

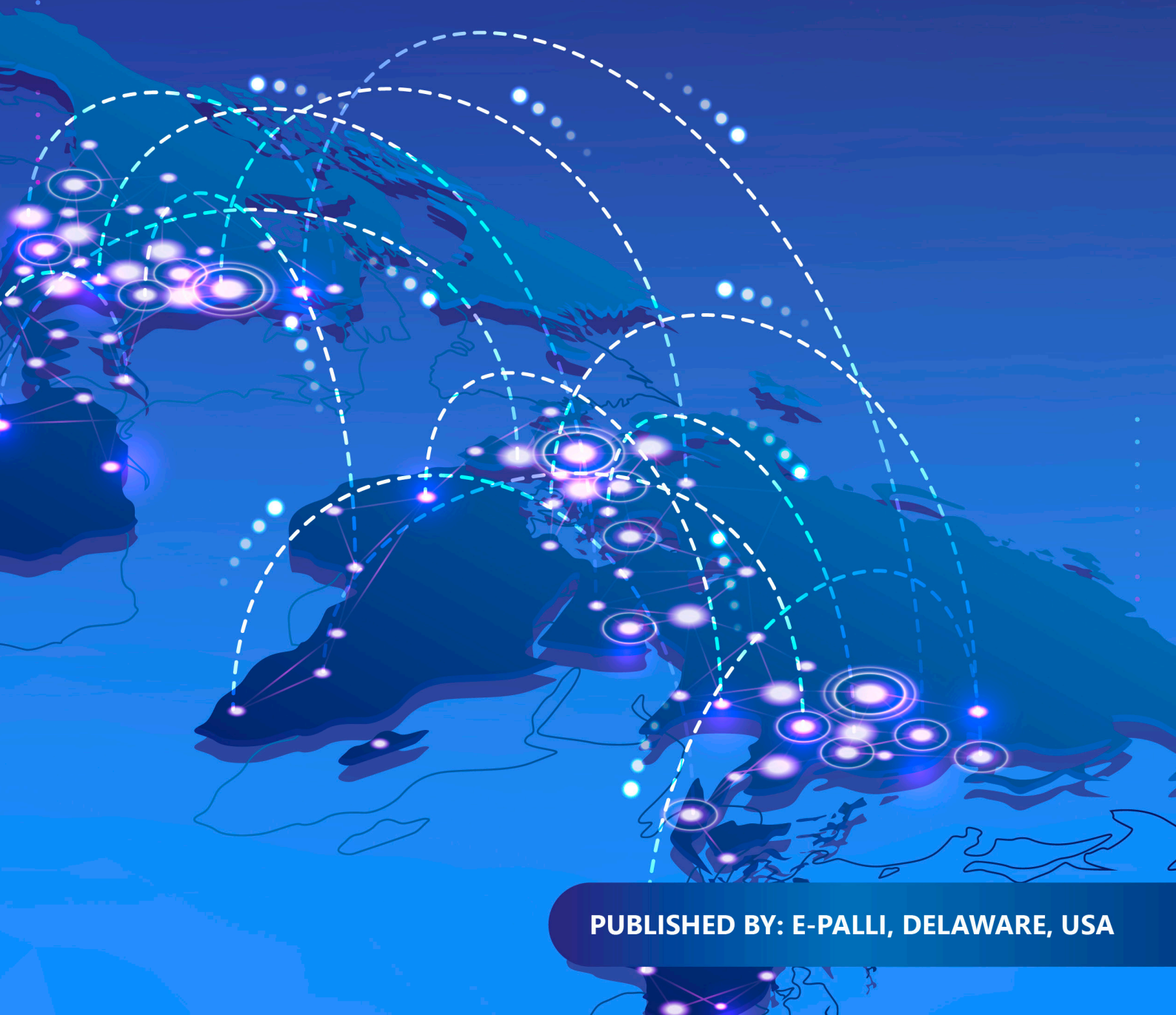


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## Infographics in Guided Discovery Lessons for Grade 6 Science

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### Article Information

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*Infographics, Guided Discovery Lessons, Instructional Materials Development, Grade 6 Science, Most Essential Learning Competencies*

### ABSTRACT

The Department of Education is delving into instructional material development to support students learning. This study aimed to develop Infographics in Guided Discovery Lessons (IGDL) for Grade 6 Science. It investigated the learning competencies in Science 6 that can be best taught using infographics as perceived by teachers. Also, it determined the effectiveness in improving the performance among the learners. The study used the descriptive research design employing research and development methodology. It surveyed 162 Science teachers from the Schools Division of Ilocos Norte on the essential competencies using needs assessment survey. The developed infographics was validated by experts and tried out to the Grade 6 pupils of San Nicolas Elementary School. A researcher-made pretest and posttest were used to determine the effectiveness of the infographics. Result showed that 46.67% of the Science 6 learning competencies were best taught using infographics. The Learning Resource Management and Development System Evaluation Tool for Print Materials was utilized for the content validity of the IGDL. In terms of content, instructional and technical qualities, the IGDL was evaluated as valid. This implies that IGDL can be utilized in the acquisition of Science concepts. The tryout result revealed that the level of performance of learners improved from needs improvement to very satisfactory level. T-test showed a significant difference between the level of performance of the Grade 6 learners in the pretest and posttest mean scores. Thus, the IGDL improved the students' performance, and it can be used as instructional material in teaching concepts in Science.

### INTRODUCTION

Filipinos regard education as the primary avenue for upward social and economic mobility. They believe that having one will enable them to enjoy *matatag, maginhawa*, and *panatag na buhay*. In addition, the Philippine government uses its fiscal, monetary, and regulatory policies to direct the country's development toward achieving *AmBisyon Natin 2040*. By 2040, the Philippines would have developed into a stable middle-class society with no poverty. People are creative and wise, and they live long and safe lives. Then there's a country with a high level of confidence, where families flourish in vibrant, culturally diverse, and resilient communities. According to the Secretary of the Department of Education, Hon. Leonor Magtolis-Briones, education is the most effective means of achieving the nation's development goals.

The Enhanced Basic Education Act of 2013, also known as Republic Act No. 10533, adopted a policy of providing a complete, adequate, and integrated system of education that meets the needs of the people, country, and community. Similarly, Filipino basic education graduates will be empowered individuals who have learned the foundations for lifelong learning, the ability to work and be productive, the ability to coexist in high-yielding harmony with local and international communities, and the capability to engage in entrepreneurship through a program based on educational principles and geared toward excellence.

Moreover, the Department of Education has the responsibility, accountability, and authority to allow Filipino learners to receive a quality, accessible, relevant,

and liberating basic education based on a pedagogically sound curriculum that meets international standards; prepare Senior High School graduates for college, technical and vocational job opportunities, as well as sport, entrepreneurial, and creative arts employment in a rapidly changing and increasingly globalized environment; and make education responsive and learner-oriented to the needs, cultural capacity and cognitive, the circumstances and diversity of learners, learning centers, schools, and communities through the suitable dialects/languages of teaching and learning.

Today, Filipino learners need lifelong learning; however, the country's educational system is in crisis. The country's educational standard was spotlighted in 2019, as shown by the findings of both national and international evaluations of student success, which highlighted Filipino students' poor performance (Malipot, 2019). Hon. Leonor Briones, DepEd Secretary, stated that Filipino students' performance in large-scale assessments such as the National Achievement Test (NAT) revealed low proficiency levels in Mathematics, Science, and English. Aside from the NAT results, the Department of Education released the results of the Programme for International Student Assessment (PISA) 2018, in which the Philippines came in last out of 79 countries and was near the bottom in Science and Mathematics (San Juan, 2019).

According to Alonsabe (2018), one of the reasons for Filipino learners' dismal performance in international and local assessments is the quality of learning resources, evaluative devices, and teaching materials. Furthermore,

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sub-standard and obsolete textbooks, lack of science apparatus, and learning materials significantly affect the students' learning condition. Subjects do not even have the prescribed books. Ambag (2018) revealed that DepEd faces many challenges in textbook quality like flooded with errors, poor and obsolete, and does not conform to competencies and learning skills.

With this kind of problem in the Philippines' educational system resulting in Filipino learners' dismal performance, it is in this context that the development of instructional materials is deemed necessary. In almost every instruction, the teacher prepares teaching and learning resources to supplement the learners' interest and understanding. Through the advancement of technology, teaching and learning have been revolutionized and the learning environment set up became electronically and technologically empowered that allows learners to capture the lessons without discarding their enthusiasm for quality learning.

One of the instructional materials that can be developed, utilized, and implemented in teaching Science concepts is infographics. Infographics are instructional materials to assist the pupils in comprehending science concepts. Infographics are the combination of the words "information" and "graphics." Smiciklas (2012) defined Infographics as a presentation of data or ideas that attempt to transmit complicated ideas and concepts to viewers in a manner that can be immediately absorbed and easily understood. Recent studies have pointed out that 75% of the brain's information comes from the visual format (Williams, 2009).

Nowadays, many clients and designers prefer infographics design as a recent common design and visualization tool to convey their messages visually exciting and engaging while presenting essential data and details (Hassan, 2016). The picture tells a thousand words is an expression that fits in the so-called term infographics. Infographics, according to Gamonal (2013), are more than just images. The main aim is to simplify the complex and clarify how complicated anything is in the most precise way possible using graphical language (Rueda, 2014). More importantly, when engaging with it, infographics give fun and gratification to the student's learning style and help promote robust retention, learning, and comprehension of ideas (Lyra, et al., 2016).

It is in this context that stirred up the researcher to develop an Infographics in Guided Discovery Lessons to address the scarcity of learning resources and be used as supplementary instructional material to help learners in the acquisition of scientific knowledge, concepts, and skills, thereby supporting the delivery of lessons in the K to 12 Basic Education Curriculum particularly the Science Education. Likewise, this helps Grade 6 learners develop their basic science processes, problem-solving, critical thinking, and information literacy skills.

## LITERATURE REVIEW

### On Infographics and its Effectiveness

The ways in which information is offered and accessed have shifted in the 21st century. There has been increasing and escalating interest in using the ability of technology to deliver information visually to attract the attention of learners in school and in the community. This led to the need for new pedagogies, strategies, approaches, and methods of teaching and learning that are more learner-centered (Davidson, 2014).

### Defining infographics

Data visualization is a technique for transforming data into a visual form, while infographics express a full story portraying a message with images, sentences, and design elements. To put it another way, an Infographic is a full product that tells a story. Simultaneously, data visualization is used to create infographics (Krum, 2013). The word infographics (coinage for information graphic) is described by Islamoglu et al. (2015) as a modern type of data visualization that is well-known for its effectiveness in conveying information in both print and digital settings. Infographics, according to Locoro et al. (2017), are a tool that tells users. The contents of infographics are arranged in detail, understood, and interpreted by the audience, according to Dunlap and Lowenthal (2016).

Additionally, Ozdamli, Kocakoyun, Sahin, and Akdag (2016); Tugrul (2017); and Uygarer and Uzunboylu (2017) believe that infographics are an extremely beneficial portal for transmitting information, as they simplified data in a complex and lengthy document. Bradshaw and Porter (2017), on the other hand, propose that Infographics are a unique way of visually conveying condensed details while still having an interesting impact on its characteristics.

On the other hand, Krauss (2012) defines infographics as a visual image used to represent data. According to him, the traditional K to 12 curriculum supports reading and writing in interpreting events, self-expression, and meaning. However, it is significant to consider that when the learners take an active role in learning engagement, it encourages meaning-making and understands what has been experienced.

Meanwhile, as one of the goals of infographics, it is believed that the more nuanced knowledge on a particular subject is portrayed understandably and visually, the more it makes sense to the recipient. It should contain data that is both catchy and understandable in order to facilitate visual transfer. People can be persuaded, guided, and mobilized using infographics if they have visual content and useful features. Toth (2013) describes infographics as a visual presentation with a combination of text that provides the viewer with both qualitative and quantitative information.

Infographics, according to Smiciklas (2012), are a type of image that combines information and design and allows individuals and organizations to convey messages to a group of people in a concise manner. Graphics, phrases, and design elements are the key components of infographics. Infographics are made up of text of varying lengths, pictures with varying quantities of

data ranging from theoretical to life-like, and graphical elements like arrows, movement lines, zoom boxes, and other accentuating devices (Holsanova, Holmberg and Holmqvist, 2012).

### Use of infographics as a strategy

The general aim of using infographics, according to Holsanova, Holmberg, and Holmqvist (2012), is to explain and classify problems so that readers can easily conceptualize and comprehend complex ideas and processes. The main goal of infographics was refined by Lamb and Johnson (2014) into five specific purposes: (a) visualizing complicated relationships; (b) arranging ideas in a useful way; and (c) telling a story to relay ideas with words and images in an entertaining way rather than using just words. (d) making data meaningful with analogies, patterns, and examples to turn data into information; and (e) efficiently comparing information.

Krum (2013) divided the goals of infographics into three groups, similar to that of public speaking: to inform, entertain, and motivate the audience. Infographics, like public speeches, begin with an introduction to arouse the reader's interest and encourage them to spend time studying them. It concludes with a question that asks readers to say what they want to do with the knowledge they've just learned.

The statement released by Visual.ly Inc. (2013), a website that shares data visualization, states that infographics present complex and challenging data rapidly and concisely. It also integrates images and text to convey information. It also involves patterns or trends that make it easy to comprehend and compare with text alone. More so, it is engaging and beautiful to the audience who put to use this remarkably awesome stuff.

Lamb and Callison (2012) support that infographics materials are vital for 21st-century learners in content areas. It enriches the pupil's understanding and offers an opportunity to involve pupils in learning multidisciplinary subjects that include reading an expository text in which they find difficult. It also plays a provocative act in active studying.

Kharbach (2012) mentions the widespread utilization of Infographics in instruction and learning, which becomes a necessary tool in magazines, newspapers, and digital media proportionate to social media like Twitter and Youtube, which deliver information, not just only text but its educational capacity in visual communication. Lamb and Callison (2012) assert that infographics can help the audience envision the "big picture" of the ideas troublesome and laborious to comprehend.

The study of Gebre and Polman (2015) suggested that using infographics in science education as an instructional tool is vital because it must need core examination. It must be related to existing infographics and involve learners in producing their Infographics to understand topics and concepts. The results illuminated the different aspects of educators' view on designing infographics' quality features that can withdraw learners' attention in

the classroom incorporated by it. The approach taken by the researchers to have the education and graphic design experts participate in the study proved valuable in gaining insight into the construction of infographics. However, uncovering student perceptions of the same infographics would be of great help and necessary to grasp how students decode the information would help them know how to use infographics in science education effectively.

Tuncali (2016) utilized infographics to spread awareness on environmental concerns and concluded that infographics are beneficial instruments in initiating consciousness in an ecological event and transpiring a specific communication to individuals and groups of people utilizing social channels Facebook, Twitter, and Instagram, and the like.

Pirasenko and Bndarev (2016) concluded the great importance of infographics on foreign language study and educational technologies integration, which was seen to be entertaining, thought-provoking practicable to learners and viewers.

Further, Bradshaw and Porter (2017) explored about the use of infographics as a modern and up-to-date instructional tool in nursing education. It showed that nursing mentors must know the basics of Infographics making and make sense and utilize this medium in their respective classes to deliver unified information and be used likewise in clinical education.

According to Dunlap & Lowenthal (2016), infographics reinforce attention from an instructional standpoint, reduce cognitive load, create visually appealing artifacts, enable or construct schema by using symbols and knowledge of learners.

In the study of Davis and Quinn (2014), infographics can help with writing and reading comprehension. It also improved critical thinking and synthesizing skills while clarifying difficult subjects like science, history, and math. In addition, according to Dur (2014), infographics will help students improve their academic performance. It can also help students improve life skills and attitudes like science, systematic thinking, and teamwork. Infographics can be used for hands-on learning and problem-solving, according to Davidson (2014), while Meacham (2015) views them as a means of interaction.

Elements and qualities of good infographics. According to all meanings in the literature, infographics should depict a plot, a concept, or a method, and use an attention-grabbing design to clearly illustrate multifaceted facts. As a result, topics and concepts that will be portrayed as infographics should be visually appealing, tell a story, and convey a message (Lamb & Johnson, 2014). Infographics show the same details that can be displayed in a conventional manner using just words or a combination of words and images.

Infographics are an important visualization tool that caters to understanding and learning complex knowledge in simple typography, according to Lankow, Ritchie, and Crooks (2012). Infographics, on the other hand, are created using graphic elements such as color and

typography, as well as content-related layout elements such as charts, schemes, tables, and the like. In the teaching and learning process, the use of complete graphics and design elements can be crucial and essential.

The designs and elements in infographics are not new, according to Dick (2014). Pictures, forms, symbols, graphics, and texts are all used to express ideas and details. It is clear that infographics' creativity in ensuring knowledge transfer is being used in content creation. Briefly, Tuncali (2016) claims that infographics turn knowledge into a clear and explanatory visual narrative by transforming current data used in the graphic information.

According to Krum (2013), infographics should contain an introduction, key message, and conclusion that corresponds to the story's format. Similarly, Davis and Quinn (2013) specified some factors like the determination of the motive, the decision on the infographics' functional elements, determining the infographics, presenting data, where the audience can apprehend, and creating all essential characteristics of infographics, which are helpful and convincing. And the study of Lankow, Ritchie, and Crooks (2012), the key goals of infographics are visual appeal, understanding, and retention. The technical characteristics of these goals differ depending on the infographic's intent.

According to Krauss (2012), visually representing information and data engages other brain segments, allowing individuals to view an issue from various perspectives. Foschiera, et al. (2014) assert that infographics are an image-rhetorical text which consists of spoken ingredients related to pictorial data such as image, map, photos, graphics and the like.

It enables the reader to meet the needs of data used by the reader audience in decoding hard-to-tell ideas. Infographics should have significant features like appreciating the aesthetic appeal, utilizing titles and pictures appealing to the audience. It needs the quality of being clear enough to read. It also presents the extent of emotions that can be glanced to the language and array of pigment used. It includes an immense desire to use definite illustrations and terminologies. Also, it explores concise references and statistics relevant to the data.

According to Alshehri & Ebaid (2016), infographics should be organized to make an effect on users and readers when accurately representing ideas. Visual graphics from multimedia activities provided a highly efficient learning outcome because it involved a dynamic, practical, and tellingly presentation. Visual representations, as well as a supportive learning atmosphere, can assist teachers in simplifying the elaboration of lessons for students.

Kibar's study (2016) presents a model of infographics as a means of strategic learning.

He said that a developer and maker of infographics should be knowledgeable of content, must be skillful in designing visually, and must be adept in implementing digital design so that lay-outing of such will be helpful and impressive.

### **Effectiveness of infographics**

Vanichvasin (2013) conducted a study with twenty (20) fourth-year undergraduate students to investigate the effectiveness of using infographics. The result showed that the use of infographics could elevate the understanding and permanence of visual communication ideas. Hence, it can improve the kind of learning when utilized as a tool for learning. It was noted that the material developed can arouse the pupil's attention in understanding the text and the whole concept and ideas.

Alshehri and Ebaid (2016) investigated and employed an experimental method by administering pretest and posttest in Mathematics where interactive infographics were used. The results showed that interactive infographics were useful devices in delivering curriculum and instruction to learners and mathematics subjects at grade school.

The study of Sudakov, et al. (2014) presented a computerized banner sequence that used infographics, allowing learners to comprehend more quickly. The posters were designed to utilize in mathematics undergrad subjects to cater to the actual, accurate, and detailed paradigm of incorporating science climates in mathematics. Hence, revealing that 50% of the learners agree that infographics were a fascinating and potent way of fostering and increasing interest in learning concepts. Also, it is an essential tool in the education system and shows functional integration in the classroom to demonstrate the application of Mathematics.

To build the contact channel between the site and the user, Rueda (2014) used infographics to plan audio-visual contents presented by the Usable Adaptive Hypermedia System (SHAU). The creation of information of 30 students before and after using the SHAU 2.0 was researched and analyzed using a quantitative approach using the ANOVA method. The findings revealed that creating audio-visual contents based on graphic design using infographics with cutting-edge technology enhances the learning process.

In the research conducted by Al-Mohammadi (2017), it employed the two-group quasi-experimental design on sixty-four student participants. The investigation indicated the efficiency of utilizing the infographics procedure in teaching the program fundamentals to develop analytical and rational expertise.

Ozdamlı, et al. (2017) investigated designing infographics and evaluating their usefulness. The investigation revealed a significant and positive difference in the views of 43-grade school teachers and 51 elementary pupils before and after training on the management and self-value of infographics design in a specified learning environment. The effectiveness of graphic information usages in grammar education was investigated by Rezaei and Sayadian (2015). They used an experimental design, and infographics were introduced and implemented to the learners in the experimental group. In a non-test group, on the other hand, the conventional approach was used. The results show the positive effect of applying Infographics to the grammar study and improvement of the learners.

Cifci (2016) investigated the impact of infographics on student achievement and attitudes toward geography lessons. Students' academic performance and motivation improved when infographics were used in the lessons. The visual and verbal skills of the students were also enhanced. Furthermore, the study discovered that infographics can be used efficiently and widely in geography lessons at various grade levels as graphic learning content. Similarly, where students' achievement and attitudes in geography lessons are poor, infographics are recommended for use in class discussions. Ashehri and Ebaid (2016) developed an interactive infographic-based instructional design model for teaching mathematics. The findings show a significant difference between the mean scores of students in the experimental and control groups in the post-achievement test at the 0.05 degree of confidence. Additionally, interactive infographics are effective teaching and learning resources in teaching Mathematics in the elementary level. In light of the literature mentioned above, the use of infographics as a visual learning tool is effective, as evidenced by Richard's Mayer Cognitive Theory of Multimedia Learning (CTML). The CTML was created as a result of research into how people learn and what constitutes significant learning. Visual and verbal stimuli are received through two separate channels, each with reduced processing power. Only when the necessary cognitive mechanisms for selecting, organizing, and integrating knowledge are used will meaningful learning occur.

## MATERIALS AND METHODS

### Research Design

This study employed the descriptive research design using the Research and Development methodology. This deals with the process of establishing, validating, and investigating instructional materials for instruction and representing education outputs targeted.

This study was conducted in three (3) phases: 1) Planning Phase; 2) Development Phase; and 3) Validation Phase. Figure 2 shows the stages followed in the development of the infographics.

### Population and Sample

Three sets of respondents were utilized in this study. In the planning stage, all Grade 6 Science teachers of SDOIN were involved in answering the needs assessment survey. In the validation of the Infographics in Guided Discovery Lessons, the panel of experts/validators composed of two master teachers, one school head, two professors from the academe, and two supervisors were tapped to review and score the validity of the infographics. Respondents were chosen based on their field of interest, availability, and expertise. For the third set of respondents, one group pretest-posttest experimental design was used. Twenty (26) Grade 6 learners were involved in the study. The non-probability purposive sampling technique was used in the selection of samples in the study.

### Instruments

There were three (3) research instruments used in this study, namely: needs-assessment questionnaire, validation rating scale, and researcher-made test.

The needs assessment questionnaire is necessary to determine the learning competencies in Grade 6 Science that can be best taught using infographics. The questionnaire contains the following parts: Part I is the teacher respondents' personal information; Part II is the information regarding what learning competencies in Grade 6 Science teachers perceived can be best taught using infographics.

Below is the evaluation criterion

#### Scale Qualitative Description

- |   |   |
|---|---|
| 3 | Competency that can be best taught using infographics (CBT)       |
| 2 | Competency that may or may not be taught using infographics (MNT) |
| 1 | Competency that cannot be taught using infographics (CNT)         |

Meanwhile, the validation rating scale, which utilized the Learning Resources Management and Development System (LRMDS) Assessment and Evaluation Rating for Print and Poster Resource Materials adopted from DepEd 2008, Regional Handbook in Content Evaluation of Supplementary Materials, was used to evaluate the IGDL. The five-point scale scheme is used in determining the validity of the IGDL. The experts assessed the IGDL in terms of content, instructional, and technical qualities. Responses to evaluation criterion were indicated and interpreted using the following five-point scale:

#### Scale Description Qualitative Description

- |   |  |
|---|--|
| 5 | Excellent Embodies total applicability of the criterion requirement                |
| 4 | Very Satisfactory Embodies considerable applicability of the criterion requirement |
| 3 | Satisfactory Embodies some applicability of the criterion requirement              |
| 2 | Fair Embodies limited applicability of the criterion requirement                   |
| 1 | Poor Fails to address the criterion requirement.                                   |

Lastly, the researcher-made test, which comprises 30 items based on the learning competencies from the second quarter, was used to measure the effectiveness of the developed IGDL. This was given to the Grade 6 pupils before and after the use of the infographics developed.

The test was validated by three master teachers and two school heads who have taught Science for at least five years. The test was sent to the validator's email address and then returned to the researcher to incorporate the suggestions and recommendations.

### Data Gathering Procedure

Before the data gathering, the researcher secured ethical clearance from the University Research Ethics Review Board (URERB). Then, permission to conduct the study was requested from the Schools Division Superintendent (SDS) and the concerned School Heads,

who supervised the teacher-respondents and learners. Data gathering started upon approval of the requests. All respondents and panel of experts/validators were given detailed instructions on how to complete the survey questionnaires and the validation of the Infographics in Guided Discovery Lessons.

In the needs assessment survey, the researcher asked SDS's permission to post the online survey questionnaire in SDOIN Facebook Infoboard for faster consolidation of results and data gathering. For convenience and efficiency, the researcher used Google Forms to collect the respondents' responses. The learning competencies that can be best taught using infographics as perceived by teachers were used as the bases for the development of Infographics in Guided Discovery Lessons (IGDL).

In the validation of the material, the IGDL and validation tool were sent to the experts/validators' panel through their email addresses. The validators' comments and suggestions were used as bases for the refinement and final revision of the IDGL.

To test the effectiveness of the developed infographics, a tryout to Grade 6 pupils was conducted. Pretest and posttest were administered online using the Quizalize Application. The results of the test were automatically recorded and analyzed in the application. After the pretest, the Infographics in Guided Discovery Lessons was introduced to the Grade 6 pupils through online modality. Then, the posttest was administered through the Quizalize Application. The pretest and posttest scores were computed, tabulated, compared, analyzed, and interpreted to measure the effectiveness of IGDL.

**Data Analysis**

Mean was used in determining the learning competencies in Science 6 that can be best taught using infographics. The mean of each competency was interpreted using the ranges of means with the corresponding descriptive interpretation.

Range of Means	Descriptive Interpretation
2.35 - 3.00	Can be best taught using infographics (CBT)

1.67 - 2.34	May/may not be taught using infographics (MNT)
1.00 - 1.66	Cannot be taught using infographics (CNT)

Furthermore, mean was also used to describe the validity of the Infographics in terms of content, instructional and technical qualities. This was interpreted using the following range of means, with their corresponding descriptive interpretations:

Range of Means	Descriptive Interpretation
4.20 - 5.00	Very Highly Valid (VHV)
3.40 - 4.19	Highly Valid (HV)
2.60 - 3.39	Moderately Valid (MV)
1.80 - 2.59	Slightly Valid (SV)
1.00 - 1.79	Not Valid (NV)

Meanwhile, pretest and posttest scores were interpreted using the following range of scores with corresponding descriptive interpretations:

Range of Mean Scores	Descriptive Interpretation
25 – 30.00	Outstanding (O)
19 – 24.99	Very Satisfactory (VS)
13 – 18.99	Satisfactory (S)
7 - 12.99	Needs Improvement (NI)
0 - 6.99	Poor (P)

Moreover, the means of the pretest and posttest were computed. To determine the significant difference of the mean scores before and after using Infographics in Guided Discovery Lessons, a t-test for dependent samples was used.

**RESULTS AND DISCUSSION**

**Results**

Learning Competencies in Grade 6 Science that Can Be Best Taught Using Infographics

Table 1 shows the result of the survey among Grade 6 teachers on their perceived learning competencies that can be best taught using infographics in teaching Science. The essential competencies were ranked according to teachers' perceptions of the learners' needs in Grade 6 Science.

(RPMS Manual, 2018). Thus, the level of learners' a

**Table 1:** Learning competencies in Grade 6 Science that can be best taught using infographics as perceived by the teachers.

Quarter	Learning Competencies		Mean	Descriptive Interpretation
1st Quarter	1.	Explain how the organs of each organ systems work together	2.97	CBT
	2.	Report on the importance of maintaining proper body functioning of these systems	2.17	MNT
	3.	Examine the characteristics that distinguish one vertebrate from another and serve as a basis for their classification.	1.80	MNT
	4.	Determine the distinguishing characteristics of invertebrates and vertebrates	2.41	CBT
	5.	Observe rare animals found in the tropical rainforests, coral reefs, and mangrove swamps.	1.79	MNT

2nd Quarter	6.	Compares spore-bearing plants with cone-bearing plants	1.72	MNT
	7.	Describes ferns and mosses life cycles	2.06	MNT
	8.	Communicates propagation techniques	2.13	MNT
	9.	Discuss the interactions among non-living and living things in coral reefs, tropical rainforests, and mangrove swamps.	2.96	CBT
	10.	Describe the physical conditions of tropical forests, coral reefs, and mangrove swamps	1.98	MNT
	11.	Communicate the importance of feeding relationships among living things in the ecosystem	2.31	MNT
	12.	Explain the need to conserve and protect tropical forests, coral reefs, and mangrove swamps	2.65	CBT
	13.	Communicates propagation techniques	2.13	MNT
	14.	Discuss the interactions among non-living and living things in coral reefs, tropical rainforests, and mangrove swamps.	2.96	CBT
	15.	Describe the physical conditions of tropical forests, coral reefs, and mangrove swamps	1.98	MNT
	16.	Communicate the importance of feeding relationships among living things in the ecosystem	2.31	MNT
17.	Explain the need to conserve and protect tropical forests, coral reefs, and mangrove swamps	2.65	CBT	
3rd Quarter	18.	Infers that gravity and friction affect people and objects	2.73	CBT
	19.	Demonstrate how sound, heat, light, and electricity can be transformed from one form to another	2.72	CBT
	20.	Manipulates simple machines & describes their characteristics and uses	2.46	CBT
	21.	Demonstrate practical and safe use of simple machines	2.06	MNT
	22.	Identify electrical devices at home and school that converts electrical energy to light, heat, sound, and motion	2.26	MNT
4th Quarter	23.	Describe the changes in the Earth's surface as a result of earthquakes and volcanic eruptions	2.85	CBT
	24.	Describe warning signs of an earthquake and volcanic eruption	2.28	MNT
	25.	Enumerates what to do before, during, and after the earthquake and volcanic eruptions	2.94	CBT
	26.	Collects and interprets data on the weather	2.23	MNT
	27.	Describe the different seasons in the Philippines	2.38	CBT
	28.	Differentiates between rotation and revolution and describe the effects of the Earth's motion	2.48	CBT
	29.	Compares the planets of our solar system	2.40	CBT
	30.	Constructs a model of the solar system that show the relative sizes of each planet and the relative distances from the sun	2.31	MNT

*Legend:*

<i>Range of Means</i>	<i>Descriptive Interpretation</i>
2.35 - 3.00	Can be best taught using infographics (CBT)
1.67 - 2.34	May or may not be taught using infographics (MNT)
1.00 - 1.66	Cannot be taught using infographics (CNT)

**Validity of the Infographics in Guided Discovery Lessons**

The developed infographics was validated in terms of their content quality, instructional quality, and technical quality using the Content Validation Rating Scale adopted

from the LRMDS Evaluation Tool for Print and Poster of the Department of Education.

Content Validity. Table 2 shows that all criteria in evaluating the content quality of IGDL obtained mean scores ranging from 3.86 (HV) to 4.86 (VHV). According to the validators, the content of the IGDL is consistent with topics/skills found in the DepEd learning competencies for the subject and grade/year level it was intended (4.86) and contributes to enrichment and reinforcement or mastery of the identified learning objectives (4.86). However, the content that promotes and stimulates critical thinking got the lowest mean (3.86) among the items in validating the content quality.

**Table 2: Mean rating on the content quality of the infographics**

Criteria	Mean	Descriptive Interpretation
1. Content reinforces, enriches, and leads to the mastery of certain learning competencies for the level and subject it was intended.	4.71	VHV
2. Content is consistent with topics/skills found in the DepEd learning competencies for the subject and grade/year level it was intended.	4.86	VHV
3. Content contribute to enrichment and reinforcement or mastery of the identified learning objectives.	4.86	VHV
4. Content is accurate.	4.57	VHV
5. Content is up to date.	4.29	VHV
6. Content promotes and stimulates critical thinking.	3.86	HV
7. Content conveys a clear message of the subject or topic.	4.71	VHV
8. Content is relevant to real life.	4.43	VHV
9. Content is logically developed and organized.	4.57	VHV
10. Content makes use of clear and easy-to-understand information and graphics.	4.71	VHV
<b>Overall Mean</b>	<b>4.56</b>	<b>VHV</b>

*Legend:*

Range of Means	Descriptive Interpretation
4.20 - 5.00	Very Highly Valid (VHV)
3.40 - 4.19	Highly Valid (HV)
2.60 - 3.39	Moderately Valid (MV)
1.80 - 2.59	Slightly Valid (SV)
1.00 - 1.79	Not Valid (NV)

**Instructional Validity**

Table 3 shows the favorable responses of validators to

all the criteria in the instructional quality of the IGDL with weighted mean scores ranging from 4.00 (HV) to 5.00 (VHV). The panel of experts believed that the instructional quality of the IGDL arouses and sustains the interest of the learners (5.00), and the material is enjoyable, stimulating, challenging, and engaging (5.00). Moreover, the material is appropriate and suitable for the intended users (4.71); colors and graphics are relevant instructional reasons (4.57), and it supports teachers in the delivery of concepts (4.57). On the other hand, two of the criteria under the instructional quality got a mean

**Table 3: Mean rating on the content quality of the infographics**

Criteria	Mean	Descriptive Interpretation
1. The purpose of the material is well-defined.	4.00	HV
2. The material achieves its defined purpose	4.29	VHV
3. The learning objectives are measurable and clearly stated.	4.29	VHV
4. The level of difficulty is appropriate and suitable for the intended users.	4.71	VHV
5. The graphics and colors are appropriate instructional reasons.	4.57	VHV
6. The material effectively stimulates the creativity of the target user.	4.29	VHV
7. The material is enjoyable, stimulating, challenging, and engaging.	5.00	VHV
8. The material arouses and sustains the interest of the learners.	5.00	VHV
9. The material provides relevant background knowledge to have a meaningful understanding of the content.	4.00	HV
10. The material supports teachers in the delivery of concepts.	4.57	VHV
<b>Overall Mean</b>	<b>4.47</b>	<b>VHV</b>

*Legend:*

Range of Means	Descriptive Interpretation
4.20 - 5.00	Very Highly Valid (VHV)
3.40 - 4.19	Highly Valid (HV)
2.60 - 3.39	Moderately Valid (MV)
1.80 - 2.59	Slightly Valid (SV)
1.00 - 1.79	Not Valid (NV)

of 4.00 with descriptive interpretation as highly valid, namely, the purpose of the material is well-defined, and the developed IGDL provides background knowledge to have a meaningful understanding of the content.

**Technical Quality**

It can be gleaned from Table 3 that all criteria in validating the IGDL's technical quality obtained mean

scores ranging from 4.29 to 4.86. Based on the data presented, the printing of the IGDL is of good quality (4.86), illustrations are attractive and appealing (4.86), layout and design are pleasing to look at (4.86), the paper used contributes to easy reading (4.86), and durable

binding to withstand frequent use (4.86). On the other hand, the material got the lowest on the items that the layout must have adequate illustrations with text (4.29) and harmonious blending of elements (4.29).

**Table 4: Mean rating on the technical quality of the infographics.**

Criteria	Mean	Descriptive Interpretation
1. Prints		
1.1 Size of letters is suitable to the intended user.	4.57	VHV
1.2 Spaces between words and letters facilitate reading.	4.57	VHV
1.3 Font is easy to read.	4.71	VHV
1.4 Printing is of good quality	4.86	VHV
2. Illustrations		
2.1 Simple and easily recognizable.	4.57	VHV
2.2 Clarify and supplement the text.	4.29	VHV
2.3 Properly labeled or captioned.	4.71	VHV
2.4 Realistic/appropriate colors.	4.57	VHV
2.5 Attractive and appealing.	4.86	VHV
3. Layout and Design		
3.1 Pleasing and attractive to look at.	4.86	VHV
3.2 Simple	4.57	VHV
3.3 Adequate illustration with text.	4.29	VHV
3.4 Harmonious blending of elements	4.29	VHV
4. Paper and Binding		
4.1 Paper used contributes to easy reading.	4.86	VHV
4.2 Durable binding to withstand frequent use.	4.86	VHV
5. Size and Weight of Resource		
5.1 Easy to handle.	4.57	VHV
5.2 Relatively light.	4.57	VHV
<b>Overall Mean</b>	<b>4.62</b>	<b>VHV</b>

*Legend:*

<i>Range of Means</i>	<i>Descriptive Interpretation</i>
4.20 - 5.00	Very Highly Valid (VHV)
3.40 - 4.19	Highly Valid (HV)
2.60 - 3.39	Moderately Valid (MV)
1.80 - 2.59	Slightly Valid (SV)
1.00 - 1.79	Not Valid (NV)

**Effectiveness of the Infographics in Guided Discovery Lessons**

The developed IGDL from the second quarter was

utilized in the try-out mainly because it is within the coverage of the study. Topics include components of the ecosystem, food chain, food web ecological pyramid, and interactions in the ecosystem. Moreover, according to teachers, the second quarter learning competencies that can best be taught using infographics are considered the Most Essential Learning Competencies (MELCs) recommended by DepEd during the pandemic. Based on the table, the pupils' scores improved from 11.62 (needs improvement) to 21.35 (very satisfactory). This means that the IGDL is a suitable and effective material, as shown by the obtained mean ratings in the pretest and posttest.

**Table 5: Learners' level of performance before and after the administration of the infographics.**

	Mean	Descriptive Interpretation	Standard Deviation	Mean Difference	t-test	p-value
Pretest	11.62	Needs Improvement	5.53	9.73	18.224*	0.000
Posttest	21.35	Very Satisfactory	4.66			

*Legend: \*significant at 5% level*

## DISCUSSION

### Learning Competencies in Grade 6 Science that Can Be Best Taught Using Infographics

There were two (2) learning competencies in the First Quarter that can be taught using infographics, four (4) in the Second Quarter, three (3) in the Third Quarter, and five (5) in the 4th Quarter. In addition, the learning competencies with the means ranging from 2.38 to 2.97 were perceived by the teachers that can be best taught using infographics in Grade 6 Science.

Moreover, among the 30 learning competencies prescribed by the Department of Education under the K to 12 BEC for Grade 6 Science, fourteen competencies can be best taught using infographics based on teachers' assessment. These 14 competencies are congruent to the Most Essential Learning Competencies provided by the Department of Education this time of the pandemic.

The identified 14 learning competencies served as the basis for developing IGDL for Grade 6 Science.

### Validity of the Infographics in Guided Discovery Lessons for Grade 6 Science

The developed infographics was rated very highly valid in terms of content (4.56), instructional (4.47), and technical (4.62) qualities. The overall mean of 4.55 implies that the IGDL is highly recommended for teaching Grade 6 Science.

In terms of content quality, the IGDL may contribute to the delivery of concept in Science 6. The contents are accurate, up-to-date, carefully planned, and logically developed. According to Ozdamli and Ozdal (2018), infographics are popular in education since they provide a lot of information in a concise manner. The material is well structured and appealing, promoting and stimulating cognitive abilities.

Furthermore, the overall mean of the IGDL's instructional quality is 4.47 with a descriptive interpretation of very highly valid. This shows that the developed material can be ideal for teaching Science concepts. According to Ware (2012), effective infographics materials communicate or convey messages, concepts, and ideas without requiring someone to read the associated text thoroughly. Also, Singh and Jain (2017) suggest that effective Infographics increase learners' motivation and curiosity.

The IGDL's technical quality has an overall mean of 4.62 with a descriptive interpretation of very highly valid. The developed infographics features various data visualization, including information, graphics, appearance, layout, background colors, font style and size; illustrations; and diagrams used. The study conducted by Krum (2014) confirms that infographics must be unique, innovative, and cost-effective methods for producing media resources (digital and non-digital) with the following components picture, graphs, charts, flow diagrams, and texts.

### Effectiveness of the Infographics in Guided Discovery Lessons

Results of the tryout showed that the pupils' mean scores

improved from 11.62 (needs improvement) to 21.35 (very satisfactory). This means that the IGDL is a suitable and effective material for Grade 6 Science.

Moreover, the t-test result showed a significant difference at .05 level in the mean scores of learners in the pretest and posttest. It implies that the features of the IGDL can motivate and sustain the interest of the grade 6 pupils that eventually improved their test scores from pretest to posttest.

Such finding was similar to the study of Magallanes (2019) on the effectiveness of infographics on the mastery level of Grade 6 learners in Science, which revealed that the employed intervention significantly improved learners' acquisition of Science concepts.

## CONCLUSIONS

Based on the findings of the study, there are some learning competencies in Grade 6 Science that, in the perception of the Grade 6 teachers, are best taught using infographics.

Further, it can be concluded that the developed Infographics in Guided Discovery Lessons are valid in terms of content, instructional, and technical qualities. Moreover, the IGDL is effective in teaching Grade 6 Science. Thus, it can be used by Grade 6 Science teachers for their pupils to attain the learning competencies indicated in the curriculum for Grade 6 Science. Therefore, Mayer's Cognitive Theory of Multimedia Learning showed that when concepts and ideas are expressed in the form of signs, images, graphs, text, and colors rather than only text, learners understand the concepts better. As a result, students will be able to create knowledge, become active learners, explore concepts, and participate in creative activities.

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