THE EFFECTIVENESS OF INFOGRAPHICS IN TEACHING CHEMICAL BONDING AMONG GRADE 9 STUDENTS

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APPROVAL SHEET

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XVie

DEDICATION

This is one of my greatest accomplishment in which I exerted so much of my time, effort, and knowledge so I will treasure this forever. Furthermore, I am also hoping to obtain a doctoral degree, thus, as part of my educational journey, I am one step closer to my ultimate dream.

I am dedicating this humble piece of achievement to:

NENITA G. ATILLO, my grandmother;

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VIRGINIA Q. ATILLO, my mother;

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ABSTRACT

For the last two decades researchers found out that students usually lack a deep conceptual understanding of the key ideas related to chemical bonding and, most of the time fail to apply their mental models into a logical conceptual framework (Taber, 2001). To address this problem, the researcher tested the effectiveness of two types of infographics, namely animated and static, in teaching chemical bonding among Grade 9 students. Mixed-method particularly sequential exploratory research design was used in this study. The output of this study is a new, innovative and creative teaching aid using infographics. Based on the latest K-12 Curriculum Guide, the topic on chemical bonding was the input variables. The instrument underwent through expert validation. The researcher employed test-retest to validate the content of the instrument with one-week interval. The Pearson Product Moment Correlation was 0.849 this meant that the instrument was reliable for a group research. This instrument was used in Grade 9 students divided into two experimental groups, student-respondents exposed to animated and to static infographics, which had 20 participants each in a Pre-test and Post-test basis. The researcher used Group Assessment of Logical Thinking (GALT) Test in determining the respondents of this study. The result of the analysis in the post-test mean scores between the two groups of student-respondents, separately exposed to the two forms of infographics was calculated at 0.05 having a p-value of 0.001. This means that animated and static infographics have different effect on the performance of the student-respondents in chemical bonding. The student-respondents exposed to animated

infographics obtained higher post-test mean score compared to those who were exposed to static infographics. Therefore, it can be concluded that the two forms of infographics can improve the performance of the students in complex and abstract topics like chemical bonding. However, according to the result, animated infographics is more effective compared to static infographics because it offered a more attractive and interactive visual presentation to learners.

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CHAPTER I

THE PROBLEM AND ITS SETTING

Introduction

On its global setting, and various field the recent advancements of science and technology are incessantly contributory to the progress of many countries particularly those that are still on the process of development. Developing countries pledged to invest in promoting quality education to sustain these trends (Capanzana & Avilla, 2017).

In the Philippines, based on the result of Trends in International Mathematics and Science study (TIMS) in 2003, Philippines ranked 41st and 42nd out of 45 participating countries in mathematics and science, respectively. The improvement of science and technology education is one of the government's priorities thereby creating science as one of the core subjects in all education levels. The trends revealed that Filipino students when they graduate in high school have low mastery level in science and mathematics (Capanzana & Avilla, 2017).

Furthermore, the National Achievement Test (NAT) is the Philippines' standardized test designed to find out students' achievement level, strengths and weaknesses in five key subject areas at the end of the school year. In the local scene, the Division of Samar obtained the subsequent National Achievement Test (NAT) result, which unconcealed low performance in Science. 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 % passing percentage

(DepEd Samar, 2018). Both globally and locally Filipino students have low performance in science and the government should act responsibly in their educational reforms. At the present, the government's initiative of adopting the K to 12 curriculum in its educational system is expected to give positive results and help the students to overcome their difficulties in learning the subject.

On the other hand, several students find chemistry topics difficult to learn and understand and most importantly it is a vital subject in the curriculum. Chemical bonding particularly is important in understanding the compositions of chemical compounds and connected ideas and studies have shown that students struggle with this idea (Dhindsa & Treagust, 2009). Researchers are deeply concerned about secondary and tertiary students' (a) perceptions of chemistry being tough, (b) experiencing a problem in learning the topic, (c) inadequate background content information for learning advanced content, and (d) ability to apply their knowledge to real-world problems (Dhindsa & Treagust, 2009).

Moreover, chemical bonding is one of the vital key concepts in chemistry. It is also important in areas within physical sciences where understanding is developed through numerous models and where learners are expected to interpret a large complex symbolic representation of chemical bonds (Taber & Coll, 2002). Learning about chemical bonding allows the learner to make predictions and give explanations about physical and chemical properties of substances.

The main goal of chemistry teaching is to come up with a more effective, pedagogically and scientifically based sound strategies to teach high school students the concepts of chemical bonding. This aim is actually motivated by many studies conducted worldwide which revealed that the traditional approach in teaching chemical bonding is misconceived and problematic. Moreover, for the last two decades, researchers found out that students usually lack a deep conceptual understanding of the key ideas related to chemical bonding and most of the time fail to apply their mental models into a logical conceptual framework (Taber, 2001).

To address the above-mentioned problems related to chemistry teaching and learning, researchers have suggested the enhancement of chemistry curriculum including attending to course content development, teacher/student relationship, students' social background, learning styles, use of technology and alternative elucidation to increase the student's participation and performance in chemistry (Abilola & Dhindsa, 2012).

Advances in information and communication technologies have raised new digital skill challenges and are compelling for visual communication skills (Osterman, 2013). Saban (2002) supported it by saying, once academics support teaching method with pictures and graphics, they will reach additional students and catch their attention.

The reality is that almost all human perceptions that come from its close surrounding are no inheritable by the sight and human brain contains a good tendency to research knowledge in a visual way (Shafipoor et al., 2016). Also, according to Dur (2014), studies revealed that visual communication is more effective compared to verbal

communication. This is because the human mind can understand visual communication easily in a short period of time and more permanently.

Infographic could be a newer and more interactive form of info visualization able to support learning. Infographic is designed to speak a particular set of information to a specific audience by turning complicated and abstract ideas into intuitive knowledge (Smiciklas, 2012). It is a combination of the words "information" and "graphics" used to combine the data into a design and introduced as a teaching tool to help the instructors within the teaching and learning session to facilitate learners significantly within the higher learning establishment.

As a visual tool, it presents helpful information in a very meaningful way, simpler to look at and effective to speak knowledge with. Infographics has been used since prehistoric times. Smiciklas (2012) has defined infographic as the provision of knowledge and ideas in a visual way making an attempt to transfer information to students in a better manner and quicker than ancient text ways.

In this regard, the researcher was motivated to conduct this study to investigate the effectiveness of infographics as a visual tool in teaching chemical bonding (ionic, covalent and metallic bonding). As students are in a constant process of development, this study additionally aimed to boost student learning which is able to facilitate their own academic growth and to arouse students' interest in chemistry, specifically in chemical bonding, and not just to learn its concepts and applications, but as well as to come up with a new, creative and informative means of delivering the said topic using infographics.

Statement of the Problem

The study investigated the effectiveness in teaching chemical bonding using infographics and the lived experiences of Grade 9 students of Bonga National High School during the school year 2018 - 2019.

Specifically, the study sought answers to the following questions:

1. What are the pre-tests mean scores of two groups of student-respondents exposed to animated infographics and static infographics?
2. Is there a significant difference between the pre-test mean scores of the two groups of student-respondents separately exposed to two forms of infographics?

3. What are the post-tests mean scores of two groups of student-respondents exposed to animated infographics and static infographics?
4. Is there a significant difference between the posttest mean scores of the two groups of student-respondents separately exposed to two forms of infographics?
5. What are the lived experiences of the student-respondents pertaining to the use of two different forms of infographics in learning chemical bonding?

Null Hypotheses

The following null hypotheses were tested based on the above specific questions:

1. There is no significant difference between the pre-test mean scores of the two groups of student-respondents separately exposed to two forms of infographics.

2. There is no significant difference between the post-test mean scores of the two groups of student-respondents separately exposed to two forms of infographics.

Theoretical Framework

The study is anchored on the Theory of Constructivism and Motivation. Constructivism is basically a theory that relies on observation and scientific study, about how people learn. According to this theory, individuals construct their own understanding and things about the world, through experiencing things and think on those experiences (Bereiter, 1994). While Cherry (2010), defined motivation as "the process that initiates, guides and maintains goal-oriented behaviors. Motivation is to understand what makes people work, whether it is doing a task, learning a work method, or anything. It entails the physical, expressive, social, and psychological forces that stimulate one's own behavior. In general, motivation is usually used to describe "why someone will do something?".

Moreover, the rationalization of the theory of constructivism is mostly attributed to Jean Piaget. He articulated mechanisms by which information is internalized by learners. He said that through processes of accommodation and assimilation, people

construct new knowledge from their experiences. It is vital to know that constructivism is not a common pedagogy. In fact, constructivism is a theory describing how learning happens, regardless of whether learners are utilizing their experiences to comprehend a lecture or following the directions for building a model plane. In both cases, the speculation theory of constructivism suggests that learners construct ideas out of their experiences (Tobias, 2009).

Constructivism has roots in psychology, philosophy, sociology, and education. However, it is important for educators to understand constructivism. It is equally important to know the implications this way of learning has for teaching and for teacher professional development (Tam, 2000).

Constructivism is best understood in terms of how people use information, resources, and facilitate others to construct and improve their mental models and their problem-solving strategies (Woolfolk, 2007). The constructivist model of teaching permits learners to construct knowledge, whether this construction reflects objective realities, or the construction is perceived to sharpen one's cognitive development for acquiring higher-level intellectual development or the development of knowledge should happen in a very social interactive setting with the mediation of people.

The main target in the constructivist classroom is to shift from teacher-centered to student-centered. Here the classroom is no longer a place where the teacher ("expert") pours knowledge into passive students, who wait like empty vessels to be stuffed. The students are obliged to be actively concerned in their own method of learning in the

constructivist model. Teacher's functions are as a facilitator who coaches, mediates, prompts, and helps students develop and assess their understanding, and thereby their learning.

Motivation also refers to "the reasons underlying behavior" (Guay et al., 2010). The motivation that is animated by personal enjoyment, interest, or pleasure is called intrinsic motivation. As Deci et al. (1999) observed, "intrinsic motivation energizes and sustains activities through the spontaneous satisfactions inherent in effective volitional action. It is manifest in behaviors such as play, exploration, and challenge seeking that individuals often do for external rewards". Researchers typically distinguished intrinsic motivation with extrinsic motivation which is a motivation ruled by reinforcement contingencies. Historically, educators consider intrinsic motivation to be more desirable and lead to higher learning outcomes than extrinsic motivation (Deci et al., 1999).

Motivation covers a constellation of beliefs, perceptions, values, interests, and actions that are all closely connected. As a result, numerous approaches to motivation will specialize in cognitive behaviors, non-cognitive aspects, or both. Gottfried (1990) defines academic motivation as "enjoyment of school learning characterized by a mastery orientation; curiosity; persistence; task-endogeny; and the learning of challenging, difficult, and novel tasks".

Thus, teachers' must primarily be guided by goals that assign importance to develop a student's motivation to learn. Second, there is a need to make a blueprint on identifying those aspects or structures of the classroom that are docile. These structures should represent the classroom organization and should relate to instructional planning,

then identify strategies that will serve to reinforce the motivation of all students. These strategies or applications must be grounded in theory and research and evaluated in reference to developmental factors and in relation to alternative motivation constructs, as well as individual variations (Ames, 1990).

Furthermore, previous researches and studies have revealed the effectiveness of utilizing infographics in education and the infographics' role in increasing students' success after they are used as an alternative to texts. Infographics are current technologies which are visual presentations in which graphic drawings (illustrations, symbols, maps, graphics, etc.) are combined with verbal language to transform complicated information and concepts into pictures and drawings that can be clearly and apparently understood and assimilated.

Infographics can be designed in more than one type, and perhaps the most distinguished ones are static and animated types. The static infographics denote the graphics that are designed for the objective of printed use or digital use in websites or to be viewed on a screen as digital presentations without integrating any motion, or animated elements or motion properties. As for the animated infographics, they refer to the graphics designed for being displayed on graphics animated video screens on video websites such as YouTube, TV ads, or animated shows on smartphones, etc. The elements and the data in the animated type are in a state of continuous movement and they are characterized by abundant creativeness within the choice of communicatory movements that facilitate to supply the animation in a motivating and pleasurable manner (Hassan, 2016).

As it was mentioned, infographics facilitate and motivate learning compared to traditional texts, as well as enable learners to participate effectively in the learning process, which results in long-lasting learning (Schrock, 2014). Some studies compared the effectiveness of the two types of infographic designing, animated and static and they concluded with completely different finding. Results confirmed that static infographics are more effective in increasing students' performance, while other researchers have demonstrated that animated infographics are more effective in improving students' performance (Peters, 2013). Hence, this necessitates conducting further research and studies to compare the efficacy of these two types in teaching chemical bonding, as the case in this study.

In summary, the theory of constructivism describes how people use the perceived information and utilize it to construct and enhance their perception and problem-solving skills. On the other hand, the theory of motivation simply pertains the underlying reasons on a particular behavior, either intrinsic or extrinsic. Both of these theories were utilized in investigating how infographics, animated and static, can help improved the performance of students in chemical bonding.

The theories of constructivism and motivation served as the central foundation in the conduct of this study. Integrating the theory of constructivism facilitates the construction and improvement of student's mental models which helps them in understanding the concepts of chemical bonding through the utilization of infographics. Based on the above-mentioned statements and information, infographics can aid learning and human perception because of its visual attractiveness. Thus, the ideas of the theory

of motivation helped the researcher to develop instructional materials aided with infographics to encourage the learners to have the needed enthusiasm, interest, and participation in the entire duration of the study. Both of these theories allowed the researcher to have a successful conduct of this research study.

Conceptual Framework

The scheme shown in Figure 1 reflects the conceptual framework of the study. The base frame represents the subjects and research environment where the study was conducted – Grade 9 Students of Bonga National High School, Brgy. Bonga Motiong Samar, school year 2018-2019. The same frame is connected upward to a series of frame indicating the research process.

The large frame indicates the integration of Theory of Constructivism and Motivation in the whole process and it encloses two boxes representing the two research independent variables, which are using printed and animated infographics in teaching chemical bonding indicates. 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 will be disseminated to the research environment. The same also connected upward to the top most box representing the end goal of the study, which is to determine the Improved Performance in Chemical Bonding of the two groups in the study.

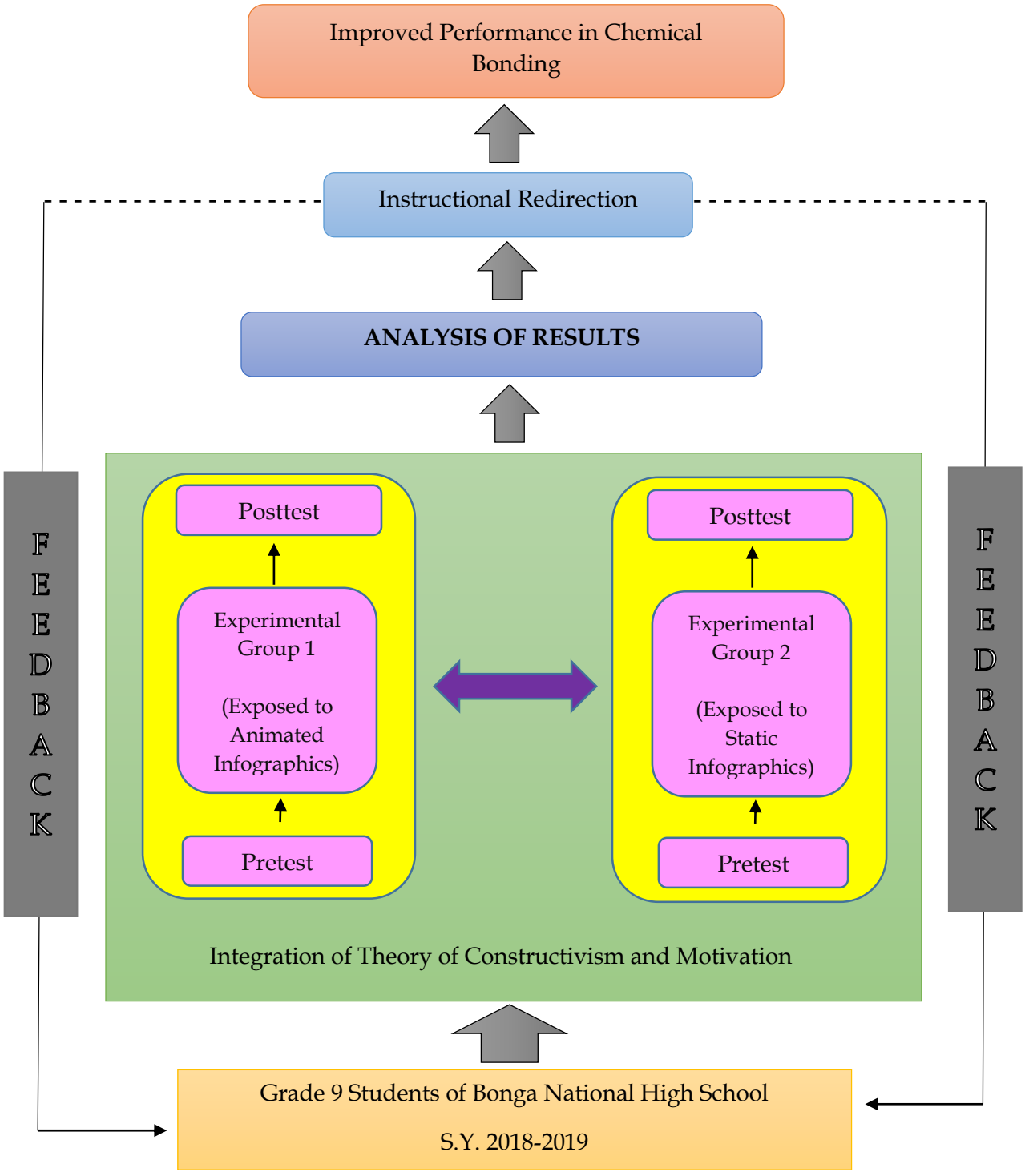

Figure 1. Schema of the Conceptual Framework Showing the Research and Diagram of the Study

Significance of the Study

This study would be beneficial to teachers, administrators, students and to future researchers.

Teachers. The result of this study would motivate teacher to develop and use infographics in delivering their lesson, specifically in chemical bonding, and to increase the positive educational outcomes that promote learning.

Administrators. The study would serve as an eye-opener on the pedagogical approaches and the quality of education being provided to students. As such, they would come up with improved curricula, plans, and programs that give attention to the needs of the students and trained teachers to apply the suitable teaching approaches and acknowledge the use of infographics in delivering lessons to enhance and ensure learning in a diverse type of students.

Students. The importance of using infographics in teaching is that it promotes better understanding specifically in chemical bonding by presenting colorful, attractive and informative visual aids. This may help also students to make connections across concepts, and other disciplines. Using infographics in teaching reinforces students' critical thinking skills, helps student's master concepts and reinforces the instruction about chemical bonding.

Future Researchers. The results of this study would serve as reference material for future researchers in conducting, sequential and parallel inquiries to this present investigation

Scope and Delimitation

This study involved the use of infographics in two ways, printed and animated. It was used as a visual tool in teaching chemical bonding and in the evaluation of its effectiveness among Grade 9 Students of Bonga National High School, Brgy. Bonga, Motiong, Samar.

Chemical bonding is selected primarily because it is a topic at all levels that is not usually taught to provide sustainable and effective learning. Moreover, the manner of delivery is incomplete and sometimes oversimplified. Reflected in the numerous problems (including acquiring misconceptions) as a deficiency when students learn this topic, some researchers expressed their dissatisfaction with the way in which chemical bonding is taught; however, there are only a few researchers who have proposed new teaching pedagogies and models to overcome these problems (Nahum et. al, 2007).

Based on the above arguments, the aim of the present study was to use infographics in discussing chemical bonding and investigate and compare the effectiveness of printed and animated infographics. In the learning process, learning activities enable the transfer of the information in various educational environments and teaching materials used in these environments play an important role.

Since this study used the advent of technology, there were some cases that sessions were affected when technology failed to perform its expected function. Moreover, there were some cases that not all the participants were present in every session during the

experimental phase for some personal matters, which affect their performance in the post-test.

This study was conducted during the school year 2018-2019.

Definition of Terms

The following terms were defined conceptually and /or operationally for easy reference and understanding of the study.

Infographics. The term "infographics" combines the terms "information" and "graphics". The attraction and power of infographics are partly due to the variety of representations that can be used, including charts, graphs, zoom boxes, histograms, icons, tree diagrams, and even pictures. It is also a composition of concise explanatory text and visual representations that are blended to convey a story-like message that is attractive and easy to understand (Parkinson, 2016). In this study, a teaching aid to assist teachers in teaching chemical bonding.

Animated Infographics. This term refers to the graphics designed for being displayed on graphic animated video screens, on video websites such as YouTube, TV ads or animated presentations on smartphones, etc. The elements and the data in the animated type are in a state of continuous movement, and they are characterized by much creativity in the selection of expressive movements which help to produce the animation in an interesting and enjoyable way (Hassan, 2016). As used in this study, animated infographics is one type of infographics that uses animation, sound effects, pictures, diagrams, and graphs.

Static Infographics. The static infographics denote the graphics which are designed for the objective of printed use or digital use in websites, or to be viewed on a screen as digital presentations without integrating any motion, or animated elements, or motion properties (Hassan, 2016). In this study, the static infographics is one type of infographic that is printed only without animation, only text, pictures, graphs, and diagrams.

Effectiveness. A measure of the extent to which a specific intervention, procedure, regimen, or service, when deployed in the field in routine circumstances, do what is intended to do for the specified population (Wojtczak, 2002). For the purpose of this study, the effectiveness of the animated and static infographics as a teaching aid were measured and investigated.

Chemical Bonding. A chemical bond is a physical process responsible for the interactions between atoms and molecules, and that which confers stability to bounded particles (Wikipedia, 2010). As used in this study, chemical bonding is the topic focused on this study.

Experimental Method. The experimental method is a method of research that test hypotheses concerning cause-and-effect relationships. It represents a valid approach to the solution of educational problems, both practical and theoretical (Gay, 1992). As used in the study, it is the method applied to test the effectiveness of infographics, animated and static.

Experimental Group. An experimental group is a group that receives an experimental procedure or a test sample (Helmenstine, 2018). In this study, there were two experimental groups the first group used animated infographics and the second group used static (printed) infographics.

CHAPTER II

RELATED LITERATURE AND STUDIES

This chapter presents concepts and ideas regarding the research problem reviewed from different sources.

Related Literature

Science teaching in school is usually simple, wherein factual ideas need to be presented authentically and meaningfully for the students to understand the scientific concepts. One of the very complex and abstract topics in school is chemical bonding. Very frequently, when considering the manner of teaching chemical bonding, the arguments are absorbed on pedagogical issues rather than scientifically related disagreements. Unnecessary to say, seeking a core understanding of chemical bonding becomes more problematic when we try to translate key ideas to the classroom practice (Nahum et al, 2007).

Nahum et al. (2010) summarized the analysis of chemical bonding and coated varied aspects of it together with the manner it is being taught, the misconceptions, bonding models, and different factors. Therefore, lecturers should create effective teaching educational materials in presenting the lessons on chemical bonding.

In delivering any topics it is important to consider how the human brain works. According to Hyerle (2008) the brain receives information through the eyes and this is about 80 to 90 percent. Moreover, every minute the human brain can absorb about 36,000

images. While Holcomb and Grainer (2006) state that human cognitive and visual system have the ability to process information in less than a half second and this is based on neuroscience. The fact is that information enters the brain through electrical signals perceived by the human senses. These signals are in the form of electrical pulses and are actually representation of external environment. Based on the biological perspective, these appear to the physical reference of perception and cognition.

One of the ways in presenting information and lesson is through visuals. Visuals are vital in organizing the information and viewing a selected setting. For this purpose, it is very important to visualize the information and utilize visuals in teaching environments. One in each of the visuals employed in presenting the information is graphics (Bulduk, 2016). Graphics allow visualizing the information for comparison with an existing one. Moreover, today's learning strategies have unconcealed an efficient manner of presenting single dimensional knowledge given by classical graphics. This manner is enabled by infographics, and infographics as a recent material is employed to find knowledge in an exceedingly desired context inside a bound data flow.

In previous years, infographics are progressively employed in science communication and education. From the science and communications point of view, infographics support rich description of scientific development, have visual attractiveness to interact readers an extended period, and facilitate to succeed in readers with totally varied backgrounds (Mol, 2011).

The term "instructional infographics" came out in 2014 when researchers investigated the sustainability of infographics in an educational context.

Studies divulged that infographics may come through a spread of educational context. In 2014, Saurbier applied infographics to integrate high-order thinking skills in college student's leadership instruction, and stated that infographics improved students' disciplinary competency and increased their success skills and power (Saurbier, 2014). Fowler concerned students in making infographics for science lectures and ascertained that infographics clarified and attuned scientific misconceptions; developed high-order thinking skills together with analysis, synthesis, and wise judgment; and facilitated the development of creative presentations (Fowler, 2015).

As an iconic-verbal text, an infographic is composed of verbal components associated to graphical data (images, maps, graphics, etc., which is capable of meeting the requirements of data. The most imperative characteristics of the infographic genre are: 1) it appreciates visibility, utilizing titles and illustrations directly associated with the subject to attract the reader; 2) it is a sort of script that needs legibility, within which data is distributed in little and fragmented text blocks, with several potential reading entry points; 3) it presents a particular degree of feeling, resorting to a spread of colors and a conversational language; 4) it possesses a high degree of significance, utilizing detailed pictures and vocabulary, and exploring accurate sources and statistics associated with the knowledge (Foschiera et al., 2014).

Infographics are visual representations that integrate data derived from knowledge and graphics to express a message. Infographics are information visualizations that present complicated data instantly and clearly. These visualizations are oftentimes accustomed to aid in knowledge interpretation. Currently, style pointers

for infographics exist lightly beneath the umbrella of many disciplines that embody philosophical theory and graphics style (Rahim et al., 2016)

Moreover, infographics offer an exceptional manner of human action insight in reports, on social media, in shows, or posters. Visuals are processed inside one tenth of a second, and other people bear in mind 80% of what they see (Semetko & Scammell, 2012). Thus, visualized data presentation may be quicker, more practical additional reliable technique of engagement with an audience, specifically to students.

The design of infographics ought to be resilient to hold transmission of information visual image, style details that replicate the information properly and an entertaining and apprehensible general design that will fulfill the main function of infographics. Effective infographics design is about graphic design and knowledge visual image design.

Meacham conducted a study in 2015 and used infographics in her science class; She confirmed that the students could present complex processes and ideas and that infographics could be used anywhere in educational style either as a pre-teaching tool or to strengthen topics. Later studies (Fredrick, 2013; Sudakov et al. 2016) have pedigree Meacham's statement that infographics can be used as a primary point of discussion and as a culminating experience of authentic learning by letting the students demonstrate their ability to totally comprehend a topic and summarize its central themes in an exceedingly concise manner.

According to Krum (2014), the creators of the infographic ought to think about the foremost structure, accuracy, responsibility, depth, and practicality and to give some thought to decoration. Infographics would like analyzing, evaluation, and creation. To present an exceedingly huge set of information, graphs and applied mathematics chart or topographical context to a story with a map must be applied. These infographics are known as knowledge visual image tools.

Davis and Quinn (2014), asserted that infographics can efficiently support writing and reading comprehension and may clarify difficult subjects like science, history, and math whereas strengthening critical thinking and creating skills. Additionally, Dur (2014) examined the potential expansion of infographics in education and over that, their role in enhancing students' educational achievement, infographics may develop students' life skills and attitudes, such as research studies, systematic thinking and cooperation skills. Infographics can even be used for active learning, problem-solving, engagement, and to reinforce students' reflective and inventive thinking (Islamoglu et al., 2015; Karre, 2015). The advantages and edges of infographics are noted and documented primarily by librarians and academic practitioners. Few empirical studies have examined the impacts of infographics on students' accomplishments, life skills or affectional development. It is one of the first studies to investigate infographics' influence on students' performance in a course in education and to explore students' perceptions regarding the utilization of infographics using scientific conducts and effective instruments.

According to Morrison (2013), infographics analysis within the last decade has mostly pursued on the role graphics play as the attention-getting device, whether or not they encourage recall and comprehension, and whether or not they are used primarily to enhance an article's content or to grab a reader's attention.

Previous studies revealed that infographics aid comprehension and recall. The researchers proved how infographics showed mastery of the concept and means to extend the concept of real-world application for students, and demonstrated that infographics are the ideal tool of the 21st century to scaffold and support learning assessment among learners and teachers (Shively & Maine, 2013)

From the point of view of learning sciences, infographics do not seem to be simply a source to acquire knowledge, but also a cognitive instructional material to learn with. Learning implies utilizing tools that will serve as means to construct information and facilitate understanding of a phenomenon. In a situation where students generate the infographics by themselves, these inscriptions will facilitate to produce an idea or concretize their understanding. Such inscriptions do not seem to simply suggest conveying the learner's understanding, but they are conjointly also tools of constructing and advanced refining internal representations. That is, internal (mental) illustrations of a topic are not preconditions for external representations; they are created and refined within the process of building the external representation. In the teaching and learning process, constructing the infographics helps students to develop non-linear ways of thinking, reasoning and representing (Wu & Puntambekar, 2012).

Researchers also demonstrated that utilizing multiple representations, like infographics and modeling, helps learners to develop scientific reasoning and writing skills (Demirbag & Gunel, 2014; Namdar & Shen, 2016), establish the relationship between ideas (Jonassen & Carr, 2000), and determine representational adequacy and enhance their delineative competency (Gebre & Polman, 2016; diSessa, 2004).

As teachers, utilizing and making infographics can develop visual acquirement skills, which are able to facilitate the lecturers to form a sense of and appraise visual information. In addition, through the activity of coming up with a visible illustration of complicated concepts, they will have interaction with the content in an exceedingly sustained manner, presumably expanding their understanding of it (Matrix et al., 2014).

Infographics may be used once the students need to induce across the huge idea or create some point to learners. Topics that are difficult for learners might lend themselves well to infographics. Or, if they need facts that are quite complicated to learn, the researcher might investigate how they could be turned into infographics. Infographics can be categorized into the following: comparison, flow chart, timeline, process, image-based, data, narrative, metaphor, combination, and others. Several of the infographics can be used as background reading for the course and may be useful because the students complete their future assignments (Dalton & Design, 2014)

It is easy to show existing knowledge, show the relationship between ideas, justify processes and events, discuss lecture content and summarize the knowledge through infographics. Infographics may be accustomed to totally different academic functions.

Since comprehensive concepts may be given through infographics, they will be used for various functions like showing the link between different concepts, transferring processes and events, presentation of the content of the course and summarizing the topics learnt (Meeusah & Tangkijviwat, 2013).

Pedagogically, infographics have several edges, not solely it may be accustomed in enhancing engagement and attracting the reader; the speed at which knowledge can be conveyed is quicker once given visually rather instead of purely traditional format. Moreover, infographics will facilitate teachers to reflect on their teaching strategies by offering a fresh perspective on their work and considering it from a distinct angle. Our take on Infographics provides really an "active" learning experience: this hand- on approach fosters thinking through creating, providing a unique engagement with the topic for the researcher.

Related Studies

The following are relevant studies reviewed by the researcher that helped her planning and structuring the study.

A study entitled "Learning with Multiple Representations: Infographics as Cognitive Tools for Authentic Learning in Science Literacy" was conducted by Gebre (2018). This paper exhibited a descriptive case study where infographics—visual representation of information and concepts—had been utilized as cognitive instruments to encourage learning, considering numerous representations in the context of student's science school reporting in secondary school.

Regardless of complementary nature of the two research foci, researches on cognitive devices and various representations have developed individually. This was the result of just looking into cognitive devices narrowly centered around mechanical transformation artifacts and their effect on students' performance with poor attention to learner agency and structures of activity. Challenges aroused literally on sustainability pertaining to cognitive tools in classroom teaching and learning. Utilizing information from a design-based research project where the students in secondary school made a unique infographic-based science news reports, this exhibited how infographics could serve as process-oriented cognitive instruments for learning and instruction alongside with science-literacy in the classroom contexts. Findings have significance in the study and design structures of learning environments concerning representations.

The study of Gebre (2018) and the present study are related in the sense that both studies focused on the utilization of infographics as a cognitive tool for authentic learning. The study of Gebre is different from the present study in the sense that the previous study used data from a design-based research project where secondary school on students created authentic infographic-based science news reports while the present study was on the use of infographics in teaching chemical bonding on grade 9 students only.

Alrwele (2017) did a study entitled "Effects of Infographics on Student Achievement and Students' Perceptions of the Impacts of Infographics". Infographics, a combination of "information" and "graphics" were utilized in the current study which served as an instructional assignment in a preliminary educational program course.

This study's objectives were to find out if the utilization of infographics broughts about a remarkable difference in college female students' accomplishment and investigate the students' insights of the infographics' impact. Utilizing a quasi-experimental design, this study was performed with 165 respondents divided into two groups: test (N = 83) and control (N = 82). The study lasted for nine sessions each of 2-hour span. Data were gathered utilizing accomplishment tests and a questionnaire surveying students' perception. Results showed that there was higher accomplishment in the experimental group over the control group. Almost 90% of respondents in the experimental group stated that infographics had a positive impact on their intellectual, effective development and life skills. Conclusions were drawn and directions to future investigations were examined.

The study of Alrwele and the present study are related in the sense that both studies focused on the effectiveness of infographics on student's academic performance. The study of Alrwele was different from the present study in the sense that the participants of this study were female students only while the present study covered both male and female students. Moreover, infographics was used as an instructional assignment in an introductory curriculum course while in the present study, it was used in teaching chemical bonding among Grade 9 students.

Alshehri and Ebiad (2016) conducted a study entitled "The Effectiveness of Using Interactive Infographic at Teaching Mathematics in Elementary School". The study was designed to explore the effectiveness of using interactive infographics in the second grade of elementary school specifically in the teaching of mathematics.

The study utilized a semi-experimental approach through pre and post-tests for two groups; experimental and control group where the study sample was comprised of 32 students from the second grade in the first semester of the academic year (1435-1436h). They were randomly selected and divided into two groups; one was a control group which consisted of 17 students (studying with traditional method); the other one is experimental (pilot) group which consisted of 15 students (studying with interactive infographics method). The researcher developed an instructional design model for teaching mathematics using interactive infographics. The results showed that there were statistically significant differences at the level (0.05) between the means of students' scores of the experimental group and control group in post achievement test in favor of the experimental group in which concluded that interactive infographics was an effective tool in teaching and learning mathematics at elementary school.

The above study is comparable to the present study on the basis of using infographics in the teaching and learning process aiming to enhance the students' performance in the subject. However, the difference is that the subject focus of the study was mathematics while this study was on science, specifically on chemistry on the topic of chemical bonding and the previous study's respondents were elementary students while in this study were Grade 9 secondary students. Also, the study of Alshehri and Ebiad (2016) used semi-experimental approach and this study used mixed-method particularly sequential exploratory.

Hassan also conducted a study entitled "Designing Infographics to support teaching complex science subject: A comparison between static and animated Infographics" in 2016. The purpose of his study was to investigate the creation of infographics that could convey information effectively and to determine which format was more effective in teaching difficult science subjects, animated or static. There were 30 participants, 15 for each group. Part of the methodology were the making of infographics using its two form. Animated or static applied in science subject which were considered difficult, specifically the Phases of the Moon. This study also tested the student's comprehension and retention. Hassan's hypothesis was that animated infographics was more effective compared to static infographics but the result of his study implied that using a properly designed infographics could effectively facilitate learning science complex subjects. In other words, both type of infographics was effective in teaching complex science subjects.

The above-mentioned study is similar to this study since both tested the effectiveness of two forms of infographics, animated and static, and also the purpose of this study is similar to Hassan (2016) which were to create a teaching aid that would help the learners to comprehend complex science subjects. However, the study differed in the setting, and the focus topic in science. This study focuses on chemical bonding while Hassan's study focused on the Phases of the Moon.

Another study conducted by Lyra et al. (2016) entitled "Infographics or Graphics+Text: Which Material is Best for Robust Learning?" Infographic is a type of data visualization tool that utilized realistic configuration with upgrade human capacity to

distinguish designs and patterns. It was prominently used to spread information. Yet, there are some researches that examine how infographics influence learning and individual factors, like learning styles and enjoyment of the information influence infographics perception. In this sense, this paper portrayed a case study performed in an internet stage were 27 college students were arbitrarily assigned to view infographics (n=14) and graphics+text (n=13) as learning materials on the same subject. Additionally, they responded on questionnaires of enjoyment and learning styles. The researchers' discoveries showed that there was no correlation between learning styles and post-test scores of the participants. Furthermore, they did not find indifference as regards to learning between students utilizing graphics or infographics. Furthermore, learners who were utilizing infographics they discovered a significant and positive correlation between correct answers and the positive self-assessment of enjoyment/delight. They additionally distinguished that students who utilized infographics kept their obtained information longer than students who only utilized graphics+text, demonstrating that infographics might better support robust learning.

The study of Lyra et al. and the present study were related in the sense that both studies investigated how infographics affect learning. The study of the group of Lyra was different from the present study in the sense that the previous study was on robust learning while the present study was on chemical bonding.

Mohaddeseh, Roghayyeh and Shafipoor (2016) conducted a study entitled "Infographic (information graphic); a tool for increasing the efficiency of teaching and learning processes".

According to their study, the world is proceeding to the utilization of modern technology in the teaching process. Classroom teachers may not know about infographics advantages in the teaching and learning process. Half of the mind were allocated to visual functions; therefore, humans were primarily more on visuals. Moreover, 65% of individuals were visual learners. The most significant perspective was that pictures are being transformed simultaneously. We understand them 60,000 times quicker than on reading text. Findings showed that utilizing infographics to classrooms might encourage learning, memorizing and retrieving information. This research study demonstrated how students learning could be improved through the utilization of infographics.

The above study is similar to the present study because the two studies used infographics in improving the teaching-learning process. The above study differed from the mentioned study in terms of research locale and respondents. The above study was conducted internationally and the respondents were teachers while the present was a local study and involved Grade 9 students.

The study of de Oliveira et al. (2016) entitled "Infographics and Pericyclic Reactions: Multimodal Resources in Teaching of Organic Chemistry". This study utilized infographics as a pedagogical alternative to the study of a very significant theme in Chemistry Teaching. They discussed the probability of utilizing infographics in the classroom, as a distinction to improve the learning for the constructions and elaborations of different dialects and composed readings. They have produced dynamical content using ThingLink, an internet program that allows authors to bring life the images through the addition of audio, videos, socially organized profiles, writings, and other similar

content. After making a free account within the service, the user may upload a base image and attach corresponding content for a basic manner, without the required advanced programming techniques. The methodology made utilization of multimodal modes that improved learning and was in line with the enhancement of proposals for pedagogical purposes in contemporary times.

The study above study is similar to the present study since both studies focused on use infographics as a pedagogical alternative to the study of a very important theme in Chemistry Teaching. However, the two studies differed in some aspects, the present study was only in getting the effect of using infographics in teaching chemical bonding unlike the study of the group of de Oliveira which they created dynamical content utilizing ThingLink was highly different from the research design of the present study.

Yildirm (2016) did a study entitled "Infographics for Educational Purposes: Their Structure, Properties and Reader Approaches". According to this study, infographics was one of the modern educational tools applied to provide information utilizing different visuals, such as texts, pictures, diagrams, and graphs to their readers. The utilization of infographics got gradually widespread both in advertising activities of business organization and educational environment. In this study, the perspectives from those who utilized infographics to instructional purposes toward educational impacts of infographics were analyzed in addition to instructional material, type of infographics, preference, and structures of infographics. The respondents of the study wree composed of students of Ataruk University, Kazim Karabekir Education faculty. The research study was conducted with 37 females and 27 male students, a total of 64 respondents.

All students had the experience of reading infographics. According to the findings of this research study, they preferred to utilize infographics to their basic learning processes and they found it very instructive. Moreover, infographics were considered as one of the vital instructional materials that made learning more permanent.

The above study is deemed similar to the present study on the basis of the topic of the two studies which are the use of infographics for educational purposes. However, the two studies differed in research design. The study of Yildirim was quantitative research design while the present were mixed-method particularly sequential exploratory research design.

Rezaei and Sayadian (2015) conducted a study "The Impact of Infographics on Iranian EFL Learners' Grammar Learning". The study aimed to enhance the grammatical ability of EFL learners and committed to improving grammatical knowledge in a distinctive method. According to the researchers, it was time to disregard stereotyping grammatical learning which infrequently took part of the readers' mind in the learning procedures and centering their consideration on using media and visualizations in form of infographics in sentence structure. This study was intended to investigate the effect of infographics instruction with respect to Iranian EFL learners' grammar learning based on the researcher's inspiration to figure out experimental proofs in Iranian English language learners. The grammar teaching was delivered through two methods; one, through the infographic's instruction, and the other, through the monotonous and traditional method. Based on the result of paired t-test, it was discovered that infographic instruction was an effective instrument to improve EFL learners to learn foreign language grammar.

The study of Rezaei and Sayadian is comparable to the present study because the two studies used infographics in instruction and in improving the student's knowledge. Moreover, both studies used two methods; one, through the infographic's instruction, and the other, through monotonous and traditional techniques. However, they differed in two aspects first on the subject matter. The previous study focused on grammar while the present study focused on chemical bonding and second on locale and respondents. The above study was a foreign study and involved EFL learners unlike the present which was a local one and involved Grade 9 students.

Another study was conducted by Matrix (2014) entitled "Teaching with Infographics: Practicing New Digital Competencies and Visual Literacies". This study examined the utilization of infographics as a teaching assignment in an online classroom. It claimed for the advantage of adopting this creative assignment teaching and learning and recognized the technical and pedagogic challenges that might emerge in doing so. Information and perceptions were drawn from two case studies, both on online class and a blended one and communication fields, taught at two distinctive institutions. This paper exhibited how incorporating a research-based graphic styles assignment into coursework challenged and motivated students' visual advanced literacies. The paper included useful insights and identified best practices emerging from the authors' classroom experience with the infographic assignment, and from students' perception on the use of infographics. The paper infered that this sort of inventive assignments obliges students to perform precisely those advanced digital competencies needed in a progressing visual advanced society.

The study of Matrix is similar to the present study since both studies focused on the creative use of infographics in the teaching-learning process. However, the two studies differed in that the present study was after getting the relationship between the traditional strategy and the integration of infographics in teaching chemical bonding while the study of Matrix used infographics was used as a teaching assignment in the online college classroom.

A study entitled "Infographics in Education: Review on infographics Design" was conducted by Naparin and Saad (2012). This paper was intended to investigate how infographics worked in various fields and then centered on its educational application. To attain this objective, a total of 55 articles from four databases coating those time starting with 2004 until 2016 were investigated based on their setting. The investigation demonstrated that 30 articles discussed the infographics, 18 articles expounded infographics in the education field and seven articles engaged in infographics styles and structures. Infographics style and structure techniques different areas could be applied in outlining a useful infographics application for instruction and learning purposes.

Naparin and Saad's study is relevant to this present study in the sense that the concerns of both studies were about the use of infographics in the teaching and learning process. The two studies differ in terms of other variables such as using infographics in Chemical Bonding, which was not considered in the study of Naparin and Saad.

The review identified outstanding features of infographics which could provide a promising technique for instruction and could serve a variety of purposes.

The benefits and advantages of infographics have been noted and documented primarily by researchers and educational practitioners; few studies have examined the impacts and effectiveness of infographics on students' achievement, life skills, or effective development. On the other hand, since in chemical bonding, according to some researchers, students face numerous problems learning this topic, therefore, infographics might aid and offer a more interactive, informative, and effective learning instructional materials to teachers teaching this topic.

CHAPTER III

METHODOLOGY

This chapter discusses the research design, instruments used in data gathering, validation of the instrument, sampling procedure, data gathering procedure and statistical analysis of data.

Research Design

The researcher utilized the mixed-method approach particularly sequential exploratory research design to investigate the difference in students' performance using the two types of infographics, namely, animated and static (printed) infographics. The aforementioned type of infographics was used in teaching chemical bonding among Grade 9 students of Bonga National High School, Brgy. Bonga, Motiong Samar, which competencies were based on the K-12 Curriculum Guide. The performance of students was used to determine the difference between the two independent variables.

Mixed method research design mainly sequential exploratory was applied in this study that converged the elements of quantitative and qualitative data collection. To obtain the quantitative data the researcher statistically analyzes the scores collected using the validated instrument based on the pre-test and post-test result. To obtain the qualitative data the researcher conducted an interview with the participants using the semi-structured questions made by the researcher. All data gathered through pre and post-test and interview were carefully analyzed and interpreted using the appropriate

statistical tool. This method helped the researcher to answer the research questions of this study come up with valid and reliable result.

For the qualitative research component of the study, it employed statistical tools such as frequency count and percentage, mean, standard deviation, weighted mean, T-test for dependent samples, and T-test for independent samples.

The experimental group exposed to Animated Infographics was assigned as the experimental group 1, and the group exposed to Static (Printed) Infographics was assigned as the experimental group 2. Before this, the two experimental groups had been given a pre-test in the form of a multiple choice and essay.

They were also evaluated through a post-test using the same instrument. The results of both tests were computed using appropriate statistical tool to determine the effectiveness of the experimental materials, which were static and animated infographics.

On the other hand, the quantitative data were derived from an interview to each student-respondent to both experimental groups.

Instrumentation

The instruments utilized in gathering the data in this study were the following:

GALT Test. GALT stands for Group Assessment of Logical Thinking which is a 12-item paper and-pencil Piagetian test of logical thinking that focuses on the six modes of reasoning, one of which is concrete operational, and five of which are formal operational (proportional reasoning, controlling variables, probabilistic reasoning, correlational reasoning, and combinatorial logic). There are 12 illustrated problems in the

GALT Test. For 10 of the 12 questions, students were required to choose the appropriate multiple-choice response for the problem and the rationale, which was also in multiple-choice format, for the selected response. The question was considered to be correct only if both parts of the question, answer and rationale, are correct. Then, the remaining two questions, which concern combinatorial logic, were not multiple choice and the students need to provide their own logical combinatorial patterns. The researcher employed two-tiered test. This test was used to group the students according to their scientific reasoning.

Multiple Choice Achievement Test in Chemical Bonding. This is knowledge and skills test on understanding on what is happening during the formation of compounds in the form of a written test. It consists of 25 items covering the three major types of chemical bonding namely, ionic 9, covalent 8, and metallic bonding 8.

Short Essay Question. The short essay questions were used as an instrument for revealing and distinguishing among students' conception on chemical bonding. It consisted of five items covering the three major type of chemical bonding, five points each. Students' responses were analyzed. Students' responses were evidence of students' conceptions on chemical bonding.

The production of this instrument was in accordance to the number of participants of the study; therefore there were 40 copies-20 copies for the experimental group 1 who were exposed to animated infographics, and 20 copies for the experimental

group 2 who were exposed to static infographics. These tests were administered to Grade-9 students in the two experimental groups, in one-to-one testing procedure.

A licensed professional teacher administered the written test from the pre-testing to the post-testing. Both groups were given an hour to take the test. Identical testing procedures were strictly observed so that the threats to internal validity like history and instrumentation assumed not to pose as rival factors.

Validation of the Instrument

The researcher drafted the Achievement test in chemical bonding and it was submitted to her adviser. After incorporating the suggestions, the said achievement test underwent expert validation particularly parallel test validation.

Right after this, test-retest was administered to measure the reliability of the instrument, but before administering the test for pilot testing the researcher sought approval from the school principal. Another letter of consent for the participants and their parents was been given before the conduct of the pilot testing using the prescribed form. When the permission was secured, the test was administered to Grade 9 (15 students) of Calapi National High School, Brgy. Calapi Motiong Samar. Pearson r was used to determine the reliability of the achievement test in chemical bonding. The researcher assured the participants in the piloting that their scores would be treated as confidential.

After a week the same test was administered. The Pearson Product Moment Correlation was 0.849. This meant that the instrument was reliable for a group research.

Sampling Procedure

The respondents of this study were Grade 9 Students of Bonga National High School, Brgy. Bonga Motiong Samar. There were two sections in Grade 9-Socrates was composed of 27 students while Grade 9-Copernicus was composed of 33 students, both was handled by the researcher. The researcher used GALT Test in determining the participants of the study. All students took the test. The score and the sex, male or female, served as the bases for the grouping. Those who got the same score and with same sex from both sections were matched until the researcher complete all the 20 participants in both experimental groups, with a total of 40 participants.

Data Gathering Procedure

The researcher wrote a letter, duly noted by her research adviser to the Schools Division Superintendent of the Department of Education Division of Samar to conduct the study in Bonga National High School, District of Motiong, Division of Samar. The researcher used the approved letter as reference to seek the approval of the principal of Bonga National High School to allow her to conduct the study.

When the permission was secured from the school principal another letter of consent was given to the parents of the selected participants to ask their permission in the participation of their children in the research study. The researcher also sought the consent of the students to be part of this study.

After obtaining all the necessary approvals and consents, the experimental procedure followed. This had two phases; the pre and post-experimental phase.

Pre-Experimental Phase. The pretest was personally administered to the students personally by the researcher. Before the administration of the test, participants were assured that their responses would be confidential. After the administration of the pretest the two experimental groups were exposed to infographics in learning chemical bonding. The first group was exposed to static (printed) infographics and the second group was exposed to animated infographics.

The experimentation was conducted for 10 sessions; every session lasted for one (1) hour. The topic, Chemical Bonding, was taught in both experimental groups, but they differed in the type of infographics used as mentioned above. Both groups were handled by the researcher in their scheduled time as approved by the principal. Experimental group 1 was scheduled at 10:45 to 11:45 in the morning, while the other group at 2:00 to 3:00 in the afternoon. The researcher ensured that the room was conducive and well-structured and avoided any distractions that may affect the learning of the participants in the study.

Post-Experimental Phase. After the exposure of the two groups in the two types of infographics it was followed by the administration of the post-test using the same instrument. The test papers were retrieved by the researcher and were tabulated, analyzed and interpreted.

An interview method was employed to the participants to both experimental groups to obtain their perceptions on the use of infographics in teaching chemical bonding, which was also used as a proof of its effectiveness.

Questions ask were:

1. Does the infographic (printed/animated) create a sense of excitement? How does this infographic (printed/animated) create a sense of excitement? Or how does it not?
2. Does using infographics help you understand the concepts in chemical bonding? How does infographics (printed/animated) help you understand the concepts of chemical bonding? Or how does it not?
3. What is your perception of using infographics (printed/animated) as a tool for learning chemical bonding?

After conducting the interview, the gathered responses were analyzed by an expert on a process called NVivo. It was a qualitative data analysis that gave emphasis on the actual spoken words of the participants, and the results were interpreted by the researcher.

Statistical Treatment of Data

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

Mean. This was used to determine the average scores of the subjects in their pre-test and post-test with each of the two teaching strategies.

Pearson Product Moment Correlation (Pearson r). This was used to determine the association on the pre-test and post-test scores of the two experimental groups.

Standard Deviation. This was used to determine the compactness of the scores for pre-test and post-test of each group that determined their cooperation as a group.

T- test for Dependent Samples. This was used to test the significant difference between the mean scores in the pre-test and post-test of each group.

T- test for Independent Samples. This was used to test the significant difference between the mean scores of students in pre-test and post-test of both groups.

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 purpose of this research was to determine the effect of infographics in teaching chemical bonding in Grade-9 students at Bonga National High School.

This study took 10 days. Their participation involved taking pre-test and post-test, and interview for their lived experiences in the use of infographics in learning chemical bonding.

Risks and discomforts

There were no known risks associated with this research.

Potential benefits

There were no monetary benefits that were been given to the participants in this study. However, this study offered a new, creative and innovative way of teaching chemical bonding to teachers.

Protection of confidentiality

The data that were gathered from this study wer treated with confidentiality. Names were optional in questionnaires that were given to them. No names appeared in the research report or any identifying mark about the participant. And in the event that results would be published, participant's identity would 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. It was also emphasized to the student-respondents that they would not be reprimanded in any way if they will decide not to participate or to withdraw from this study.

Research data disposal

Research data were disposed through shredding for the printed materials and media sanitation with the assistance of IT personnel for the recorded data taken from the interview.

CHAPTER IV

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.

Pre-test Mean Scores of Student-Respondents Exposed to Animated and Static Infographics

Table 1 shows that the pre-test mean scores of students-respondents exposed to animated infographics and static infographics.

Table 1

Pre-test Mean Scores

Students	Pre-test Scores	
	Animated	Static
1	10	12
2	12	7
3	10	6
4	4	7
5	8	7
6	9	8
7	7	8
8	5	7
9	4	4
10	6	5
11	7	8
12	6	5
13	5	7
14	8	12
15	11	7
16	10	5
Students	**Pre-test Scores**	
	Animated	**Static**
18	11	9
19	8	6

20	10	9
Total	160	146
Mean	8.0	7.3

The data above reveals that the pre-test mean scores using animated infographics is 8.0 while in static infographics is 7.3.

Difference in Pre-test Mean Scores

As reflected in Table 2, there is difference in pre-test mean scores between the respondents exposed to animated and static infographics regarding their knowledge on chemical bonding.

Table 2

Comparison in Pre-test Mean Scores Between Animated Infographics and Static Infographics

Group	n	Mean	SD	p-value	Evaluation	Decision
Animated	20	8.0	2.43	0.334	Not Significant	Accept H_o
Static	20	7.30	2.08			

Legend: a = 0.05; df = 38

The acquired pre-test mean scores of student exposed to animated infographics was 8.0 and those who were exposed to static infographic was 7.30. These resulted to a 0.334 p-value which is greater than the 0.05 significant level indicating no significant difference in knowledge of chemical bonding between the respondents exposed to animated and static infographics. Thus, the hypothesis "there is no significant difference between the pretest mean scores of the two groups of student-respondents separately exposed to two forms of infographics", was accepted.

Post-test Mean Scores of Student-Respondents Exposed to Animated and Static Infographics

The post-test mean scores of students-respondents exposed to animated and static infographics is given in table 3.

Table 3

Post-test Mean Scores

Students	Post-test Scores	
	Animated	Static
1	41	38
2	36	30
3	35	36
4	31	30
5	36	27
6	41	32
7	38	34
8	39	32
9	35	27
10	27	30
11	30	29
12	34	29
13	38	33
14	31	29
15	34	33

Students	Post-test Scores	
	Animated	Static
16	33	30
17	38	32
18	39	28
19	31	28
20	32	27
Total	699	614
Mean	34.95	30.7

The result shows that the post-test mean score of respondents exposed to animated infographics is 34.95 while to static infographics is 30.7. This indicates that the respondents exposed to animated infographics yielded a higher score compared to those who were exposed to static infographics. Animated infographics can convey more information compared to static infographics. This led to attention and attraction to the viewers in which they understood more about the information presented to them (Medina, 2013).

Difference in Post-test Mean Scores

Table 4 provides the comparison in post-test scores between the animated infographics and static infographics.

Table 4

Comparison in Post-test Mean Scores Between Animated Infographics and Static Infographics

Group	n	Mean	SD	p-value	Evaluation	Decision
Animated	20	34.95	3.87	0.001	Significant	Reject H_o
Static	20	30.70	3.03			

Legend: a = 0.05; df = 38

The capitulated data revealed a p-value of 0.001 which was lesser than the 0.05 significance level indicating significant difference in level of knowledge of the chemical bonding between the two experimental groups. The hypothesis "there is no significant difference between the posttest mean scores of the two groups of student-respondents separately exposed to two forms of infographics", was rejected.

Based on the data, animated group performed better than static group. This is congruent with the result of the study of Dur (2014), wherein he stated that animated infographics help learning advanced and spatial science subjects compared to static infographics which only contains diagrams and pictures.

Lived Experiences of Students Exposed to Animated Infographics

The following were the derived themes from the research question answered by the participants exposed to animated infographics:

1. Does the infographic (animated) create a sense of excitement? How does this infographic (animated) create a sense of excitement? Or how does it not?

Theme 1: Exciting Lesson is the Reason

Participant 3: *"Oo. An animated infographics nakakadugang excitement labi na an mga videos."* (Yes. The animated infographics add excitement specially the videos.)

Participant 5: *"Oo. An animated infographics usa han bag-o nga pamaagi han pagtutdo na nakahatag hin excitement ha ak kay kakaiba dere parehas hit tradisyonal na pagtutdo."* (Yes. Animated infographics is one of the new instructional aid which give me excitement for it is very different from the traditional way of teaching.)

Participant 7: *"Oo. An animated infographics importante para maintindihan*

namun an mga butang nga dere kami maaram ngan an infographics nakahatag ak hin excitement asya naapi ako hit am mga activity ha klase."(Yes. Animated infographic is important for us to understand things that we do not know and infographic gives me excitement that is why I joined in every activity in our class.)

Participant 9: *"Oo. Nakaka excite kay para ha ak bag-o hiya na pamaagi hin pagtutdo ni ma'am asya namamate ako."*(Yes. It is exciting for it was a new way of teaching used by my teacher, so I really listen to the discussion.)

Participant 15: *"Oo. Maupay pamate han leksyon nga dere kapa maaram kun may animated infographics labi na kay makuri an topic na chemical bonding nakahatag hiya hin bag-o na pamaagi para mahibaro kami asya nakaka excite."*(Yes. It is very wonderful to listen to the discussion specially if you do not know the lesson. Most of all chemical bonding was a difficult subject. It offers a new way of learning. Very exciting.)

Animated infographic as manifested in the responses, provided excitement in learning chemical bonding because there are pictures, colors used, moving objects, and especially the videos. Therefore, animated infographics captured the attention and focus of the student-respondents and triggered their excitement. Lamb and Johnson (2014) stated that words and pictures that blend harmoniously together can tell a story in an exciting manner. This is also congruent with the statement of Matrix and Jodson (2014), who said that infographics has many advantages including presenting facts in a

visualized data form, and videos to expressive symbols, images and also being easy to reproduce. To encourage excitement in discussing chemical bonding teachers must use animated infographics.

2. Does using infographics help you understand the concepts in chemical bonding? How does infographics (animated) help you understand the concepts of chemical bonding? Or how does it not.

Theme 2: Understanding is Grasping

Participant 4: *"Oo. Kay han naggamit han animated infographics han pagtutdo madali ako nahibaro han chemical bonding. Pagkakatapus hit pag tutdo han chemical bonding pag-uli ko balay damu ak la gihap nahinunumduman ngan nahihibaruan han chemical bonding labi na an pag tra-transfer ngan sharing han electrons."*(Yes. In u sing animated infographics in teaching I have no difficulties in learning chemical bonding. Even if I got home already, I still remembered everything how did the sharing and transfer of electrons in chemical bonding occur.)

Participant 7: *"Oo. Nakabulig ha akon an paggamit han animated infographics mas madali ko naintindihan an chemical bonding ngan damu an ak nahibaruan tungod hito."*(Yes. The use of animated infographics helped me to easily understand chemical bonding and I really learned a lot with the use of animated infographics in teaching)

Participant 11: *"Oo. An animated infographics nakabulig para maintindihan ko*

an konsepto han chemical bonding kay an leksyon nagin mas interesado ako."(Yes. Animated infographics helps me to understand the concepts of chemical bonding because I have become interested to the lesson.)

Participant 15: *"Oo. Nakabulig hiya para mas maintidihan ko an chemical bonding, labi na an mga metal ngan non-metal kun diin hira na klase hin chemical bonding tas malaksi ako nga nahibaru."*(Yes. It helped me to understand what is chemical bonding, especially in distinguishing metal from non-metal, and I easily learned the topic.)

Participant 17: *"Oo. An animated infographic na gin gamit pagtutdo han chemical bonding nakabulig gud ha ak, waray ako kurie han leksyon han chemical bonding nagin mas madali ko liwat mahinumduman an gin leksyon nakaka batun ak dayun hit mga pakiana ngan hit am quiz."*(Yes. Will the animated infographics used in teaching chemical bonding, I have no difficulties in learning the lesson and most of all my retention on the topic was good and I easily answered the question related to chemical bonding and our quizzes.)

The content and the manner of using animated infographics contributed a lot in understanding the concepts related to chemical bonding which was proven by the consolidated responses of the student-respondents. This implies that a well-made animated infographic applied in teaching chemical bonding it will ensure that learning will take place. The continuous motion or animated scenes attract more viewers and

readers because of their peculiar visual animation features (Lanko, et.al., 2012). Moreover, Parkinson (2016) stated that infographics allows readers to understand because of its concise explanatory text and visual presentation. Based on these statements, learning the concepts of chemical bonding is possible with the aid of animated infographics; consequently, educators can apply this in delivering this lesson.

3. What is your perception of using infographics (animated) as a tool for learning chemical bonding?

Theme 3: Using Animated Infographics is Applicable in Teaching Chemical Bonding

Participant 2: *" An masisiring ko maupay nga gumamit hin animated infographic labi na power point kay naiingganyo kami mamati tas mas madali namun naintihan an konsepto han chemical bonding."* (I recommend to use animated infographic in powerpoint because we were encouraged to listen and we easily understood the concepts of chemical bonding.)

Participant 6: *"An masisiring ko han paggamit han animated infographics ha pag tutdu han chemical bonding dako iya bulig maupay unta kun gagamitun ini ha pagtutdo para mas madali maintidihan ngan mamate it mga studyante."*(I can say that it is better to use animated infographics in teaching chemical bonding for an easy and smooth delivery of the lesson and for the students also to easily understand the topic and for them to listen well to the discussion.)

Participant 10: *"Ha akon masisiring maupay gamitun an animated infographics*

ha pag tutdo ha mga studyante para hira mahibaru ngan maintindihan an chemical bonding ngan iba pa na magkuri na leksyon."(In my opinion, it is very helpful to use animated infographics in teaching students for them to learn and understand chemical bonding and other difficult lessons.)

Participant 16: *"Para ha akon maupay gamitun an animated infographic para mahibaruan an chemical bonding labi an pag kakaiba han covalent, ionic ngan metallic bonding kay naipapakita hin maupay an ira pagkakaiba iba."*(For me it is better to use animated infographic to learn chemical bonding specially the difference of covalent, ionic, and metallic bonding.)

Participant 20: *"Para mas madali maintindihan an chemical bonding hit mga studyante mas maupay na gamitan hin animated infographic para mas matutdo hin maupay, klaro, ngan komprehensibo."* (For a better understanding of the students on chemical bonding it is advisable to use animated infographic to deliver the lesson better, more clearly, and more comprehensively.)

Chemical bonding can be taught in a more interactive way with pictures, animations and videos that will enhance learning and this is possible with the use of animated infographics as manifested on the responses of the student-respondents. They suggested that teachers must use animated infographics in teaching for it provides an easy way of delivering lesson and it promotes optimum learning. Therefore, animated infographics reduces the complexity of the concepts of chemical bonding. Le, et al. (2016) mentioned that infographics help teachers develop an appealing activity which captures

student's attention and knowledge on the subject matter, and making it easy to be recalled. In addition, infographics also provide and enrich teachers with innovative teaching methods, and it gives also opportunities for students to demonstrate their understanding (Sahrir et al., 2016). Teachers must always innovate their teaching pedagogy that suits to the level of intelligence and understanding of their students. One of the best ways is using animated infographics. With the help of this type of infographics science teachers can now teach chemical bonding more interactively and more easily to understand.

Lived Experiences of Students Exposed to Printed Infographics

The following were the derived themes from the research questions answered by the participants exposed to printed infographics:

1. Does the infographic (printed) create a sense of excitement? How does this infographic (printed) create a sense of excitement? Or how does it not?

Theme 1: Printed Infographics Promotes Exciting Lessons

Participant 3: *"Oo. Nagin excited ako ha leksyon kay may printed infographic na gin hahatag ha am nga nagpapadali ha ak pag intindi kun anu it chemical bonding. Pero bagan mas maupay ada kun nag luluya an mga atoms parehas han ak nakita ha usa na video."* (Yes. I have become excited in our lesson because of the printed infographics given to us for they made me understand what

is chemical bonding. However, it was much better if the atoms are moving like what I saw in a video.)

Participant 8: "*Oo. An printed infographic na gin gamit ni ma'am pagtutdo kasi nakahatag hin gana pamate asya nagin excited ako ha leksyon han chemical bonding.*" (Yes. Printed infographics used by my teacher in teaching gave me an appetite to listen so I have become excited in our lesson on chemical bonding.)

Participant 12: "*Oo. Mas nagin maupay ko na kc pamate han am leksyon han may printed infographic na nagin gamit hi ma'am pag tutdo asya excited na ak hit kada leksyon ni ma'am.*" (Yes. I found it very interesting to listen to our discussions with printed infographic, that is why, there was a feeling of excitement in every lesson.)

Participant 14: "*Oo. An printed infographics nakabulig an mga kolor, design ngan inpormasyon gin gamit para magin madali an pag-intindi han leksyon tas dere makurian kami na mga studyante han am leksyon.*" (Yes. In the printed infographics the colors, designs and information helped us to easily understand the lesson and it made the lesson easy for us.)

Participant 20: "*Oo. Naiingganyo kami pamate tungod han paggamit han printed infographics kay mas masayun an topic nga chemical bonding gamit ito kaysa basahun it libro. Ngan mas uupay pa kun may animation siguro na gin papakita ha am.*" (Yes. It encouraged me to listen when my teacher used printed infographics because it was much easier to learn chemical bonding using

printed infographic compared to learning it just by reading books. Probably, it was much better if there were animation while it was presented to us)

Based on the above themes, the lesson became more exciting with the use of printed infographics. Students response coincided on this theme as they articulated that with the use of this type of infographics, the lesson on chemical bonding became more exciting and interesting. As stated by Alfino (2007), graphics and pictures are effective tool which capture the interest in learning the subject. Furthermore, according to Matrix and Hodson (2014), infographics can outstrip the monotony and boredom of students which promote positive orientation toward the topic. It is a concrete evidence that teachers are encouraged to utilize printed infographics to stimulate the student's excitement and interest on the lesson, particularly on chemical bonding.

2. Does using infographics help you understand the concepts in chemical bonding? How does infographics (printed) help you understand the concepts of chemical bonding? Or how does it not?

Theme 2: Ideas are Physical Objects

Participant 1: *"Oo. Nahibaro ako han chemical bonding labi na han mga metal ngan non-metals tungod han printed infographics kay klaro an impormasyon mahitungod han am topic."* (Yes. I learned a lot about chemical bonding,

specially about metals and non-metals with the help of printed infographics because the pieces information were clear pertaining to our topic.)

Participant 3: *"Oo. An printed infographics nakabulig hiya para mas madali ko maintidihan an chemical bonding ngan kun paanu nagkakamay ada chemical bonding."* (Yes. Printed infographics helps a lot for me to understand what is chemical bonding and how chemical bonding occurs.)

Participant 10: *"Oo. Nakaka ingganyu kasi pamate han leksyon na may nakikita na pictures han gin tututdo parehas han printed infographic na gin gamit ni ma'am asya naintindihan ko an konsepto han chemical bonding."(*Yes. It is very encouraging to listen to the discussion if there are pictures related to the lesson like with printed infographics used by our teacher, that is why I was able understand the concepts of chemical bonding.)

Participant 12: *"Oo. Nakabulig hiya akon para ma-intindihan an chemical bonding kay an mga picture nga nagpapakita han tulo na klase han chemical bonding informative ngan simple an paagi kuntra ha libro mo la babasahun."*(Yes. It helped me to understand chemical bonding because of the pictures that showed how these three types of chemical bonding occurs. These were informative and simple compared to just reading from books.)

Participant 16: *"Oo. An paggamit ni ma'am han printed infographic nakabulig para mas madali kami mahibaru ngan tungod hito mas malaksi ak nahibaro han chemical bonding."*(Yes. When my teacher used printed infographic, it

helped us easily understand the topic and it helped me easily understand the concepts of chemical bonding.)

Utilizing printed infographics helped the student-respondents to understand the concepts of chemical bonding. This was based on their statement backing up the second research question. This meant that this type of infographics offers a clearer and more understandable delivery of complex concepts like chemical bonding. Infographics reduce cognitive load; thus, learners can focus more on the content allowing them to understand (Majooni et al, 2017). Similarly, Krum (2015), stated that visual presentations with images and drawings can transform complex information clearly, and can be interestingly understood and assimilated. To avoid too much complexity in discussing chemical bonding it is recommended to use a well-planned and organized printed infographics to promote better learning outcomes.

3. What is your perception of using infographics (printed) as a tool for learning chemical bonding?

Theme 3: Teaching Chemical Bonding is Easy with Printed Infographics

Participant 1: *"An akon masisiring ha paggamit han printed infographic ha pagtutdo nakakabulig gud hiya kay gin papadali niya an iba iba nabutang mahitungod ha chemical bonding."* (In my opinion, it is advisable to use printed infographics because they make lessons easy specially things pertaining to chemical bonding.)

Participant 10: *"Maupay an printed infographic kay dere la kami nag e-iimagine han am leksyon kay may nakikita kami, maupay kun gagamitun ito ha pagtutdo labi na ha chemical bonding tas uupdan hit mga video han tulo na klasi hin chemical bonding."*(It is good to use printed infographic because we are not just imagining our lesson, we have something to look at. It was much better if it will be used in teaching, specially in chemical bonding together with videos of the three types of chemical bonding.)

Participant 16: *"An masisiring ko han paggamit han printed infographics ha pag tutdu han chemical bonding dako iya bulig maupay unta kun gagamitun ini ha pagtutdo para mas madali maintidihan ngan mamate it mga studyante."*(I can say that it is better to use printed infographics in teaching chemical bonding for easy and smooth delivery of the lesson and for the students also to easily understand the topic and for them to listen to the discussion.)

Participant 18: *"Para ak mas maupay kun may printed infographics ha pagtutdo kay naipapakita maupay an mga konsepto nga kailangan nam mahibaruan gamit ini."*(For me I advise to use printed infographics in teaching to show clearly and comprehensively the concepts that we need to learn.)

Participant 20: *"Ha akon masisiring nakakabulig an printed infographic ha pag tutdo ha mga studyante para hira mahibaru ngan maintindihan an chemical bonding."*(In my opinion, it is very helpful to use printed infographics in teaching students for them to learn and understand chemical bonding.)

It is reflected on the responses that using printed infographics is the answer for a better understanding of the concepts of chemical bonding. This implies that students tend to learn faster using printed infographics. Krum (2013) affirmed that infographics are visually attractive that can orient the audience and make their attention focused. Consequently, static infographics offer the needed flexibility for the students to navigate the entire infographics subject, visually read the text, and display simultaneously until they understand the subject completely (Dick, 2012). Teachers always struggled on how they can make difficult lesson like chemical bonding easy. To address this problem they can use a well-made printed infographic.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIOS AND RECOMMENDATIONS

This chapter presents the summary of major findings, the conclusions and the recommendations that were formulated based on the results of the study.

Summary of Findings

The following are the salient findings of the study.

1. In terms of the pre-test result the mean scores of respondents exposed to animated infographics was 8.0 while in static infographics was 7.30. Based on the result there was insignificant difference on their scores.

2. The result of t-test for independent samples revealed a computed p-value of 0.334. It was very clear that the p-value was greater than 0.05 significance level indicating no significant difference in knowledge of chemical bonding between the respondents exposed to animated and static infographics. The hypothesis "there is no significant difference between the pre-test mean scores of the two groups of student-respondents separately exposed to two forms of infographics", was accepted.

3. The post-test mean scores of respondents exposed to animated infographics was 34.95 and 30.70 to static infographics which showed that the respondents exposed to animated infographics obtained higher score compared to the other group, static infographics.

4. In the post-test mean scores of the two groups it was revealed that the computed p-value of 0.001. The p-value was lesser than the 0.05 significance level indicating significant difference in level of knowledge of the chemical bonding between the two experimental groups. The hypothesis "there is no significant difference between the post-test mean scores of the two groups of student-respondents separately exposed to two forms of infographics", was rejected.

5. The following were the lived experiences of student-respondents exposed to animated and static infographics:

As manifested in the responses of the student-respondents after they were exposed to animated infographics, the researcher came up with themes which were equivalent to their lived experiences. The first theme which was "*Exciting Lesson is the Reason*" meant that the pictures, the colors used, moving objects or animations, and specially the videos in animated infographic, as manifested in the responses, provided excitement in learning chemical bonding. Thus, animated infographics captured the attention and focus of the student-respondents and triggered their excitement. The second theme was "*Understanding is Grasping",* wherein based on the consolidated responses of the student-respondents, it proved that the content and the manner of using animated infographics contributed a lot on the understanding of the concepts of chemical bonding. Using a well-made animated infographic on chemical bonding will ensure learning to take place. Finally, the last theme answered the last question pertaining to their lived experiences which was "*The Perks of Using Animated Infographics in Teaching*

Chemical Bonding". Learning chemical bonding with the use of animated infographics is more interactive and effective because of its pictures, animations and videos that attracted and enhanced the students' learning of chemical bonding as revealed in their responses. They suggested that teachers must use animated infographics in teaching for they provided an easy way of delivering lessons and they promote optimum learning. Therefore, animated infographics reduce the complexity of the concepts of chemical bonding.

The other group was exposed to static infographics and out of their lived experiences, the researcher formulated themes. The first theme was "*Printed Infographics Promotes Exciting Lessons"*. From the theme, the lesson became more exciting with the use of printed infographics. Students response coincided on this theme as they articulated that with the use of this type of infographics, the lesson on chemical bonding became more exciting and interesting. *"Ideas are Physical Objects"* was the second theme which illustrated that printed infographics offered a clearer and more understandable delivery of complex concepts like chemical bonding, it helped the student-respondents to understand the concepts of chemical bonding. Lastly, the third theme is "*Teaching Chemical Bonding is Easy with Printed Infographics"*. It is reflected in the responses that using printed infographics is the answer for a better understanding of the concepts of chemical bonding. Teachers always struggled on how they can make difficult lesson, like chemical bonding easy. To address this problem, they can use a well-made printed infographic.

Conclusions

The following are the conclusions derived from the finding:

1. The pre-test mean scores of the student-respondents exposed to static infographics were almost the same with those exposed to animated infographics having a .70 difference. Therefore, both groups had nominal idea on the concepts of chemical bonding.

2. There was no significant difference in knowledge on chemical bonding between the student-respondents exposed to animated and static infographics based on their pre-test result.

3. The post-test mean scores of the student-respondents exposed to animated infographics obtained higher score compared to static infographics.

4. There was a significant difference on the post-test result between the student-respondents exposed to animated and static infographics on their level of understanding of the concepts of chemical bonding. The student-respondents exposed to animated infographics showed greater understanding on the concepts of chemical bonding based on their post-test mean score difference.

5. The lived experiences of the student-respondents exposed to animated infographics revealed that using animated infographics ignited excitement, helped them understand the concepts of chemical bonding and there was an ideal form of learning materials to be utilized by the teacher in teaching chemical bonding. While the student-

respondents exposed to static infographics also revealed that it added excitement, enhanced learning and helped the teacher in teaching chemical bonding.

Recommendations

The following are the recommendations of the study based on the conclusions above.

1. Secondary teachers teaching science are encouraged to utilize infographics in delivering their lesson to encourage interest and interaction among their learners.

2. School administrators may send their science teachers to ICT integration programs, content-based seminars, and pieces of training to enhance their computer skills.

3. Secondary teachers can conduct further studies on the effectiveness of infographics on Gas Laws or other chemistry related topics.

4. It is highly recommended that this study be replicated by involving a larger group of respondents on high school level.

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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 28, 2019

MARIZA S. MAGAN, Ed.D., CESO V
Schools Division Superintendent
Department of Education
Division of Samar
City of Catbalogan

Madam:

Greetings!

The undersigned will be conducting a study entitled, "The Effectiveness of Infographics in Teaching Chemical Bonding among Grade 9 Students" 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 allow her to conduct the study in Bonga National High School, Bonga, Motiong Samar on grade 9 students.

Thank you for considering this request with a favorable nod.

Best regards and more power.

Very Truly yours,

CHRISVIE A. MIRALLES
Researcher

Noted by:

ESTEBAN A. MALINDOG, Ph. D.
Dean, Graduate Studies

Approved:

MARIZA S. MAGAN, Ed.D., CESO V
Schools Division Superintendent

APPENDIX B

LETTER TO THE SCHOOL HEAD OF CALAPI NATIONAL HIGH SCHOOL

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

January, 2019

NOEL D. EBIAS
Head Teacher-IV
Calapi National High School
Calapi, Motiong Samar

Sir:

Greetings!

The undersigned will be conducting a study entitled, "The Effectiveness of Infographics in Teaching Chemical Bonding among Grade 9 Students" 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, I am requesting permission from your good office to allow me to conduct Pilot Testing of my research instrument in your school on selected grade 9 students.

Thank you for considering this request with a favorable nod.

Best regards and more power.

Very Truly yours,

CHRISVIE A. MIRALLES
Researcher

Noted by:

NICOLAS O. BOCO JR.
Thesis Adviser

Approved:

NOEL D. EBIAS
Head Teacher-IV

APPENDIX C

LETTER TO THE SCHOOL HEAD OF CALAPI NATIONAL HIGH SCHOOL

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

January 28, 2019,

HECTOR P. PONFERRADA
Secondary School Principal-I
Bonga National High School
Bonga, Motiong Samar

Sir:

Greetings!

The undersigned will be conducting a study entitled, "The Effectiveness of Infographics in Teaching Chemical Bonding among Grade 9 Students" 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, I am requesting permission from your good office to allow me to conduct my study in your school on selected grade 9 students.

Thank you for considering this request with a favorable nod.

Best regards and more power.

Very Truly yours,

CHRISVIE A. MIRALLES
Researcher

Noted by:

NICOLAS O. BOCO JR.
Thesis Adviser

Approved:

HECTOR P. PONFERRADA
Secondary School Principal-I

APPENDIX D

LETTER TO THE RESPONDENTS

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

February 15, 2019

Dear Respondent,

Greetings!

The undersigned will be conducting a study entitled, "The Effectiveness of Infographics in Teaching Chemical Bonding among Grade 9 Students" 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 and cooperation by responding to the attached Pretest on Chemical Bonding to the best that you can. 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,

CHRISVIE A. MIRALLES

Researcher

APPENDIX E

PRETEST/POSTTEST ON CHEMICAL BONDING

Name:_____ Grade:_____ Score:_____

TEST I. MULTIPLE CHOICE

DIRECTIONS: Carefully read each item and choose the letter of the correct answer. Write your answer on the space provided for.

_____**1. Which of the properties of atoms is the most suitable reference for the kind of bond that will take place between/among them?**

A. atomic size
B. electronegativity
C. ionization Energy
D. electron affinity

_____**2. What kind of particle is produced after covalent bonding?**

A. atom
B. ion
C. molecule
D. electron

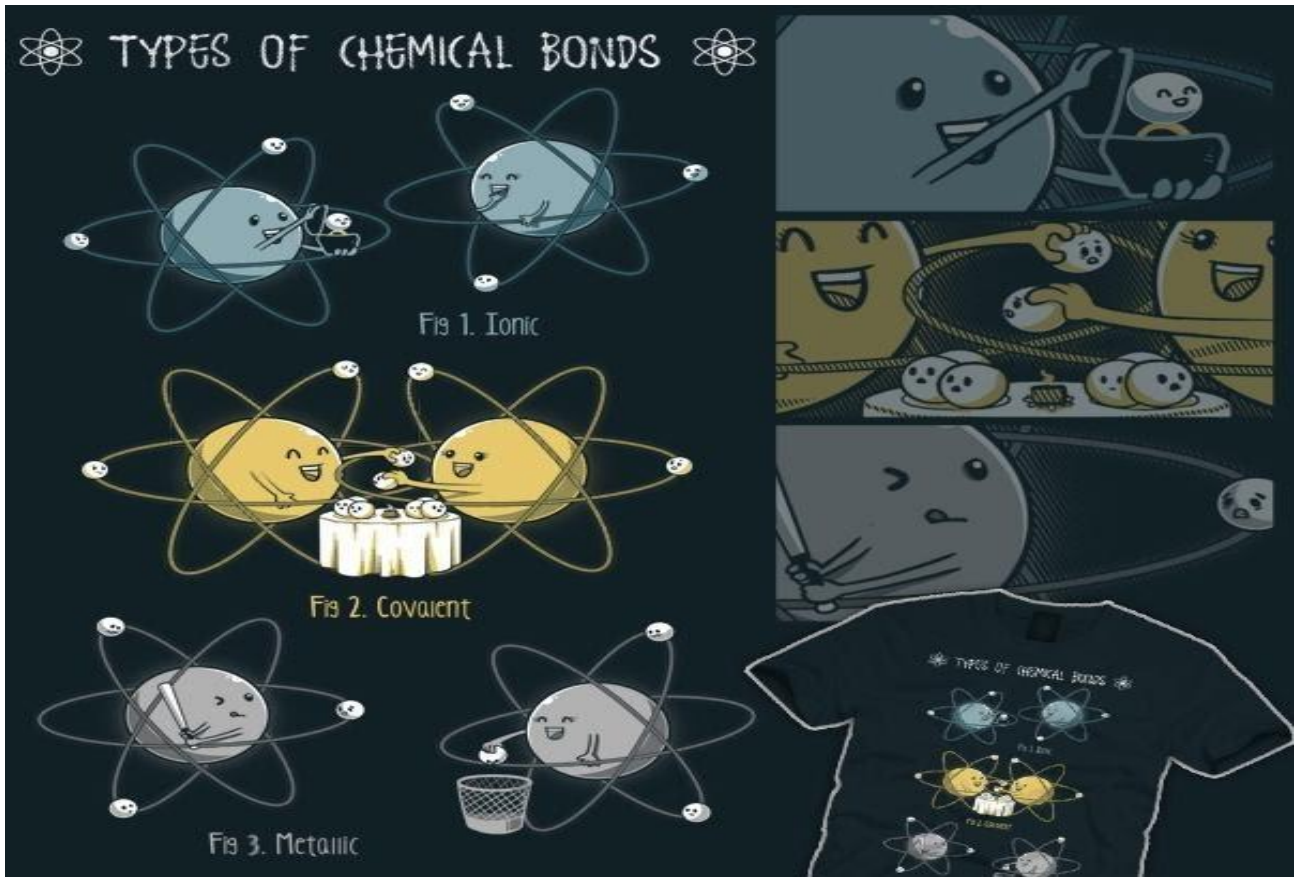
_____**3. How does ionic bonding take place?**

A. Two non-metallic elements of different kinds form strong forces.
B. Two non-metallic element of the same kind form strong forces of attraction.
C. A non-metallic element like fluorine is attracted to a metallic element like a sodium.
D. A metallic element like sodium transfer an electron to a non-metallic element like fluorine.

_____**4. What kind of chemical bond will form between two oxygen atoms?**

A. ionic bond
B. metallic bond
C. polar covalent bond
D. nonpolar covalent bond

_____**5. The picture below shows what is happening in**



A. ionic bond B. metallic bond C. covalent bond D. All of the above

_____**6. Which of the following type of bonds will have the highest electrical and thermal conductivity?**

A. ionic bond
B. metallic bond
C. polar covalent bond
D. nonpolar covalent bond

_____**7. Why can metals be hammered without breaking?**

A. They are ductile.
B. They are not brittle.
C. They are malleable.
D. Their particles are strong.

_____**8. Covalent bonding take place when**

A. atoms share electrons with one another.
B. the attraction between atoms is strong.
C. atoms collide with one another.
D. atoms attain stability.

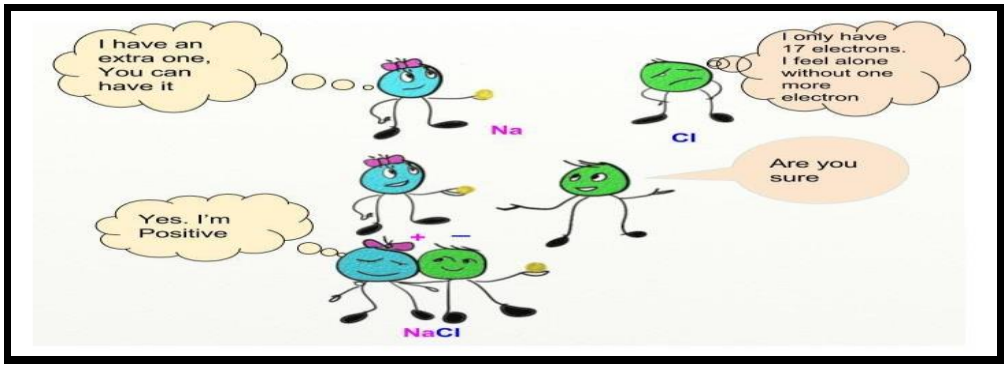
_____**9. Nitrogen belongs to family 5A and it is diatomic. How many nonpolar covalent bonds will there be in N2 molecule?**

A. 1
B. 2
C. 3
D. 4

_____**10. Which of the following will have the highest melting temperature?**

A. sodium chloride (salt)
B. paraffin wax (candle)
C. sucrose (table sugar)
D. lead wire

_____**11. Which of the following gives the best explanation on the picture below in relation to ionic bonding?**



A. Sodium contains greater number of electrons that is why she give one to Chlorine.
B. Chlorine has less number of electron that is why Sodium give her electron to him.
C. Chlorine has a greater electronegativity compares to Sodium that is why it gains electron from Sodium.
D. Sodium has greater electronegativity compare to Chlorine.

_____**12. How many electrons are being shared between the two carbon atoms in the compound ethyne? Ethyne has the Lewis structure: H−C≡C−H.**

A. 1
B. 2
C. 3
D. 6

_____**13. What most likely happen to a non-metallic element after ionic bonding?**

I. It forms a cation
II. It forms an anion
III. It becomes stable
IV. It becomes unstable

A. I and II
B. II and III
C. III and IV
D. I and IV

_____**14. What kind of bond will result when two identical non-metallic atoms combine?**
A. ionic bond
B. metallic bond
C. polar covalent bond
D. nonpolar covalent bond

_____**15. Choose two elements that would likely form an ionic bond among the following elements: Li, Si, F, Ne.**
A. Li and Si
B. Si and F
C. Ne and Si
D. Li and F

_____**16. How is the bond in MgF_2 different from Br_2?**
A. The bond in Br_2 is metallic while the bond in MgF_2 is covalent.
B. The bond in Br_2 is covalent while the bond in MgF_2 is ionic.
C. The bond in Br_2 is ionic while the bond in MgF2 is covalent.
D. There is no bond difference between the two.

_____**17. Why do metals are good conductors of electricity?**
A. because it shines when light strikes its surface
B. because it can be drawn into wires
C. because of its free valence electrons that carries the charge
D. all of the above

_____**18. What kind of force is present in ionic bond?**
A. repulsive force
B. electrostatic force
C. neutral force
D. retentive force

_____**19. Which of the following substance will dissolve in water will conduct electricity?**
A. glucose
B. oil
C. gasoline
D. monosodium glutamate

_____**20. What bond holds the atoms of the elements in Group 1 and 2 of the Periodic Table.**

A. ionic bond
B. metallic bond
C. polar covalent bond
D. nonpolar covalent bond

_____21. Which of the following is not a property of metal?

A. good conductor of heat
B. luster
C. malleability
D. low melting point

_____22. Which one of the following is most likely an ionic compound?

A. $CaCl_2$
B. CO_2
C. CS_2
D. SO_2

_____23. Which of the following diagrams is that of a metallic atom?

A.


B.


C.


D.


_____24. Which phrase best describes a metallic bond?

A. Sharing of electrons between atoms.
B. Attraction between molecules.
C. Transfer of electrons from one atom to another.
D. Attraction provided by mobile electrons for a network of positive ions.

_____25. When you cut an electric copper wire, what force of attraction is broken?

A. Ionic bond
B. Metallic bond
C. Covalent bond
D. Hydrogen bond

TEST II. SHORT ESSAY QUESTIONS (5 Points Each)

DIRECTIONS: Explain and give what is required in the following questions. Be sure to give the basis for your answer.

26. Make a diagram or a table that compares ionic, covalent, and metallic bonding. Make sure to (include what kind of elements form these bonds (ex. Non-metal or metal), the strength of their bonds, electron movement and the kind of elements or compound formed.

27. Using Lewis Dot Structures, show how an ionic bond forms. Show electron movement, and show the correct Lewis Dot Structures for the resulting ions. Just make sure they would bond ionically. You may choose the two elements to use for this bond.

28. Show how the compound methane (CH_4) forms using Lewis Dot Structures. Show the correct Lewis Dot Structures for the atoms of the elements involved and the resulting compound.

29. Would an atom of Cesium and Iodine join to form an ionic compound?

30. What do you think will make bonding among metals possible?

Prepared by:

CHRISVIE A. MIRALLES

Researcher

APPENDIX F

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, "The Effectiveness of Infographics in Teaching Chemical Bonding among Grade 9 Students" 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,

CHRISVIE A. MIRALLES
Researcher

APPENDIX G

CONSENT FORM FOR PARTICIPATION IN A RESEARCH STUDY

"THE EFFECTIVENESS OF INFOGRAPHICS IN TEACHING CHEMICAL BONDING AMONG GRADE 9 STUDENTS"

Title of the Study

Description of the research and your participation

You are invited to participate in a research study conducted by CHRISVIE A. MIRALLES. The purpose of this research is to determine the effect of infographics in teaching chemical bonding in grade 9 students at Bonga National High School.

Your participation will involve taking the pre-test and post-test and interview for your perception in the use of infographics in delivering the lesson.

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 CHRISVIE A. MIRALLES at 0907-575-4217. 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 ask questions. I give my consent to participate in this study.

Participant's signature: __ Date:

APPENDIX H

RESPONSES BASED ON THE LIVED EXPERIENCES OF THE STUDENT-RESPONDENTS

Live Experiences of Students Exposed to Animated Infographics

Below are some responses of the respondents on the use of animated infographics on the following questions:

1. Does the animated infographic create a sense of excitement? How does this animated infographic create a sense of excitement?

Participant 1: *"Oo. Pag tikang pala hit discussion may tunog na ngan may mga nagluluya ngan may kolor sanglit namamate gud ak maupay."*(Yes. At the beginning of the discussion there were sound effects and moving objects so I listened attentively.)

Participant 2: *"Oo. Naiingganyo kami pamate tungod han paggamit ni ma'am han animated infographics."*(Yes. It encouraged me to listen when my teacher used animated infographics.)

Participant 3: *"Oo. An animated infographics nakakadugang excitement labi na an mga videos."*(Yes. The animated infographics adds excitement specially the videos.)

Participant 4: *"Oo. An mga examples may kolor tas an pag babalhin han electron ngan pag share para magin stable gamit an animated infographics kauupay nakakadugang pa kun paano gin tututdo ni ma'am an leksyon kay klaro ngan madali maintindihan. "*(Yes. The examples are colorful and how the transfer and sharing of electrons was showed using animated infographics was very wonderful and amazing and the manner on how the teacher discussed each topic was clear and understandable.)

Participant 5: *"Oo. An animated infographics usa han bag-o nga pamaagi han pagtutdo na nakahatag hin excitement ha ak kay kakaiba dere parehas hit tradisyonal na pagtutdo." (*Yes. Animated infographics is one of the new instructional aid which gives me excitement for it was very different from traditional way of teaching.)

Participant 6: "*Oo. An infographics nakabulig an mga kolor, art ngan an mga video para magin madali an pag-intindi han leksyon tas dere makurian an mga studyante hit ira leksyon.* (Yes. In the infographics the colors, arts and videos helped us to easily understand the lesson and it made the lesson easy for the students.)

Participant 7: *"Oo. An animated infographics importante para maintindihan namun an mga butang nga dere kami maaram ngan an infographics nakahatag ak hin excitement asya naapi ako hit am mga activity ha klase."*(Yes. Animated infographic is important for us to understand things that we do not know and infographic gives excitement that is why I joined in every activity in our class.)

Participant 8: "*Oo. Naiinganyu kami pamate tas makiaapi hit mga activity hito na subject tas nakakabulig hiya para mahinumduman namun tam leksyon."*(Yes. It encouraged us to listen and to cooperate in the activities and also it helps us to recall easily our lesson.)

Participant 9: *"Oo. Nakaka excite kay para ha ak bag-o hiya na pamaagi hin pagtutdo ni ma'am asya namamate ako"*(Yes. It is exciting for it was a new way of teaching used by my teacher so I really listen to the discussion.)

Participant 10: *Oo. Maupay pamate pag may animated infographics kami na nakikit-an tas maupay pamate pag may mga larawan ngan iba pa.*(Yes. It was very interesting to listen to the discussion if there is an animated infographic because we have something to look at, we see pictures and other stuffs.)

Participant 11: *"Oo. Nakakahatag hin excitement kay an animated infographics nakakabulig para malaksi kami mahibaru han leksyon."*(Yes. It adds excitement because animated infographics helps us to easily understand the lesson.)

Participant 12: *"Oo. Maupay pamate han leksyon nga dere kapa maaram kun may animated infographics labi na kun may videos ngan may mga pictures han chemical bonding, nakaka excite."*(Yes. It was very wonderful to listen to the things that you do not know with animated infographics specially if there were videos and pictures of chemical bonding, very exciting.)

Participant 13: *"Oo. Maupay pamate han leksyon nga dere kapa maaram kun may animated infographics labi na kun may videos ngan may mga pictures han chemical bonding, nakaka excite."*(Yes. It was very wonderful to listen to the things that you do not know with animated infographics specially if there were videos and pictures of chemical bonding, very exciting.)

Participant 14: *"Oo. Maupay pamate han leksyon nga dere kapa maaram kun may animated infographics labi na kun may videos ngan may mga pictures han chemical bonding, nakaka excite."*(Yes. It was very wonderful to listen to the things that you do not know with animated infographics specially if there were videos and pictures of chemical bonding, very exciting.)

Participant 15: *"Oo. Maupay pamate han leksyon nga dere kapa maaram kun may animated infographics labi na kay makuri an topic na chemical bonding nakahatag hiya hin bag-o na pamaagi para mahibaro kami asya nakaka excite."* (Yes. It was very wonderful to listen to the discussion specially if you do not know the lesson, most of all chemical bonding was a difficult subject it offers a new way learning, very exciting.)

Participant 16: *"Oo. Naiinganyu kami pamate tas makiaapi hit mga activity hito na subject tas nakakabulig hiya para mahinumduman namun tam leksyon.* (Yes. It encouraged us to listen and to cooperate in the activities and also it help us to recall easily our lesson.)

Participant 17: *"Oo. An mga examples may kolor tas an pag babalhin han electron ngan pag share para magin stable gamit an animated infographics kauupay nakakadugang pa kun paano gin tututdo ni ma'am an leksyon kay klaro ngan madali maintindihan."*(Yes. The examples were colorful and how the transfer and sharing of electrons was showed using animated infographics was very wonderful and amazing and the manner on how the teacher discussed each topic was clear and understandable.)

Participant 18: *"Oo. Pag tikang pala hit discussion may tunog na ngan may mga nagluluya ngan may kolor sanglit namamate gud ak maupay."*(Yes. At beginning of the lesson there were sound effects and moving objects that is why I really listen to the discussion.)

Participant 19: *"Oo. Naiingganyo kami pamate tungod han paggamit ni ma'am han animated infographics."*(Yes. It encouraged me to listen when my teacher used animated infographics.)

Participant 20: *"Oo. Naiinganyu kami pamate tas makiaapi hit mga activity hito ma subject tas nakakabulig hiya para mahinumduman namun tam leksyon.* (Yes. It encouraged us to listen and to cooperate in the activities and also it helps us easily remember the lesson.)

2. Does using animated infographic helps you understand the concepts in chemical bonding? How does animated infographic help you understand the concepts of chemical bonding? Or how does it not.

Participant 1: *"Oo. Kay nakakabulig an powerpoint na may animated infographics para maintindihan hit mga studyante an chemical bonding labi na han mga studyante nga dere dayun nakakaintindi."* (Yes. The power point with animated infographic helps us to understand chemical bonding especially those students who have difficulties in understanding the concepts of chemical bonding.)

Participant 2: *"Oo. An paggamit ni ma'am ha animated infographic nakabulig para mas madali kami mahibaru ngan tungod hito mas malaksi ak nahibaro han chemical bonding."*(Yes. When my teacher used animated infographic, it helps us to easily understand the topic and it help me to easily understand the concepts of chemical bonding.)

Participant 3: *"Oo. Nakakabulig an power point na may animated infographics han mga studyante na namamate labi na an mga dere gud nakakaintindi."*(Yes. Power point with animated infographics help students specially those who have difficulties in understanding the topic.)

Participant 4: *"Oo. Kay han naggamit han animated infographics han pagtutdo madali ako nahibaro han chemical bonding. Pagkakatapus hit pag tutdo han chemical bonding pag-uli ko balay damu ak la gihap nahinunumduman ngan nahihibaruan han chemical bonding labi na an pag tra-transfer ngan sharing han electrons."*(Yes. Using animated infographics in teaching I have no difficulties in learning chemical bonding. Even I got home already, I still remember everything how does the sharing and transfer of electrons in chemical bonding occurs.)

Participant 5: *"Oo. Nakakabulig an animated infographics para madali maintindihan namun an chemical bonding ngan damu an studyante an nahihibaro dayun ha eskwelahan labi na ha science subject.* (Yes. Animated infographics help us to easily understand chemical bonding and many students also can easily understand science subject using infographics.)

Participant 6: *Oo. Nakabulig hiya para mahibaro ako dayun han chemical bonding.* (Yes. It helps me to easily understand chemical bonding)

Participant 7: "Oo nakabulig ha akon an paggamit han animated infographics mas madali ko naintindihan an chemical bonding ngan damu an ak nahibaruan tungod hito."*(Yes. The use of animated infographics helps me to*

easily understand chemical bonding and I really learned a lot with the used of animated infographics in teaching.)

Participant 8: *"Oo. Kay an animated infographic gin papakita niya hin maupay kun an konsepto na gusto ipakita han maestra."*(Yes. Animated infographics clearly shows the concepts the teachers want to teach.)

Participant 9: *"Oo. Maupay kay nahibaro kami han chemical bonding tas nakabulig hiya para mas madali nam maintindihan ito an topic."(*Yes. It is good becausse we understand what is chemical bonding and it helps us to easily understand the topic.)

Participant 10: *"Oo. An mga pictures ngan videos han chemical bonding nakikita ko gud kun anu an chemical bonding tas iba iba hit na klase."*(Yes. The pictures and videos of chemical bonding allows me to fully understand chemical bonding and its different types.)

Participant 11: *"Oo. An animated infographics nakabulig para maintindihan ko an konsepto han chemical bonding kay an leksyon nagin mas interesado ako."*(Yes. animated infographics helps me to understand the concepts of chemical bonding because I have become interested to the lesson.)

Participant 12: *"Oo. Dako an nahibulig para maintindihan ko an konsepto han chemical bonding damu ak nahibaruan."*(Yes. It helps a lot, I understand the concepts of chemical bonding and I learned a lot because of it.)

Participant 13: *"Oo. Nakabulig an animated infographics para maintindihan ko an konsepto han chemical bonding damu ak nahibaruan."*(Yes. Animated infographics helps me to understand the concepts of chemical bonding, I learned a lot.)

Participant 14: *"Oo. Dako an nahibulig han animated infographics para maintindihan ko an konsepto han chemical bonding ngan damu ak nahibabaruan."* (Yes. Animated infographics helps a lot for me to understand the concepts of chemical bonding, I learned a lot.)

Participant 15: *"Oo. Nakabulig hiya para mas maintidihan ko an chemical bonding, labi na an mga metal ngan non-metal kun diin hira na klase hin chemical bonding tas malaksi ako nga nahibaru."*(Yes. It helped me to understand what is chemical bonding, especially in distinguishing metal from non-metal, and I easily learned the topic.)

Participant 16: *"Oo. An mga pictures, videos nga an iba nga animation ha animated*

infographic dako an nahibulig ha ak para mas madali ko maintindihan an mga konsepto chemical bonding."(Yes. The pictures, videos and other animations in the animated infographics contributed a lot in my understanding in the concepts of chemical bonding.*)*

Participant 17: *"Oo. An animated infographic na gin gamit pagtutdo han chemical bonding nakabulig gud ha ak, waray ako kurie han leksyon han chemical bonding nagin mas madali ko liwat mahinumduman an gin leksyon nakaka batun ak dayun hit mga pakiana ngan hit am quiz."*(Yes. The animated infographics used in teaching chemical bonding, I have no difficulties in learning the lesson and most of all my retention on the topic was good and I easily answered the question related to chemical bonding and our quizzes.)

Participant 18: *"Oo. An paggaamit han animated infographics han pagtutdo han chemical bonding dako gud an nahibulig kay an mga picture, an mga animation ngan video nakadugang hiya hin gana para mamate ako han discussion."* (Yes. With the used of animated infographics in teaching chemical bonding contributed a lot in teaching chemical bonding because of the pictures, animations used and the videos encouraged me to listen to the discussion.)

Participant 19: *"Oo. Nakabulig an animated infographics para mas madali ko maintindihan an am leksyon kay an leksyon nagin mas nagin ganado ngan dere boring tungod han mga animation."*(Yes. Animated infographics used in the delivery off the lesson helped me to effortlessly understand the topic and the discussion become so exciting and not boring because of the animation.)

Participant 20: *"Oo. An mga animation, picture ngan video an naghatag ak hin gana para mamate han leksyon asya nahibaro ak dayun kun anu an chemical bonding."*(Yes. The animations, pictures and videos significantly increased my interest to listen on the discussion, therefore I easily learned what is chemical bonding.)

3. What is your perception of using animated infographic as a tool for learning chemical bonding?

Participant 1: *"An ak masisiring ha animated infographics nakakahatag hiya hin pamaagi para mas madali mahitutdo hit maestra it iya leksyo."*(I can say that animated infographic offers a much easy way of delivering lessons to teachers.)

Participant 2: *" An masisiring ko maupay nga gumamit hin animated infographic labi na*

power point kay naiingganyo kami mamati tas mas madali namun naintihan an konsepto han chemical bonding."(I recommend to use animated infographic in power point because we were encouraged to listen an we easily understand the concepts of chemical bonding.)

Participant 3: *"An masisiring ko an power point na may animated infographics nakabulig ha ak labi na an mga videos kay mas madali ko naintindihan an leksyon."*(I can say that power point with animated infographics helps me a lot, specially the videos because I easily understand the topic.)

Participant 4: *"An masisiring ko ha animated infographics nagpapadali hiya han leksyon ngan nakaka inganyo para mamate hit leksyon."*(I can say that animated infographic makes lesson easy and it encourage learners to listen.)

Participant 5: *"Gin rerekomindar ko an paggamit han animated infographic ha pagtutdo kay nakakabulig hiya para mas madali an pag pa-intidi ngan pagtutdo ha eskwelahan."*(I recommend to use animated infographic for the students to easily understand the topic and easy and smooth delivery of lessons in school.)

Participant 6: *"An masisiring ko han paggamit han animated infographics ha pag tutdu han chemical bonding dako iya bulig maupay unta kun gagamitun ini ha pagtutdo para mas madali maintidihan ngan mamate it mga studyante."*(I can say that it is better to use animated infographics in teaching chemical bonding for easy and smooth delivery of the lesson and for the students also to easily understand the topic and they will listen to the discussion.)

Participant 7: *"Maupay it animated infographics na gamit hit pagtutdo hit chemical bonding kay gin papasayun it leksyon ngan mas maupay mamate hit maestra."*(It is good to use animated infographics in teaching chemical bonding because it makes the lesson easy and interesting.)

Respondent 8: *"Para ak mas maupay kun may animated infographics ha pagtutdo kay naipapakita maupay an mga konsepto nga kailangan nam mahibaruan gamit ini."*(For me I advise to use animated infographics in teaching to show clearly and comprehensively the concepts that we need to learn.)

Participant 9: "*Para ha akon maupay nga magamit hin animated infographics kay nakakabulig hiya kun paano nagkakaiba an covalent, ionic ngan metallic bonding ngan maupay liwat kasi an pagtutdo han am maestra."*(For me it is better to use animated infographic in teaching because it can clearly demonstrate the difference between covalent, ionic and metallic bonding and of course our teacher delivered the lesson very well.)

Participant 10: *"Ha akon masisiring maupay gamitun an animated infographics ha pag tutdo ha mga studyante para hira mahibaru ngan maintindihan an chemical bonding ngan iba pa na magkuri na leksyon.* (In my opinion it is very helpful to use animated infographics in teaching students for them to learn and understand chemical bonding and other difficult lesson.)

Participant 11: *"Damu an akon nahibaruan han chemical bonding gamit an animated infographics."*(I learned a lot about chemical bonding using animated infographic.)

Participant 12: *"Damu an akon nahibaruan gamit an animated infographic nahibaruan ko dayun an mga butang hitungod han chemical bonding."*(I learned a lot using animated infographics, I learned easily things pertaining to chemical bonding.)

Participant 13: *"Damu an akon nahibaruan gamit an animated infographic kay labi na an mga butang hitungod ha chemical bonding."*(I learned a lot by using animated infographics, most of all things related to chemical bonding.)

Participant 14: *"Damu an akon nahibaruan han paggamit han animated infographic labi an mga butang nga dere pa ako maaram."*(I learned a lot using animated infographic specially thing that I do not know.)

Participant 15: *"Nakabulig hiya para maintindihan ko an chemical bonding"*(It helps me to understand chemical bonding.)

Participant 16: *"Para ha akon maupay gamitun an animated infographic para mahibaruan an chemical bonding labi an pag kakaiba han covalent, ionic ngan metallic bonding kay naipapakita hin maupay an ira pagkakaiba iba."*(For me it is better to use animated infographic to learn chemical bonding specially the difference of covalent, ionic and metallic bonding.)

Participant 17: *"Maupay an animated infographic nga gamitun pag tutdu hit chemical bonding kay gin papasayun it leksyon ngan nakakadugang gana pamate."*(It is best to use the animated infographic in teaching chemical bonding because it makes the lesson easy and it adds appetite to listen.)

Participant 18: *"It chemical bonding makuri na leksyon labi na kun ha libro kala mag babasa ngan aadman ito, asya makakabulig ha mga studyante kun gagamitan hin animated infographic kay gin papasayun an leksyon pero klaro."*(Chemical bonding is a difficult subject specially if you will just learn it from books that is why to help students, it is best to use animated infographic because it makes the lesson easy yet clear.)

Participant 19: *"Maupay an epekto han animated infographic ha pagtutdo labi na hit chemical bonding na leksyon kay nag papadugang hin interes ngan gana ha klase tas mas madali maintindihan it chemical bonding paggamiti han animated infographic kay may mga pictures, animations ngan videos."*(There is significant effect in using animated infographic in teaching chemical bonding lessons because it encourages interest and appetite to listen in the discussion and it allows better understanding of chemical bonding when taught with animated infographic with its pictures, animations and videos.)

Participant 20: *"Para mas madali maintindihan an chemical bonding hit mga studyante mas maupay na gamitan hin animated infographic para mas matutdo hin maupay, klaro, ngan komprehensibo."*(For a better understanding on chemical bonding of students it is advisable to use animated infographic to deliver the lesson better, clear, and comprehensive.)

Live Experiences of Students Exposed to Static Infographics

Below are some responses of the respondents on the use of static infographics on the following questions:

1. Does the printed infographic create a sense of excitement? How does this printed infographic create a sense of excitement?

Participant 1: *"Oo. An color ngan picture nga gin gamit han printed infographic nakakahatag excitement kun anu an chemical bonding."*(Yes. The color and pictures used in printed infographic adds excitement on what is chemical bonding.)

Participant 2: *"Oo. An printed infographic nga gin gamit nakahatag akon hin excitement kay na cu-curious ako kun anu it chemical bonding."*(Yes. Printed infographics used creates a sense of excitement because I have become curious on what is chemical bonding.)

Participant 3: *"Oo. Nagin excited ako ha leksyon kay may printed infographic na gin hahatag ha am nga nagpapadali ha ak pag intindi kun anu it chemical bonding."*(Yes. I have become excited in our lesson because of the printed infographics given to us for it made me understand what is chemical bonding.)

Participant 4: *" Oo. Damu an ak nahibabaruan ha am leksyon gamit an printed infographic asya excited ako ha klase."*(Yes. I learned a lot in our discussions using printed infographic that is why I have become exited in attending our class.)

Participant 5: *"Oo. Nakakabulig kasi ha am an printed infographic ha pag intindi han am leksyon han chemical bonding, nagin ganado ako ha klase ngan excited perme."*(Yes. Printed infographic allows me to understand our lesson in chemical bonding, it encouraged me to listen, that is why I am always excited to attend our class.)

Participant 6: *"Oo. Tungod han paggamit ni ma'am han printed infographic bagan nagin exciting an kada leksyon asya nagin interesado ako kun anu an chemical bonding."*(Yes. When my teacher used printed infographic, I have become more excited in our lessons and developed interest on what is chemical bonding.)

Participant 7: *"Oo. Nagin exciting kc an amun discussion han mayda na printed infographic kay nagin masayun an leksyon."*(Yes. Our discussions have become exciting because of printed infographic and it makes our lesson easy.)

Participant 8: *"Oo. An printed infographic na gin gamit ni ma'am pagtutdo kasi nakahatag hin gana pamate asya nagin excited ako ha leksyon han chemical bonding."*(Yes. Printed infographics used by my teacher in teaching gives me an appetite to listen so I have become excited in our lesson on chemical bonding.)

Participant 9: *"Oo. Nagin excited ako nam leksyon kay may printed infographic nga gin gamit hi ma'am pagtutdo kay kada printed infographic na gin hahatag ni ma'am napupukaw tak interes pamate."*(Yes. I have become excited in our lesson because of the printed infographic used by my teacher, every printed infographic given to us awakened my interest to listen.)

Participant 10: *"Oo. Nagin excited ako pamate kay mas madali ako nahibaro han am leksyon tungod han printed infographics han chemical bonding."*(Yes. I have become excited to listen in our discussion because it was more easier for me to understand the lesson with the used of printed infographics on chemical bonding.)

Participant 11: *"Oo. Dere na kc perme chalk ngan board nala am gamit ha discussion asya mas excited na ako pamate."*(Yes. We did not just used calk and board in the delivery of the lesson that is I felt the excitement to listen.)

Participant 12*:* *"Oo. Mas nagin maupay ko na kc pamate han am leksyon han may printed infographic na nagin gamit hi ma'am pag tutdo asya excited na ak hit kada leksyon ni ma'am."*(Yes. I found it very interesting to listen in our discussions with printed infographic that is why there was a feeling of excitement in every lesson.)

Participant 13: *"Oo. Naiingganyo kami pamate tungod han paggamit ni ma'am han printed infographics asya kada leksyon exciting."*(Yes. It encouraged me to listen when my teacher used printed infographics that is why every lesson was exciting.)

Participant 14: *"Oo. An printed infographics nakabulig an mga kolor, design ngan impormasyon gin gamit para magin madali an pag-intindi han leksyon tas dere makurian kami na mga studyante han am leksyon.* (Yes. In the printed infographics the colors, designs and information helped us to easily understand the lesson and it made the lesson easy for us.)

Participant 15: *"Oo. An printed infographics importante para maintindihan namun an mga butang nga dere kami maaram ngan an infographics nakahatag ak hin excitement ha pag tikang han leksyon ngan kalipayan ha katapusan han leksyon."*(Yes. Printed infographics are important for us to understand things that we do not know and it gives us excitement at the start of the lesson and happiness at the end of the lesson.)

Participant 16: *"Oo. Maupay pamate han leksyon nga dere kapa maaram kun may printed infographics labi na kun may may mga pictures han chemical bonding."*(Yes. It is very interesting to listen to the things that you do not know with printed infographics specially if there are pictures of chemical bonding.)

Participant 17: *"Oo. Naiinganyu kami pamate tungod han printed infographics kay gin pasayun hiton an leksyon kay may mga picture han iba-iba na klase han chemical bonding."*(Yes. It encouraged us to listen with printed infographics because it made the lesson easy with the help of the pictures of the different type of chemical bonding.)

Participant 19: *"Oo. Naiinganyu kami pamate tas mag-upay an mga activity hito na topic gamit an printed infographics tas nakakabulig hiya para mahinumduman namun tam leksyon."*(Yes. It encouraged us to listen because the activities are interactive using printed infographics and also it helps us to easily remember our lesson.)

Participant 20: *"Oo. Naiingganyo kami pamate tungod han paggamit ni ma'am han printed infographics kay mas masayun an topic nga chemical bonding gamit ito kaysa basahun it libro."*(Yes. It encouraged me to listen when my teacher used printed infographics because it is much easier to learn chemical bonding using printed infographic compare to learning it just by reading books.)

2. Does using printed infographic help you understand the concepts in chemical bonding? How does printed infographic help you understand the concepts of chemical bonding? Or how does it not.

Participant 1: *"Oo. Nahibaro ako han chemical bonding labi na han mga metal ngan no-metals tungod han printed infographics kay klaro an impormasyon mahitungod han am topic."*(Yes. I learned a lot about chemical bonding, specially about metals and non-metals with the help of printed infographics because the informations are clear pertaining to our topic.)

Participant 2: *"Oo. Kay mas gin malaksi ako nga nahibaro gamit an printed infographics."*(Yes. I easily learned the lesson with the used of printed infographics.)

Participant 3: *"Oo. An printed infographics nakabulig hiya para mas madali ko maintidihan an chemical bonding ngan kun paanu nagkakamay ada chemical bonding."*(Yes. Printed infographics helps a lot for me to understand what is chemical bonding and how chemical bonding occurs.)

Participant 4: *"Oo. An mga picture na gin gamit ngan an mga impormasyon na nakabutang ha printed infographic nakabulig para mas madali ko maintindihan an chemical bonding."*(Yes. The pictures used and informations in the printed infographic helped me to easily understand chemical bonding.)

Participant 5: *"Oo. An printed infographic nakabulig hiya para maintindihan ko an chemical bonding tungod han mga gin gamit na pictures ngan klaro nga mga inpormasyon mahitungod han chemical bonding."*(Yes. Printed infographic helped me to understand chemical bonding because of the pictures and clear informations pertaining to chemical bonding used on it.)

Participant 6: *"Oo. Nakabulig an printed infographics para maintindihan ko an chemical bonding kay gin pa simple an leksyon kuntra ha libro."*(Yes. It helped, printed infographics, for me to understand chemical bonding because it made the lesson simple compare on books.)

Participant 7: *"Oo. An paggamit han printed infographics naka pasayun ha ak pag intindi han konsepto han chemical bonding."*(Yes. Using printed infographics offers an easier way for me to understand the concepts of chemical bonding.)

Participant 8: *"Oo. Makuri an chemical bonding han ha libro la ako nag bibinasa kay waray mga picture ngan makuri ko maintindihan an mga naksurat pero han gumamit na an ak maestra han printed infographic han pagtutdue nya ha am mas*

nagin masayun ko an chemical bondng."(Yes. Chemical bonding is very difficult in books when I read it because there is no pictures and it is hard for me to understand the words written on books, but when my teacher used printed infographics it was been easy for me to understand chemical bonding.)

Participant 9: *"Oo. An paggamit ni ma'am han printed infographic nakabulig para mas madali ako nga nahibaro han konsepto chemical bonding."*(Yes. When my teacher used printed infographic, it helped me to easily understand the concepts of chemical bonding.)

Participant 10: *"Oo. Nakaka ingganyu kasi pamate han leksyon na may nakikita na pictures han gin tututdo parehas han printed infographic na gin gamit asya naintindihan ko an konsepto han chemical bonding."*(Yes. It is very encouraging to listen to the discussion if there are pictures related to the lesson like with printed infographics, that is why I was able understand the concepts of chemical of chemical bonding.)

Participant 11: *"Oo. An mga picture ngan impormasyon ha printed infographics nga nakaka ingganyo akon pamate."*(Yes. The pictures and informations in the printed infographics that encouraged me to listen.)

Participant 12: *"OO. Nakabulig hiya akon para ma-intindihan an chemical bonding kay an mga picture nga nagpapakita han tulo na klase han chemical bonding informative ngan simple an paagi kuntra ha libro mo la babasahun."*(Yes. It helped me to understand chemical bonding because of the pictures that shows how these three types of chemical bonding occurs are informative and simple compared if you will just read it on books.)

Participant 13: *"Oo. Ha libro nakurian ako pag-intindi kun anu an chemical bonding peru han printed infographics na gin gamit ni ma'am pagtutdo mas madali ko naintindihan an mga konsepto han chemical bonding."*(Yes. In books I have difficulties in understanding the chemical bonding but when my teacher used printed infographics in our discussion, I easily understand the concepts of chemical bonding.)

Participant 14: *"Oo. Makuri ako mahibaru kun puro la yakan ngan ha chaclkboard ha klase peru han may printed infographics na nga gin gamit hi ma'am pagtutdo ha am han chemical bonding gin padali hini an akon pag-intindi han konsepto han chemical bonding."*(Yes. I actually have difficulties in understanding lessons specially if it is just pure talking and with the use of chalkboard only, but when my teacher used printed infographics in teaching chemical bonding it allows me to easily understand the concepts of chemical bonding.)

Participant 15: *"Oo. Maupay kasi it may nakikit-an na picture kun anu an nahinanabu hit mga element ha proseso han chemical bonding asya nakaupay nga gumamait hi ma'am han printed infographics kay may picture tas may impormasyon nakabulig akon para maintindihan an konsepto han chemical bonding."*(Yes. Actually, it is good that there are pictures on what is happening to the elements during the process of chemical bonding that is why it was good that may teacher used printed infographics, it helped me to understand the concepts of chemical bonding.)

Participant 16: *"Oo. An paggamit ni ma'am ha printed infographic nakabulig para mas madali kami mahibaru ngan tungod hito mas malaksi ak nahibaro han chemical bonding."* (Yes. When my teacher used printed infographic, it helps us to easily understand the topic and it help me to easily understand the concepts of chemical bonding.)

Participant 17: *"Oo. Nakakabulig an pictures ngan imporsyon ha printed infographics ha akon ngan na namamate labi na an mga dere gud nakakaintindi."*(Yes. The pictures and informations in animated infographics help a lot specially those who have difficulties in understanding this topic.)

Participant 18: *"Oo. Kay han naggamit hi ma'am han printed infographics han pagtutdo madali ako nahibaro han chemical bonding. Bisan ha balay nahinunumduman ko pa an am gin discuss.* (Yes. When my teacher used printed infographics in teaching, I have no difficulties in learning chemical bonding. Even at home, I still remembered what we have discussed.)

Participant 19: *Oo. Nakabulig hiya para mahibaro ako dayun han chemical bonding kay may picture ngan an mga impormasyon nga aadto ha printed infographics nag hatag akon kalinawan kun anu an chemical bonding."*(Yes. It helps me to easily understand chemical bonding because of the pictures and informations in the printed infographics gives me enlightenment on what is chemical bonding.)

Participant 20: *"Oo nakabulig ha akon an paggamit han printed infographics para mas madali ko maintindihan an chemical bonding ngan damu an ak nahibaruan tungod hito kay mas masayun an discussion kun mayda hito."*(Yes. The used of printed infographics helps me to easily understand chemical bonding and I really learned a lot because of using infographics in teaching because it makes the lesson simple and easy to comprehend.)

3. What is your perception of using printed infographic as a tool for learning chemical bonding?

Participant 1: *"An akon masisiring ha paggamit han printed infographic ha*

pagtutdo nakakabulig gud hiya kay gin papadali niya an iba iba nabutang mahitungod ha chemical bonding."(In my opinion it is advisable to use printed infographics because it makes lessons easy specially things pertaining to chemical bonding.)

Participant 2: *"Maupay hiya gamitun kay nakakabulig hiya paramapadali it leksyon han chemical bonding."*(It is recommendable to use printed infographics because it makes the lesson on chemical bonding easy.)

Participant 3: *"Maupay hiya gamitun ha pagtutdo kay mas napapakita kun paanu an ionic, covalent ngan metallic bonding."*(It is applicable to use it in teaching because it really shows how ionic, covalent and metallic bonding occurs.)

Participant 4: *"Napapadali niya an leksyon han chemical bonding asya maupay kun gagamitun hiya kay dere mahubya an klase."*(It makes the lesson on chemical bonding easy so it is applicable to be used so the class will not be boring.)

Participant 5: "An printed infographic gin papasayun an leksyon han chemical bonding, maupay kun gagamitun hiya ha pag tutdo."*(Printed infographic makes the lesson easy on chemical bonding, so it is good to be used in teaching.)*

Participant 6: *"Nakabulig an printed infographic para mahibaruan ko an chemical bonding, maupay kun gagamitun hiya ha pagtutdo para mas madali liwat mahibaro an iba."*(Printed infographic helps me to understand chemical bonding, it is recommendable to be used in teaching so others will easily learn chemical bonding also.)

Participant 7: "*Maupay hiya gamitun ha pagtutdo para nakikita gud an proseso han chemical bonding peru. Mas maupay kun mas may video kay may nagluluya nga sound."*(It is good when used in teaching so that I can see the process of chemical bonding. Much better if there is video because there are actions and sound.)

Participant 8: *"An printed infographic epektibo nga nag papasayun han leksyon parehas hit chemical bonding asya maupay kun gagamitun gud hiya ha pagtutdo."*(Printed infographic is an effective tool in making lesson easy just like chemical bonding, much better if it will be used in teaching.)

Participant 9: *"Nakakagana ha klase asya maupay kun gagamitun hiya ha kada leksyon."*(It encouraged me to listen in class, much better if it will be used in every discussion.)

Participant 10: "*Maupay an printed infographic kay dere la kami nag e-iimagine*

han am leksyon kay may nakikita kami, maupay kun gagamitun ito ha pagtutdo labi na ha chemical bonding tas uupdan hit mga video han tulo na klasi hin chemical bonding."(It is good to use printed infographic because we are not just imagining our lesson, we have something to look at, much better if it will be used in teaching specially in chemical bonding together with videos of the three types of chemical bonding.)

Participant 11: *"An ak masisiring ha printed infographics nakakahatag hiya hin pamaagi para mas madali mahitutdo hit maestra it iya leksyo.""*I can say that printed infographic offers a much easy way of delivering lessons to teachers."

Participant 12: *"An masisiring ko maupay nga gumamit hin printed infographic kay an mga picture han chemical bonding nga nahatag hin impormasyon tas naiingganyo kami mamati tas mas madali namun naintihan an konsepto han chemical bonding."*(I recommend to use printed infographic because it has pictures that gives useful information on chemical bonding and because we were encouraged to listen and most of all we easily understand the concepts of chemical bonding.)

Participant 13: *"An masisiring ko an impormasyon ha printed infographics nakabulig ha ak labi na an mga informative pictures kay mas madali ko naintindihan an leksyon."*(I can say that printed infographic helped me a lot, specially the informative pictures because I easily understand the topic.)

Participant 14: *"An masisiring ko ha printed infographics nagpapadali hiya han leksyon ngan nakaka inganyo hiya pamate hit leksyon."*(I can say that printed infographic makes lesson easy and it encourage learners to listen in the discussion.)

Participant 15: *"Gin rerekomindar ko an paggamit han printed infographic ha pagtutdo kay nakakabulig hiya para mas madali an pag pa-intidi ngan pagtutdo ha eskwelahan."*
(I recommend to use printed infographic for the students to easily understand the topic and for easy and smooth delivery of lessons in school.)

Participant 16: *"An masisiring ko han paggamit han printed infographics ha pag tutdu han chemical bonding dako iya bulig maupay unta kun gagamitun ini ha pagtutdo para mas madali maintidihan ngan mamate it mga studyante."*(I can say that it is better to use printed infographics in teaching chemical bonding for easy and smooth delivery of the lesson and for the students also to easily understand the topic and they will listen to the discussion.)

Participant 17: *"Maupay it printed infographics na gamit hit pagtutdo hit*

chemical bonding kay gin papasayun it leksyon ngan mas maupay mamate hit maestra, mas maupay kun may video liwat unta kay mas mamate ito it mga studyante."(It is good to use printed infographics in teaching chemical bonding because it makes the lesson easy and interesting and much better if there are videos of chemical bonding it will encourage the students to listen.)

Participant 18: *"Para ak mas maupay kun may printed infographics ha pagtutdo kay naipapakita maupay an mga konsepto nga kailangan nam mahibaruan gamit ini."*(For me I advise to use printed infographics in teaching to show clearly and comprehensively the concepts that we need to learn.)

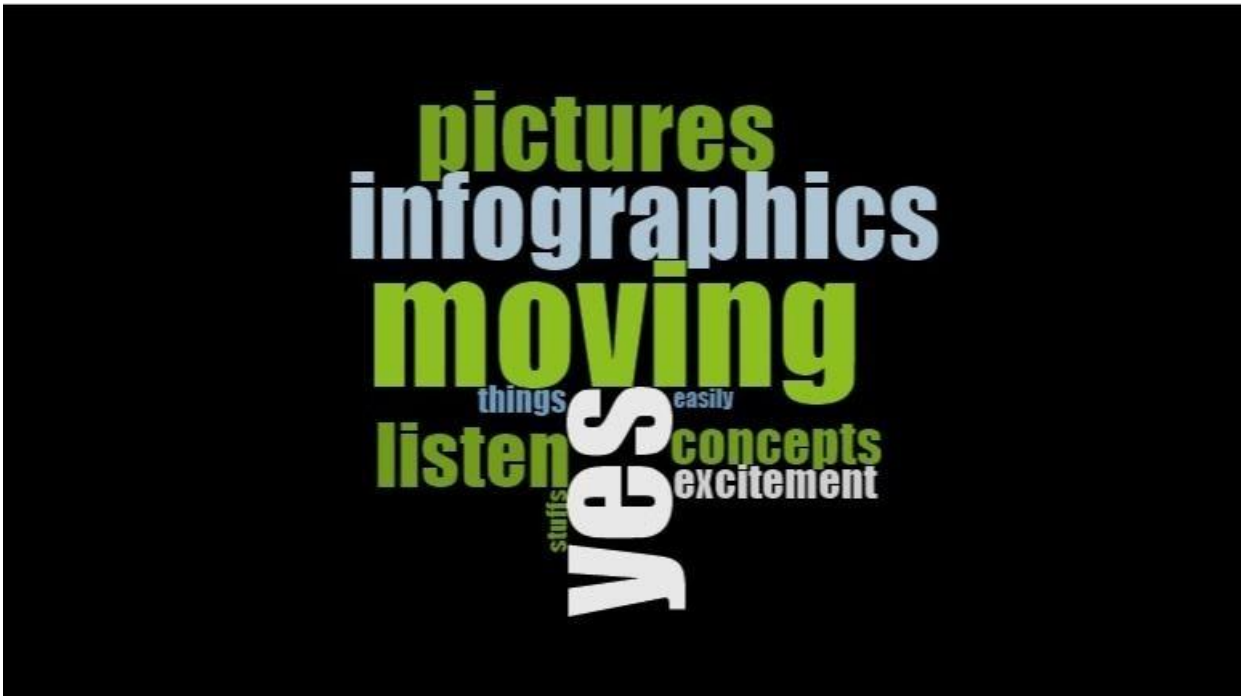
Participant 19: *"Para ha akon maupay nga magamit hin printed infographics kay nakakabulig hiya kun paano nagkakaiba an tulo nga klase han chemical bonding."*(For me it is better to use printed infographic in teaching because it can clearly demonstrate the difference between the three types of chemical bonding.)

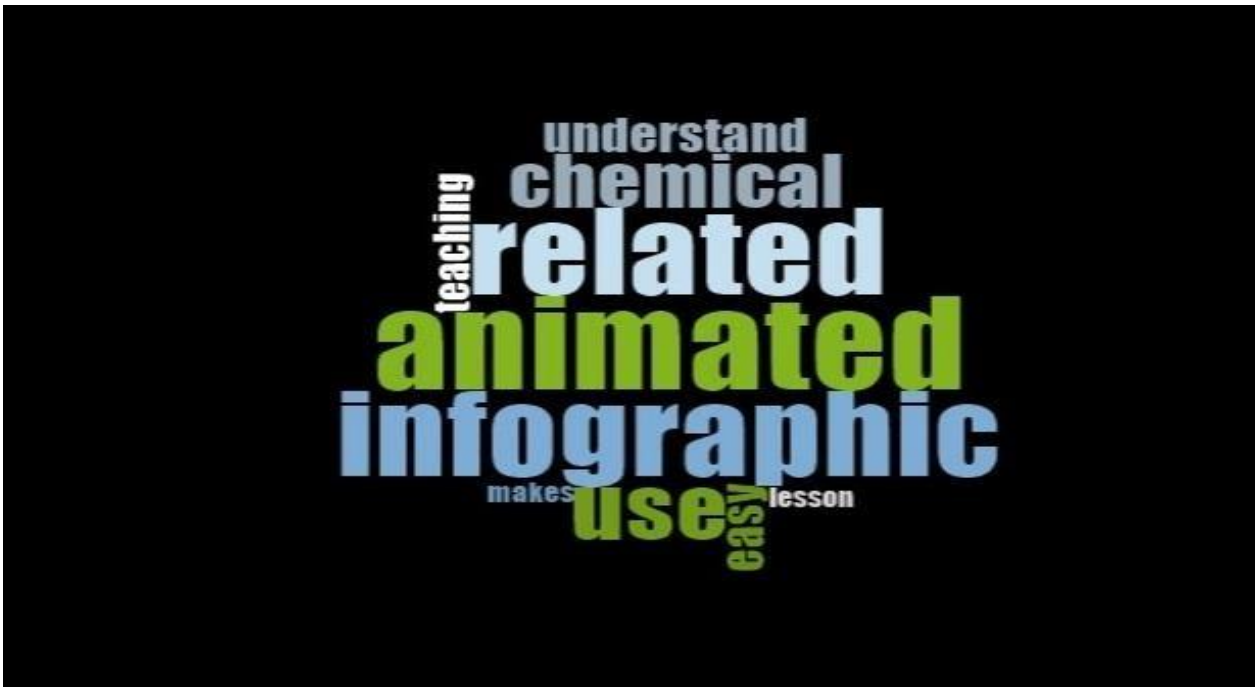
Participant 20: *"Ha akon masisiring nakakabulig an printed infographic ha pag tutdo ha mga studyante para hira mahibaru ngan maintindihan an chemical bonding."*(In my opinion it is very helpful to use printed infographics in teaching students for them to learn and understand chemical bonding.)

APPENDIX I

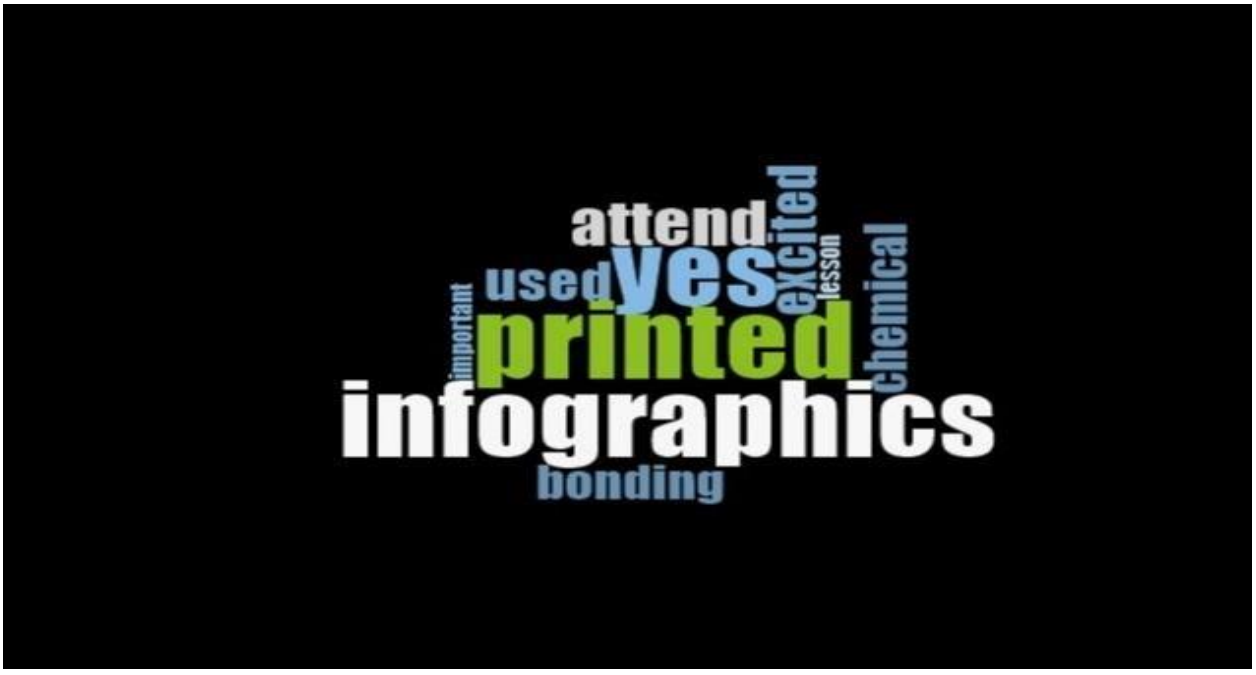
WORD CLOUD

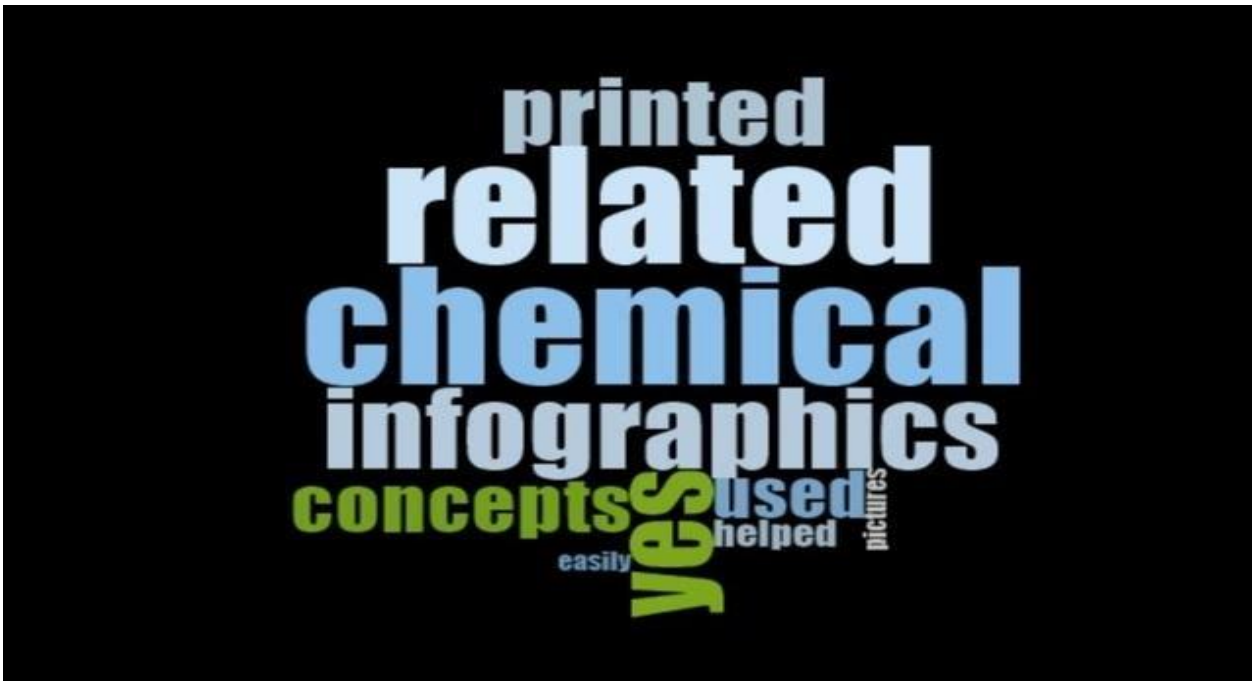
Animated Infographics

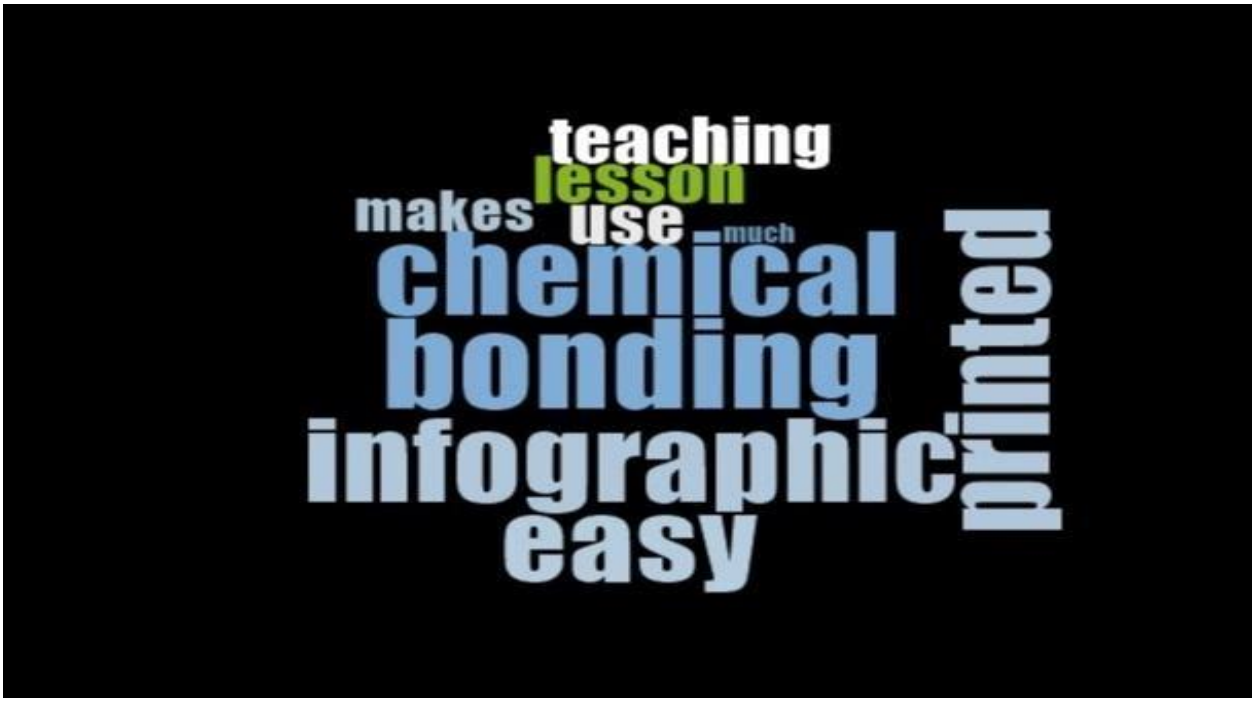




Static (printed) Infographics




printed
related
chemical
infographics
concepts
yes
used
helped
pictures
easily


teaching
lesson
makes
use
much
chemical
bonding
infographic
easy
printed

C U R R I C U L U M V I T A E

CURRICULUM VITAE

Name	:	Chrisvie A. Miralles
Address	:	Brgy. Oyandic Motiong Samar
Date of Birth	:	November 12, 1991
Place of Birth	:	Poblacion 1-A, Motiong Samar
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EDUCATIONAL BACKGROUND

Elementary	:	Motiong Central Elementary School Motiong, Samar 1998-2004
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Tertiary	:	Samar State University Catbalogan City, Samar 2009-2014 Bachelor of Secondary Education major in Biology
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WORK EXPERIENCE

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LIST OF TABLES

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