Utilization of the Modified Frayer Model and Semantic Map Its Effectiveness on The Attitude of Grade 7 Science Learners

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ABSTRACT

The study examines the link between the attitude toward science of the subjects in both experimental and control groups after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching and utilizing the modified Frayer model and semantic map graphic organizers. The results show that most of the subject students in the experimental group after the intervention strongly agreed that they; usually understand what they are talking about in science, easily understand science, feel confident in their ability to understand scientific concepts and ideas, and science developed their reasoning and problem-solving skills. However, the control group showed that the non-utilization of the instruction is ineffective in improving the student subjects of their attitude toward science. It appears that the utilization of this graphic organizer is more successful in enhancing subjects' attitudes toward science than the non-utilization of the teaching method. This suggests that the use of these graphics organizers is an effective method for enhancing students' attitudes toward Science. The mean score of the control group before and after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching was 2.17 with a standard deviation of 0.27, and the mean score of 2.15 with a standard deviation of 0.29, respectively. The t-value is 0.344 and the p-values is 0.732, which is greater than 0.05. The results no significant difference in the attitude of the subjects in the control group toward science. The experimental group before the utilization of the Modified Frayer Model and Semantic Map graphic organizers is 2.83 with a standard deviation of 0.551, while the mean score of the experimental group is 4.21 with a standard deviation of 0.49. that the t-value is -13.435 with a p-value of 0.000, which is less than 0.001, this show that the difference is highly significant.

The difference between the control and experimental after the non-utilization and utilization of the Frayer Model and Semantic Map was with a mean score of 2.15 with a standard deviation of 0.29 after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching, while the experimental group has a mean score of 4.21 with a standard deviation of 0.49 after the instruction utilizing the Modified Frayer Model and Semantic Map graphic organizers. The results show that the mean of the experimental group is significantly higher than the mean of the control group. The t value is -25.504 with a p-value of 0.000 which is less than 0.001, highly significant. Considering the results presented above, the null hypothesis states that there is no significant difference in the motivation toward science of the subjects in the experimental group after receiving instruction utilizing the modified Frayer model and semantic map graphic organizers, was rejected.

Keywords: Modified Frayer Model, Semantic Map, Graphic Organizers, and attitude towards Science

INTRODUCTION

Students' attitude towards science education is taken into consideration, it is important that it can influence

their engagement in learning outcomes in studying the subject matter. Students' interests and attitudes towards school science can have an effect on the quantity and quality of their learning outcomes. Additionally, students' skills in science support their engagement in science learning activities. Students' involvement and their perspectives on science are influenced by the learning environment and motivation as well. According to a study, the science laboratory learning environment of students and science learning motivation can be used to determine their student engagement in science learning. In a related finding, motivation to learn science is said to have moderated the linkage between the attitudes toward STEM courses and interest in STEM careers among secondary students as per Razali et al. (2020). Research has also shown that career motivation also stimulates learners' science learning. The topic of attitudes toward science has been discussed for many years in science education research, as noted by Aini et al. (2019) above.

Additionally, Denessen et al. (2015) indicated that longitudinal studies had confirmed a decrease in more positive attitudes about science and technology among elementary students; however, girls were found to show negative attitudes less compared to their male peers. Furthermore, it is also observed that learners with positive attitudes about science perform well in science class (Hacieminoglu, 2019). Finally, variables that impact on students' perceived attitude towards science include interest, motivation, teacher support, challenge, gender, learning environment, and career motivation. These aspects can influence students' involvement & results on science education grounds. Educators and researchers must be aware of these influences to encourage a favorable perspective on science and improve students' performance.

The Frayer Model and Semantic Maps as Instruction Strategies for Enhancing Students' Attitude Toward Science, using the Frayer Model as a way of developing the vocabulary of selected students in science. The students work with this model for example by defining the term word, offering some instances and non-cases, and creating a picture or a drawing on the topic. Active engagement with vocabulary encourages better comprehension to increase the likelihood of the learner having a positive view of science (Estecioa, 2017). Unlike semantic maps which are visual representations of the web as a series of connected and related concepts, students who draw semantic maps can visualize interconnections in scientific ideas, discovering relationships of different ones. Seeing complex subjects presented visually could also aid the students in developing a more coherent and organized understanding of science and improve their attitude toward it (Shin, 2022). The Frayer Model and semantic maps allow learners to engage in active engagement involving critical thinking, and meaningful connection to real-life situations. Through these instructional strategies, learners can find science engaging and applicable in their daily lives, thus developing a positive perception of science. Moreover, using the Modified Frayer Model and semantic maps can contribute positively to the students' inclination toward science. Such instructional strategies result in greater student participation, enhanced comprehension, and genuine learning links that can help improve students' opinions about science.

The ultimate goal of the researchers is to provide evidence-based recommendations for teachers and educators on how to effectively integrate the modified Frayer Model and Semantic Map graphic organizers into their teaching practices to improve students' science comprehension and science skills, by investigating the influence of specific graphic organizers like Frayer model and Semantic Map. The researchers can help identify the best methods and techniques in the classrooms, and also, support students in achieving academic success in science, particularly by identifying the best attitudes in learning science.

Objectives of the study

This study aimed to investigate the influence of modified Frayer Model and Semantic Map graphic organizers on the student's attitude towards Science of the Grade 7 students in Alabel National High School, Sarangani Philippines during the School Year 2022-2023. Specifically, this study tried to:

1. Describe the attitude toward Science of the subjects in the experimental and control groups before and after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching and instructions utilizing the modified Frayer model and semantic map graphic organizers;
2. Find out the difference in the attitude toward Science of the subjects in the control group before and after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching;
3. Examine the difference in the attitude toward Science of the subjects in the experimental group before and after receiving instruction utilizing the modified Frayer model and semantic map graphic organizers;
4. Ascertain the difference in the attitude toward Science of the subjects in the control and experimental groups after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching and instruction utilizing the modified Frayer model and semantic map graphic organizers;

Hypotheses of the Study

1. There is no significant difference in the attitude toward science of the subjects in the control group before and after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching and instructions utilizing the modified Frayer model and semantic map graphic organizers;
2. There is no significant difference in the attitude toward science of the subjects in the experimental group before and after receiving instruction utilizing the modified Frayer model and semantic map graphic organizers;
3. There is no significant difference in the attitude toward science of the subjects in the control and experimental groups after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching and instruction utilizing the modified Frayer model and semantic map graphic organizers;
4. There is no significant difference between the attitude toward science of the subjects in the experimental group after receiving instruction utilizing the modified Frayer model and semantic map graphic organizers.

METHODOLOGY

Research Design

The study utilized a quasi-experimental research design. Quasi-experimental research designs, like experimental designs, test causal hypotheses. Quasi-experimental designs identify a comparison group that is as similar as possible to the treatment group regarding baseline (pre-intervention) characteristics (White & Sabarwal, 2014). The experimental subjects were assessed in their attitude using the Modified Frayer Model and Semantic Map. This quantitative study utilized a pre-survey and post-survey with the experimental groups to determine if the Modified Frayer Model and Semantic Map graphic Organizers enhance students' attitudes toward Science.

The researcher employed pre-survey and post-survey designs to compare two groups after only one group received treatment (Creswell, 2003). The posttest-only quasi-experimental methodology comprised two processes: a) compiling and analyzing data and information statistically, and b) completing a comparison analysis of the experimental groups (Christensen et al., 2014; Creswell, 2013).

This research study employed one control and experimental groups which were compared, both groups received the non- utilization the Modified Frayer Model and Semantic Map and the utilization of the Modified Frayer Model and Semantic Map graphic organizer. The pre and post-survey were compared to

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measure the attitude of the subjects toward Science after receiving the intervention.

Study Sites

This research study was conducted at Alabel National High School, located at Lalisan St. Poblacion Alabel Sarangani Province, Philippines. The school was established on July 27, 1966, through Republic Act 5447 (Barrio Charter) by Dr. Pedro T. Orata, the founder of barrio schools. It was then put into law on May 26, 1988, by Pres. Corazon Cojuangco-Aquino, the Republic Act No. 6655, a free public act, emphasized subsidizing all barangay high schools by the national government.

The school is dedicated to offering the best educational resources to both residents of Barangay Poblacion, Alabel, and the surrounding areas by the school's vision "We dream of Filipinos who passionately love their country and whose competencies and values enable them to realize their potential and contribute meaningfully to building the nation. As a learner-centered public institution, the Department of Education continuously improves itself to serve its stakeholders better" and to its mission "To protect and promote the rights of every Filipino to quality, equitable, culture-based, complete primary education where: Students learn in a child-friendly, gender-sensitive, safe and motivating environment, Teachers facilitate learning and constantly nurture every learner", and has more than 56 years of experience in the field of education. With this, the administrators and staff maintain an environment conducive to good learning as stewards of the institution. Families, communities, and other interested parties are actively involved and co-responsible for fostering lifelong learning. Alabel National High School follows the K-12 curriculum with a whole level of secondary education from Grades 7-10 (Junior High School) to Grades 11-12 (Senior High School).

To support the existing educational facilities, Alabel National High School is equipped with various of the best facilities, including a Multifunction gym that also functions as an outdoor activity gym, a large Learning Centre field, an introduction to information technology as a medium for teaching with using computers in the computer laboratories, a learning atmosphere that is conducive and adapted to the needs of students, Chemistry, and Biology, a library equipped with computers, Indoor and Outdoor Play Area, Basketball Court and School canteen, and Parents Lounge designed explicitly for parents waiting for students to go home.

RESPONDENTS AND DATA COLLECTIONS

The subjects of this research study were grade seven junior high school students of Alabel National High School. One experimental and controlled group were identified as the subject for this research, each group was composed of fifty (50) students a total of one hundred (100) subjects took part in both pre-post-test and survey questions. The subjects of the study were both subject classes of the researcher, they were chosen not only for their accessibility and convenience but also because they are heterogeneous in terms of academic performance. Using heterogeneous classrooms as subjects in the Quasi-experimental method is advantageous. Heterogenous classes have varying abilities, backgrounds, and experiences, that can provide ample sources of data for the study (Cohen, Manion, & Morrison, 2018). Furthermore, The diverse student populations can draw applicable and more realistic conditions of the classroom set-up under treatment. This also can reflect the reality of most classroom settings, which can improve the external validity of the study, which can lead to a better capture of the complexity of the classroom environment, variations of students' abilities, attitudes, motivation, background, and learning styles (Trochim & Donnelly, 2016).

Before the study was conducted the researcher sought consent from the school division superintendent of the Division of Sarangani (See Appendix I). The researcher waited for the approval of the superintendent and sent a letter to the principal of Alabel National High School for the school conduct of the study (See Appendix II). Upon receipt of the approved letter, the researcher sent the Parent Consent Form (See Appendix III). The parent consent form was the basis for the Student Assent Form (See Appendix IV). The

study was conducted in the first School Year 2023-2024 grading period. Participation in this research as a subject is voluntary. The instrument used in this research study was adapted and students were required to answer the questions using the Google sheet form. This was administered in both the two computer laboratories. The Junior High School Coordinators and Homeroom Teachers helped the researcher distribute the informed consent form and student assent form to all potential subjects for the study. The potential subjects and parents were given one week to fill out and return the forms. Furthermore, the homeroom teacher, the grade seven coordinators, and the researcher administered the instrument before the intervention and after the intervention.

The administration of survey questionnaires were administered online (Google Forms) which means that the researcher did not use a hard copy of the test. In Alabel National High School culture, non-academic time means the extracurricular activity time or after school, which is 4:00 p.m. This is the time that the study subjects will answer the survey questions, before and after the intervention, on separate dates, to ensure that teaching-learning classes will not be not disrupted. Students who were identified as the subjects of the study were gathered in each room for the administration of the instruments. The homeroom teachers reminded the students that (a) they were volunteer participants and had the right to decline participation at any time without punishment, (b) their data would be kept anonymous and confidential, and (c) they could feel free to ask questions if they will not understand any part of the questionnaires. The researcher will explain the study's purpose and instruct them to complete the online survey.

Ethical Consideration

Prior to accessing the questionnaire, potential participants were informed of the study's purpose and nature through a consent form. This research study undergoes additional assurances set by CLSU dissertation committee supervision on the strict adherence to the University's Ethical Standard on research activities to seek the university's Ethics Review Committee (ERC) approval.

The data obtained from this study was stored in the author's data bank and shall only be shared with CLSU's official statistician. Strict confidentiality of data and anonymizing measures shall be adhered to in all stages of the data-gathering procedure until its analysis. Results may be shared with respondents and participating institutions if requested.

Instrument Used

Instruments are the tools that a researcher uses to collect data for the research study. It comes in several forms that are often used to the needs of a specific question or field. (Kumar, 2019). Surveys and questionnaires are tools used for measuring, observing, and documenting in both quantitative and qualitative research. It can be administered in person, by phone, or on any digital platform. The instrument design used in research is critical and essential for accurately representing data-studied phenomena (Fowler, 2020).

The instrument used in this study the attitude toward science consisted of 15 questions adapted from the instrument developed by Schruba (2016) in the study "Evaluation of Student Attitude Toward Science and Self-Efficacy in a Non-major College Biology Course". Furthermore, the researcher modified some of the statements in the instruments to fit the current research study. The subjects of the study were asked to answer the questions online through Google Forms. Using the 5-point Likert Type response where 1-Strongly Disagree, 2-Disagree, 3-Undecided, 4-Agree, and 5-Strongly Agree— the subjects of the study were asked to click the appropriate box of their response.

Additionally, the adapted research instrument was divided into three (3) parts. The first part of the instrument was about interest in Science with five different statements about possible interests of the subjects towards science. The second part of the instrument was about the importance of Science with five

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different statements about the possible perception of the subjects on the importance of Science. The third part was about the scientific literacy of the research subject toward science which has five different statements.

Lastly, the instrument used for intervention was the Modified Frayer Model and Semantic Map Graphic Organizers developed and enhanced by the researcher. The modified Frayer Model has four quadrants and in the middle of the four quadrants is the circle where a topic or term is to be written. The four quadrants represent different functions in the concept studied. The first quadrant is about, "How it Works" the second is "What it can be used for" the third is "What it can't be used for" and the last is" Diagram or label it" This model is flexible depending on the course topic since the coverage of the course topic during the conduct of this research was focused more on Chemistry therefore these sequence adapting the representation of each quadrant above. A semantic Map graphic organizer is also known as a concept map, this is a visual tool that organized and illustrates relationships. It has a central topic at the center and branches out for ideas related to the topic. It may be connected by arrows or lines. The arrows or lines represent its relationship to the main topic and also make the visual path of the definition, description, and flow of the concept.

DATA ANALYSIS

The answers provided by the subjects through the questionnaires were analyzed by descriptive and inferential analyses. The study utilized a quantitative approach and collected information through pretest and posttest. The collected data were analyzed using Statistical Package for Social Sciences (SPSS) and MS Excel Worksheet to make the computations easier in treating the data. The researcher tabulated and summarized the collected data using Microsoft Excel. Mean and standard deviation was used to describe the attitude toward the Science of the subjects in the experimental and control groups before and after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching and instructions utilizing the modified Frayer model and semantic map graphic organizers.

To address the first objective mean and standard deviation were used to describe the attitude toward Science of the subjects in the experimental and control groups before and after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching and instructions utilizing the modified Frayer model and semantic map graphic organizers.

To address the second, third, and fourth t-tests were applied to find out the difference in the attitude toward Science of the subjects in the control group before and after receiving the Modified Frayer Model and Semantic mode of teaching; examine the difference in the attitude toward Science of the subjects in the experimental group before and after receiving instruction utilizing the modified Frayer model and semantic map graphic organizers; ascertain the difference in the attitude toward Science of the subjects in the control and experimental groups after receiving the Modified Frayer Model and Semantic mode of teaching and instruction utilizing the modified Frayer model and semantic map graphic organizers.

RESULTS AND DISCUSSION

The data collected were analyzed and explained using statistical methods, in line with the research objectives.

This section consists of four parts between the control and experimental groups, such as a description of the subjects' attitude in Science under the Control group before and after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching, a description of the attitude in Science of the subjects in the experimental group before and after receiving instruction utilizing the modified Frayer model and semantic map graphic organizers, the difference in the attitude in Science of the subjects in the control

group before and after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching, the difference in the attitude in Science of the subjects in the experimental group before and after receiving instruction utilizing the modified Frayer model and semantic map graphic organizers, the difference in the attitude in Science of the subjects in the control and experimental groups after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching and instruction utilizing the modified Frayer model and semantic map graphic organizers.

Subjects' Attitudes Toward Science of Experimental and Control Groups Before After Receiving the Non-utilization of Modified Frayer Model and Semantic Map Mode of Teaching and Instructions Utilizing the Modified Frayer Model and Semantic Map Graphic Organizers

The study examines the link between the attitude toward science of the participants in both experimental and control groups after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching and utilizing the modified Frayer Model and Semantic Map Graphic Organizers. The researcher considers factors such as interest in science, the Importance of Science, and Scientific Literacy. The researcher calculated and presented Descriptive statistics: frequency count, percentage, and mean standard deviation; Inferential Statistics, paired-sample t-test, and independent-sample t-test

Table 1 shows the overall pooled mean of the control group before and after the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching was 2.17 and 2.8, respectively, which shows that subject students mostly disagreed with the condition statements. The overall pooled mean of the experimental group was 2.8 and 4.21 which shows that most subject students after utilization of the Modified Frayer Model and Semantic Map graphic organizers strongly agreed that they; usually understand what they are talking about in science, easily understand science, remember most of the things they learned in science classes, feel confident in their ability to understand scientific concepts and ideas, and science developed their reasoning and problem-solving skills. This just signifies that overall most of the subject students in the experimental group show interest in Science, lay the importance of Science, and scientific literacy improved.

This claim is supported by Palmer et al. (2017) that science's importance depends on pleasure, motivation, and attitudes toward scientific subjects as career opportunities. There is evidence that increasing the enjoyment, interest, and perceived competence of students improves numbers choosing to study science subjects at school Students' understanding and confidence can be amplified through the two models in relation to science concepts which are seen as important and thus enhancing the perception values.

Interest in Science

It can be seen in Table 1 that the pooled mean for interest in the science of the subjects in the control group before receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching was 2.00, while the pooled mean for interest in science after the non-utilization of Modified Frayer Model and Semantic Map mode of teaching was 2.12. This was followed by the statements "Science is one of my favorite subjects" with pooled mean of 2.06 and 2.42; "I would like to do some extra or un-assigned reading in science" with pooled mean of 2.24 and 2.16, and "the only reason I am taking science because I have to" with pooled mean of 1.84 and 1.90 before and after non-utilization of the Modified Frayer Model and Semantic Map mode of teaching, respectively. The control group's mean scores are fairly close for both Mean 1 and Mean 2, with a slight increase in scores when looking at Mean 2. This signifies that most of the subjects in the control group before and after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching disagreed that they were taking science because they have to, to do some extra or un-assigned reading in science and science as their favorite subject.

Additionally, the pooled mean for interest in the science of the subjects in the experimental group before the

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utilization of the Modified Frayer Model and Semantic Map graphic organizers was 2.78, while the pooled mean of the experimental group after the intervention was 4.14. It was seen that there's a big difference between the two mean results. Followed by the statements "I would like to do some extra or un-assigned" with the pooled mean of 3.02 and 4.18; "I have the real desire to learn Science" with the pooled mean of 2.88 and 4.10; "The only reason I am talking science is that I have to" with the pooled mean 2.88 and 4.14 before and after the utilization of the Modified Frayer Model and Semantic Map mode of teaching, respectively. This explains that subject students in the experimental group agreed that they have a real desire to learn science, and that they're taking science because they have to, to do some extra or un-assigned reading in science and science as their favorite subject, however, after receiving the intervention it was seen that most of the students in the experimental group show that that they're agreed to the statement about interest in science. This may be because the students in the experimental group enjoyed and engaged in learning science and hands-on activities given while utilizing graphic organizers.

This claim is backed up by Marty et al. (2017), who argue that traditional modes of science education are not strongly connected to students' ordinary experiences. Academic traditions have taught about science, its products, and methods but not always as something directly related to one`s everyday living. Applied tradition is centered on developing practical application of scientific knowledge and skills used by pupils on a daily basis. It seeks to create a relationship between science and society by directing students to consider their own decisions involving socio-scientific problems.

Table 1. Subjects' perceived attitude toward Science

Attitude	**Mean1**	**Mean2**	**Mean1**	**Mean2**
	Control		**Experimental**	
Interest in Science				
1. Science is something that I enjoy very much.	2.04	1.96	2.70	4.10
2. I have a real desire to learn science.	1.84	2.16	2.88	4.14
3.The only reason I am talking science is because I have to.	1.82	1.90	2.52	4.10
4. I would like to do some extra or un-assigned reading in science.	2.24	2.16	3.02	4.18
5. Science is one of my favorite subjects.	2.06	2.42	2.76	4.18
Pooled Mean	**2.00**	**2.12**	**2.78**	**4.14**
Importance of Science				
1.It is important to me to understand the work I do in the science class.	2.12	2.28	3.10	4.20
2. Most of the ideas in science is very useful.	2.54	2.38	3.02	4.24
3. Science is of great importance to my development.	2.38	2.22	2.76	4.22
4. I can get along perfectly well in everyday life in school with science.	2.26	2.30	2.90	4.32
5. Learning Science can give me confidence in learning.	2.22	1.92	2.52	4.26
Pooled Mean	2.30	2.22	2.86	4.25
Scientific Literacy				
1. I usually understand what we are talking about in science.	2.20	2.02	3.26	4.22
2. I easily understand science.	2.10	1.98	2.84	4.42
3. I remember most of the things I learn in science class.	2.16	2.38	2.56	4.18
4. I feel confident in my ability to understand scientific concepts and ideas.	2.20	1.98	2.80	4.20
5. Science developed my reasoning and problem solving skills.	2.36	2.24	2.80	4.18
Pooled Mean	2.20	2.12	2.85	4.24
Over-all Mean	2.17	2.15	2.83	4.21

Legend:

0.00 – 1.80	Strongly Disagree	Control/Experimental Mean1 = (Before) Mean Attitude toward Science
1.81 – 2.60	Disagree	Control/Experimental Mean2 = (After) Mean Attitude toward Science
2.61 – 3.40	Undecided	
3.41 – 4.20	Agree	
4.21 – 5.00	Strong Agree	

Importance of Science

Table 1 shows that the pooled mean for the importance of science of the subjects in the control group before receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching was 2.30, while the pooled mean of the control group after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching was 2.22. Followed by the statements "Most of the ideas in science is very useful" with pooled mean of 2.54 and 2.38; "Science is of great importance to my development" with a pooled mean of 2.38 and 2.22; "Learning Science can give me confidence in learning" with the pooled mean of 2.22 and 1.92 before and after non-utilization of Modified Frayer Model and Semantic Map mode of teaching, respectively. Results show that the subjects in the control group disagreed on the importance of understanding their work in science, that science is useful, that science can give great importance in their development, and that learning science can give confidence in learning, even before and after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching. This may be because students in a controlled group experienced the traditional way of teaching where students rely mostly upon teachers' instructions and lack of applicability in students' everyday lives.

According to Marty et al. (2017), these traditional ways of teaching science have been questioned because they do not relate to the experiences and interests of ordinary learners. Traditionally, this involves teaching the techniques and products of science without much reference to how they relate or are applicable in people's everyday lives. Applied traditions focus on teaching scientific knowledge and skills to be used by students in practice. Moral tradition seeks to create bonds among students' decisions about socio-scientific matters in a manner that relates to science and society.

It is also shown in Table 1 that the pooled mean for the importance of science for the subjects in the experimental group before utilizing the Modified Frayer and Semantic Map graphic organizers was 2.86, while the pooled mean after the intervention was 4.25. This shows that the subjects agreed that science gives them confidence, ideas in science are very useful, they understand their work in science and science gives great importance to their development. This overall result was supported by the following statements "It is important to me to understand the work I do in the science class" with the pooled mean of 3.10 and 4.20; "Most of the ideas in science is very useful" with the pooled mean of 3.02 and 4.24, and "Learning Science can give me confidence in learning" with the pooled mean of 2.52 and 4.26 before and after utilizing the Modified Frayer Model and Semantic Map as intervention. The results show that most of the students in the experimental group after the intervention agreed that they understand the work they do in science and give importance to their development, also, they believed that most of the ideas in science is useful and Science can give them confidence in learning. This may be because students acquire their confidence, and understanding, and find the importance of science when they're learning with the utilization of the tools inside the classroom such as the Modified Frayer Model and Semantic Map.

Dazzeo and Rao (2020), confirm this finding when he notes that there are two specific instructional approaches; Frayer Model and Semantic Mapping that are known to develop, improve, and promote student's understanding and self-confidence. The Frayer Model: A Graphic Organizer for Learning New Concepts. Literature reveals that it works in improving students' performance and their grades in different subjects for example biology, economics and physics (Akhtar et al., 2020).

Scientific Literacy

It can also be seen in Table 1 that the pooled mean of the subjects in the control group before and after the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching were 2.20 and 2.12, respectively. This was supported by the statements "Science developed my reasoning and problem-solving skills" with the pooled mean of 2.36 and 2.24; "I remember most of the things I learn in science class" with a pooled mean of 2.16 and 2.38, and "I easily understand Science" with the pooled mean of 2.10 and 1.98 before and after the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching. This shows that students disagreed that Science developed their reasoning and problem-solving skills, they remember most of the things they learned in science and they can easily understand science. This may be because subject students in the control group were not satisfied with their curiosity in learning science, this often uses a teacher-oriented methodology as described earlier, in which the teacher teaches the students through reading, lecture, demonstration, etc.

In particular, the study by Bernardo et al. (2023), aimed at assessing machine-learning techniques for profiling of low-proficiency science students from the Philippines. It showed a poor average science literacy score of Filipino learners than with others that suggest, traditional teaching methods might not give good scientific literacy learners in the Philippines.

On the other hand, the pooled mean of the experimental group before and after the utilization of the Modified Frayer Model and Semantic Map graphic organizers as the intervention were 2.83 and 4.21, respectively. Followed by the statements "I usually understand what we are talking about in science" with the pooled mean of 3.26 and 4.22; I easily understand science" with a pooled mean of 2.84 and 4.42, and "Science developed my reasoning and problem-solving skills" with the pooled mean of 2.80 and 4.18, respectively. This shows that subject students in the experimental group agreed that they; usually understand what they are talking about in science, easily understand science, and science develop their reasoning and problem-solving skills. This may be because subject students in the experimental group were able to utilize the Modified Frayer Model and Semantic Map graphic organizers comprehensively. Utilizing the four grid boxes and map-connected ideas enables learners to comprehend as well as retrieve a certain concept through the comprehensive description. The model makes it easier for teachers to pass across their messages and also enables students to understand scientific ideas better.

Studies indicate that incorporating the Frayer Model and the Semantic Map is likely to lead to improvements in students' scientific proficiency. For instance, an investigation carried out by Akhtar and Saied (2022) revealed that the Frayer model could enhance the scientific literacy of the students. It was established at the end of the study that students had an easy time understanding scientific concepts through the use of the Frayer Model and were able to recall what they learned in their science lessons.

Likewise, in another study by Hartono et al. (2023), the relationship between adopting the Frayer model and the semantic map, the science literacy level of high school students was explored (Hartono et al., 2023). It was evident that the application of the Frayer model enhanced students' ability to read and write science concepts related to genetics. The study also highlighted the use of such instructional models as the Frayer model among others, which are instrumental in improving students' comprehension about scientific concepts.

Difference in the Attitude Toward Science of the Subjects in the Control Group Before and After Receiving the Non-utilization of the Modified Frayer Model and Semantic Map Mode of Teaching

Table 2 illustrates the comparison of the subject's attitude toward science in the control group before and after receiving non-utilization of the Modified Frayer Model and Semantic Map mode of teaching. The Mean score of the control group was analyzed using inferential statistics and paired-sample statistics to determine if there was a significant difference between the results.

Table 2. Differences in the attitude toward Science of the subjects in the control group before and after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching

Control Group	n	Mean	SD	$t_{(49)}$	p-value	Interpretation
Before	50	2.17	0.27	0.344	0.732	Difference is NOT significant
After		2.15	0.29			

According to the data presented in the table 2, the mean score of the control group before and after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching was 2.17 with a standard deviation of 0.27, and the mean score of 2.15 with a standard deviation of 0.29, respectively. These results suggest that the mean scores are not significantly higher than the mean score of the subjects after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching. The table also shows the t-value is 0.344 and the p-value is 0.732, which is greater than 0.05. This may explain why the attitude of the subjects insignificantly did not improve after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching in Science. This seemed to suggest that the non-utilization of the Modified Frayer Model and Semantic Map way of teaching is not effective in improving student subject's attitudes toward science. Maybe because students were not able to get involved during the teaching-learning process. This explains that the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching was mostly led by the teacher and was not engaged leading to a weakened perception of learning science.

The findings supported by Shah and Khan (2015) investigated the impact of multimedia-assisted learning the academic outcomes and attitudes among elementary education students. The lack of satisfaction of student's desires or goals by the teachers led the students to develop a negative attitude towards Science learning. This implies that the non-utilization of the Modified Frayer Model and Semantic Map teaching techniques might not be successful in engaging students and meeting their expectations hence the negative perception of the study of Science. Another study indicated that traditional modes of teaching approaches are linked with negative science attitudes (Tomas & Geaca, 2018). This includes rote learning, which is a common feature of traditional teaching methods. Rote learning can lead to a lack of engagement and interest in science among students.

With the findings stated above, the null hypothesis which states that there is no significant difference in the attitude toward science of the subjects in the control group before and after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching, is accepted.

Difference in the Attitude Toward Science of the Subjects in the Experimental Group Before and After Receiving Instruction Utilizing the Modified Frayer model and Semantic Map Graphic Organizers

It is shown in Table 3 the difference in the attitude of the student subjects towards the experimental group before and after receiving the instruction utilizing the Modified Frayer Model and Semantic Map graphic organizers, by analyzing the before and after mean scores of the experimental group.

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Table 3. Difference in the attitude toward Science of the subjects in the experimental group before and after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching

Experimental Group	n	Mean	SD	$t_{(49)}$	p-value	Interpretation
Before	50	2.83	0.55	-13.435	0.000	Difference is highly significant
After		4.21	0.49			

The table reveals that the mean score of the experimental group before the utilization of the Modified Frayer Model and Semantic Map graphic organizers is 2.83 with a standard deviation of 0.551, while the mean score of the experimental group is 4.21 with a standard deviation of 0.49. These findings show that the mean score of the experimental group after the intervention is significantly higher than of before the utilization of the instruction. Furthermore, the table shows that the t-value is -13.435 with a p-value of 0.000, which is less than 0.001. The difference in the subject's attitude towards science under the experimental group before and after receiving the instruction utilizing the Modified Frayer Model and Semantic Map graphic organizers can be most likely due to the fact that student's attitudes towards science were more of social interaction and collaboration where it ignites their interest in a science subject, understanding the importance of science and being literate in learning science.

Supported by the study carried out by Yasir, et al. (2022) the study focused on the efficacy of ethnoscience-based mind mapping video in improving student's science literacy competency. Results indicated that mind mapping using video scribe helped students construct their understanding of science materials, and improve scientific literacy and interest. Hence it is evident that semantic mapping may enhance students' interest in science and understanding of science concepts. Semantic mapping was also explored by Sopian (2019) in a research that investigated vocabulary mastery among ninth graders. This revealed that the experimental group performed better than the control group because semantic mapping does help with students' vocabulary acquisition. This implies that semantic mapping influences students' language development and is of significance to scientific literacy. Furthermore, research has revealed that the Frayer Model influences interest in science as well as student's expectations about working with sciences. It has been found that a combination of Frayer Model and parents' support, self-efficacy and value beliefs, can directly predict students' expectations of science career (Wang et al. 2019). Students' interest in science should also be increased by improving their understanding of scientific theories and allowing them to use these theories in practical situations (al-Tonsi, 2022).

With the above findings, the null hypothesis states that there is no significant difference in the attitude toward science of the subjects in the control and experimental groups after receiving the non-utilization of the Modified Frayer Model and Semantic Map mode of teaching and instruction utilizing the modified Frayer model and semantic map graphic organizers, is rejected.

Difference in Attitude Toward Science of the Subjects in the Control and Experimental Groups After Receiving the Non-utilization of Modified Frayer Model and Semantic Map Mode of Teaching and Instruction Utilizing the Modified Frayer Model and Semantic Map Graphic Organizers

Table 4 presents the difference in attitude toward Science of the student subjects in the control and experimental groups after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching and instruction utilizing the Modified Frayer Model and Semantic Map graphic organizers, by analyzing the mean scores of the two groups.

The table reveals that the mean score of the control group was 2.15 with standard deviation of 0.29 after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching, while the experimental group has a mean score of 4.21 with a standard deviation of 0.49 after the instruction utilizing

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the Modified Frayer Model and Semantic Map graphic organizers. The results shows that the mean of the experimental group is significantly higher than the mean of the control group.

Table 4. Difference in attitude toward Science of the subjects in the control and experimental groups after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching and instruction utilizing the modified Frayer model and semantic map graphic organizers

Groups	n	Mean	SD	$t_{(98)}$	p-value	Interpretation
Control	50	2.15	0.29	-25.504	0.000	Difference is highly significant
Experimental		4.21	0.49			

The table also presents that the t value is -25.504 with a p-value of 0.000 which is less than 0.001, highly significant. The attitude toward Science of the student subjects in experimental group utilizing the Modified Frayer Model and Semantic Map graphic organizers resulted in significant improvement in learning science. However, the control group showed that the non-utilization of Modified Frayer Model and Semantic Map mode of teaching seems not effective in improving the student subjects of their attitude towards science.

Additionally, it appears that the utilization of the Modified Frayer Model and Semantic Map graphic organizers was more successful in enhancing subjects attitude towards science that of the non-utilization of Modified Frayer Model and Semantic Map mode of teaching method. This is may be because the subjects were enjoyed using specific organizers like Frayer Model and Semantic map in learning science, collaborating to one another leads them to be literate in science, understand the importance of science to their development and build their confidence that makes them interested to the subject matter in science.

The utilization of Modified Frayer Model and Semantic map resulted in a significant improvement of the student subjects to their attitude toward science. This suggests that the use of these graphic organizers is an effective method for enhancing subjects attitudes towards Science. It was observed that in the attitude of the students under the experimental group before and after utilizing these specific graphic organizers in the classroom there might be several factors that attributed to the attitude of the student subjects. These may include their understanding of scientific concepts and their ability to apply them in the real-world context, their literacy skills in thinking critically, analyzing information, and understanding the nature of science, this further develops a learning environment that promotes active engagement, meaningful connections to the real-world contexts and deep understanding in recognition of the importance of science in their life as learners.

Research regarding the Frayer Model and Semantic Map shows that the Frayer Model Model may act as an interesting aid for students to learn new science ideas, it is important to note that the model only works if used effectively. Therefore, the Frayer Model encourages active learning by engaging students with them to define and explore the characteristics and examples of science concepts. This can help improve student's interest in Sciences as this may facilitate a deeper understanding of scientific concepts (Dazzeo & Rao, 2020). Artayasa et al. (2021) conducted a study that explored whether Guided Inquiry Learning supplemented by Concept Maps enhances students' scientific literacy. It was therefore established at the end the inquiry learning approach coupled with a concepts map assisted scientific literacy students. Fitria et al. (2023) examined the effectiveness of a graphic organizer-based scientific literacy learning model in elementary schools. The study concluded that this learning model was effectively used in fourth-grade classrooms, suggesting its potential to enhance students' scientific literacy.

Considering the results presented above, the null hypothesis states that there is no significant difference in the motivation toward science of the subjects in the experimental group after receiving instruction utilizing the modified Frayer model and semantic map graphic organizers, is rejected.

CONCLUSION

Prior to being exposed to the non-utilization of Modified Frayer Model and Semantic Map mode of teaching most of the subjects in the control group before and after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching disagreed that science is something that they enjoyed very much, that they had a real desire to learn science, they're taking science because they have to, to do some extra or un-assigned reading in science and science as their favorite subject. It was seen that there's a big difference between the two mean results. This explains that most of the students in the experimental group disagreed to disagreed that science is something that they enjoyed very much, that they have a real desire to learn science, and that they're taking science because they have to, to do some extra or un-assigned reading in science and science as their favorite subject, however, after receiving the intervention it was seen that most of the students in the experimental group show that that they're agreed to the statement about interest in science. This may be because the students in the experimental group enjoyed and engaged in learning science. Furthermore, results show that the subjects in the control group disagreed on the importance of understanding their work in science, that science is useful, that science can get perfectly well life every day, and that learning science can give confidence in learning, even before and after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching.

Also, the subjects agreed that science gives them confidence, ideas in science are very useful, they understand their work in science and science gives great importance to their development. This shows that student subjects in the experimental group agreed that they; usually understand what they are talking about in science, easily understand science, remember most of the things they learned in science classes, feel confident in their ability to understand scientific concepts and ideas, and science developed their reasoning and problem solving skills. This may be because subject students in the experimental group were able to utilize the Modified Frayer Model and Semantic Map graphic organizers comprehensively. Utilizing the four grid boxes and map-connected ideas enables learners to comprehend as well as retrieve a certain concept through the comprehensive description. The model makes it easier for teachers to pass across their messages and also enables students to understand scientific ideas better.

The results from the control group, before and after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching that the attitude of the subjects insignificantly did not improve after receiving the non-utilization of Modified Frayer Model and Semantic Map mode of teaching in Science. This seemed to suggest that the non-utilization of Modified Frayer Model and Semantic Map way of teaching is not effective in improving student subject's attitudes toward science. Maybe because students were not able to get involved during the teaching-learning process. This explains that the non-utilization of Modified Frayer Model and Semantic Map mode of teaching was mostly led by the teacher and was not engaged leading to a weakened perception of learning science. Furthermore, the difference in the subject's attitude towards science under the experimental group before and after receiving the instruction utilizing the Modified Frayer Model and Semantic Map graphic organizers can be most likely due to the fact that student's attitudes towards science were more of social interaction and collaboration where it ignites their interest in a science subject, understanding the importance of science and being literate in learning science.

The attitude toward Science of the student subjects in experimental group utilizing the Modified Frayer Model and Semantic Map graphic organizers resulted in significant improvement in learning science. However, the control group showed that the non-utilization of Modified Frayer Model and Semantic Map mode of teaching seems not effective in improving the student subjects of their attitude towards science. Additionally, it appears that the utilization of the Modified Frayer Model and Semantic Map graphic organizers was more successful in enhancing subjects attitude towards science that of the non-utilization of Modified Frayer Model and Semantic Map mode of teaching method. This is may be because the subjects were enjoyed using specific organizers like Frayer Model and Semantic map in learning science,

collaborating to one another leads them to be literate in science, understand the importance of science to their development and build their confidence that makes them interested to the subject matter in science.

The utilization of Modified Frayer Model and Semantic map resulted in a significant improvement of the student subjects to their attitude toward science. This suggests that the use of these graphic organizers is an effective method for enhancing subjects attitudes towards Science. It was observed that in the attitude of the students under the experimental group before and after utilizing these specific graphic organizers in the classroom there might be several factors that attributed to the attitude of the student subjects. These may include their understanding of scientific concepts and their ability to apply them in the real-world context, their literacy skills in thinking critically, analyzing information, and understanding the nature of science, this further develops a learning environment that promotes active engagement, meaningful connections to the real-world contexts and deep understanding in recognition of the importance of science in their life as learners.

Hence, utilizing the Modified Frayer Model and Semantic Map graphic organizers for instructions during the teaching-learning process led to a noteworthy enhancement in the student's attitude towards Science. This implies that utilizing the Modified Frayer Model and Semantic Map graphic organizers is a successful approach and technique to improve student subjects' attitudes toward Science. This would improve students' attitudes toward Science at Alabel National High School of Alabel Sarangani Province.

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