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Kinesthetic learning approach and process skills in science laboratory activities

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Abstract
Purpose: This study aimed to determine the influence of students' kinesthetic learning approach on e-learning process skills in a science laboratory during the COVID-19 Pandemic.
Research methodology: This quantitative study utilized a descriptive-correlational approach. This study administered two sets of survey questionnaires: an adapted survey questionnaire and a validated researcher-made questionnaire to determine the level of kinesthetic learning approach on e-learning and the level of students'science process skills. Mean and Pearson's r were the statistical tools used in this study. Further, there is no significant relationship between the kinesthetic learning approach of students and their science process skills.
Results: The findings showed that the level of kinesthetic learning approach of the students on e-learning in the new normal education is average and contributory to these findings were critical thinking, collaborative skills, creativity and innovation, and technology application. Meanwhile, the level of students' process skills in performing laboratory activities in science is high; specifically, the indicator basic science process skills are high and integrated science process skills are high.
Limitations: Using a complete enumeration technique, 128 Grade 9 students during the school year 2021-2022 were selected based on the criterion that they experienced conducting science laboratory activities in a new normal setting.
Contribution: The findings of the study were deemed significant to students, teachers, school administrators, and future researchers because they highlighted the need to align learning approaches to the learning needs of students, specifically in the science learning process, for them to actively engage and participate in learning.
Keywords: *Kinesthetic learning approach to e-learning, science process skills, science, grade 9 students, quantitative study descriptive-correlational approach.*
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1. Introduction

Science process skills in laboratory activities are significant in science education. However, during the COVID-19 crisis and public lockdown, scientific education at all levels worldwide faced significant challenges in organizing and implementing not only theoretical but also practical components of instruction. Through this, all are challenged to teach online, resulting in a significant absence of the traditional kinesthetic learning approach to education in conducting laboratory activities in science. Hence, the shift to an online environment for science activities has had a negative influence on students' ability to develop science process skills by performing science laboratory activities in a new normal setting.

On a worldwide scale, UNICEF (2020) stated that more than 1.5 billion students of every age around the world have been affected by school and university closures due to the pandemic. In the Western United States, Sansom (2020) cited that in terms of understanding chemistry concepts during the pandemic, students did not perform any hands-on laboratory work in this version of remote instruction, so they were unable to gain any additional skills with lab techniques and were therefore unable to continue building their expertise in science practices.

According to Aktamis and Ergin (2008), the goal of science education is to teach students how to use scientific process skills. In Slovakia, Babinčáková and Bernard (2020) found that during online lessons and laboratory activities, teachers expressed dissatisfaction that students did not develop manual laboratory skills, that multiple datasets were not explored and studied very well, and that they could not interact directly with their students, resulting in less effective discussion and less ability development in relation to laboratory activities.

Meanwhile, in the Philippines, Pacifico and Prudente (2021) at De La Salle University, Manila, Philippines, conducted a study on Grade 12 STEM students from a private school in Taytay Rizal, where most students were unable to submit their four-page laboratory worksheet outputs during their first experiment on a remote-learning setup for limiting and excess reagents. A total of 57 students completed and passed the aforementioned activity, accounting for only 30% of the responses, according to the report. As a result, the low frequency of completed and passed experiments involving limiting and excess reagents may be due to the unmastered methodologies, concepts, and abilities connected to the issue, which may impair their science process skills and performance in laboratory activities.

In an interview, grade 12 STEM students at a public school stated that the lack of hands-on learning makes it difficult for them to study in an online environment. One student added that if they were not the ones doing and directing the experiments and exercises, and if there was no supervision or guidance from the teacher, then it would be hard for them to do the activities. There would also be a barrier that prevents them from absorbing lessons and hinders them from developing scientific process skills. According to Abd Rauf, Rasul, Mans, Othman, and Lynd (2013), this can be achieved during the teaching and learning of science by providing opportunities to inculcate science process skills in their lessons.

In conclusion, this research aimed not only to understand students' performance in kinesthetic activities during the COVID-19 pandemic, but also to assist teachers in effectively integrating kinesthetic approaches in scientific teaching with students and closing learning gaps between traditional and new normal settings. On the other hand, this research may also help improve the incorporation of kinesthetic learning approaches, not only in a new normal setting of education but also in the development of society in terms of using various online modalities to help students develop their science process skills and competency in performing laboratory activities in the field of science.

1.1 Statement of the Problem

The purpose of this study was to explore students' kinesthetic learning approach to e-learning and their science process skills in performing laboratory activities in science at St. Mary's College of Tagum amidst the COVID-19 pandemic.

Specifically, this study sought to answer the following questions.

What is the level of kinesthetic learning approach of students to e-learning in the new normal of education in terms of:

1. critical thinking;
2. collaborative skills;
3. creativity and innovation; and
4. technology application?

What is the level of students' science process skills in performing laboratory activities in science in the new normal of education in terms of

1 basic science process skills
2. integrated science process skills?

Is there a significant relationship between the kinesthetic learning approach to e-learning and students' process skills in performing laboratory science activities?

1.2 Hypothesis

The following hypotheses were formulated and tested at a significance level of 0.05:

1. There was no significant relationship between the kinesthetic learning approach in e-learning and students' process skills in performing laboratory activities in science.
2. There are no indicators of the kinesthetic learning approach in e-learning that most significantly affect the science process skills of students conducting laboratory activities in science.

1.3 Review of Related Literature

1.3.1. Kinesthetic Learning Approach to e-Learning

Hands-on science is a popular educational technique in schools that includes action and participation in direct natural activities. This is an experience in which students actively handle items to gain information or comprehension. Laboratory lessons provide a significant pedagogical benefit by assisting students in transitioning from concrete facts and circumstances to abstract knowledge of the theories, concepts, and principles that these observations have led to (Bates, 2015). One more reason why laboratory education is advantageous from a pedagogical standpoint, according to him, is that it incorporates learners into a core cultural trait of science and engineering: all ideas must be rigorously explored in order to be regarded as true (Bates, 2015). Students must engage in bodily sensorimotor motions that result in motor patterns that guide reasoning and enable comprehension of the scientific processes explored when conducting science experiments with physical equipment (Kontra et al., 2015, as cited in Adkins (2020)).

In a study on the kinesthetic learning approach in e-learning, Wood and Sereni-Massinger (2016) discovered that by integrating active learning strategies in a digital environment with critical thinking activities and replication of actual experiences, students were engaged and able to gain a practical understanding of the subject. In this study, role-playing and real-world applications, such as simulations, interactive technologies, and gaming interfaces, allowed kinesthetic learners to fully immerse themselves in the learning environment.

Hence, it can be concluded that it is also the philosophy behind the kinesthetic learning approach, which is a model that promotes learning through doing because kinesthetic learning is a hands-on approach to education that works (Room), and that students who are learning science subjects and performing laboratory activities should be engaged in an experiential style of learning, especially at times like this, as we are experiencing a global crisis where drastic changes happen in relation to the learning of the students.

1.3.2. Science Process Skills for Doing Laboratory Activities in Science

Students' scientific processing skills help them comprehend science, obtain research approaches and methodologies, and solve challenges. According to Khayotha, Sitti, and Sonsupap (2015), the goal of science education is to enable individuals to use science process skills, which means being able to define problems in their environment and observe, analyze, hypothesize, experiment, conclude, generalize, and apply the information they have with the necessary skills. Students can learn these science process skills through various science education activities (Padilla, 1986). As a result, it is critical for students to develop scientific process skills that allow them to generate scientific information while also learning about the nature of science through their experience (UTA, 2017).

Another key point is that science process skills are crucial practical skills for developing scientific knowledge, and they play a vital part in students' process of producing scientific information and learning the nature of science by doing and experiencing it firsthand. Students with science process skills actively participate in their learning (Fugarasti, Ramli, & Muzzazinah, 2019). Students also discover a wide range of topics and solve numerous problems autonomously as a result of their activities (Everett, 2018). Furthermore, students will have first-hand experience with the innovative concept development process. Knowledge obtained from practical tasks has an effect on long-term memory. If the learning stage is designed in such a way, students will have opportunities to actively participate in learning (Safaah, Muslim, & Liliawati, 2017). Finally, students' mental activity is described by process skills, which necessitates reasoning. To inspire pupils to perform scientific inquiries, teachers must teach science skills, such as facts, ideas, and theories (Maranan, 2017).

1.4 Theoretical/Conceptual Framework

This research study is anchored in John Dewey's learning-by-doing approach, which emphasizes the importance of experiential learning in education. Pegg (2017) highlights the value of a hands-on approach, and Staff (2017) supports kinesthetic learning, which is learning-by-doing. As indicated by Wood and Sereni-Massinger (2016), online learning plays a crucial role in consolidating ideas and theoriesWood and Sereni-Massinger (2016). While Prabha (2016) stresses the necessity of hands-on experience in science laboratory activities, Bilgin (2006) addresses the significance of hands-on experience in science classes. In general, the theory of experiential learning states that involving students is significant in essential activities. (96)

Bartlett and Bell (2018) emphasize the value of a kinesthetic learning strategy and how it might improve student engagement in online learning. Kramer, Olson, and Walker (2018) discovered that, while teaching science process skills, well-made online courses can be more effective than conventional techniques. According to Staff (2017), allowing students to participate in practical activities can improve their learning processes. As Willits (2020) showed, a cyberschool environment may foster collaborative engagementWillits (2020), and science education can teach people how to use scientific methods in their daily lives, as shown by Aktamis and Ergin (2008).

Critical thinking, collaborative thinking, creativity, and technological application are crucial for successful online learning, according to the study of AlMahdawi, Senghore, Ambrin, and Belbase (2021) on chemistry e-learning during the COVID-19 pandemic. Students' engagement, understanding, and confidence were improved through online teamwork. Technology can also enhance creativity and innovation. This study suggests that by integrating a variety of digital tools with virtual laboratories and manipulatives, students may collaborate, construct, and explore new interpretations, concepts, designs, applications, and inventions.

However, the study of Santos and David (2017) highlights the importance of evaluating science process skills and integrating performance indicators to determine the SPS level of proficiency. Basic science process skills are crucial for scientific investigations, whereas integrated skills involve complex activities and hands-on e-learning. Despite the COVID-19 pandemic, a kinesthetic learning approach to hands-on laboratory activities remains relevant to learners' proficiency in conducting science laboratory activities. Therefore, integrating these skills into an SPS-level assessment is crucial to effective learning.

Figure 1 presents the conceptual paradigm of the study, and the independent variable is the kinesthetic learning approach to e-learning, wherein students' online class experiences should be related to a kinesthetic learning approach to e-learning. The indicators of the independent variable comprised critical thinking, collaborative skills, creativity, innovation, and technological application. The dependent variable was the science process skills in performing science laboratory activities of Grade 9 junior high school students, while the indicators of the dependent variable were the basic and integrated science process skills. The conceptual model shown in Figure 1 was formed by connecting the findings of various research investigations.

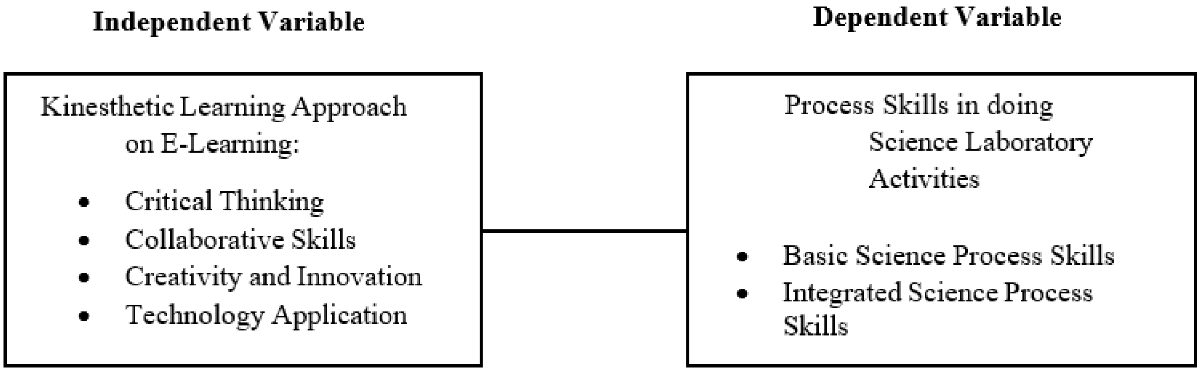

Figure 1. Conceptual Paradigm of the Study

1.5 Significance of the Study

This study explored students' kinesthetic learning approaches to e-learning and science process skills in performing laboratory activities in science in a new normal setting. These findings may benefit a variety of educational stakeholders including students, teachers, academic institutions, administration, and future researchers.

Students. Students may benefit significantly from the findings of this study because they will be more aware of the importance of using a kinesthetic approach to science when performing laboratory activities. It may assist them in learning how to deal with their learning style, since it encourages interaction and a hands-on approach to the subject. Finally, they may understand the importance of science process skills in interpreting phenomena, answering questions, formulating hypotheses, and obtaining knowledge.

Teachers. Furthermore, teachers can benefit from this research because they will be more aware of students' kinesthetic approaches to performing laboratory activities in science through e-learning. By understanding their learning preferences and determining what works best for them, this research may assist them in assessing which style is most relevant to students' learning. Teachers may help children by putting what they have learned from this research into use and giving them more opportunities to learn through a range of activities. It can also help them find answers to their students' specific questions about this online science learning approach as well as perform laboratory activities in this new normal setting.

Academic Institutions and Administration. The findings of this study may be useful to academic institutions and administrations, as they are responsible for the systematic transmission of knowledge and skills. They play a role in curriculum development; they can become more aware of these students' science process skills in e-learning during the pandemic. In addition, they must understand these insights and implement additional strategies to deal with this type of learning style.

Future Researchers. Furthermore, the findings of this study may be used as a guide for future large-scale research. The findings of this study can be used as a guide when researching subjects relevant to the subjects explored in this study.

2. Methodology

2.1. Research Design

This study used a descriptive-correlational quantitative design to statistically quantify and assess the variables. Quantitative research seeks to understand society, and this yields objective data that can be expressed using statistics and graphs (Williams, 2021). In addition, quantitative research involves collecting and analyzing numerical data, which are used in science and social science to identify patterns and averages, formulate hypotheses, assess causal relationships, and extrapolate results (Bhandari, 2023).

This study is quantitative in nature because it attempted to quantify the problem and understand its scope by looking for results that could be projected to a larger population. This research design is appropriate for this study because its goal was to determine the significant relationship between the kinesthetic learning approach in e-learning and science laboratory process skills in performing science laboratory activities. It is descriptive, as it outlines population or phenomenon characteristics; thus, it characterizes a population group and does not analyze why something happened. In the descriptive research, no variables were controlled for because they were observational. Researchers cannot control the nature or behavior of the variables (McCombes, 2019).

Using correlational design, we were able to examine and explain the relationship between the kinesthetic learning approach in e-learning and the science laboratory process skills in performing science laboratory activities, as well as the connection between these variables.

Additionally, the surveys measured the independent and dependent variables, and, according to McLeod (2018), a questionnaire collects data via phone, computer, or mail. This survey approach is the most suitable and efficient way to measure 128 grade 9 students at St. Mary's College of Tagum, Inc. in the school year 2021-2022.

2.2. Research Respondents

The respondents of this quantitative study were Grade 9 junior high school students enrolled in the school year 2021-2022 in one of a private school in Tagum City. A total of 128 Grade 9 students from the school year 2021-2022 were selected based on the criterion that they had experienced conducting science laboratory activities in the new normal setting. This study employed complete enumeration techniques, in which the entire population that shared a particular set of experiences and characteristics was surveyed (Research). Because a relatively small percentage of the overall population often possesses a specific set of qualities that researchers are interested in studying, it is likely that researchers chose to investigate the entire population. Total population sampling can be used to gain a deeper understanding of a topic in which an individual is interested. This was also because the entire population sampling included every member of the target population.

A local map of Tagum City, Davao del Norte, is presented in Figure 2. Although the implementation of educational services is still primarily the responsibility of the Department of Education, the City Administration of Tagum has been working to alleviate the shortage of educational inputs. The Local Government Unit (LGU) has been developing, upgrading, and constructing schools since the city was incorporated.

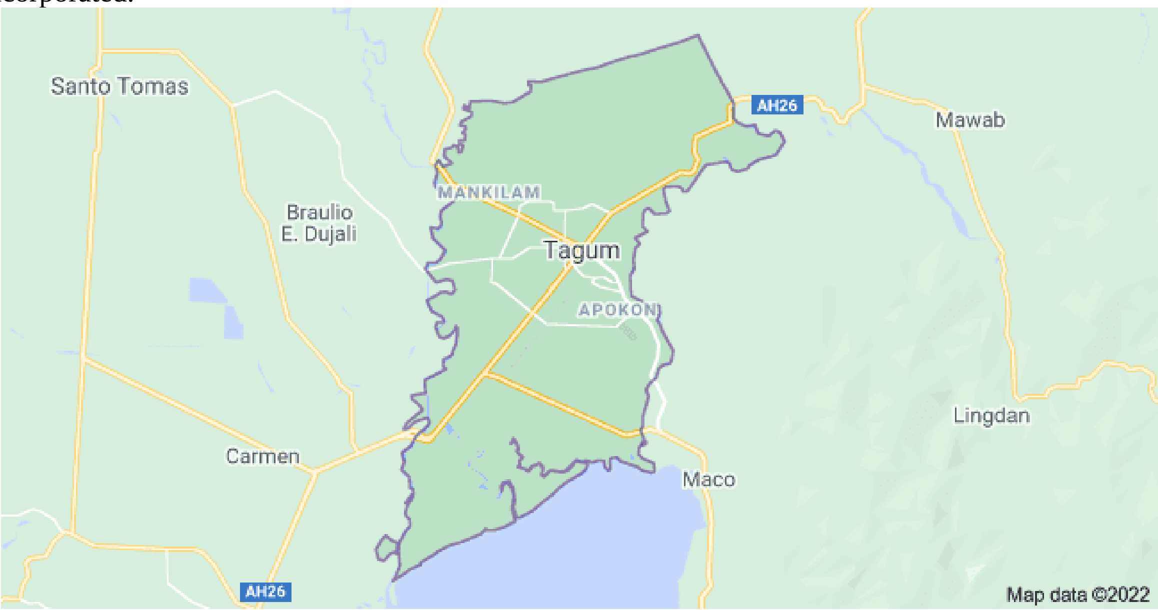

Figure 2. Map of Tagum City, Davao del Norte
Source: https://maps.google.com › maps

2.3. Research Instrument

The study used a researcher-made checklist and adapted questionnaires to gather information from the students' profiles. The questionnaires were pilot tested on 30 non-participants using Google Forms. The independent variable was adapted from previous research, whereas the dependent variable was a self-assessment questionnaire measuring students' process skills in science laboratory activities. These questionnaires were modified by the researchers.

Kinesthetic Learning Approach for e-learning. The first instrument is an adapted questionnaire from the study by AlMahdawi et al. (2021) entitled "High School Students' Performance Indicators in Distance Learning in Chemistry during the COVID-19 Pandemic" which was modified by the researchers to measure the kinesthetic learning approach to e-learning, which comprises critical thinking, collaborative skills, creativity, innovation, and technology application.

The researchers chose AlMahdawi's questionnaire over any other questionnaire because it is the most suitable for the study in relation to the kinesthetic learning approach to e-learning. There were 17 items for which the respondents were asked to describe the four indicators. Five items address critical thinking, five address collaborative skills, three address creativity and innovation, and the final four address technology application. Each statement was assessed on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

However, the Cronbach's alpha value shows that the questionnaire items have a high level of internal consistency, making them appropriate for this investigation. The instrument passed reliability testing and pilot testing. As shown in the study by AlMahdawi et al. (2021), the reliability coefficient for the five-point Likert scale is 0.939, which is higher than the usual acceptance level of 0.6. Moreover, in the analysis of the pilot test that was conducted by the researchers, the Cronbach value was 0.853 with a mean inter-item correlation of 0.254, which indicates a good consistency of the kinesthetic learning approach in e-learning, which means that the instrument is reliable.

To assess the students' level of kinesthetic learning approach to e-learning in the new normal of education, the range of means, descriptive equivalent, and interpretation as parameters were employed:

Range of Mean	Descriptive Equivalent	Interpretation
4.20 - 5.00	Very High	This means that kinesthetic learning approach of the students on e-learning in the new normal education is very highly evident.
3.40 – 4.19	High	This means that kinesthetic learning approach of the students on e-learning in the new normal education is highly evident.
2.60 - 3.39	Average	This means that kinesthetic learning approach of the students on e-learning in the new normal education is moderately evident.
1.80 – 2.59	Low	This means that kinesthetic learning approach of the students on e-learning in the new normal education is less evident.
1.00 – 1.79	Very Low	This means that kinesthetic learning approach of the students on e-learning in the new normal education is not evident.

Process Skills in Doing Science Laboratory Activities. The second instrument that is used to determine and measure students' level of science process skills in science laboratory activities is an adapted self-assessment from the study of Santos and David (2017) entitled "Self-and Teacher-Assessment of Science Process Skills" which was modified by the researchers and validated by science teachers. The tool was divided into two domains, namely Basic Science Process Skills and Integrated Science Process Skills, based on the results of the self-assessment questionnaire provided within the school year. Each statement was assessed on a 5-point Likert scale ranging from 1 (never) to 5 (always). However, this instrument has passed validity testing and has undergone a pilot test. Given the analysis of the pilot test, the results show that the 13-item questionnaire had a Cronbach's value of 0.871 with a mean inter-item correlation of 0.345, which indicates a good consistency of process skills in performing science laboratory activities, which means that the instrument is reliable.

To interpret the results on students' level of science process skills in conducting science laboratory activities, the range of means, descriptive equivalent, and interpretation were employed as follows:

Range of Mean	Descriptive Equivalent	Interpretation
4.20 – 5.00	Very High	This means that the students' science process skills in doing science laboratory activities is outstanding.
3.40 – 4.19	High	This means that the students' science process skills in doing science laboratory activities is satisfactory.
2.60 – 3.39	Moderate	This means that the students' science process skills in doing science laboratory activities is moderately evident.
1.80 – 2.59	Low	This means that the students' science process skills in doing science laboratory activities is fairly satisfactory.
1.00 – 1.79	Very Low	This means that the students' science process skills in doing science laboratory activities did not meet the expectations.

2.4. Data Gathering Procedure

Following panel members' approval, the researchers used subsequent research processes to collect data for the study.

Permission to Conduct the Study. The researchers obtained ethical clearance from the research ethics committee and sought approval for academic affairs from the school president, school principal, program head, and vice president. They also provided a letter to the science teacher stating their assistance in the study's success. The researchers sought approval from the Data Protection Officer to obtain the necessary data from the school registrar. This letter serves as a gatekeeper for this study.

General Orientation and Seeking of Consent from Research Respondents. The researchers sought help from a grade 9 science teacher as the gatekeeper for the study, ensuring confidentiality and access to personal data. They conducted a virtual meeting two days before the study to explain the research activity, its significance, and the importance of informed consent and parental consent forms. After a 30-minute orientation, informed consent and parental consent forms were distributed to the students to ensure their willingness to participate. Students were informed that both forms would be collected a day before the study, and that those who did not return consent would not be included. To protect the respondents' confidentiality, they were encouraged to use the comment section of the virtual platform for questions or clarifications. All personal data, including parental consent, were kept confidential.

Administration and Retrieval of Online Survey Questionnaire. The researchers provided instructions on answering the online survey questionnaires for both variables, allowing respondents to answer at their convenience within two to three days. After the study, the researchers immediately retrieved their responses. The researchers were also available for queries via virtual or phone calls, ensuring a smooth and efficient process for respondents.

Check, collect, and process the data. The researchers collected and analyzed data from the respondents using online survey questionnaires for each variable. The data were tabulated and analyzed by a statistician. The researchers interpreted the data and drew conclusions. The data were stored in an encrypted folder on a password-protected computer or a laptop. The information was kept for one year and then securely destroyed to prevent unauthorized access or dissemination. Electronic data were deleted, and material copies were completely destroyed through tearing and shredding.

2.5. Statistical Treatment of Data

The following statistical instruments were used for a more thorough interpretation and analysis.

Mean. This tool was used to determine the level of kinesthetic learning approach of the students on e-learning and the level of students' process skills in performing laboratory activities in science in the new normal education of grade 9 students for the school year 2021-2022 at St. Mary's College of Tagum Inc. based on the given indicators of each variable. This was used to answer Problems 1 and 2.

Pearson r. This tool was used to determine the significant relationship between the kinesthetic learning approach to e-learning and students' process skills in performing laboratory science activities. This is used to answer Problem 3.

Regression Analysis. This tool is utilized in this study to determine what indicators of the kinesthetic learning approach to e-learning most significantly affect the process skills of students in performing laboratory activities in science. This was used to solve Problem 4.

3. Results and Discussions

3.1. Level of Kinesthetic Learning Approach of the Students on e-learning in the New Normal Education in terms of Critical Thinking

The item "It is easy to understand new concepts in science in online classes" obtained the highest mean of 3.69 with a descriptive equivalent of high. This is followed by the item "Science activities in an online demonstration approach by the teacher makes me understand it easily," which has a mean of 3.50. On the other hand, the item "Having an online project in science is challenging" was the lowest indicator, with a mean of 1.84 or lower.

Meanwhile, the overall level of kinesthetic learning approach of the students on e-learning in the new normal education in terms of critical thinking had a mean of 2.90 with a descriptive equivalent of average. This means that students' kinesthetic learning approach to e-learning in the new normal of education is moderately evident. A standard deviation of 0.47 (SD<1.0) indicates the homogeneity of the responses for this indicator. Although students experience struggles in performing virtual science laboratory writing, it is moderately evident that students find the learning approach engaging.

Table 1. Level of Kinesthetic Learning Approach of the Students on E-Learning in the New Normal Education in terms of Critical Thinking

Items	SD	Mean	Descriptive Equivalent
1. It is easy to understand new concepts in science in online classes.	0.99	3.69	High
2. Virtual laboratory activities are interactive approaches to online learning.	0.99	3.38	Average
3. Having an online project in science is challenging.	0.99	1.84	Low
4. Writing virtual laboratory observation reports is difficult.	0.98	2.12	Low
5. Science activities in an online demonstration approach by the teacher makes me understand it easily.	0.94	3.50	High
Category Mean	**0.47**	**2.90**	**Average**

The findings concur with the ideas of Noris and Saputro (1970), who pointed out that learning tools utilizing virtual laboratory media are effective in improving students' critical thinking skills.

Accordingly, the study of Salam, Setiawan, and Hamidah (2010), cited in Noris and Saputro (1970), supports the findings of the study, as it emphasizes that the use of media in the form of a virtual laboratory can improve students' understanding of concepts, thus improving their critical thinking. A similar idea was shared by Cortázar et al. (2021), who stated that online project-based learning fosters the development of critical thinking.

3.2. Level of Kinesthetic Learning Approach of the Students on E-learning in the New Normal Education in terms of Collaborative Skills

Table 2 presents the kinesthetic learning approach of the students to e-learning in the new normal of education in terms of collaborative skills. The item "Collaborative learning activities in online science classes make me engaged" obtained the highest mean of 3.56 with a high descriptive equivalent. This is followed by the item "Science online classes provide various opportunities for collaborative group work approaches," which has a mean of 3.39. On the other hand, the item "Online science classes make it easy to work in groups" is the lowest, with a mean score of 3.21, or average.

Table 2. Level of Kinesthetic Learning Approach of the Students on E-Learning in the New Normal Education in terms of Collaborative Skills

Items	SD	Mean	Descriptive Equivalent
1. Science online classes provide various opportunities for collaborative group work approaches.	1.09	3.49	High
2. Collaborative learning activities in online science classes makes me engaged.	0.98	3.56	High
3. Online science classes make it easy to work in groups.	1.30	3.21	Average
4. Online science classes enhance my collaborative learning activities.	1.05	3.42	High
5. Presenting our projects in online science classes is easier for a more collaborative learning.	1.05	3.39	Average
Category Mean	**0.87**	**3.42**	**High**

The overall mean rating on the level of kinesthetic approach of the students on e-learning in the new normal education in terms of collaborative skills is 3.42 or high, which indicates that the kinesthetic learning approach of the students on e-learning in the new normal education is highly evident. The standard deviation of 0.87 (SD<1.0) implies the homogeneity of the responses for this indicator. It can be noted that respondents considered the importance of collaboration in conducting science activities, as is evident from their responses.

The result corroborates the ideas of Huezo (2017), who stated that interaction is an advantage to online classes wherein collaborative assignments can target critical higher-order thinking abilities required for learning in school and beyond, from the value of social learning to the practical application of communication and teamwork. The experience of trietiak (2020) confirms these findings, as she stated that she used group work as a way to boost classroom engagement and build a connection in the online classroom with the aim of offering and receiving feedback on students' individual projects because peer feedback is utilized to enhance their work.

3.3. Level of Kinesthetic Learning Approach of the Students on E-Learning in the New Normal Education in terms of Creativity and Innovation

Table 3 presents the level of kinesthetic learning approaches of the students to e-learning in the new normal of education in terms of creativity and innovation. The item "Engaging in online science lessons boosts my idea creation techniques, such as brainstorming," had the highest mean of 3.65 with a descriptive equivalent of high. This was followed by the item "Engaging in online science classes helps me solve complex problems," which has a mean of 3.53. The item with the lowest mean of 3.48 with a descriptive equivalent of low is "Engaging in online science classes limits my ability to be innovative.".

Table 3 . Level of Kinesthetic Learning Approach of the Students on E-Learning in the New Normal Education in terms of Creativity and Innovation

Items	SD	Mean	Descriptive Equivalent
1. Engaging in online science lessons boost my idea creation techniques such as brainstorming.	0.98	3.65	High
2. Engaging in online science classes help me solve complex problems.	0.97	3.53	High
3. Engaging in online science classes limits my ability to be innovative.	1.00	2.52	Low
Category Mean	**0.54**	**3.23**	**Average**

The level of kinesthetic learning approach of students to e-learning in the new normal of education in terms of creativity and innovation has a category mean of 3.23, or average. This implies that the item statements of the indicator "creativity and innovation" are moderately evident. The standard deviation of 0.54 (SD<1.0) indicated the homogeneity of the respondents' responses. The results imply that students consider engaging in online science classes as one of the best ways to create and share ideas. They even turned down the idea that engaging in an online science class limits their abilities.

The results of this study are consistent with the ideas of Esjeholm (2012) and Abedini (2020), who emphasized that in today's digital age, learners' cognitive abilities and creativity are influenced more by tools that include digital technologies, which helps facilitate their creativity and innovation with their capacities. In addition, Yustina, Syafii, and Vebrianto (2020) found that the manifestations conform to the study findings, as they found that project-based learning (through learning by doing) in online learning has the following advantages: students develop plans for projects that include brainstorming ideas, creativity, and innovation, and with that, students may be able to work together and be better than before, help one another, explain one another, and think creatively.

3.4. Level of Kinesthetic Learning Approach of the Students on E-Learning in the New Normal Education in terms of Technology Application

Table 4 shows the level of the kinesthetic learning approach of the students to e-learning in the new normal of education in terms of technology application. The item "Using technology saves time in online science classes" attained the highest mean of 3.75 with a descriptive equivalent of high, and it is followed by the item "I enjoy using the digital applications for my online science classes," which has a mean of 3.73. The lowest item, "Working with an approach of a new application or tool in an online science class makes me very confident," had a mean of 3.45 with a descriptive equivalent of high.

Table 4. Level of Kinesthetic Learning Approach of the Students on E-Learning in the New Normal Education in terms of Technology Application

Items	SD	Mean	Descriptive Equivalent
1. I enjoy using the digital applications (i.e., Microsoft teams, Canva, Jamboard, Gmeet, Schoology, and Zoom) for my online science classes.	0.97	3.73	High
2. Using technology saves time in online science classes.	1.02	3.75	High
3.Working with an approach of a new application/tools in an online science class makes me very confident.	0.95	3.45	High
4.When it comes to understanding science concepts, I understand it much better with an approach of integrating it with technology	0.91	3.59	High
Category Mean	**0.76**	**3.63**	**High**

The findings of the study have a category mean of 3.63 with a high descriptive equivalent, which means that the kinesthetic learning approach of students to e-learning in the new normal of education is highly evident. Moreover, the standard deviation value of 0.76 (SD<1.0) shows homogeneity of the responses to the items on the kinesthetic learning approach of the students on e-learning in the new normal education in terms of technology application. This implies that it is highly evident that students find technology applications significant for learning, especially in the new normal of education. The use of digital applications in their online science classes helps them understand science concepts easily.

The findings of the study are in parallel with the statements of Christensen (2019), who pointed out that using technology engages students in simulated experiences such as science projects and motivates them to hone their teamwork abilities. The proper use of technology allows students to experience exposure to various online learning tools. As seconded by Liu, Wang, Lei, Wang, and Ren (2020), they expressed that technology application through immersive virtual reality (IVR) helped students better understand science concepts in their study and that the high level of usefulness and perceived ease of use suggested that IVR did not distract students from their learning activities.

3.5. Summary of the Level of Kinesthetic Learning Approach of the Students to E-Learning in the New Normal Education

Reflected in Table 5 is the summary analysis of the measure of the level of kinesthetic learning approach of students to e-learning in the new normal of education. The data showed that among the four indicators, technology application had the highest mean of 3.63, with a high descriptive equivalent. This was followed by collaborative skills, which had a mean score of 3.42 or higher. Creativity and innovation have a mean of 3.23, or average. Finally, the lowest indicator is critical thinking, which has a mean of 2.90, or average.

The overall mean rating for the variable kinesthetic learning approach of the students on e-learning in the new normal of education was 3.30, with an average descriptive equivalent. The standard deviation of 0.52 (SD<1.0) signified the homogeneity of the respondents' responses. The average finding implied that the kinesthetic learning approach of students to e-learning in the new normal of education was moderately evident. Students consider using an online learning approach in science. They demonstrated that this could help them develop their learning skills, as indicated by their responses.

Table 5 . Summary of the Level of Kinesthetic Learning Approach of the Students to E-Learning in the New Normal Education

Indicators	SD	Mean	Descriptive Equivalent
Critical Thinking	0.47	2.90	Average
Collaborative Skills	0.87	3.42	High
Creativity and Innovation	0.54	3.23	Average
Technology Application	0.76	3.63	High
Overall	**0.52**	**3.30**	**Average**

This finding confirms Sauro (2022) contended that an increase in both on-task behavior and learning outcomes was observed among students who underwent a kinesthetic learning approach. Her study showed that providing learners with the materials they will use in learning activities, whether face-to-face or virtual, can help advance their knowledge. Exposing them to different online simulations will help students learn the concepts of lessons. Thus, this study revealed that the kinesthetic approach to learning is a good technique and effective tool for learning.

3.6. Level of Process Skills in Doing Science Laboratory Activities in Terms of Basic Science Process Skills

Table 6 shows the level of process skills in performing science laboratory activities in terms of the basic science process skills. The item "I had to be real and honest with myself while measuring, predicting, and inferring in doing science laboratory activities" attained the highest mean of 4.16 with the descriptive equivalent of high. It is followed by the item "It challenged my basic science process skills (i.e., measuring, predicting, and inferring) as a student to give a well-deserved score," which has a mean of 3.98. The item "I see the actual results of my own level of process skills in measuring, predicting, and inferring in terms of doing science laboratory activities" has the lowest mean of 3.66 with the descriptive equivalent of high.

Table 6. Level of Process Skills in Doing Science Laboratory Activities in Terms of Basic Science Process Skills

Items	SD	Mean	Descriptive Equivalent
1. I see the actual results of my own level of process skills in measuring, predicting, and inferring in terms of doing science laboratory activities.	0.90	3.66	High
2. I become aware of how to develop my own process skills (i.e., measuring, predicting, and inferring) in doing science laboratory activities.	0.95	3.86	High
3. I realized myself-capability and skills in measuring, predicting, and inferring in doing science laboratory activities.	0.97	3.77	High
4. I gave myself a deserving score in doing science laboratory activities.	1.02	3.82	High
5. I had to be real and honest with myself while measuring, predicting, and inferring in doing science laboratory activities.	0.99	4.16	High
6. It challenged my basic science process skills (i.e., measuring, predicting, and inferring) as a student to give a well-deserved score.	1.08	3.98	High
Category Mean	**0.81**	**3.87**	**High**

The category mean for the level of process skills in performing science laboratory activities in terms of basic science process skills is 3.87 with a descriptive equivalent of high, which means that the students' basic science process skills in doing science laboratory activities are highly evident. The standard deviation of 0.81 (SD<1.0) indicates that the measures of variability of the items are closer to each other or have homogeneity of responses. Further, it can be seen from the findings that students enjoy learning activities that encourage them to make inferences, predict, conduct experiments, and measure. It is evident that they want participation and collaboration, even online.

This result is parallel to the ideas of Susanti and Anwar (2019), who found that all basic science process skills serve as prerequisites for integrated process skills, regardless of modality. It goes along that Simpler process skills are necessary to learn more complex skills. In other words, developing integrated skills requires basic scientific skills.

Similarly, the findings of the study confirm Piaget's Theory of Cognitive Development, as cited by Maranan (2017), which specifies that students' mastery of basic science concepts and basic process skills must be established for learners to acquire knowledge easily. Students with good processing skills can actively engage in learning activities. the K–12 curriculum includes scientific literacy as its goal. This means that teachers must help students improve their process skills, logical thinking abilities, and critical thinking skills to help them become independent learners. Zeidan and Jayosi (2015) found that students with a good attitude toward science are more motivated to concentrate on the scientific process. In other words, students' interest in science grows as they comprehend basic scientific process skills, which, in turn, raises their attitudes about science.

3.7. Level of Process Skills in Doing Science Laboratory Activities in Terms of Integrated Science Process Skills

Table 7 displays the level of process skills in performing science laboratory activities in terms of the integrated science process skills. The items "I became aware of my strengths and weaknesses while interpreting data and making scientific models in doing science process skills" and "My score is strong evidence of my learning in terms of interpreting data and making scientific models in doing science laboratory activities" have the highest mean rating of 3.95 with a descriptive equivalent of high. On the other hand, the item "I scored high in the levels of process skills in interpreting data and making scientific models" had the lowest mean of 3.51 with a high descriptive equivalent.

Table 7. Level of Process Skills in doing Science Laboratory Activities in terms of Integrated Science Process Skills

Items	SD	Mean	Descriptive Equivalent
1. I see the actual results of my own level of process skills in measuring, predicting, and inferring in terms of doing science laboratory activities.	0.90	3.66	High
2. I become aware of how to develop my own process skills (i.e., measuring, predicting, and inferring) in doing science laboratory activities.	0.95	3.86	High
3. I realized myself-capability and skills in measuring, predicting, and inferring in doing science laboratory activities.	0.97	3.77	High
4. I gave myself a deserving score in doing science laboratory activities.	1.02	3.82	High
5. I had to be real and honest with myself while measuring, predicting, and inferring in doing science laboratory activities.	0.99	4.16	High
6. It challenged my basic science process skills (i.e., measuring, predicting, and inferring) as a student to give a well-deserved score.	1.08	3.98	High
Category Mean	**0.81**	**3.87**	**High**

The category mean of the level of process skills in performing science laboratory activities in terms of integrated science process skills was 3.83, with a high descriptive equivalent. The results show that the measures of variability of the indicators on integrated science process skills are relatively small and are slightly close to each other, with an overall standard deviation of 0.84. This implies that the data were homogenous according to the given data. Moreover, the results showed that the level of process skills in performing science laboratory activities in terms of integrated science process skills was highly evident. This means that learners become aware of their strengths and weaknesses while interpreting data and making scientific models while using science process skills.

The results bear on the ideas of Riovero, as cited by Coronado (2019), who emphasized that science is more than having scientific information. This is more about experiencing and proving these concepts. It does not focus on one central idea of making experiments but on making inferences, noting observations, and making analyses. Thus, scientific knowledge must be supported by lessons that involve explanations and even reflection. Schools must focus on activities that develop integrated science processing abilities and deepen students' comprehension of scientific concepts.

3.8. Summary on the Level of Students Science Process Skills in Doing Laboratory Activity in Science in the New Normal Education

Table 8 shows a summary of the level of students' science process skills in performing laboratory activities in science in the new normal education, which has an overall mean of 3.85, indicating a high descriptive equivalent. This means that the expectations of students' process skills in performing science laboratory activities are highly evident. In addition, the table shows that the measures of variability of basic and integrated science process skills were relatively small and close to each other, with an overall standard deviation of 0.80. This finding indicates that the learners'science process skills are activated. They are aware that these skills can help them learn science.

Table 8. Summary of Students' Science Process Skills in Doing Laboratory Activity in Science in the New Normal Education

Indicator	SD	Mean	Descriptive Equivalent
Basic Science Process Skills	0.81	3.87	High
Integrated Science Process Skills	0.84	3.83	High
Overall	**0.80**	**3.85**	**High**

This finding is in conformance with the ideas of Balmeo (2022), who stated that laboratory exercises and experiments with hands-on components help enhance students' scientific reasoning abilities because they give them the opportunity for real-world hands-on learning. This is also in parallel to the statement by Irwanto, Rohaeti, Widjajanti, and Suyanta (2017), who stressed that process skills involve reasoning and describe students' academic achievement. Laboratory activities give students the chance to practice a range of abilities, making it far more valuable than traditional learning. This relates to the finding that laboratory activities enhance and develop students' science process skills.

3.9. Significance of the Relationship between the Kinesthetic Learning Approach to E-Learning and Students' Process Skills in Doing Science Laboratory Activities

Table 9 presents the computed data on the relationship between the kinesthetic learning approach of the students and their process skills in performing science laboratory activities.

Table 9. Significance of the Relationship between the Kinesthetic Learning Approach to E-Learning and the Students' Process Skills in Doing Science Laboratory Activities

Variables	r	r^2	p-value	Decision on Ho	Decision on Relationship
Kinesthetic learning approach of the students on e-learning and students' science process skills	0.171	0.029	0.054	Not Rejected	Not Significant

As shown in the table, a computed r-value of 0.171 indicates a negative correlation between students' kinesthetic learning approach on e-learning and their science process skills. The coefficient of determination, 0.029, signifies that only 2.9% of the variations in the kinesthetic learning approach could be attributed to students' science process skills. Thus, 97.1 percent is a chance variation that can be considered as another factor that influences students' science process skills that is not included in this study.

The findings negate the concepts of Samsudin, Haniza, Talib, and Ibrahim (2015): there is a link between kinesthetic intelligence and science process skills, emphasizing that science-processing abilities are related to kinesthetic intelligence because they require experimentation and observation using their senses of sight, hearing, touch, taste, and smell to learn about objects and phenomena.

Correspondingly, in the study of Magulod Jr (2019), could give bearing in this study as he mentioned that among the possible learning styles, group learning styles have the highest mean score, which means the majority students place a high importance on group learning and teamwork. When they work and collaborate with others, they can easily remember the knowledge and ideas imparted to them. Consequently, group engagement through group projects during class helps students learn more effectively. Group learning is best when there are real encounters and experiences.

4. Conclusion

4.1. Summary of Findings

The following findings are listed and briefly described in the chapter:

1. Technological application obtained the highest mean of 3.63 out of the four indicators used to determine the kinesthetic learning approach in e-learning, followed by collaborative skills, with a mean of 3.42. Next, creativity and innovation had a mean score of 3.23, while critical thinking had the lowest score, with a mean score of 2.90. The students' level of kinesthetic learning approach to e-learning in the new normal of education obtained an overall mean of 3.30 and was characterized as an average.
2. In identifying the level of science process skills in doing science laboratory activities, the first indicator, basic science process skills, obtained the highest mean of 3.87, followed by integrated science process skills with a 3.83 mean. Both indicators gained a descriptive equivalent of high, with 3.85 as an overall mean that is also described as high.
3. The significant relationship between the kinesthetic learning approach of students and students' science process skills. The computed r-value of 0.171 indicates a negligible correlation between students' kinesthetic learning approach to e-learning and their science process skills. The coefficient of determination, 0.029, signifies that only 2.9% of the variations in the kinesthetic learning approach could be attributed to students' science process skills. Thus, 97.1 percent is a chance variation, which can be considered as another factor that influences students' science process skills that are not included in this study.

4.2. Conclusions

From the findings of this study, the following conclusions were drawn.

1. The level of the kinesthetic learning approach of students on e-learning in new normal education is moderately evident.
2. The level of students' process skills in performing laboratory activities in science in the new normal education is satisfactory.
3. There is no significant relationship between the kinesthetic learning approach of students and their science process skills.

4.3. Recommendations

Following a thorough analysis of the results and conclusions of this study, the following recommendations were made:

1. Students may explore other means to maximally develop their science process skills and may also apply real-world experiences in their online experiential learning activities that will help improve their process skills in performing science laboratory activities. They may incorporate other learning strategies to increase interactive learning opportunities that may help them improve their science process skills, as they are given opportunities to learn remotely through their learning style preferences.
2. Science teachers may try to utilize the digital applications brought about by technology and incorporate them into their science activities, which would help improve their science process skills even in an online environment. They may try out simulations for students to observe the actual experiments with their students as reactors. Teachers may encourage students to note their observations based on simulations and encourage them to take part in discussions.
3. School administrators may provide support for the implementation of simulations and experiments in online science classes, as well as facilities and resources that would be useful in conducting

experiments. They may also uplift the capabilities of their teachers by providing development training that focuses on different teaching strategies and approaches in science in the digital world to gain understanding and knowledge on the concept of how to conduct experiments in the e-world. In this way, teachers can improve their skills, which they can apply to teaching science remotely.

4. Future researchers could use this study to discover significant issues related to the kinesthetic learning approach to e-learning in relation to students' process skills in performing laboratory activities. Other factors, including group learning styles and collaboration, may play a crucial role in investigating their relationship with improving students' science process skills. Future researchers may also broaden the scope of this research and extend it to other schools for a more detailed examination and analysis based on the findings.

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References

Abd Rauf, R. A., Rasul, M. S., Mans, A. N., Othman, Z., & Lynd, N. (2013). Inculcation of science process skills in a science classroom. *Asian Social Science,* 9(8), 1911-2017.

Abedini, Y. (2020). Students' creativity in virtual vs. Classroom courses on the basis of their personality traits: A prediction study. *Electronic Journal of E-Learning,* 18(6), pp525-536-pp525-536.

Adkins, D. G. (2020). Effects of Hands-On Experiences on Student Achievement, Interest, and Attitude in Chemistry.

Aktamis, H., & Ergin, Ö. (2008). *The effect of scientific process skills education on students' scientific creativity, science attitudes and academic achievements.* Paper presented at the Asia-Pacific forum on science learning and teaching.

AlMahdawi, M., Senghore, S., Ambrin, H., & Belbase, S. (2021). High school students' performance indicators in distance learning in chemistry during the COVID-19 pandemic. *Education Sciences,* 11(11), 672.

Babinčáková, M. r., & Bernard, P. (2020). Online experimentation during COVID-19 secondary school closures: Teaching methods and student perceptions. *Journal of chemical education,* 97(9), 3295-3300.

Balmeo, M. G. (2022). Junior High School Students' Science Process Skills Evaluation through Alternative Laboratory Experiment. *Online Submission,* 2(1), 72-86.

Bates, A. W. (2015). *Teaching in a digital age: Guidelines for designing teaching and learning*: BCcampus.
Bhandari, P. (2023). Correlational Research | When & How to Use.
Bilgin, I. (2006). THE EFFECTS OF HANDS-ON ACTIVITIES INCORPORATING A COOPERATIVE LEARNING APPROACH ON EIGHT GRADE STUDENTS'SCIENCE PROCESS SKILLS AND ATTITUDES TOWARD SCIENCE. *Journal of Baltic Science Education*(9).
Christensen, D. (2019). How does technology affect education?
Coronado, R. (2019). Correlations between Science Process Skills and Test-Taking Abilities among Grade VIII Students: Input in Designing Test Matrix. *Ascendens Asia Journal of Multidisciplinary Research Abstracts*, 3(2B).
Cortázar, C., Nussbaum, M., Harcha, J., Alvares, D., López, F., Goñi, J., & Cabezas, V. (2021). Promoting critical thinking in an online, project-based course. *Computers in Human Behavior,* 119, 106705.
Esjeholm, B.-T. (2012). *The relation between students' creativity and technological knowledge in cross-curricular technology and design projects.* Paper presented at the PATT 26 Conference.
Everett, D. (2018). How to teach rate experiments.
Fugarasti, H., Ramli, M., & Muzzazinah, M. (2019). *Undergraduate students' science process skills: A systematic review.* Paper presented at the AIP Conference Proceedings.
Huezo, E. (2017). Benefits of Collaborative Assignments in Online Courses.
Irwanto, I., Rohaeti, E., Widjajanti, E., & Suyanta, S. (2017). *Students' science process skill and analytical thinking ability in chemistry learning.* Paper presented at the AIP Conference Proceedings.
Khayotha, J., Sitti, S., & Sonsupap, K. (2015). The Curriculum Development for Science Teachers' Training: The Action Lesson Focusing on Science Process Skills. *Educational Research and Reviews,* 10(20), 2674-2683.
Kramer, M., Olson, D., & Walker, J. (2018). Design and assessment of online, interactive tutorials that teach science process skills. *CBE—Life Sciences Education,* 17(2), ar19.
Liu, R., Wang, L., Lei, J., Wang, Q., & Ren, Y. (2020). Effects of an immersive virtual reality-based classroom on students' learning performance in science lessons. *British Journal of Educational Technology,* 51(6), 2034-2049.
Maranan, V. M. (2017). Basic Process Skills and Attitude toward Science: Inputs to an Enhanced Students' Cognitive Performance. *Online Submission*.
McCombes, S. (2019). Descriptive Research | Definition, Types, Methods & Examples.
McLeod, S. (2018). Questionnaire: Definition, examples, design and types. *Simply psychology*, 78, 350-365.
Noris, M., & Saputro, S. (1970). The Virtual Laboratory Based on Problem Based Learning to Improve Students' Critical Thinking Skills. *European Journal of Mathematics and Science Education,* 3(issue-1-june-2022), 35-47.
Pacifico, E., & Prudente, M. (2021). *Grade 12 STEM students' perceptions and experiences in home-grown chemistry experiments.* Paper presented at the DLSU Research Congress.
Padilla, M. J. (1986). The Science Process Skills. Research Matters... To the Science Teacher.
Pegg, M. (2017). D is for Dewey: His approach to education. *Retrieved from*.
Prabha, S. (2016). Laboratory experiences for prospective science teachers: A meta-analytic review of issues and concerns. *European Scientific Journal,* 12(34), 235-250.
Research, L. n. d. Total population sampling.
Room, T. G. Making Science Fun: STEM Education And Kinesthetic Learning.
Safaah, E., Muslim, M., & Liliawati, W. (2017). *Teaching science process skills by using the 5-stage learning cycle in junior high school.* Paper presented at the Journal of Physics: Conference Series.
Salam, H., Setiawan, A., & Hamidah, I. (2010). *Pembelajaran berbasis virtual laboratory untuk meningkatkan penguasaan konsep pada materi listrik dinamis.* Paper presented at the Proceedings of The 4th International Conference on Teacher Education.

Samsudin, M. A., Haniza, N. H., Talib, C. A., & Ibrahim, H. M. M. (2015). The relationship between multiple intelligences with preferred science teaching and science process skills. *Journal of Education and Learning,* 9(1), 53-59.
Sansom, R. L. (2020). Pressure from the Pandemic: pedagogical dissatisfaction reveals faculty beliefs. *Journal of chemical education,* 97(9), 2378-2382.
Santos, M. D., & David, A. P. (2017). Self-and teacher-assessment of science process skills. *The Normal Lights,* 11(1).
Sauro, K. (2022). The effects of incorporating kinesthetic learning on learning outcomes and on-task behavior.
Staff, E. (2017). Kinesthetic Learning: A Hands-On Approach to Teach the Public About EM.
Susanti, R., & Anwar, Y. (2019). *Implementation of learning based on scientific approach to improve science process skills of biology education students in general biology course.* Paper presented at the Journal of Physics: Conference Series.
trietiak. (2020). Online Collaborative Learning in Higher Education: A Review of the Literature.
UTA. (2017). Importance of Science Education in Schools.
Williams, T. (2021). Why Is Quantitative Research Important?
Willits, C. (2020). PA Virtual School Newsroom
Wood, N., & Sereni-Massinger, C. (2016). *Engaging online kinesthetic learners in active learning.* Paper presented at the N. Callaos, J. Horne, M. Savoie, B. Sanchez, & A. Tremante, Proceedings of the 7th International Multi-Conference on Complexity, Informatics and Cybernetics and Society and Information Technologies.
Yustina, Y., Syafii, W., & Vebrianto, R. (2020). The effects of blended learning and project-based learning on pre-service biology teachersâ€™ creative thinking through online learning in the covid-19 pandemic. *Jurnal Pendidikan IPA Indonesia,* 9(3), 408-420.
Zeidan, A. H., & Jayosi, M. R. (2015). Science Process Skills and Attitudes toward Science among Palestinian Secondary School Students. *World journal of Education,* 5(1), 13-24.