if energy can neither be created nor destroyed, where does it come from? And why do we need to conserve energy when it is indestructible.

Figure 3.4

ScIMs Module 2: Work and Energy

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Module 3 Heat and Temperature

Overview

Heat is everywhere, we do not see how heat transfer happens. You have learned that heat transfer takes place between objects from higher temperature to lower temperature. Either by conduction, convection and radiation. Heat is the primary concern of man on how to conserve it in natural sources, to produce it with the least cost and how to control it for the maximum use. This time you will learn the effects of heat transfer to the materials, the factors that affect the amount of heat and describe how these are related to the amount of heat being transferred. The insight of heat and temperature is not related only in average kinetic energy but also to the specific heat capacity.

Module three (3) focused on the lessons on Heat and Temperature. Temperature was the first topic. It was presented by a Riddle that highlighted the concepts in temperature. The Heat Energy lesson presented by the game entitled Sparkling Stone demonstrated the relationship of heat and temperature. It showcased the production of fire using the said materials above. Effects of Heat was the last topic on module 3. It was presented through the game Steam Boat which demonstrated the effects of hot or steam water on the movement of boat in a particular time.

Figure 3.5

ScIMs Module 3: Heat and Temperature

Module four (4) highlighted the lesson on Electricity. The "Electrical Quantities" made use of the game Simple Electric Circuit that focused on the relationship of current, voltage and resistance. Ohm's Law was the second topic that was presented using the game Bicycle Dynamo. It determined the effects of the force and movement that was being applied to the pedal and its effects to the brightness ofthe bulb. The topic "Equivalent Resistance" and "Alternative Energy" made use of the game Salt Solution. It showed the effects of salt solution that serves as an alternative source of energy.

Figure 3.6

ScIMs Module 4: Electricity

Module five (5) focused in the lessons of “Light and Sound”. Propagation and Doppler effect in sound were the first topics that made use of the game String Telephones which demonstrated the passing of a message through cans and strings. “Dancing Dry Leaves” a game that was used to present the topic on “Effects of Sound” demonstrated the movement of particle that affects the speed of sound in an object. “Visible Light” was the last topic on Module 5. It was delivered through the Game Prism that focused on the production of different colors.

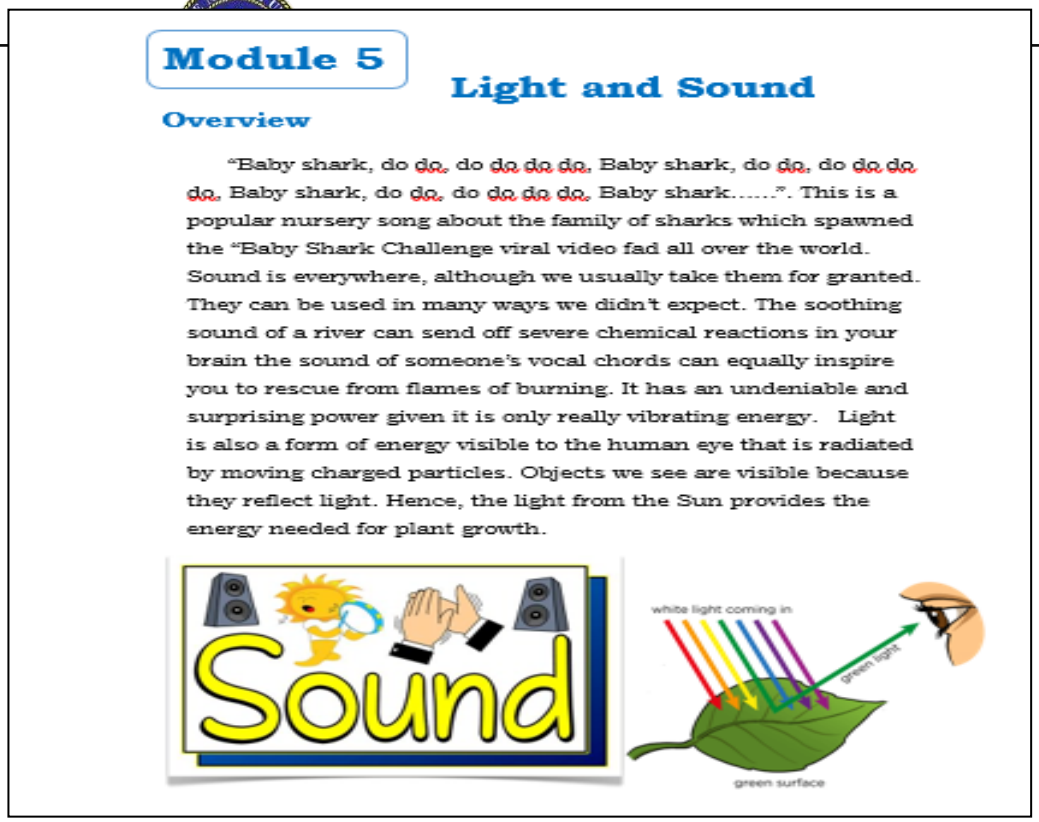

Figure 3.7

ScIMs Module 5: Light and Sound

A good instructional material should promote certain desirable results (Romiszowski, 2008; Hannafin, Land & Oliver, 2007). It should stimulate interest,

command attention, be easily understood and promote active interaction on the part of the learners (Jonassen, 2011). By providing clear and attainable objectives, the learning process would be more effective (Lucas & Corpuz, 2007).

In order to measure the internal consistency of the evaluators' responses in evaluating the ScIMs, the Cronbach's Alpha Coefficient was determined. Table 3.1 presents the levels of agreement of the experts during the first and second tryouts in evaluating the ScIMs using the assessment tool adopted in the study of Agorilla (2015). As the experts rate the material during the first try out, they agreed with their responses with Cronbach's Alpha Coeffient of .675 described as "acceptable".

For the second try out, Cronbach's Alpha Coeffient gained .715 which implies that there is an "acceptable" of the agreement of the expert's in terms of materials, content, clarity, presentation and relevance. They agreed that the material follows a definite framework for each ScIMs that contributes to their efficiency. A properly structured learning resources encourages students to learn more because better understanding of the concept is warranted if concepts and ideas are presented in an organized manner. On the other hand, the study of Del Carmen (2015) shows that the total measure of interrater reliability of experts was 0.58 that indicates it "poor".

Reliability Statistics of Experts' Validation

Table 3.1

Measure of Interrater Reliability Scoring Rubrics of Normal University

Area	Cronbach's Alpha Coeffient	Verbal Interpretation
First Pilot Test	.675	Acceptable
Second Pilot Test	.715	Acceptable

In the first try out of the developed instructional materials, each module had a pretest and posttest. The T-test of dependent means was applied to determine whether there exists any difference between the pretest and post-test scores after exposure to the developed instructional material. Table 3.2 shows all the five modules that earned a significant difference (in pretest and post-test) at 0.05 level of significance. This means that the students changed significantly as a result of the exposure to the instructional material. Prior to the preparation of the ScIMs the researcher gathered additional insights from the practitioners on the preparation of the materials specifically on the

content and on how to use the games. The next phase was the review of the topics and learning competencies found in the Curriculum Guide of K to 12 as well as in the budget of work particularly in the first grading period or first quarter in grade eight Science. The second phase in the ScIMs preparation is the organization of each topic. The development

phase was writing the ScIMs, printing, binding and viewing of the materials, evaluation of the adviser, and the initial revision of the ScIMs. The last phase is the validation phase. The ScIMs were pilot tested for the first try out, then validated by the experts using checklist adopted by the researcher from Libranda (2004), Hernandez (1999), Salvador (2005), Rivera (2011) and Agorilla (2015).

Table 3. 3.

Descriptive Statistics Pre and Post Test of Trial 1

	Paired Differences				
	Mean	SD	SEM	t	p
Module1PreTest - Module1PostTest	-3.07	1.29	0.20	-15.23	0.00
Module2PreTest - Module2PostTest	-3.00	1.20	0.19	-15.95	0.00
Module3PreTest - Module3PostTest	-3.26	1.50	0.23	-13.95	0.00
Module4PreTest - Module4PostTest	-2.82	1.46	0.23	-12.37	0.00
Module5PreTest - Module5PostTest	-3.00	1.44	0.23	-13.26	0.00

After the first try out the developed ScIMs using games were revised based on the feedback of the teachers and students who used the ScIMs including the ideas gained by the researcher during observation in the first try-out, like the need to revise the mechanics of the games. Here are some comments and suggestions of teachers and students as well. The instruction or procedure should be easily understood by the learners. The point system should be clear considering the availability of materials. Icons should have uniform size and the format should be based on the DepEd guidelines in constructing the instructional materials.

Table 3.4:

Descriptive Statistics Pre and Post Test Trial 2

	Paired Differences				
	Mean	SD	SEM	t	p
Module1PreTest - Module1PostTest	-3.07	1.29	0.20	-15.23	0.00
Module2PreTest - Module2PostTest	-3.00	1.20	0.19	-15.95	0.00
Module3PreTest - Module3PostTest	-3.26	1.50	0.23	-13.95	0.00

Module4PreTest - Module4PostTest	-2.82	1.46	0.23	-12.37	0.00
Module5PreTest - Module5PostTest	-3.00	1.44	0.23	-13.26	0.00

Revision of Science Instructional Materials (ScIMs)

In the first try-out the result of the pre and posttest is not high. The researcher considered the suggestions of the experts in developing the ScIMs. The suggestions where basically on the mechanics or procedure that needs to be fit with learners' understanding. They also suggested the addition of images in order for better understanding of the students. The revisions made by the researcher yielded an improvement on learners' performance.

The experts said *"The instructions or procedures should be easy to understand by the learners"*. The other said "*the point system should be clear and you should consider the availability of the materials within our place*". These suggestions were the basis for the second revision of the ScIMs. During the try out, the teachers observed that the students are aggressive in playing the game that disturb other classes. These observations were considered during the third revision of the ScIMs.

According to Lombardi and Oblinger (2009), teachers should devise meaningful and appropriate assessment strategies to bring authentic learning experiences for the learners that must be aligned with the instructional objectives at hand. The evaluators commended the way ScIMs were written in clear and simple manner which make the material easy to read. The illustrations showcased in the ScIMs are appropriate with clear lay out to encourage understanding of the concepts.

According to Voltz, Sims and Nelson (2010) learners' learning experiences also depends on effective instructional materials and enhanced visual materials. They also continued that learners tend to develop their imagination when the illustrations used have clear details and vivid colors. Furthermore, exploring the visual details with suitable language used promotes better understanding of the context of the materials. Among the experts' comments are that the material guarantees that the illustrations in the ScIMs are very appropriate and pleasing to encourage more understanding of concepts.

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CHAPTER 4

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of the Study

The purpose of the study was to develop and validate Science Instructional Materials (ScIMs) using games in teaching Science lessons on Force, Motion, and Energy. The lessons/topics set by the Department of Education were the primary basis of constructing the ScIMs.

The researcher developed fifteen different game-based activities in Force, Motion, and Energy for grade eight students in high school. This study was directed in the Input-Process-Output system. The input components were K to 12 curriculum guide, textbooks in Physics, learning modules, laboratory manuals, guidelines and criteria set by the Department of Education in constructing the ScIMs. The process output was the developed and validated ScIMs using games in grade 8 Physics. The second phase in the ScIMs is the organization of the topics with corresponding games. The development phase was writing the ScIMs, proofreading, editing, and printing of the material, evaluation of the adviser, and the initial revisions of the ScIMs.

The last phase is the validation phase. The ScIMs were pilot tested for the first try out, then validated by the experts using the checklist adopted by the researcher

followed by the second revision of the ScIMs. The ScIMs were put tested again for the second try out and subjected again for expert validation followed by third revision.

The expected contents for the competencies for grade eight are covered where the degree of success of students is measurable. Easy to visualize illustrations, diagram and figures are present to aid and allow students to view concepts from different perspective and different forms. The language of the activity is easy for students to comprehend and follow because of limited technical terms used and within the context of Filipino students. The games used in the activities are valid and properly integrated to the concepts, where chosen "Laro ng Lahi and other games were used in the activities are among those most common within Filipino student's cultural or social context. "Laro ng Lahi" as class activity promotes collaboration among students. It also serves as a good source learning experience. The activities can be easily reproduced because the materials used in the activities are indigenous.

The developed activities can improve and develop students' critical thinking skills and conceptual understanding in physics which can further arrive with application of concepts to real life situations. It has the capability to elicit and address common misconceptions of students for they are free to explain the line of reasoning of their answers. The activity can also serve as assessment tool for the teacher.

Summary of Results

The data gathered and analyzed revealed the following:

Fifteen (15) game-based activities were developed for eight junior high school.

2. The developed activities were validated and rated as "Acceptable" by the expert validators.

3. The values of the reliability coefficient α of different areas of the instrument used are all acceptable. The interrater reliability coefficient κ of the ratings of the validators is interpreted as "moderate agreement".

Limitations

The developed and validated Science Instructional Materials (ScIMs) did not include the electronic games and extreme sports games. Further, the developed and validated ScIMs modules were not tried out among learners in rural areas.

Conclusions

Based on the assessment of the ScIMs developed, they are fit to be used in science classes for the junior high school of the new K to 12 Curriculum. Teachers can use these games as supplementary activities for instructions on Forces, Motion and Energy. Outdoor physics can trigger students' thinking and give them deeper understanding of concepts and methods in physics. With the activity, students were

aided in dealing with the performance of the learners and developed certain cognitive skills. The developed material most probably guarantees a time efficient class, where students are expected to grasp specific concepts by the end of the allotted time for science.

The ScIMs developed are validated to have various usefulness. Using the developed games will turn the classes active and participative, since the materials needed on the activities can be provided by the students, and it can be reproduced easily and inexpensively. The ScIMs are as well designed for ease of administering to students; teachers will facilitate the students in performing the task. It can also be used as an assessment tool which can be helpful in detecting students' misconceptions. It is also aligned to the K-12 curriculum assessment scheme where performance based evaluation is given priority.

Recommendations

The developed game-based ScIMs are intended for the use of grade eight junior high school students, in a city school. It is recommended that the developed modules be tried out among the junior high school in rural areas. It is also recommended that the developed and validated ScIMs using games may be used to supplement instructional materials in grade eight Forces, Motion and Energy and an

experimental study may be conducted using games as instructional strategy to test its effectiveness.

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PUBLICATION OFFICE
Taft Avenue, Manila 1000, Philippines

AUTHENTICITY RESULT

Date of Release:	April 02, 2018
Result Code:	2018-0409
Submission ID:	937977743
Title of Output:	Development and Validation of Science Instructional Materials (SCIMS) Using Games in Grade 8 Forces, Motion, and Energy
Author (s):	Marjory Largo

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