DEVELOPMENT AND VALIDATION OF A COMIC STRIP TEACHING MATERIAL IN PARTICLE NATURE OF MATTER

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R. B. R

DEDICATION

I dedicate this comic book to all students that it might be useful and helpful in their study.

To my husband, Antonio Rosel and children, Antonia Kyle and Francis Matthew for being my great source of inspiration.

And to my mother Lydwin R. Butial, I humbly dedicate this small piece of achievement to you.

Above all to the Almighty God, for His guidance and support.

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ABSTRACT

This study developed and validated a comic strip teaching material on particle nature of matter in the District of Jiabong, Division of Samar during the school year 2018-2019. This research is quantitative in nature. The output of this study is particle nature of matter comic strip for Grade 8 students. The topic about particle nature of matter in the Curriculum Guide were the input variables. The researcher developed a comic strip and it was validated through expert validation by the three chemistry professors of Samar State University. It also utilized quasi-experimental research design using Pre-Test Post-Test Mean Game to investigate the differentiation in students' conceptual understanding of the particle nature of matter. Based from the assessments of expert in chemistry the contents of the comic strip are found to be valid with overall mean 4.67. The mean score for appropriateness obtained by the comic strip was calculated at 4.67 which can be interpreted as very highly adequate. The acceptability of the comic strip teaching material was found to have a very high extent of acceptability with overall mean of 4.56. In terms of relevance and usability it has weighted mean of 4.67 which can be interpreted as very highly relevant and very useful while the weighted mean for efficiency is 4.33 which can be interpreted as highly efficient. This implies that the developed and validated comic strip teaching material greatly affect the performance of the students in the class; the result also signifies that students were able to learn the lesson easily through the use of comics.

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Chapter 1

THE PROBLEM AND ITS SETTING

Introduction

Globally, Science education has been a primary concern of the United Nation Educational Scientific and Cultural Organization (UNESCO) since it is inauguration and is the key element in all communication programs. The Intersectoral Platform on Science Education emphasized the necessity for more innovative approaches for science instruction to boost interest in science and engineering. Upholding science education at all educational levels, and scientific literacy in society, in general, is a fundamental building block to build a country's capability in science and technology (UNESCO, 2017).

Science Education in the Philippines is reflected in the K to 12 curriculum. From one grade level to another, concepts and skills are presented in spiral progression with increasing levels of complexity for a deeper understanding of core concepts. Science contents in spiral progression from elementary to high school highlights no break in the curriculumn. Because of the structuring of the contents, it is expected that some chemistry topics are already taught in elementary grade. The curriculum guide in science revealed the following: in grade 3 states of matter, in grade 4 properties of matter, in grade 5 changes of matter, in grade 6 mixtures, in grade 7 solutions, in grade 8 particle nature of matter and atoms, in

grade 9 chemical bonding, and in grade 10 compound and biomolecules, chemical equations (Science Curriculum Guide, 2012).

A unifying theory of the above science contents is the particulate nature of matter (Adbo and Taber, 2009). The particulate nature of the matter is evaluated by several authors as significant for student's long-term success in the pursuit of chemistry (de Vos and Verdonk ,1996; Snir, Smith and Raz, 2003; Liu and Lesniak ,2004; Taber,2005; Othman, 2008; Adbo, 2009; Ozmen, 2011 and Treagust ,2013). It is supported by Valdines (2000) that the appropriate understanding of the particulate nature of matter is very important in learning chemistry.

The particle nature of matter is vital to almost every topic in chemistry. Failure to understand this concept would affect the learning of other chemistry topics such as atoms, molecules, the behavior of gases, properties of matter, phase changes, chemical reaction and conservation of matter to name a few and this is the reason why the particle nature of matter is so important (Ayas et al., 2010). Particle in chemistry is nonfigurative concept that the student understanding about the microscopic properties of matter are quite low and they have alternative conception such as the order, the number, the size, the movement of particles and spaces between them (Ozmen, 2010).

In this generation, children have a short attention span, varied teaching approach is needed to facilitate learning. One approach is to include comics in education. The principle of learning supports this, that the more senses that are involved in teaching the more the better the learning (Corpuz & Salandanan, 2013).

Young readers have little interest in reading plain materials that are too difficult to digest. Drolet (2010) said that the interest level is high when reading materials like comics contain drawings or illustrations. As schools are faced with greater accountability, development of materials is necessary to respond to the fast-changing needs of the learners. Jackson (2009) suggested that sequential arts are a key ingredient for cognitive development. He claimed that a good comic book can leave a powerful experience by bringing the readers into the world of narrative.

UNESCO reported that "participation and achievement rates in basic education in the Philippines had fallen dramatically" (World Education News Review, 2018). Despite of the goals of K to 12 curricula, the Philippines has exhibited a consistently low performance in international surveys such as Trends in International Mathematics and Science Study (TIMSS), out of 25 participating countries, the Philippines ranked 23rd in TIMMS' Math and Science in 2003, (Senate of the Philippines, 2011).

In the local setting, the Department of Education Samar Division grade 10 National Achievement Test (NAT) results revealed low performance in science (DepEd Samar, 2018). For the school year 2013-2014, the mean percentage score (MPS) in Science is 64.79% and in the school year 2014-2015, it was 62.72% which is lower than the national passing percentage of 75 %. In the same years, NAT results of Jiabong National High School in Science is 71.40 and 73.13, which is again lower than the national passing percentage of 75 % (NETRC, 2015). This

scenario could mean a lot of things, maybe some basic concepts in science particularly in chemistry like the particle nature of matter is not fully understood by the students.

The concept of particle nature of matter was selected primarily because it is the major topic to be taught in chemistry based on the K to 12 science curriculum guide. In chemistry, many of high school age failed in their struggle to learn fundamental concepts such as states of matter, evaporation, melting, condensation, vapor pressure and boiling (Canpolat, 2006; Aydeniz & Kotowski, 2012). Recent studies conducted around the world revealed that students find it very difficult to learn the scientific concept of the particle nature of matter from the late 70s up to the present (Novick and Nussbaum, 1978; Aydeniz and Kotowski, 2012; Aydeniz et al., 2017).

One possible reason for why learning these concepts is difficult is that many students are not invoking multiple representations of the fundamental chemistry concept which is the particle nature of matter (Gabel et al., 1987). They also had difficulties in explaining the concepts of states of matter, melting, evaporation, condensation, boiling and vapor pressure (Kırbulut and Beeth, 2013).

The concept of generating learning and motivation for the learners is the basis in the use of comics in education. Research has shown that comics can convey large amounts of information in a short time (The Straits Times ,2016).

Latest researches have revealed that learning with comics has great potential for enhancing science retention among learners with low levels of

literacy (Hosler & Boomer, 2011; Spiegel et al., 2013; Imperial, Jalique & Robles ,2016; Lin & Lin, 2016). However, there has been a deficiency of studies related to its effectivity in chemistry particularly in particle nature of matter. As suggested by the Department of Education (2013) chemistry concept needs a visual representation like drawings, illustrations or cartoons that will help the students to gradually understand what the particle nature of matter is all about (Science 8 Learners Module,2013).

Hence, the researcher developed and validated a teacher-made comic strip entitled "The Particle: The Building Blocks of Everything ". It is a visual representation of particles through the comic strip as a medium of instruction because students find it hard to understand the particulate nature of matter. (Novick and Nussbaum, 1978; Aydeniz & Kotowski, 2012; Aydeniz et al., 2017). They also had difficulties in explaining the particle nature of matter and the concepts of states of matter like melting, evaporation, condensation, boiling and vapor pressure (Kırbulut & Beeth, 2013). According to Gilbert & Treagust (2009), learners are not able to explain their basic understanding of the chemistry concepts at the macroscopic, microscopic and submicroscopic levels of the representation of matter. It is aligned to the aim of the Department of Education that chemistry concept must have a visual representation for them to understand what the particle nature of matter is all about (Science 8 Learners Module,2013).

Statement of the Problem

This study sought to develop and validate a comic strip teaching material on particle nature of matter in Jiabong National High School, District of Jiabong, Division of Samar during the school year 2018 – 2019.

Specifically, it sought to answer to the following questions:

1.What is the content validity of a comic strip teaching material in terms of

1.1 appropriateness, and

1.2 adequacy?

2.What is the extent of acceptability of the comic strip teaching material in terms of?

2.1 relevance,

2.2 efficiency and

2.3 usability?

3. What is the pretest mean scores of the experimental group and control group?

4. Is there a significant difference between the pretest mean scores of the experimental group and control group?

5. What is the posttest mean scores of the experimental group and control group?

6. Is there a significant difference between the posttest mean scores of the experimental group and control group?

Hypotheses

From the specific questions posted in this study, the following hypotheses were drawn and tested.

1. There is no significant difference between the pretest mean scores of the control group and the experimental group.
2. There is no significant difference between the posttest mean scores of the control group and the experimental group.

Theoretical Framework

Instructional theories play a vital role in developing and planning instructional-aid or materials. These theories facilitate in shaping the result of the educational material.

The Dual Coding theory by Allan Paivio (Paivio, 1990 and Paivio, 2014) is the main theory that hypothesize the importance of text and visuals. In developing this theory, he used the idea that the formation of mental pictures support learning (Reed, 2010). In line with Paivio, there are two ways that a person may grow on learned material: verbal associations and visual imaging. Dual-coding theory postulates that each visual and verbal data are employed to represent data (Sternberg, 2003).

Visual and verbal data are processed separately and on distinct channels within the human mind, making separate representations for the data processed in every channel. The mental codes conforming to these representations are

utilized to organize incoming data may be acted upon, stored, and retrieved for later use for the recalling of data (Sternberg, 2003). For example, in chemistry, say a student has a stored stimulus concept "Periodic table" as both word and as the images of the elements in a table. Students can retrieve the word or image or both when asked to recall the stimulus.

The flexibility to code a stimulant in dual alternative ways will increase the prospect of memory of that item compared to the simulation that was only coded in single way. It, therefore, expresses an intellectual mechanism by which visuals and their meanings are coded and decoded, as the mind works to combine both verbal and visual signals and script information. In short, it could be supported that the use of visuals and text, offers the reader many advantages, as the working memory allows stronger readers to gain a deeper understanding of the meaning of the text.

The theory reflects the relation between the verbal system of linguistics and the semiotic system of images, both simultaneously present in the text, aiding in the reader's creation of a mental, dual coding system that is both supportive, connected and interacting, by which the reader can more easily, readily and effectively derive and generate inferences and comprehend the overall meaning of texts.

This study is also affixed on the Theory of Human Development espoused by Hurlock (1982). The theory states that human development is divided and ordered according to stages or phases. Hurlock (1982) opines that as the world of

the youngster expands with their entrance to the school, learning interests developed. With the broadening of those interests, understanding comes. What has been obscure before become clearer as they grow and advance within the academic ladder. The children enter into the "stage of concrete operations" in thinking, a time once the obscure and vague ideas of babyhood become specific and concrete. Human beings learning progressed from sensorimotor, preoperational, concrete, and formal operational stages, cognitive processes are engaged in which experiences merge to form new concepts and ideas. Piaget's language for these terms is assimilation and accommodation.

As applied in this study, there is a need for a visual aid in discussing the abstract thought in chemistry like for example in particle nature of matter. Particle in chemistry is nonfigurative concept that the student understanding about the microscopic properties of matter are relatively low and they have alternative conception such as the order, the number, the size, the movement of particles and spaces between them (Ozmen, 2010). It would be easy for the students to learn the concepts since they to have a clearer image about particle nature of matter. Students learn best if they really see or visualize the concepts being feed unto them by their teachers thus, there's a need for specific and concrete teaching materials.

The study is also anchored on the Theory of Constructivism by Jean Piaget, who articulated the mechanisms by which information is internalized by the students. He suggested that through accommodation and assimilation, individuals construct new knowledge from their own experiences. Once people

assimilate, they incorporate the new practice into an already existing framework without changing that framework. It is necessary to note that constructivism is not a specific pedagogy. It is a theory describing how learning happens. It also suggests that learners create knowledge out of their experiences (Tobias & Duffy, 2009).

Constructivist viewed that constructing meaning is learning and it must be concerned with actual involvements and contexts that make the student able to learn. Since science instruction could be a method of supporting the method of construction, it should be structured in order to be simply understood by the learner since it's designed to facilitate extrapolation and or fill within the gaps. With this principle in mind, constructivist modifies beliefs and closely follow the accepted scientific understanding (Colburb, 2010).

The developed comic strip teaching materials supports the constructivist approach. Through this teaching material, the learning environments can result in distinctive and exciting atmosphere whereby the learners are engaged in authentic and significant task through the activity in the comics strip. The comic strip let the students applies the particle model of matter to explain the changes in matter in a real- life setting. The comics also support the idea that individuals construct their own idea and thought of everything around him, through experiencing things and self-reflection (Bereiter, 1994). The developed comics strip embraced the theory that once we encounter one thing new, we got to merge it with our previous ideas and skills, changing what we tend to believe, or even discarding the new data as

irrelevant. In any case, we are active designers of our own knowledge and understanding.

The study is anchored also in the theory of multiple intelligences which was proposed by Howard Gardner (1994). Consequently, there are eight styles of intelligence that exist in human. In his book "Frames of Mind: The Theory of Multiple Intelligences," he expressed that all people have different kinds of intelligences. Each intelligence relates to a different domain of human life and activity. These multiple intelligences include verbal–linguistic, visual-spatial, body-kinesthetic, auditory-musical, logical-mathematical, interpersonal communication, intrapersonal communication, and naturalist. The visual-spatial processing is an individual's ability to process visual stimuli to comprehend spatial relationships between objects and to visualize different images. The latest research of Morgan (2013) described children who are high scorers on an IQ test, far exceed the average in visual-spatial processing tasks.

Accordingly, Gardner (1994) emphasized that schools must strive to develop this intelligence, at the same time they must recognize that visual-spatial children will learn through visual aid. It strengthens the concepts that the comics can be utilized in the classroom to increase literacy in addressing the scholastic needs of differentiated learners. As applied to this study, there are students who are visual learners and they learn best when they read and see the concepts. As such, teachers should tailor their instruction in order to develop the learning

interest of the students which could enhance the visual-spatial intelligence of the students (Eysenck, 1994).

As schools struggle to maintain enrolment and make sure that students are not behind in the learning process, teachers must adapt their classroom to the developing needs of their students. This means by maximizing different teaching methods and tools. Gardner's theory of Multiple Intelligences application and use of the comics and graphic novels can give greater opportunities for success, both in the classroom and their lifetime career.

The Dual Coding, Human Development, Constructivism and Multiple Intelligence are the theories that facilitate in shaping the result of the developed educational material.

Conceptual Framework

Figure 1 represents the conceptual framework of the study illustrating, among other things, the research environment, the respondents of the study and the major variables involved in the study.

The box at the base reflects the respondents and research environment of the study who are selected grade 8 students of Jiabong National High School, Jiabong District, Division of Samar, for the school year 2018-2019.

The same frame is connected upward to a series of the frame indicating the research process.

The next upper box encloses the validation of the comic strip. The same is also connected to a larger frame indicating the validation process through an experiment using pretest and posttest mean game. A pretest was given to both the control group and experimental group. The pretest results of both groups was compared to ascertain that the entry behavior of both groups is the same before the start of the experiment. A post-test was be given to both groups after the experimentation to determine the knowledge they gain. The performance of the students in both pretest and posttest were compared and evaluated to determine the difference in performance of both groups.

The same large frame is connected upward to a smaller box representing the analysis and results of the study.

The base box representing the subjects and research environment is connected upward to Instructional Redirection serving as the feedback mechanism of the study where results were disseminated to the research environment. The same is also connected upward to the topmost box representing the end goal of the study, which is the improved learning in the particle nature of matter.

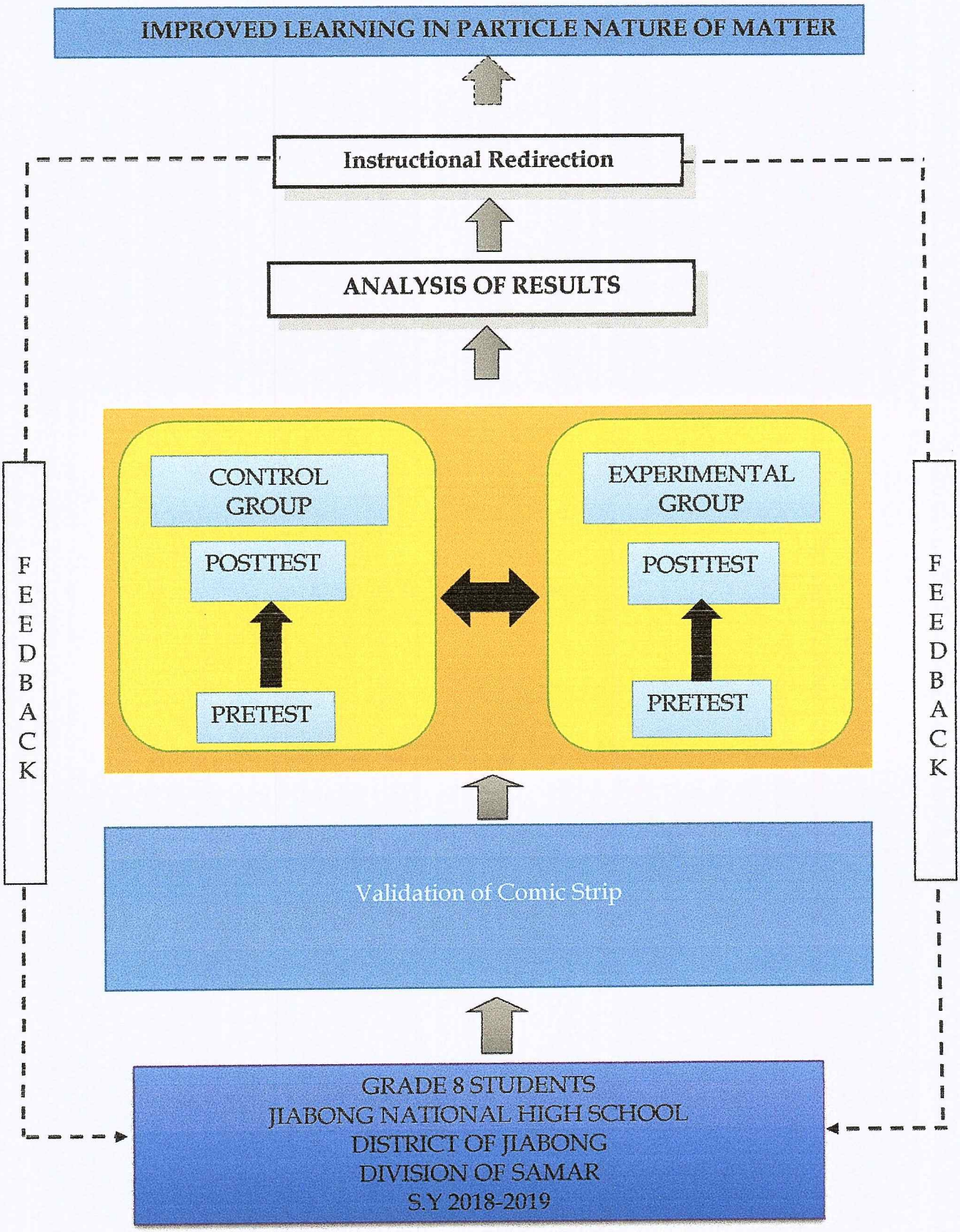

Figure 1. Schema of the Conceptual Framework Showing the Research and Diagram of the Study

Significance of the Study

The developed comic strip would have advantages to the following: students, teachers, school administrators, and future researchers in their quest for quality education.

Science teachers. The result of this study would be beneficial to teachers because a new teaching material about particle nature of matter. This would also motivate their students to love the subject more. It would be a solution in their difficulties encountered in teaching particle nature of matter and stimulate their interests to develop more instructional materials and other necessary measures for the improvement of science instruction. It would also help them in planning some learning situations that would set learners free to think and investigate concepts and principles in their immediate environment.

School administrators. The result of this study would have the empirical data that will serve as input in motivating the students to be interested in science thereby improving their performance thus it would lessen the number of dropout rate of the school. The findings of this study would also serve as input to the administration to decide well on what policies and strategies maybe formulated to improve students' performance in the classroom.

Students. The comics' strip would help them to be an independent learner. They would have a better performance in science particularly in chemistry. Their involvement in teaching and learning process would let them realize their value in taking much higher responsibility in the future.

Parents. The material would give them the assurance that their students is learning the abstract concept of chemistry. They would have the guarantee that school is finding way to match their expectation.

Future researchers. Finally, this study would serve as ready reference for future researchers as a source of information in conducting sequential and parallel inquiries to this present investigation which they might be motivated to undertake in the future.

Scope and Delimitation

This study focused on the development of the comic strip teaching material on particle nature of matter intended for grade 8 students and the said material will be validated through the developed rubric based on the input in the Science K to 12 curriculum guide. A rubric was developed also to measure the content and extent of acceptability of the comics strip teaching material.

The respondents were selected through purposive sampling. In the selection of the students as to who composed the experimental and control group, individual matching was carried out based on their sex and their score in Group Assessment and Logical Thinking (GALT) test. The respondents of the study were the identified 60 students of grade eight section A and B of Jiabong National High School, Jiabong Samar. The students of the two sections were made to participate but only sixty were included in the study. Thirty students comprised the control

group and the other thirty students were the experimental group. The study was conducted during the school year 2018-2019.

Definition of Terms

In order to provide common understanding to the readers, the following terms that were used in this study are herein defined:

Adequacy. This term refers to the quality of being capable in certain circumstances (English Oxford Dictionary, 2019). As used in this study this refers to the quality of being sufficient of the instructional material to be utilized since the basic elements for particle nature of matter are present in the comics strip.

Appropriateness. This term refers to the quality of being suitable or proper in the circumstances (English Oxford Dictionary, 2019). As used in this study this refers to the quality of being suitable of the comics strip as an instructional material for particle nature of matter since the information presented is accurate and based on the science K to 12 curriculum.

Control Group. This term refers to a group of subjects closely resembling the treatment group in many demographic variables but not receiving an active medication or factor under study and thereby serving as a comparison group when treatments results are evaluated (Random House Unabridged Dictionary, 1993). As used in this study, this term refers to a group composed of 30 grade 8 students whom lecture discussion method in science is utilize.

Comic Strip. This term refers to short series of funny drawings with a small amount of writing, often published in a newspaper (Cambridge Dictionary, 2019) . In this study it refers to the visual representation of the event of the particulate nature of matter and the phase change of a particle.

Efficiency. This term most often describes what is capable of producing desired results without wasting materials, time, or energy. (Merriam Webster's Dictionary, 2019). As used in this study, it refers to the features of the comic strip that teach the topic quickly.

Effectiveness. This term refers to a quality or state of being effective; efficacy (Webster's Third New International Dictionary,1986). As used in this study, it refers to the significant advantages in the posttest results as compared with the pretest results.

Experimental Group. This term refers to a group that is exposed to the treatment under consideration. As used in the study, it is composed of 60 selected students to be taught using the comic strip in particle nature of matter.

Particulate nature of matter. It is basically the same as the kinetic molecule theory of matter which means matter is made up of tiny particles (atoms, molecules or ions) and there is empty space between the particles (Zumdahl and Zumdahl, 2014).

Posttest. This term refers to a test given after the introduction of the experimental factor or project (Herrin, 1987). In this study, after the experimental intervention this refers to a 30-multiple choice open ended test that was

administered to both experimental and control group. It is considered in the study to measure the level of understanding of the students in particle nature of matter by the two groups of respondents. The content of this test is the same as those of the pretest but the arrangement of these item was modified to avoid bias in the results.

Relevance. This term refers to the relation to the matter at hand and the ability to recover material that satisfies the desires of the user (Merriam Webster's dictionary, 2019). In this study, it pertains to the criteria whether the comic strip has bearing for the discussion of particle nature of matter.

Usability. This term refers to the degree to which something is able or fit to be used (English Oxford Dictionary, 2019). As used in this study, it pertains to the criteria where the comic strip is easy to use and integrate for classroom use.

Chapter 2

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter contains the review of literature taken from books, encyclopedia and journals and other published materials, as well as the review of related studies taken from unpublished materials, such as theses and dissertations which have bearing on the present day study.

Related Literature

Comics is an educational tool that can engage students in a certain issue and motivate the learners to grasp relevant information in science learning (Hosler & Boomer, 2011). Research and studies on cartoons and comics in science education recommended that illustrations can lead to a better understanding of scientific phenomena than relying on textbooks. This is often true once students feel uncomfortable with the subject being lined (Trnova et al., 2013). Hosler & Boomer (2011) revealed in their study that students who are disinterested and less-motivated showed improvements in content knowledge and attitudes after they began to learn with comics. The research discerned that comics facilitate to interact students and form students' attitudes in an exceedingly positive method. Moreover, the researchers found that the interaction of text and images in comics can exceed typical textbook learning by weaving both elements into a story, that helps generate coherence and context for scientific information.

Comics can also represent real-world situations which have no clear answer just like the abstract concept of chemistry. It also has the ability to present a comprehensive and authentic situation, which engages the learner in science and can lead to increased student motivation, including situational interest and learning about uses of science in daily life (Childs et al., 2015).

The Department of Education (2013) emphasized that chemistry concept needs a visual representation like drawings, illustrations or cartoons of the different phenomena that will help the students to gradually understand the particle nature of matter (Science 8 Learners Module, 2013). It is supported by Valdines (2000) that the appropriate understanding of the particulate nature of matter is very important in learning chemistry. One researcher had suggested that comics and other graphic novels help readers develop literacy skills and it should be given to children as reading materials because it has a huge impact in developing students' visual literacy compared to an ordinary instructional material (Downey, 2009). In addition, a comic book is categorized as a second most prevalent reading choice for boys, which increased their literacy rate and increase their reading comprehension (Williams,1995; Gambell & Hunter, 2000). Jackson (2009) also suggested that a good comic book can leave a powerful experience by bringing the readers into the world of narrative. Comics can also function as a basis for youth to communicate with their peers (Arroio, 2011; Lin & Lin, 2016).

In connection to this, Grunwald (2003) point out that long textual instructions are becoming more and more difficult for many young people. If the

topic is not personally stimulating to them, they scan or overlook reading passages and try to finish the text as fast as possible. Thus, short messages set in a meaningful context and specific images such as comics suit students´ media experience better than conventional text-based instructions. It is supported by Bitz (2004), that comic book format is a powerful combination of various skills, artistic creativity, and expression making it a useful tool for students to quickly grasp ideas and increase students' learning. Moreover, it is highly recommended as instructional materials for reluctant learners (Hassett & Schieble, 2007).

Comics might be a good help in our present scenario since studies and literature conducted around the world shown that students find it hard to understand the particle nature of matter from the late 70s up to the present-day (Novick & Nussbaum, 1978; Aydeniz et al., 2017). It is supported by the research conducted by Treagust, et al. (2013) where students hold a range of alternative conceptions about particle theory including seeing matter as cloudlike which expands or contracts, with the individual particles expanding and contracting at the same time.

In developing the comic strip, the constructivist approach was utilized since learners would construct their own data out of the context provided in the learning material. The constructivist approach embraces that learning is an active process of constructing instead of gaining knowledge, thus, instruction is a process of supporting that construction rather than communicating knowledge (Colburb, 2010).

Students poor conception of about particle is disturbing because they will find it hard to comprehend topics in higher physics like kinetic molecular theory. Boz (2006) conveyed that high school learners have difficulties in applying the particle nature of matter theory in explaining phase changes, even after discussion. Even in the study conducted by Ozmen & Khalik (2007) about the primary student's view about the particle nature of matter, the results show that students in each level could not give an acceptable answer. He found out students understanding the size of particles in solid, liquid and gas form were quite low.

In contrary, comic books in and out of school have come in for a substantial amount of consideration from people who are alarmed about the curriculum experiences of childhood and youth. Many extreme claims exist among those who contend that the comic books promote many undesirable outcomes such as illiteracy, unwholesome states of mind, and delinquent behavior. Blake (2013) added that using comics to teach brings up content to be seen as not appropriate for certain age groups. On the liability side, it may be pointed out that the comic books may overstress love and money, and criticize respected groups in the population.

However, Lin and Lin (2016) emphasized that the combination of contextualized scientific language with visual representations and humor engages middle-lever achievers more than high-level achievers. The impact of comics on average students was also higher than using written texts. Students with poor comprehension benefit more from creative approaches, since high-level achievers

are already actively engaged in and motivated by science. Furthermore, Spiegel et al., (2013) found that comics in science education "can be both engaging and effective at conveying science knowledge" among a broad diversity of students.

Also, Trnova et al., (2013) found both advantages and disadvantages of comic strip which has big impact on student's science learning. The result of their study revealed that comics can help students better understand the visual associations provided by educational comics and its support the understanding of abstract concepts better than a long text written in more-or-less strictly scientific language. Rota & Izquierdo (2003) pointed out that using comic, let the teachers combined text and art in order to create an effective pedagogical tool. Furthermore, teaching science via comics by expressing a story makes the information more motivating to students.

Every teaching-learning process, learning is the end point. The teacher also plays an important role in answering questions and presenting lessons wherein the students can have a full comprehension of all the things that they should have taught (Mongaya, 2013). An instructional-aid in science is very important because the success of the learning process depends on it (Casinto & Cuizon, 2010).

With the implementation of K-12 Curriculum, development and validation of instructional materials are considered vital. As schools are faced with greater accountability, it is necessary to respond to the fast-changing needs of the learners. Millano & Probadora (2008) described that one of the serious setback in achievement of most of the educational goal is the insufficient availability of

instructional materials, thus teacher must develop their own instructional materials that can be utilized it teaching. For the development and validation of a comic strip, the procedure is adopted from Imperial et al., (2016). The researchers anchored in K-12 Curriculum Guide in selecting the topics and skills used in the comic. The validation of the comic's strip was done by the experts through the use of the rubric to assess their views on specified qualities of the learning material. Along with the revised comic, the rubric for the validity and acceptability of comic strip will be given to Chemistry Experts for final checking. After these procedures, the comic strip on particulate nature of matter was ready to use. And finally to test its effectiveness, experimentation was done through Pre-Test Post-Test Mean Game. The essential part of the material is based on Strategic Instructional Materials (SIM) principles adopted to the works of Salveijo et al., (2014).

A. Guide Card. This gives the idea of what the students expect to learn from the comic strip. This includes the importance of a module and how this relates to the condition in the environment.

B. Overview. This state the task for the learners.

C. Comic Strip. This includes the visual representation of the topics in particulate nature of matter based on changes in matter, changes in states and phase changes.

D. Reference Card. It provides readings and additional content not found in the textbook that can relate content with students' life experience.

E. Assessment. This is to check whether the objectives set for the particular activity has been realized.

The review of the literature shows that some study on the utilization of comics in science lessons has already been carried out (Williams,1995; Grunwald,2003; Downey,2009; Tatalovic, 2009; Arroio, 2011; Hosler & Boomer, 2011; Lin & Lin, 2016, Spiegel et al., 2013; Trnova et al., (2013); Treagust et al., 2013) however, the use of comics in chemistry particularly in particle nature of matter remains insufficiently researched, the generally available data of learning with comics suggests that the use of comics in investigational instructions may improve students' access to and comprehension of practical work, both in school and in non-formal educational laboratories.

Hence, they established the need to conduct the present study. They strengthened the concepts and processes of the study at hand.

Related Studies

The latest study conducted by Say & Ozmen (2018) is about" Effectiveness of concept cartoons on seventh grade students' understanding of the structure and properties of matter". The focus of the study is to work out the impact of conception cartoons on seventh grade students' ideas in the Structure and Properties of Matter. The research design of the study was quasi-experimental research and the instrument that was employed in this study is the Structure and Properties of Matter's conception test (SPMCT) and semi-

structured interviews. Forty-nine grade seven students are the sample of the study, twenty-four in experimental group and twenty-five in control group. Instrument were used during the pretest and posttest to determine the effect of comics. The post test results confirmed that learners in experimental has a remarkable increase mean of 10.44 than the control group. As a results of analyzing the written test and interview, it had been observed that the conceptions on the structure and properties of the matter using cartoons allow the students to comprehend the topic. The study shown that the students have some alternative conceptions regarding the subjects in the structure and the properties of the matter and that the concept cartoons are successful materials in identifying and correcting these alternative conceptions. The leading alternative conceptions of the students are related to atoms.

The present study is comparable to the study of by Say and Ozmen (2018) because both studies test the effectiveness of cartoons in chemistry concept for Junior High School. Both studies employed quasi-experimental research design. However, the two studies differed in many ways, the former was conducted in Turkey focusing in the effectiveness of concepts cartoons on 7th grade students understanding of the structure and properties of matter, while the present study was conducted in Jiabong National High School, in the District of Jiabong, Division of Samar focusing on the development and validation of a comic strip teaching material in particle nature of matter.

Based on the research finding of Sepriyanti & Tapia (2018) in their study "Development and validation of Mathematics Comics Media on Linear Equations and Linear Inequalities of One Variable", the result of mathematics comic media development on linear equation & inequalities of one variable at class VII Junior High School is valid and very practical to be used as mathematics learning media. The resulted mathematics comic media obtain 86.25% validity result with valid criteria by the validator. In whole, the practicality score given by the students is 90.04% with a very practical category. Meanwhile, total practicality score by both teacher and students is 85% with a practical category. They recommended for a future researcher to dig and explore more on this topic by employing qualitative research method.

The present study is the same to the study of Sepriyanti1 & Tapia (2018), considering that both studies developed and validate comic strip teaching materials for Junior High School students. However, the two studies differed in many ways. The former was conducted in Indonesia focusing on the Development and validation of Mathematics Comics Media on Linear Equations and Linear Inequalities of One Variable while the present study is conducted in Jiabong National High School, in the District of Jiabong, Division of Samar, Philippines focusing on development and validation of a comic strip teaching material in particle nature of matter.

Another current study by Affeldt et al., (2018) entitled "The use of comics in experimental instructions in a non-formal chemistry learning context"

examined the views of 6th-grade learners on comic-based experimental instructions and considered the potential of comics in inquiry-based learning. The respondents of the study are the lower secondary level in Germany, where learners are still not mature enough base on their personal behavior. They found out in the study that comics have the potential to increase learner motivation and personal engagement when dealing with scientific issues and provoking inquiry-based science learning. They recommend that comics is a positive, situational context supporting practical work as perceived by the students. They recommend to have further research in order to find out which kind of cartoon strips are the most motivating and challenging for different groups in terms of age, accomplishment, or educational background.

The study of Affeldt et al., (2018) is related to the present study that both studies utilized and test the effectiveness of comic strip teaching materials in chemistry. Both studies have used the lower secondary level. However, the two studies differed in many ways. The former was conducted in Germany while the present study will be conducted in the Philippines focusing on development and validation of a comic strip teaching material in particle nature of matter.

Cole (2017) conducted a study "Spatial Reasoning and Understanding the Particulate Nature of Matter: A Middle School Perspective". This study used mixed-methods approach in finding the relationship between spatial reasoning ability and understanding of chemistry content of middle school students and their science teachers and the ways both students and teachers discuss about

matter and substances. The data showed a positive correlation between scores on the Purdue Spatial Visualization Test of Rotations and the Particle Nature of Matter Assessment (ParNoMa) for both students and teacher. Moreover, students and teachers with higher spatial ability tended to provide more of appropriate explanation about the particle nature of matter.

The study of Cole has bearing to the current study since both studies delved on the understanding of the middle school students about the particulate nature of matter. Another similarity between the two studies is in terms of the instrument used, both have utilized the standardized test (PARNOMA) in measuring the level of understanding about particle nature of matter. However, the former study deal with spatial reasoning of the students which will not be treated in the present study.

One recent study by Imperial, Jalique & Robles (2016) entitled, "Construction and Validation of Reading Comprehension Comic on Afro- Sian Folk Narratives for Grade 8 Students." The result has a mean of 4.27 which revealed that the comic book obtained a high extent of efficiency and the mean of 4.53 revealed that the material is very highly usable. This finding implies that the comic book is very efficient and very useful. Based on the overall results, it can be inferred that the evaluators deliberated the comic book to possess a very high extent of acceptability. Hence, the evaluators consider the comic book as potential instructional material that can assist both teachers and students in improving their comprehension skills. They recommend that the developed comic book is a good

instructional material to enhance the interest and reading comprehension skills for the students.

The study of Imperial, Jalique, & Robles (2016) has bearing to the present study, considering that both studies developed and validate a comic strip teaching materials for grade 8 students. The indicators for content validity and extent of acceptability of the comic's strip were both utilized in the study. However, the two studies differed in many ways. The former was conducted in the Division of Gensan focusing construction and validation of reading comprehension comic on afro- Asian folk narrative while the present study was conducted in Jiabong National High School, in the District of Jiabong, Division of Samar focusing on the development and validation of a comic strip teaching material on particle nature of matter.

The study conducted by Estacio (2015) "Development and Validation of a Learning Assessment Tool and Instructional Material in Physics 1 (Mechanics)", he found out that the evaluation of the proposed instructional material in a form of concept cartoon was highly accepted by the experts and faculty in Physics as supported by a mean of 4.49. He recommends that in presenting the lessons the instructor is encouraged to use updated and relevant materials to augment the use and effectiveness of the proposed instructional material and assessment of learning tool in class. He recommends that concept cartoons can be used in the different parts of the learning process such as in motivation, group discussion, assessment, and assignment.

The study of Estacio is considered related to present considering that both studies developed and validate comic strip teaching materials. The main difference is that the former validate an instructional material in Physics 1 while the present study is on development and validation of a comic strip teaching material on particle nature of matter.

The study conducted by Ali (2013) entitled "Effect of Comic Strips on EFL Reading Comprehension". The study found out that comic strip use noticeably facilitated the reading comprehension of students at both levels. Ali (2013) investigated the reading comprehension of Turkish EFL learners using comics as intervention. The data revealed that all students with a comic strip regardless of proficiency and text level have high score than the ones without the comics. The results revealed comic strips enhanced their reading comprehension.

The present study has bearing on the study of Ali in the sense that both are analyzing the effect of the comic strips in the proficiency level of the students. However, the two are different in the sense that the former tested the effects of comic strips on reading comprehension while the present study focused on the understanding of the grade 8 students on particle nature of matter.

Jee et al. (2012) conducted a study on "Comic Cognition: Exploring the Potential Cognitive Impacts of Science Comics". The author draws on researches from cognitive science and education to discuss here to explore the cognitive impacts of science comics. They proposed several ways in which learning could be enhanced or impaired by understanding science comic strips and discuss

several broader issues related to the use of comic books in education, counting individual differences and informal learning.

The present study has bearing on the study of Jee et. al, considering that both explore on the cognitive impacts of science comics.

The study conducted by Yezierki (2003) entitled "Conceptual understanding of the particulate nature of matter. Pretest and posttest using Particulate Nature of Matter Assessment (ParNoMA) measures the students' conceptual understanding of the PNM regarding phases of matter and phase changes. The intervention made by the researcher is the animations of molecular-level water to remediate PNM misconceptions held by students from middle school to college where they found out that the said animations helped the learners to enhance their understanding in phase of matter and phase changes.

This study is related to the present study because both are dealing with the particulate nature of matter. The instrument used by the former was utilized by the researcher since it is already valid and reliable.

The review of the studies cited above revealed that some study on the utilization of comics and cartoons in science lessons has already been carried out (Yezierki, 2003, Jee et al. ,2012; Ali, 2013; Estacio, 2015; Imperial et al., 2016; Cole, 2017; Affeldt et. al., 2018; Sepriyantil & Tapia, 2018; Say & Ozmen ,2018) however, the use of comics in chemistry particularly in particle nature of matter remains insufficiently researched, and generally based on the result of the conducted

studies, comics has great potential for enhancing science retention among learners with low levels of literacy.

Hence, the theses and dissertations stated above which were relevant strengthen the need for this particular study.

Chapter 3

METHODOLOGY

This chapter discusses the methods that was used in the conduct of the study. Included herein are research design; instrumentation; validation of instrument; sampling procedure; data gathering procedure; and statistical treatment of data.

Research Design

This study is Quantitative in nature. Development design was used in the construction of the comics strip teaching material on particle nature of matter. The topic particle nature of matter in Grade Eight Science Curriculum Guide were the input variables in developing and planning as to the contents to be included in the comic strip teaching material. The comics was evaluated by the Expert in Chemistry through the use of rubric.

It also utilized quasi-experimental research design using Pre-Test Post-Test Mean Game to investigate the differentiation in students' conceptual understanding of the particle nature of matter.

This study employed statistical tools such as, overall mean, standard deviation, weighted mean, T-test for dependent samples, and T-test for independent samples.

Instrumentation

The instrument that was utilized in gathering data in this study are the following:

GALT test. The GALT or Group Assessment of Logical Thinking is a 12-item paper and-pencil Piagetian test made by Allan Paivio (Paivo,2014). The test was based on the six modes of reasoning, one of which is concrete operational which test the students understanding on conservation of matter. The remaining five modes are formal operational which test the proportional reasoning, controlling variable, probabilistic reasoning, correlational reasoning and combinatorial logic. It is consisting of twelve exemplified problems. For the 10 to 12 questions, students must choose the appropriate multiple-choice response for the problem and the rationale, which is also in multiple-choice format, for the selected response. The remaining two questions, which concern combinatorial logic, are not multiple choice and the students must provide their own logical combinatorial patterns. The question is considered to be correct only if both parts of the question, answer and rationale, are correct.

GALT was used by the researchers to identify the students at risk of failure regardless of the level of chemistry taught (Bunce and Hutchinson ,1993). In this study, it was utilized in selecting the respondents of the study to avoid bias.

Achievement Test. It is composed of 20 item test with five choices. It is a standardized test for the particle nature of matter and was based on the works of Ellen Yezierski (2003). The achievement test was used to determine the conceptual

understanding of the topic: the size of particles, the composition of particles, the weight of particles, the energy of particles, phases and phase change.

Rubric. The rubric was used to measure the content validity and the extent of acceptability of the comic strip. There were five choices provided for every statement with equivalent points. The choices denoted the degree of agreement, each respondent had for the comics.

The rubric for the validation of a comic strip measured the appropriateness and adequacy of the said instructional material. Likewise, for the extent of the acceptability of the comic it measured the relevance, and efficiency and usability.

The rubric undergone expert validation to guarantee that the instrument used is reliable.

Validation of the Instruments

Achievement Test. The test for the students-respondent had already undergone rigorous validation. The Particulate Nature of Matter Assessment" (ParNoMA) is a standardized test based on the work of Yezierski (2003). It is a 20 item multiple-choice test used to measure students' conceptual understanding of the PNM as it relates to phases of matter and phase changes. It is tested to 690 middle school, high school, and college students abroad of different nationalities and content validated by experts in chemistry.

It was administered to Grade 8 Students of Jiabong National High School to test the effectiveness of the comic strip. The students who used them is expected to perform significantly better than the control group (pretest and posttest).

Rubric. The rubric made by researchers needs expert comments and suggestions in the acceptability of the rubric. Taking into account of the chemistry expert's suggestions, the researchers revised the rubric. Along with the revised comic, it was given to Chemistry experts for validation purposes.

Comic Strip. For the development and validation of a comic strip, the following procedure is adopted from Imperial et al., (2016).

Stage 1 is the planning and data gathering. In the collection of data, the researchers based in the K-12 Curriculum Guide in selecting the topics and skills used in the comic.

Stage 2 is the development of the Comic strip. The researcher identified the competencies to be included in the comic based on the K-12 Science Curriculum Guide.

Stage 3 is the first validation. The researcher sought for Expert Appraisal or Judgment by Peers to informally validate the comics strip. They were three Science Master teacher of Jiabong National High School. Their suggestions, comments were incorporated to the comics. After the revision of the first draft, a Small Group Tryout or Preliminary Field second draft for trial was used by a group of 5 to 15 learners coming from grade eight students of Jiabong National High School. The researcher watched out for indicators of difficulties, such as long pauses, troubled

faces, frowns, confused look, constant flipping of pages, blank staring on a page, overt mistakes, reading over and over again, dwelling too much time on an item, and so on and so forth. The researcher made the necessary corrections on the second draft. The revisions may be minor and, therefore, the clean draft may be finalized.

Stage 4 is the Final Validation. Along with the revised comic, the rubric for the validity and acceptability of comic strip was given to Chemistry Experts for final checking. The validation of the instrument was conducted in Samar State University. After these procedures, the comic strip on particulate nature of matter was ready to use.

And finally to test its effectiveness, experimentation was done through Pre-Test Post-Test Mean Game.

Sampling Procedure

In selecting the respondents, the researchers utilized non-probability sampling method since the researcher handles only two sections in grade 8. In, addition, the particle nature of matter is for grade 8 students based on Science Curriculum Guide. The two section was composed of 48 grade 8 section A and 51 grade 8 section B. Out of the selected respondents only 60 Grade 8 Students of Jiabong National High School were purposely selected. In the selection of the students as to who composed the experimental and control group, individual matching was carried out based on their sex and their score in GALT critical test.

Students of the two sections were made to participate but only sixty were included in the study.

Data Gathering Procedure

After the development of the comic strip, the researcher sought the help of the three (3) Science Master teachers of Jiabong National High School for the informal validation. They gave commentaries and suggestions for the enhancement of the proposed material. After the revision of the first draft, a Small Group Tryout or Preliminary Field second draft for trial was used by a group of 5 to 15 learners coming from grade eight students of Jiabong National High School. The researcher watched out for indicators of difficulties, such as long pauses, troubled faces, frowns, confused look, constant flipping of pages, blank staring on a page, overt mistakes, reading over and over again, dwelling too much time on an item, and so on and so forth. The researcher made the necessary corrections on the second draft. The revisions may be minor and, therefore, the clean draft may be finalized.

Along with the revised comic, the rubric for the validity and acceptability of comic strip was given to the research adviser for checking and corrections. The researcher revised the comics and the rubric, then it was handled to the Chemistry Experts for final checking. These validators were the three (3) Chemistry College Professor from Samar State University. After validating the rubric, they gave

comments and suggestions for the improvement of the comics strip. After these procedures, the comic strip on particulate nature of matter was ready to use.

Right after the comic strip was validated and highly accepted by the expert in chemistry, the researcher wrote a letter requesting permission from the Schools Division Superintendent of Samar Division to conduct the study in Jiabong National High School, District of Jiabong. The approved request was used by the researcher as reference to seek permission to the principal to allow her to conduct the study.

With the permission secured from the school principal, Galt Critical thinking test was administered to the target respondents. Upon checking and finalizing the results, individual matching was carried out based on their score and their sex. After the respondents was finalized, pretest was given personally by the researcher to the target respondents. This was done to ensure that unimportant factors are considered and taken care of. The researcher included all the students in the two section and just marked those that belong to the experimental and control group. The students were informed that it is part of unit test so that they would have no idea about the study. The test was expected to be done in 30 minutes.

The experimentation was conducted for six days. The topic particle nature of matter was taught to the experimental group with the used of developed comic strip, while the control group was taught with same topic using lecture discussion

or traditional method. The researcher personally handled the two groups of student to minimize Hawthorne effects.

After the experiment, a posttest was administered to the two groups. This was the same pretest but different arrangement of items. To ensure high percentage of retrieval of the instrument, the researcher personally conducted the fielding of the questionnaire to the respondents, with the help of teacher-friends.

The data gathering was lasted for 6 days after which data processing followed.

Statistical Tools Used

The data that was gathered from the respondents were tallied, analyzed and interpreted quantitatively using appropriate statistical tools.

The researchers used the weighted arithmetic mean and overall mean to analyze and interpret the evaluation results done by the experts. The comic is valid if the average rating is at least 3.0. A five-point Likert scale with its matching interpretation will be utilized: 4.5 – 5.00 for Very High Extent of Validity; 3.5 – 4.49 for High Extent of Validity; 2.5 – 3.49 for Moderately Extent of Validity; 1.5 – 2.49 for Less Extent of Validity; and 1.00 – 1.49 for Least Extent of Validity. In the data processing, the researcher utilized different statistical tools, both descriptive and inferential. Among the descriptive statistics, the following was utilized: frequency count, standard deviation and weighted mean; while inferential statistics including: t-test for independent means and dependent means.

Weighted mean. This statistic was used to ascertain the group response of the respondents relative to the score in the pretest and post-test among the control and experimental group using the scale as follows:

Range	Description	
4.50 - 5.00	Very High Extent of Validity	(VHE)
3.50 - 4.49	High Extent of Validity	(HE)
2.50 - 3.49	Moderately Extent of Validity	(ME)
1.50 - 2.49	Less Extent of Validity	(LE)
1.0 - 1.49	Least Extent of Validity	(L)

T- test for Dependent Samples. It was utilized to test the significant difference between the mean scores in the pretest and posttest of each group. The computed value was compared with the critical value following the decision rule as follows: accept the null hypothesis if and when the computed value turned lesser than the critical value (computed < critical); reject the null hypothesis if and when the computed value turned equal or greater than the critical value (computed $\geq$ critical).

T- test for Independent Samples. It was utilized to test the significant difference between the mean scores of students in pretest and posttest of both groups. The computed value was compared with the critical value following the decision rule as follows: accept the null hypothesis if and when the computed value turned lesser than the critical value (computed < critical); reject the null

hypothesis if and when the computed value turned equal or greater than the critical value (computed ≥ critical).

Ethical Consideration

Upon gathering the data for this research study, the researcher observed and complied with the following ethical considerations.

Description of the research and participation

The parents, their son/daughter were invited to participate in this research study through informed consent that was given to them. The goal of this research was to determine the effect of comics strip in teaching particle nature of matter in grade 8 students of Jiabong National High School.

This study took 10 days. Their participation involved taking pre- test and post- test.

Risks and discomforts

There are no known risks related with this research.

Potential benefits

There are no monetary benefits that was been given to the participant's in this study. But this study offered a new, creative and innovative way of teaching particle nature of matter to grade 8 science teachers.

Protection of confidentiality

The data that was gathered from this study was treated with confidentiality. Names are optional in questionnaires that was given to them. No names appeared

in the research report or any identifying mark about the participant. And in the event that results were not published, participant's identity were not be revealed in any publication resulting from this study.

Voluntary participation

The participants' involvement in this research study was entirely voluntary. They were told that they may choose not to participate and they may withdraw their consent to participate at any time. Also, it was emphasized to the student-respondents that they will not be reprimanded in any way if they will decide not to participate or to withdraw from this study.

Research data disposal

Research data was disposed through shredding for the printed materials with the help of the participants in the study.

Chapter 4

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter presents the analyses of the data obtained and the corresponding interpretation in connection with the specific questions of the study.

Content Validity of Comic Strip Teaching Material in terms of Appropriateness and Adequacy

Table 1 shows the summary table on the mean and description of the content validity of the comic strip teaching material in terms of appropriateness and adequacy.

Table 1

Summary Table on the Mean and Description of the Content Validity of the Comic Strip teaching material

Area of Assessment	Weighted Mean	Description
Appropriateness	4.67	Very High
Adequacy	4.67	Very High
Overall Mean	**4.67**	**Very High**

The mean score for appropriateness as an indicator was calculated at 4. 67, interpreted as very highly appropriate while the mean score for adequacy is 4.67, interpreted as very highly adequate.

The overall rating of 4.67 disclosed that the developed book is highly commendable since the material is interpreted as very highly appropriate and

adequate. This is incongruence with the results of the study conducted by Imperial et al., (2016) where they also utilized the indicator appropriateness and adequacy in content validation of the Reading Comprehension Comic on Afro-Asian Folk Narratives for Grade 8 Students. Both study possessed a very high extent of validity as indicated by result of overall mean that range from 4.5 to 5.00. This result implies that the contents of the material are congruent and fitted to the objectives and skills of the grade 8 science curriculum guide.

Extent of Acceptability of the Comic Strip Teaching Material

in terms of Relevance, Efficiency and Usability

Table 2 presents the summary table on the mean and description of the acceptability of the comic strip teaching material.

Table 2

Summary Table on the Mean and Description of the Acceptability of the Comic Strip Teaching Material

Area of Assessment	Weighted Mean	Description
Relevance	4.67	Very Highly Relevant
Efficiency	4.33	Highly Efficient
Usability	4.67	Very High Usability
Overall Mean	**4.56**	**Very High Extent of Acceptability**

Based on the assessment of the chemistry experts, the mean score for relevance obtained by the comic strip was calculated at 4. 67, interpreted as very highly relevant, the mean score for efficiency is 4.33 as highly efficient and the

mean score for the usability of the comic strip is 4.67, as very high extent of usability.

The overall rating of 4.56 disclosed that the developed book is highly commendable since the material is very highly acceptable. This is similar with the indicator used in the study "Construction and Validation of Reading Comprehension Comic on Afro-Asian Folk Narratives for Grade 8 Students" by Imperial et al., (2016). The comics for Afro-Asian Folk narrative has used the indicator relevance, efficiency and usability to measure its extent of acceptability. Their study revealed that the comic book is very useful and can expedite students learning and retention.

Moreover, the present and former study based on the overall results, attained a very high extent of acceptability.

Pre-test Mean Scores of Student-Respondents

in Experimental and Control Groups

Table 3 presents the pre- test mean scores of the experimental and control group.

The pretest mean score of experimental group is 5.93 while the control group is 4.97. The foregoing data signified that the pretest mean of experimental group is higher than the control group.

Table 3

Pre-test Mean Scores

Students	Pre-test Scores	
	Experimental	Control
1	5	6
2	5	5
3	3	7
4	4	4
5	10	6
6	7	5
7	4	3
8	3	5
9	4	2
10	10	7
11	5	9
12	6	6
13	1	4
14	7	3
15	6	7
16	5	3
17	6	5
18	9	7
19	3	9
20	3	5
21	10	3
22	6	7
23	10	6
24	5	3
25	7	5
26	5	6
27	4	6
28	8	2
29	4	2
30	13	1
Total	**178**	**149**
Mean	**5.93**	**4.97**

Difference in Pre-test Mean Scores Between Experimental and Control Groups

Table 4 show the pre- test mean scores between experimental and control groups.

Table 4

Comparison in Pre-test Mean Scores Between Experimental and Control Groups

Group	n	Mean	SD	p-value	Evaluation	Decision
Experimental	30	5.93	2.73	0.127	Not Significant	Accept H_o
Control	30	4.97	2.06			

Legend: $\alpha = 0.05$; $df = 58$

The table shows the result of the pre-test mean scores between experimental and control group, the degree of comparison was calculated at .05 denoted a p-value of .127. The mean of Pretest of experimental group is 5.93 with a standard deviation of 2.73 and the mean of the control group is 4.97 with a standard deviation of 2.06 at .05 level of significant with df = 58. The p-value are higher than 0.05 significance level indicating not significant relationship between paired variables. This signified that the correlation between the two aforesaid variables was not significant. This mean that there is no significant difference between the pretest mean scores of the experimental and control group.

Post-test Mean Scores of Student-Respondents in Experimental and Control Groups

Table 5 presents the post- test mean scores between experimental and control group.

Table 5

Post-test Mean Scores

Students	Post-test Scores	
	Experimental	Control
1	20	13
2	20	11
3	19	13
4	19	13
5	19	12
6	19	13
7	19	13
8	19	16
9	19	13
10	19	13
11	16	13
12	19	14
13	17	13
14	19	12
15	13	13
16	13	13
17	13	13
18	19	13
19	13	13
20	19	13
21	19	13
22	17	13
23	19	13
24	19	13
25	19	13
26	16	16
27	19	13
28	19	13
29	19	13
30	19	15
Total	**538**	**395**
Mean	**17.93**	**13.17**

The mean of Posttest in experimental is 17.93 and the Post-test Mean of the control group is 13.17.

The foregoing data signified that the post-test mean of experimental group is significantly higher than the control group.

Difference in Post-test Mean Scores Between Experimental and Control Groups

Table 6 presents the difference in post- test mean scores between the experimental and control group.

Table 6

Comparison in Post-test Mean Scores Between Experimental and Control Groups

Group	n	Mean	SD	p-value	Evaluation	Decision
Experimental	30	17.93	2.18	0.001	Significant	Reject H_o
Control	30	13.17	0.99			

Legend: $\alpha = 0.05$; $df = 58$

The result of the analysis in the degree of comparison in the post-test mean scores between experimental and control group was calculated at .05 which denoted with a p-value of .001. To test further the significance of the coefficient value, the mean of posttest of experimental group is 17.93 and the mean of the control group is 13.17 at .05 level of significant with df = 58. This signified that the correlation between the two aforesaid variables was significant. Therefore, the

corresponding null hypothesis to this effect was rejected. This meant that there is a significant difference between the posttest mean scores of the experimental and control group.

Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of findings with the corresponding conclusions and recommendations based on the findings of the study.

Summary of Findings

The following are the salient findings of the study:

1. The overall rating of 4.67 disclosed that the developed book is highly commendable since the material is interpreted as very highly appropriate and adequate. Based on the assessment of the chemistry experts, the mean score for relevance obtained by the comic strip was calculated at 4. 67, interpreted as very highly relevant, the mean score for efficiency is 4.33 as highly efficient and the mean score for the usability of the comic strip is 4.67, as very high extent.

2. Based on the assessment of the chemistry experts, the mean score for relevance obtained by the comic strip was calculated at 4. 67, interpreted as very highly relevant, the mean score for efficiency is 4.33 as highly efficient and the mean score for the usability of the comic strip is 4.67, as very high extent.

The overall rating of 4.56 disclosed that the developed book is highly commendable since the material is very highly acceptable.

3. The pretest mean score of experimental group is 5.93 while the control group is 4.97. The foregoing data signified that the pretest mean of experimental group is higher than the control group.

4. There is no significant difference between the pretest mean scores of the experimental and control group, based on the degree of comparison which was calculated at .05 denoted a p-value of .127. The p-value are higher than 0.05 significance level indicating not significant relationship between paired variables. This signified that the correlation between the two aforesaid variables was not significant.

5. The post-test mean score in experimental is 17.93 while the control group is 13.17. The foregoing data signified that the post-test mean of experimental group is significantly higher than the control group.

6. There is a significant difference between the posttest mean scores of the experimental and control group. The result of the analysis in the degree of comparison in the post-test mean scores between experimental and control group was calculated at .05 which denoted with a p-value of .001. To test further the significance of the coefficient value, the mean of posttest of experimental group is 17.93 and the mean of the control group is 13.17 at .05 level of significant with df = 58. This signified that the correlation between the two aforesaid variables was significant.

Conclusions

From the findings of the study, the following conclusions were drawn:

1. Based from the rating of the Chemistry experts, the comic strip teaching material attained a very high extent of validity. Specifically, it is very highly appropriate and very highly adequate. The result implies that the contents of the comic strip teaching material are congruent and fitted to the objectives and skills of the grade 8 curriculum guide.

The evaluators considered that the comic strip teaching material is a potential instructional material that can aid both teachers and students in enhancing the students understanding on particle nature of matter.

2. The comic strip for particle nature of matter attained a very high extent of acceptability. Accordingly, the material was also considered as very highly relevant/ usable and highly efficient.

3. The students who used the comics strip teaching material performed better than those who did not. There is a significant difference in the performance of the students after the utilization of the comics strip teaching material on particle nature of matter.

Recommendations

Grounded on the conclusions drawn from the findings of the study, the following are the recommendations:

1. As it was uncovered in this study, a comic strip is a good instructional material that will enhance the interest and understanding of the students.

2. Future Researchers are encouraged to develop comics strip teaching material in other topics in chemistry like biomolecules, chemical bonding, conservation of matter, and chemical reaction.

3. Future Researchers may develop comics strip teaching material in other subjects and other grade level to come up with significant related data in the pursuits of the usage of comics in instruction.

4. Future researchers may undergo a similar process to come up with valid and reliable materials that will enhance and uplift the quality of science teaching.

5. Future researchers may use the rubric for comics' strip in testing the validity of their proposed comics strip teaching material.

6. It is recommended that this study be replicated in other schools and other degree programs as to have a wider perspective on conceptual understanding in particle nature of matter.

7. Another study be conducted in other districts for comparability of results so that each district would validate the findings of the study.

8. A study could be widened in scope from district to division-wide so that uniform intervention program be developed throughout the division.

9. Finally, the comic book may be submitted to the textbook evaluation committee of the Department of Education Division of Samar for endorsement.

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APPENDICES

APPENDIX A

LETTER TO THE SCHOOLS DIVISION SUPERINTENDENT

Republic of the Philippines
Commission on Higher Education
SAMAR STATE UNIVERSITY
COLLEGE OF GRADUATE STUDIES
City of Catbalogan

January 30, 2019

MARIZA S. MAGAN, Ph. D
SCHOOLS DIVISION SUPERINTENDENT
Department of Education
Division of Samar
City of Catbalogan

M a d a m:

Greetings!

The undersigned will be conducting a study entitled, "Development and Validation of a comic strip teaching material on Particle Nature of Matter," as one of the requirements for the degree in Master of Arts in Teaching major in Chemistry with the College of Graduate Studies of Samar State University, City of Catbalogan.

In this connection, she is requesting permission from your good Office to conduct the said study in Jiabong National High School grade 8 students.

Thank you for considering this request with a favorable nod.

Best regards and more power.

Very truly yours,

RAQUEL R. BUTIAL
Researcher

NOTED BY:

ESTEBAN MALINDOG, Ph. D
Dean, Graduate School

APPROVED

MARIZA S. MAGAN, Ph. D
Schools Division Superintendent

APPENDIX B

LETTER TO THE PARENTS

Republic of the Philippines
Commission on Higher Education
SAMAR STATE UNIVERSITY
COLLEGE OF GRADUATE STUDIES
City of Catbalogan

March 12, 2019

Dear Parent/s,

Greetings!

The undersigned will be conducting a study entitled, "Development and Validation of a Comic Strip Teaching Material on Particle Nature of Matter" as one of the requirements for the degree in Master of Arts in Teaching major in Chemistry with the College of Graduate Studies of Samar State University, City of Catbalogan.

In this regard, the undersigned requests your consent to allow your son/daughter to be a participant in my study. Rest assured that my study will not cause any harm instead it will enhance your child's knowledge and understanding in Chemistry.

Anticipating for your kind consideration.

Very Truly yours,

RAQUEL REYES BUTIAL
Researcher

APPENDIX C

CONSENT FORM FOR PARTICIPATION IN A RESEARCH STUDY

"Development and Validation of a Comic Strip Teaching Material on Particle Nature of Matter"

Title of the Study

Description of the research and your participation

You are invited to participate in a research study conducted by RAQUEL R. BUTIAL. The purpose of this research is to develop and validate a comic strip teaching material on particle nature of matter and test its effectiveness through pretest and posttest mean game.

Your participation will involve taking the pre-test and post-test to measure the effectiveness of the comic strip.

Risks and discomforts

There are no known risks associated with this research. But I need cooperation and commitment coming from you. I will consider your convenient time in the conduct of the said activities.

Potential benefits

There are no monetary benefits that would be given to you in your participation in this research.

Protection of confidentiality

Data that will be gathered from this study will be confidential, no names will appear in the research report or any identifying mark about the participant. And in the event that results will be published, your identity will not be revealed in any publication resulting from this study.

Voluntary participation

Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information

If you have any questions or concerns about this study or if any problems arise, please contact RAQUEL REYES BUTIAL at 09383208379. If you have any questions or concerns about your rights as a research participant, please contact SAMAR STATE UNIVERSITY.

Consent

I have read this consent form and have been given the opportunity to questions. I give my consent to participate in this study.

Participant's signature:_____ Date

APPENDIX D

CLASSROOM TEST OF SCIENTIFIC REASONING

Name: Sex:
Section:

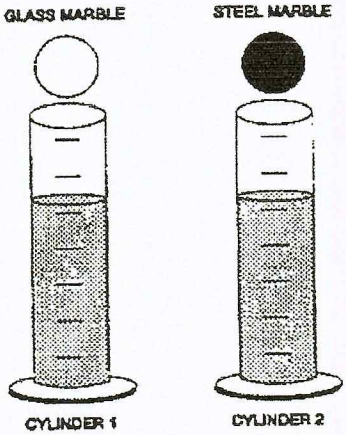
CLASSROOM TEST OF SCIENTIFIC REASONING

Multiple Choice Version

Directions to Students:

This is a test of your ability to apply aspects of scientific /logical. In some tests you will be asked to choose the best answer, show your solution, or explain your answer, or both. Try to answer as completely as you can in the space provided. On some items these explanations are more important than your actual answer. When the item lists answer, circle the best answer and explain your selection. If you do not fully understand what is being asked in an item, please ask the test administrator for clarification.

1. Two cylinders in the drawing are filled to the same level with water. The cylinders are identical in size and shape. Also shown at the right are two marbles, one glass and one steel. The marbles are the same size but the steel one is much heavier than the glass one.



When the glass marble is put into Cylinder 1 it sinks to the bottom and the water level rises to the 6th mark. If we put the steel marble into Cylinder 2, the water will rise

a. to the same level as it did in Cylinder 1
b. to a higher level than it did in Cylinder 1
c. to a lower level than it did in Cylinder 1

because

_____

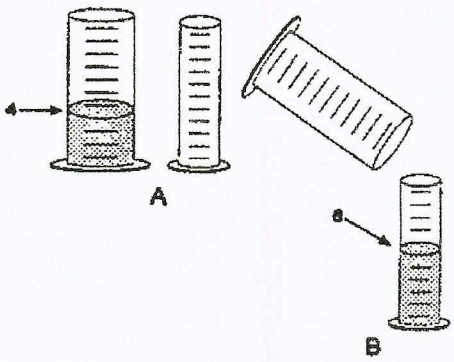
2.Suppose you are given two clay balls of equal size and shape. The two clay balls also weigh the same. One ball is flattened into a pancake-shaped piece. Which of these statements is correct?

a. The ball weighs more than the pancake-shaped piece
b. The two pieces still weigh the same
c. The pancake-shaped piece weighs more than the ball

because

_____

3.To the right are drawings of a wide and a narrow cylinder. The cylinders have equally spaced marks on them. Water is poured into the wide cylinder up to the 4th mark (see A). This water rises to the 6th mark when poured into the narrow cylinder (see B).



Both cylinders are emptied (not shown) and water is poured into the wide cylinder up to the 6th mark. How high would this water rise if it were poured into the empty narrow cylinder?

a. a.to about 8
b. to about 9
c. to about 10
d. to about 12
e. none of these answers is correct

because

_____

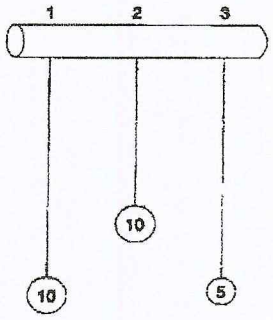
4.Water is now poured into the narrow cylinder (described in Item 5 above) up to the 11th mark. How high would this water rise if it were poured into the empty wide cylinder?

a. to about 7 1/2
b. to about 9
c. to about 8
d. to about 7 1/3
e. none of these answers is correct

because

_____.

5.At the right are drawings of three strings hanging from a bar. The three strings have metal weights attached to their ends. String 1 and String 3 are the same length. String 2 is shorter. A 10-unit weight is attached to the end of String 1. A 10-unit weight is also attached to the end of String 2. A 5-unit weight is attached to the end of String 3. The strings (and attached weights) can be swung back and forth and the time it takes to make a swing can be timed.



Suppose you want to find out whether the length of the string has an effect on the time it takes to swing back and forth. Which strings would you use to find out?

a. only one string
b. all three strings
c. 2 and 3
d. 1 and 3
e. 1 and 2

because

_____

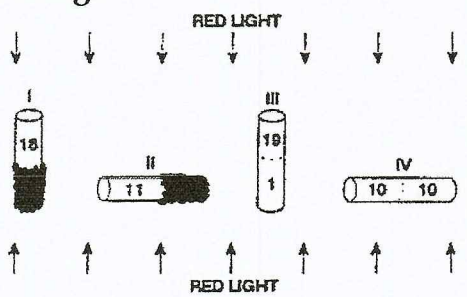
6.Suppose you want to find out whether the length of the string has an effect on the time it takes to swing back and forth. Which strings would you use to find out?

a. only one string
b. all three strings
c. 2 and 3
d. 1 and 3
e. 1 and 2

because

_____

7. Twenty fruit flies are placed in each of four glass tubes. The tubes are sealed. Tubes I and II are partially covered with black paper; Tubes III and IV are not covered. The tubes are placed as shown. Then they are exposed to red light for five minutes. The number of flies in the uncovered part of each tube is shown in the drawing.



This experiment shows that flies respond to (respond means move to or away from):

a. red light but not gravity
b. gravity but not red light
c. both red light and gravity
d. neither red light nor gravity

because

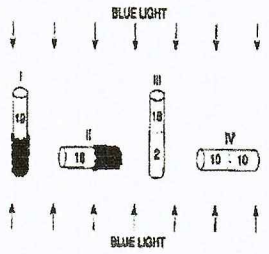
_____

8.In a second experiment, a different kind of fly and blue light was used. The results are shown in the drawing.

These data show that these flies respond to (respond means move to or away from):

a. blue light but not gravity
b. gravity but not blue light
c. both blue light and gravity
d. neither blue light nor gravity

because

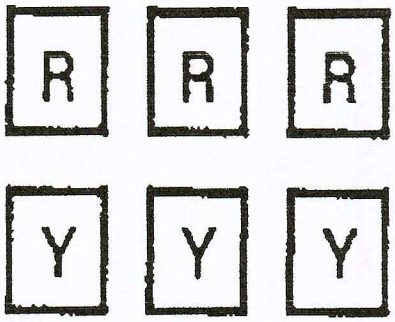


_____

9.Six square pieces of wood are put into a cloth bag and mixed about. The six pieces are identical in size and shape, however, three pieces are red and three are yellow. Suppose someone reaches into the bag (without looking) and pulls out one piece. What are the chances that the piece is red?

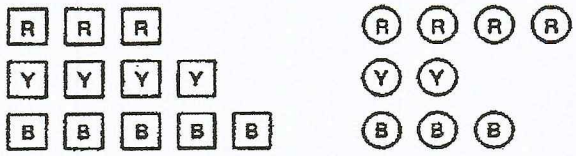
a. 1 chance out of 6
b. 1 chance out of 3
c. 1 chance out of 2
d. 1 chance out of 1
e. cannot be determined

because



_____

10.Three red square pieces of wood, four yellow square pieces, and five blue square pieces are put into a cloth bag. Four red round pieces, two yellow round pieces, and three blue round pieces are also put into the bag. All the pieces are then mixed about. Suppose someone reaches into the bag (without looking and without feeling for a particular shape piece) and pulls out one piece.



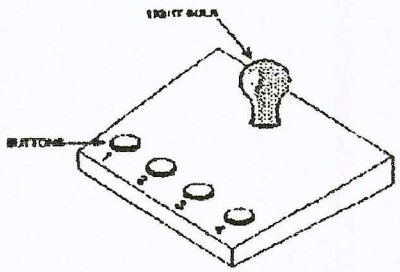
What are the chances that the piece is a red round or blue round piece?

a. cannot be determined
b. 1 chance out of 3
c. 1 chance out of 21
d. 15 chances out of 21
e. 1 chance out of 2

because

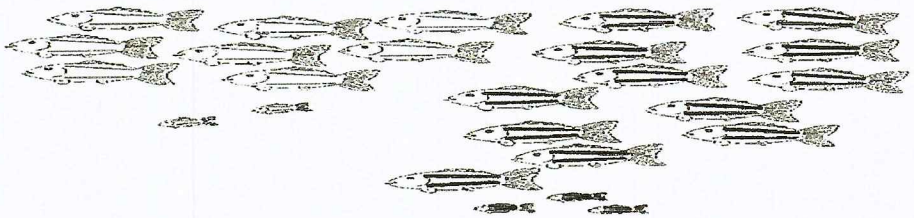
_____

11.The drawing to the right shows a box with four buttons numbered 1, 2, 3, and 4 and a light bulb. The bulb will light when the correct button, or combination of buttons, are pushed together. Your problem is to figure out which button, or which buttons, must be pushed all at the same time to make the bulb light. Make a list of buttons and all the combinations of buttons you could push to figure out how to make the bulb light.



_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

12. The fish in the drawing below were caught by a fisherman, who noticed that some of the fish were either big and some were small. Also, some had wide stripes, and other had narrow stripes. This made the fisherman wonder if there was a relation between the size of the fish and the width of their stripes.



Do you think there is a relation between the size of the fish and the width of their stripe?

a. Yes
b. No

because

_____

APPENDIX E

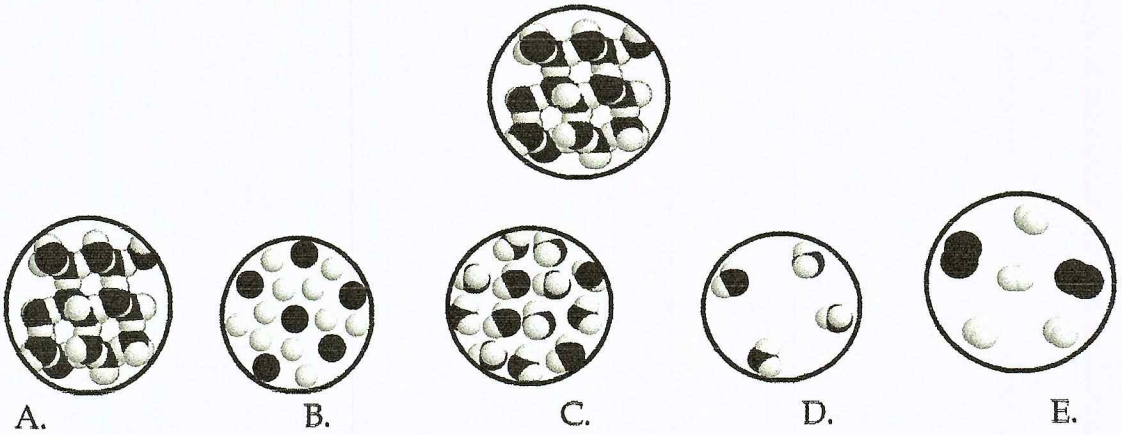
THE PARTICULATE NATURE OF MATTER ASSESSMENT (PARNOMA)

PART I. **The Particulate Nature of Matter Assessment (ParNoMA)**

Instructions:
Carefully read each question. Choose the best answer for each one and encircle the letter of the correct answer.

1. A diagram representing water molecules in the solid phase (ice) is shown below.

Which of these diagrams best shows what water would look like after it melts (changes to a liquid)?

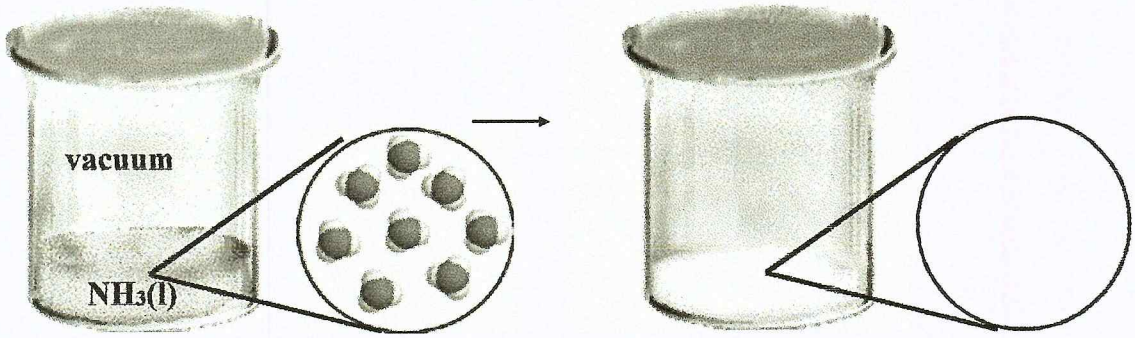


2. Consider three samples of water in three phases. The first is solid water (ice) at 0°C, the second is liquid water at 24°C, and the third is gaseous water at 100°C. The water molecules in the liquid phase _____ the water molecules in the gaseous phase.

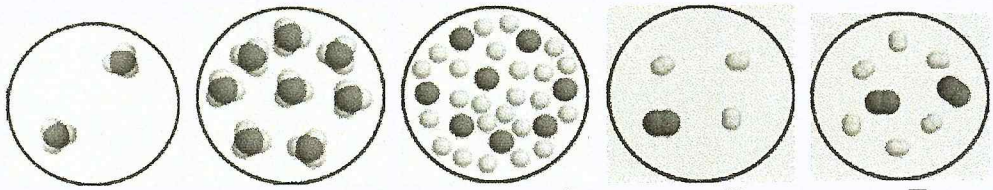
A. move faster than
B. move slower than
C. move at the same speed as
D. move more randomly than
E. travel in the same direction as

3. Which of the following processes will make water molecules larger?
   A. freezing
   B. melting
   C. evaporation
   D. condensation
   E. none of the above

4. A sample of liquid ammonia (NH_3) is completely evaporated (changed to a gas) in a closed container as shown:



Which of the following diagrams best represents what you would "see" in the same area of the magnified view of the vapor?



5. When water changes from a liquid to a gas through evaporation or vaporization, energy is required to
   A. break the bonds between the hydrogen atoms.
   B. form new bonds between the atoms.
   C. break the bonds between the oxygen and hydrogen atoms in the molecules.
   D. break the water molecules away from other water molecules.
   E. form new bonds between the molecules.

6. A water molecule in the gas phase is _____ a water molecule in the solid phase.
   A. smaller than

B. lighter than
C. heavier than
D. larger than
E. the same weight as

7. When water is vaporized, it is changed to
A. hydrogen and oxygen
B. hydrogen only
C. gaseous water
D. air, hydrogen, and oxygen
E. oxygen only

8. A pot of water is placed on a hot stove. Small bubbles begin to appear at the bottom of the pot. The bubbles rise to the surface of the water and seem to pop or disappear. What are the bubbles made of?
A. heat
B. air
C. gaseous oxygen and hydrogen
D. gaseous water
E. none of the above

9. A pot of water on a hot stove begins to boil rapidly. A glass lid is placed on the pot and water droplets begin forming on the inside of the lid. What happened?
A. The lid became sweaty.
B. Steam cools and water molecules moved closer together.
C. Water from outside leaked into the pot.
D. Hydrogen and oxygen combined to form water.
E. Steam combined with the air to wet the inside of the lid.

10. Consider three samples of water in three phases. The first is solid water (ice) at 0°C, the second is liquid water at 24°C, and the third is gaseous water at 100°C. The water molecules in the liquid phase _____ the water molecules in the solid phase.
A. move faster than
B. move slower than
C. move at the same speed as
D. move less randomly than
E. travel in the same direction as

11. A wet dinner plate is left on the counter after it has been washed. After a while it is dry. What happened to the water that didn't drip onto the counter?
    A. It changes to carbon dioxide.
    B. It just dries up and no longer exists as anything.
    C. It goes into the air as molecules of water.
    D. It goes into the plate.
    E. It changes to oxygen and hydrogen in the air.

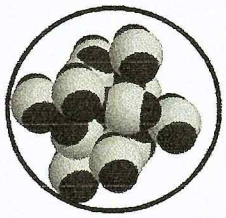
12. Which of the following processes does NOT require heat energy?
    A. evaporating water
    B. melting ice
    C. boiling water
    D. vaporizing water
    E. condensing water

13. When water molecules in the gas phase are heated, the molecules themselves
    A. expand.
    B. move faster.
    C. become less massive.
    D. change to a liquid.
    E. release air.

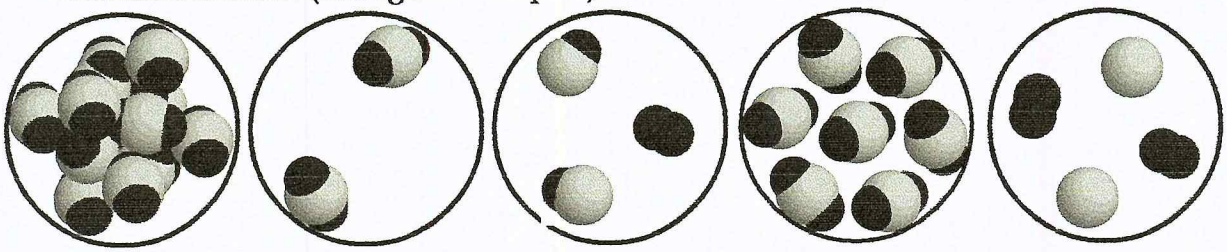
14. Which of the following processes will make molecules smaller?
    A. freezing
    B. melting
    C. evaporation
    D. condensation
    E. none of the above

15. Oxygen and hydrogen gases may be formed from liquid water through the process of
    A. vaporization.
    B. evaporation.
    C. decomposition.
    D. freezing.
    E. boiling.

16. A diagram representing carbon dioxide molecules in the solid phase, also known as dry ice, is shown below.



Which of these molecular diagrams best shows what dry ice would look like after it melts (changes to a liquid)?



A. B. C. D. E.

17. When water at 25°C is heated and changes to a gas at 110°C, the water molecules
    A. become more organized.
    B. move farther apart.
    C. stop moving.
    D. move closer together.
    E. move more slowly.

18. Which of the following processes requires heat energy?
    A. condensation
    B. freezing
    C. evaporation
    D. cooling
    E. none of the above

19. A water molecule in the liquid phase is _____ a water molecule in the solid phase.
    A. smaller than
    B. lighter than
    C. heavier than

D. larger than
E. the same weight as

20. When water at 24°C is cooled to 0°C and freezes, the water molecules
A. become less organized.
B. move much faster.
C. stop moving.
D. break apart.
E. move much more slowly.

APPENDIX F

LETTER FOR TEACHER RESPONDENTS

Republic of the Philippines
Commission on Higher Education
SAMAR STATE UNIVERSITY
COLLEGE OF GRADUATE STUDIES
City of Catbalogan

January 2019

Dear Teacher-Respondent,

Greetings!

The undersigned will be conducting a study entitled, "Development and Validation of a comic strip teaching material on Particle Nature of Matter," as one of the requirements for the degree in Master of Arts in Teaching major in Chemistry with the College of Graduate Studies of Samar State University, City of Catbalogan.

In this regard, the undersigned requests your wholehearted support to validate the comic strip. Rest assured that any information given will be treated with strict confidentiality and will be used solely for this study.

Anticipating for your kind cooperation.

Very truly yours,

RAQUEL R. BUTIAL
Researcher

Instruction: Please evaluate this Comic Book Teaching Material using the criteria provided for it. Please rate each of the criteria, by ticking (√) in the column that fits your assessment

Rubric for Content Validity for Comic Strip

Criteria	1	2	3	4	5
Appropriateness (Discussion of particulate nature of matter and phase changes)	The information presented is not accurate and is not based on the science k to 12 curriculums.	Three to Four topics on Particulate Nature of Matter presented is accurate and based on the science k to 12curriculum.	Five topics on Particulate Nature of Matter presented is accurate and based on the science k to 12 curriculum.	Six Topics on Particulate Nature of Matter presented is accurate and based on the science k to 12 curriculum.	All information presented is accurate and based on the science k to 12 curriculum.
Criteria	**1**	**2**	**3**	**4**	**5**
ADEQUACY Basic elements (title, author, Objectives,5-6 completed panels)	No content is relating to the particulate nature of matter. Comic strip is missing 3 basic elements.	One basic element is present in the Comic strip.	Two basic elements are present in the Comic strip.	Three basic elements are present in the Comic strip.	Comic strip contains all elements in a creative, organized form.

Score	Description	
5	Very High Extent	(VHE)
4	High Extent	(HE)
3	Moderately Extent	(ME)
2	Less Extent	(LE)
1	Least Extent	(L)

EXTENT OF ACCEPTABILITY OF THE COMIC STRIP

Criteria	1	2	3	4	5
EFFICIENCY (It provides examples, illustrations and real life situation for the easy understanding of the topic)	The comic strip has no features for the easy grasp of the topic	The comic strip has only few features for the easy grasp of the topic	The comic strip has some features that teach the topic quickly.	The comic strip has many features that teach the topic quickly.	The comic strip has complete features that teach the topic quickly.
USABILITY (Comic is easy to administer)	The comic is hard to administer and requires a lot of time.	The comic is slightly easy to administer and needs time.	The comic is easy to administer and time is moderately managed.	The comic is easy to administer and time is well managed.	The comics very easy to administer and maximize the use of time.
RELEVANCE (Discussion of particulate nature of matter and phase changes)	The information presented is not suitable to experience and maturation levels of learners	Three to Four contents are suitable to experience and maturation levels of learners.	Five contents of comic strip are suitable to experience and maturation levels of learners	Six content of comic strip is suitable to experience and maturation levels of learners	All content of comic strip is suitable to experience and maturation levels of learners.

Score	Description	
5	Very High Extent	(VHE)
4	High Extent	(HE)
3	Moderately Extent	(ME)
2	Less Extent	(LE)
1	Least Extent	(L)

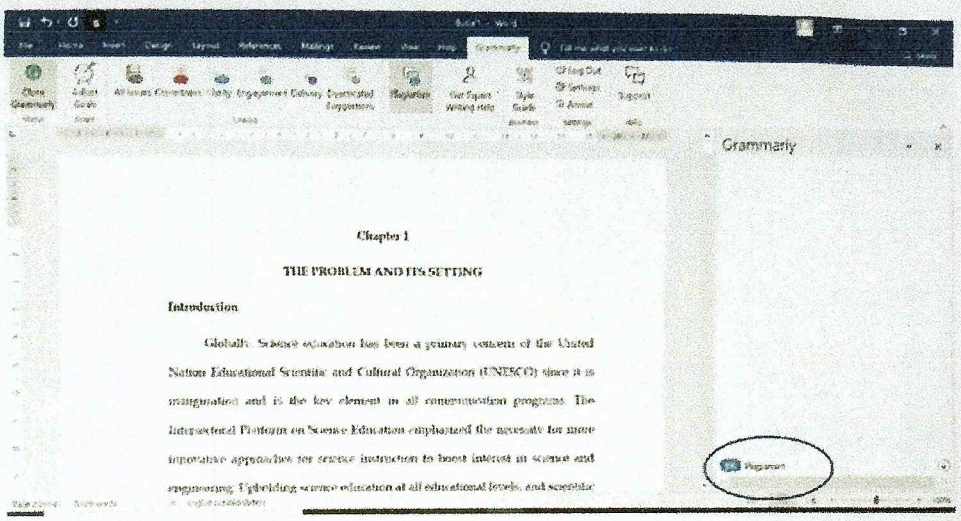
APPENDIX G

PLUG SCAN RESULT

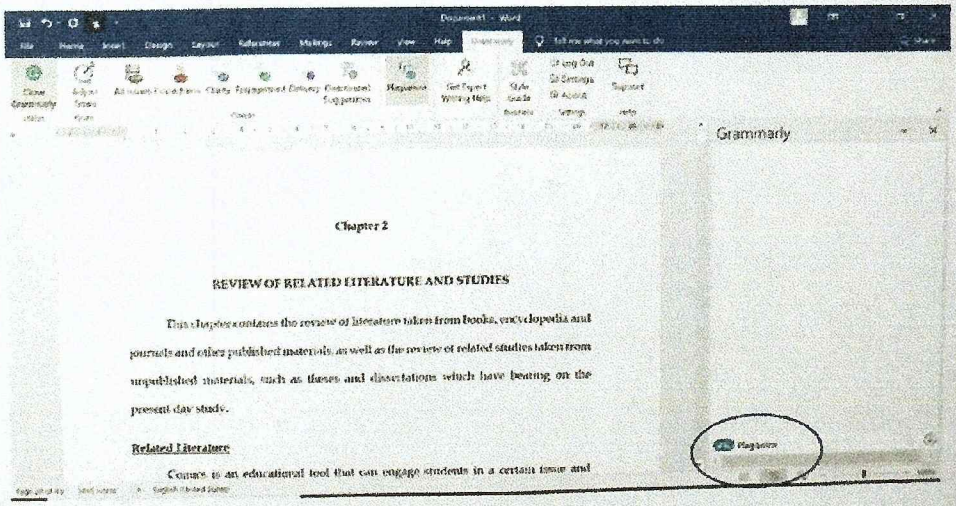
Name : **Raquel Reyes Butial**

Study Title : Development and Validation of a Comic Strip Material in Teaching Particle Nature of Matter

Plagiarism : **5% and 4 %**
Chapter 1 and Chapter 3 to 5



Chapter 2



CURRICULUM VITAE

CURRICULUM VITAE

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RELIGION	:	UNITED PENTECOSTAL CHURCH(ONENESS)
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SPECIALIZATION	:	Chemistry

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SECONDARY	:	Mercedes High School Jiabong, Samar
TERTIARY	:	Samar State University City of Catbalogan, Samar
GRADUATE STUDIES	:	Samar State University City of Catbalogan

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