STUDENTS' ATTITUDE AND THEIR LEARNING ENVIRONMENT INVIRTUAL LABORATORY CLASS

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Abstract: The purpose of the study is to determine the students` attitudes, assess their learning environment, and find out the relationship between students` attitudes and learning environment in virtual laboratory class among 173 science education students from the College of Education, Central Mindanao University. This quantitative study used descriptive correlation research as research design and data analysis. The results of the study revealed that the students' attitude in virtual laboratory classes in terms of inquiry was acceptable, and the enjoyment was highly acceptable among the respondents. For the learning environment in virtual laboratory classes, five dimensions were moderately practiced, namely: integration, material environment, teacher support, task orientation, and investigation. Only the dimension of differentiation was fairly practiced among the science education students. The result of the Pearson (r) correlation shows the significant relationship between the learning environment and students' attitudes in virtual laboratory classes. The study recommends that enhancing the setup for virtual laboratory is one of the keys to promoting a positive attitude and in performance of the students in the activities and experimentations.

Keywords: attitude, learning environment, virtual laboratory, science education

INTRODUCTION

Since the 19th century, when science was first taught systematically, the laboratory has been a fundamental part of science education, but the COVID-19 pandemic resulted in the closure of institutions and colleges. The educational institutions immediately embraced e-learning as a kind of remote education. Although this technique effectively presents content and oversees specific procedures, it has drawbacks in developing practical laboratory skills.

Since the pandemic began, it has been difficult for different institutions to engage their students in various online learning platforms, especially laboratory subjects. As a result, it's critical to determine the factors that might influence students' attitude and their learning environment in virtual laboratory activities in online learning.

Students' attitudes and the learning environment are vital during laboratory classes; the teacher and students discuss the theory they have learned in lectures and apply it through laboratory experiments. On the other hand, distance learning loses valuable hands-on exposure to such facilities and the ability to understand the subtleties of being immersed in such an environment.

Higher education is increasingly incorporating online learning platforms into teaching activities, including simulations and virtual laboratories in laboratory subjects. This new normal of learning is delivered through getting students' attention, enhancing engagement, and supporting them in gaining a deeper understanding of laboratory concepts. Creating a virtual laboratory allows students to experiment with equipment and materials that are similar to those found in a real lab while also learning how to use a computer model to improve practical abilities in professional tasks. Not every educational institution can afford to buy expensive equipment, which is also expensive to maintain, purchase supplies, and, most critically, replace when it breaks down. Virtual laboratories' adaptability

compensates for these flaws. Virtual Lab presents students with complicated challenges in a variety of domains, virtual instruments to formalize process circumstances, and the means to solve the problem; professors can monitor and diagnose the learning process. As a result, students can develop practical skills at their own pace, rather than being constrained by the educational organization's hours or geographic location [1].

The use of virtual laboratories or simulation programs eliminates some drawbacks of traditional laboratory applications and contributes positively to an educational system's achievement of its objectives. It is not always possible to observe the results of students' research in a real-world laboratory setting, particularly under low laboratory settings. The use of simulation programs can help overcome the errors that emerge from such laboratory circumstances or laboratory misuse [2].

In this study, the researchers investigated the students' attitude and their learning environment in virtual laboratory classes of Science Education students from the College of Education, Central Mindanao University.

MATERIALS AND METHODS

The study assessed the students' attitude and their learning environment of the science education students in their virtual laboratory class of College of Education, Central Mindanao University. This study utilized descriptive correlational research that focuses on the students' attitude and their learning environment in virtual laboratory classes through a survey questionnaire in gathering data.

This study adopted the questionnaire entitled, Laboratory Assessment Questionnaire used in the study, Effectiveness of Virtual Laboratories in Terms of Achievement, Attitudes, and Learning Environment among High School Science Students of Dr. Rachel Rose Oser of Curtin University in 2013. This questionnaire has internal consistency reliability (Cronbach alpha coefficient) of 0.83, which means high reliability.

Table 1: Scale description and item placement for Students' Attitude Indicators

Scale	Placement of Indicators	Scale Description
Inquiry	Question No. 1 - 8	The extent to which science activities are student-centered and curiosity provoking.
Enjoyment	Question No. 9 - 16	The extent to which students enjoy science lessons.

The assessment in determining the students' attitudes in virtual laboratory class is comprised of two scales (see Table 1). The inquiry will determine the extent to which science activities are student-centered and curiosity-provoking. It is an important scale because virtual laboratories are intended to be student-centered and provoke curiosity; attitudes towards scientific inquiry are likely to increase. Enjoyment will determine the extent to which students enjoy science lessons. It is a significant area because virtual laboratories are interactive and meant to stimulate students using audio and visual effects, enjoyment is likely to increase. The rating scale below was used to better understand the indicators of students' attitude:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

Table 2 shows the scales in assessing the learning environment in virtual laboratory classes. Integration measures the extent to which the laboratory activities are integrated with non-laboratory and theory classes. Material Environment measures the extent to which laboratory equipment and materials are adequate. Teacher Support is a measure of the extent to which the teacher is helpful to the students and shows interest in them. Individual student-

teacher interactions are assessed with this scale. Task Orientation is a measure of a student's internal motivation to complete assigned tasks and also to stay 'on task.' The investigation is the extent to which students engage in problem-solving and use inquiry skills. Differentiation measures the extent to which teachers tailor their instruction and activities for students according to their abilities, rates of learning, and interests.

Table 2: Scale description and item placement for Learning Environment Assessment Indicators

Scale	Placement of Indicators	Scale Description
Integration	Question No. 17 - 24	The extent to which regular science lessons andlaboratory activities are related
Material Environment	Question No. 25 - 32	Efficiency and functionality oflaboratory materials
Teacher Support	Question No. 33 - 40	The extent to which the teacherhelps, befriends, trusts, and shows interest in students
Task Orientation	Question No. 41 - 48	he extent to which it isimportant to complete activities planned and to stay on the subject matter
Investigation	Question No. 49 - 56	Emphasis on the skills and processes of inquiry and their use in problem solving and investigation
Differentiation	Question No. 57 - 64	The extent to which work is assigned is individualized for the pace and level of each student

The rating scale below was used to better understand the indicators of learning environment:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Practiced
4	3.41 – 4.20	Agree	Moderately Practiced
3	2.61 – 3.40	Not Sure	Fairly Practiced
2	1.81 – 2.60	Disagree	Seldom Practiced
1	1.00 – 1.80	Strongly Disagree	Not Practiced

From the population of 306 students, the researchers utilized Sloven's formula in order to get the sample size which is 173 science education students.

This study used descriptive statistics, specifically the mean to analyze the data obtained from the numerical values of the rating scale, and Pearson

(r) Correlation was used to determine the significant relationship among the variables.

RESULTS AND DISCUSSIONS

Descriptive Analysis on the Students' Attitude in Virtual Laboratory Class Students' Attitudes in Virtual Laboratory class is one of the areas in this research endeavor. It promotes strong engagement in achieving the goal of the laboratory class. Thus, it is important to examine the two dimensions of this area to understand the underlying concepts denoted among the one hundred seventy-three (173) science education students from the College of Education.

Students' Attitude: Inquiry

Table 3 presents the students' attitudes in virtual laboratory classes in terms of inquiry. The table reveals an overall mean score of 3.66 indicating "Acceptable" in the following indicators, namely: "It is better to find out scientific facts from experimenting than to be told them.", (3.99); "I would prefer to find out why something happens by doing an experiment than by being told" (3.94); "I would prefer to guess the results than to be told the expected results before doing an experiment.", (3.85); "It is better to try out different ways of setting up an experiment than to be told exactly how to set it up.", (3.79); "It is better to find an answer by doing experiments than to ask the teacher the answer.", (3.54); "I would prefer to do experiments than to read about them.", (3.52); and "I would prefer to do my own experiments than find out information from a teacher.", (3.43). One indicator scored "Moderately Acceptable," which is, "It is better to create my own hypothesis than to be given a hypothesis to test out." (3.21). The results of the study imply the significance of the inquiry as one of the students' attitudes in doing experiments and activities in their virtual laboratory classes.

Table 3: Students' Attitude Virtual Laboratory Class in terms of Inquiry

INDICATORS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
It is better to find out scientific facts from experimenting than to be told them.	3.99	Agree	Acceptable
I would prefer to find out why something happens by doing an experiment than by being told.	3.94	Agree	Acceptable
I would prefer to guess the results than to be told the expected results before doing an experiment.	3.85	Agree	Acceptable
It is better to try out different ways of setting up an experiment than to be told	3.79	Agree	Acceptable
It is better to find an answer by doing experiments than to ask the teacher the answer.	3.54	Agree	Acceptable
I would prefer to do experiments than to read about them.	3.52	Agree	Acceptable
I would prefer to do my own experiments than find out information from a teacher	3.43	Agree	Acceptable
It is better to create my own hypothesis than to be given a hypothesis to test out.	3.21	Not Sure	Moderately Acceptable
Overall Mean	3.66	Agree	Acceptable

Legend:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

The inquiry is important in a laboratory class which led to the development of a stronger model of inquiry-based learning that improves the experiment implementation quality and analytical thinking skills of the students [3]. The emphasis on inquiry in a laboratory setting has significant improvement on the students' academic achievement and a decrease in cases of laboratory anxiety [4].

Students' Attitude: Enjoyment

The data obtained from the students' attitude in virtual laboratory classes in terms of enjoyment is shown in Table 4. The table reveals an overall mean of 4.33 indicating "Highly Acceptable" in the indicators, namely: "Science is one of the most interesting school subjects.", (4.55); "The activities we do in science lessons are useful.", (4.43); "I look forward to the activities we do in science lessons.", (4.36); "The activities we do in science lessons are fun.", (4.33); "I would enjoy school more if there were activities such as the ones we do in science lessons.", (4.31); "The activities we do in science lessons helped develop my problem-solving skills.", (4.25); and "The technology used in activities makes the science lessons more exciting.", (4.23). One indicator scored "Acceptable," which is the "I enjoy the audio and visual effects of the activities we do in science lessons.", (4.18). The results of the study imply the significance of enjoyment in performing activities and experiments in a virtual laboratory class.

Table 4: Students' Attitude in Virtual Laboratory Class in terms of Enjoyment

INDICATORS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
Science is one of the most interesting school subjects.	4.55	Strongly Agree	Highly Acceptable
The activities we do in science lessons are useful.	4.43	Strongly Agree	Highly Acceptable
I look forward to the activities we do in science lessons.	4.36	Strongly Agree	Highly Acceptable
The activities we do in science lessons are fun.	4.33	Strongly Agree	Highly Acceptable
I would enjoy school more if there were activities such as the ones, we do in science lessons.	4.31	Strongly Agree	Highly Acceptable
The activities we did in science lessons helped develop my problem-solving skills.	4.25	Strongly Agree	Highly Acceptable
The technology used in activities makes the science lessons more exciting.	4.23	Strongly Agree	Highly Acceptable
I enjoy the audio and visual effects of the activities we do in science lessons.	4.18	Agree	Acceptable
Overall Mean	4.33	Strongly Agree	Highly Acceptable

Legend:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

The enjoyment in conducting activities, especially in a laboratory, will increase students' motivation and engagement in the lessons [5]. Science educators should promote a positive learning environment and make science as fun as possible which leads to enhancement in intended learning outcomes [6].

Learning Environment: Integration

Table 6: Learning Environment in Virtual Laboratory Class in terms ofIntegration

INDICATORS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
The laboratory activities are related to the topics that I am studying in my science class.	4.26	Strongly Agree	Highly Practiced
What I do in the laboratory helps me to understand the theory covered in regular science classes.	4.25	Strongly Agree	Highly Practiced
My laboratory activities and regular science classwork are related.	4.19	Agree	Moderately Practiced
The topics covered in regular science classwork are quite similar to topics in laboratory activities	4.18	Agree	Moderately Practiced
The concepts addressed in the laboratory are those I need to know for my science class.	4.17	Agree	Moderately Practiced
The skills used in laboratory activities are similar to the skills addressed in my science class.	4.16	Agree	Moderately Practiced
My regular science classwork is integrated with laboratory activities.	4.00	Agree	Moderately Practiced
I use the theory from my regular science class sessions during laboratory activities.	3.99	Agree	Moderately Practiced
Overall Mean	4.15	Agree	Moderately Practiced

Legend:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

Table 6 presents the results in terms of integration in the learning environment in virtual laboratory classes. The table reveals the overall mean of 4.15, indicating "Moderately Practiced." Two of the indicators scored "Highly Practiced," and six of the remaining indicators as "Moderately Practiced." These indicators are: "The laboratory activities are related to the topics that I am studying in my science class.", (4.26); "What I do in the laboratory helps me to understand the theory covered in regular science classes," (4.25); "My laboratory activities and regular science classwork are related," (4.19); "The topics covered in regular science classwork are quite similar to topics in laboratory activities," (4.18); "The concepts addressed in the laboratory are those I need to know for my science class," (4.17); "The skills used in laboratory activities are similar to the skills addressed in my science class," (4.16); "My regular science classwork is integrated with laboratory activities," (4.00); "I use the theory from my regular science class sessions during laboratory activities," (3.99). The results of the study imply the significance of integrating the concepts discussed in the lecture to the laboratory activities in promoting a deep understanding of the subject.

Integrating the lecture and laboratory classes promotes students' satisfaction in the class and improves their scholastic performance [8]. the integration in the laboratory of the concepts taught in lecture promotes a profound understanding of the subject and increases students' retention [9].

Learning Environment: Material Environment

Table 7: Learning Environment in Virtual Laboratory Class in terms of Material Environment

INDICATORS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
A laboratory is an appealing place for me to work in.	3.96	Agree	Moderately Practiced
I find the instructions to use the materials in laboratory activities and technology to be clear and precise.	3.88	Agree	Moderately Practiced
I find the audio and visual effects used in the technology in this class to be appealing.	3.87	Agree	Moderately Practiced
The laboratory and/or technology space has enough room for individual or group work.	3.83	Agree	Moderately Practiced
Help is available for laboratory materials when I need it.	3.83	Agree	Moderately Practiced
The materials that I need for laboratory activities and technology are in good working order.	3.65	Agree	Moderately Practiced
I do not have to wait to use both laboratory and technology materials.	3.34	Agree	Moderately Practiced
The materials that I need for laboratory activities and technology are readily available.	3.21	Not Sure	Fairly Practiced
Overall Mean	3.70	Agree	Moderately Practiced

Legend:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

The result for the material environment is present in Table 7. The table reveals an overall mean of 3.70 indicating "Moderately Practiced" in seven indicators, namely: "A laboratory is an appealing place for me to work in," (3.96); "I find the instructions to use the materials in laboratory activities and technology to be clear and precise," (3.88); "I find the audio and visual effects used in the technology in this class to be appealing," (3.87); "The laboratory and/or technology space has enough room for individual or group work," (3.83); "Help is available for laboratory materials when I need it," (3.83); "The materials that I need for laboratory activities and technology are in good working order," (3.65); and "I do not have to wait to use both laboratory and technology materials," (3.34). There is one indicator that scored "Not Sure," which the "The materials that I need for laboratory activities and technology are readily available" (3.21). The results show the significance of maintaining a conducive laboratory environment with enough materials to be utilized in accomplishing the activities and experiments.

A well-designed virtual laboratory setup will help the students in achieving better performance. It also promotes a better learning environment [10]. The availability of enough materials and the integration of technology in both virtual and physical laboratories promote motivation to the students and improvements in the laboratory output of the students [11].

Learning Environment: Teacher Support

Table 8 presents the results for the students' environments in terms of teacher support in a virtual laboratory class. The reveals an overall mean of 3.86 indicating "Moderately Practiced" in all the indicators, namely: "The teacher's questions help me to understand the topic" (4.03); "The teacher helps me when I have trouble with my work" (3.94); "The teacher guides me through activities when I am stuck," (3.93); "The teacher helps me with problems related to schoolwork," (3.91); "The teacher takes a personal interest in me," (3.78); "The teacher moves about the class to talk with me," (3.78); "The teacher is interested in my problems related to schoolwork," (3.77); and "The teacher goes out of his/her way to help me," (3.73). The results of the study highlighted the significant role of teacher support in the improvement of teacher-student interaction.

Table 8: Learning Environment in Virtual Laboratory Class in terms of Teacher Support

INDICATORS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
The teacher's questions help me to understand the topic.	4.03	Agree	Moderately Practiced
The teacher helps me when I have trouble with my work.	3.94	Agree	Moderately Practiced
The teacher guides me through activities when I am stuck.	3.93	Agree	Moderately Practiced
The teacher helped me with problems related to Schoolwork.	3.91	Agree	Moderately Practiced
The teacher takes a personal interest in me.	3. 78	Not Sure	Moderately Practiced
The teacher moves about the class to talk with me.	3.78	Agree	Moderately Practiced
The teacher is interested in my problems related to Schoolwork.	3.77	Agree	Moderately Practiced
The teacher goes out of his/her way to help me.	3.73	Agree	Moderately Practiced
Overall Mean	3.86	Agree	Moderately Practiced

Legend:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

Teacher support has a direct influence on the students' development of conceptual understanding of the laboratory activities [12]. Teacher support enhances the guided learning approach, which is a necessary method in both physical and virtual laboratory classes for improvements in the students' attitudes and perception in doing activities [13].

Learning Environment: Task Orientation

Table 9 presents the learning environment in virtual laboratory classes in terms of task orientation. The table shows the overall mean of 4.18, indicating "Moderately Practiced" in most of the indicators. There are four indicators that scored "Highly Practiced" namely: "I know the purpose of completing the activities in this class" (4.31); "Getting a certain amount of work done is important to me," (4.29); "I try to understand the work in this class," (4.27); and "I know how much work I have to do in this class." (4.24). The remaining four indicators scored "Moderately Practiced," namely: "I know what I am trying to achieve in this class" (4.20); "I do as much as I set out to do regarding the activities in this class" (4.11); "I pay attention during this class," (4.07); and "I am ready to start my work in this class on time," (3.98). The result of the study signifies the importance of providing clear and sound task orientation for better engagement and focus on the class and activities.

Task orientation is an important aspect of effective teaching and learning. It promotes good perception towards learning because of well- planned instruction and effective learning evaluation [9].

Table 9: Learning Environment in Virtual Laboratory Class in terms of Task Orientation

INDICATORS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
I know the purpose of completing the activities in this class.	4.31	Strongly Agree	Highly Practiced
Getting a certain amount of work done is important to me.	4.29	Strongly Agree	Highly Practiced
I try to understand the work in this class.	4.27	Strongly Agree	Highly Practiced
I know how much work I have to do in this class.	4.24	Strongly Agree	Highly Practiced
I know what I am trying to achieve in this class.	4.20	Agree	Moderately Practiced
I do as much as I set out to do regarding the activities in this class.	4.11	Agree	Moderately Practiced
I pay attention during this class.	4.07	Agree	Moderately Practiced
I am ready to start my work in this class on time.	3.98	Agree	Moderately Practiced
Overall Mean	4.18	Agree	Moderately Practiced

Legend:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

Learning Environment: Investigation

Table 10: Learning Environment in Virtual Laboratory Class in terms of Investigation

INDICATORS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
I find out answers to questions by doing investigations in this class.	3.88	Agree	Moderately Practiced
I carry out investigations to answer the teacher's questions in this class.	3.85	Agree	Moderately Practiced
I solve problems by using information obtained from my own investigations in this class.	3.85	Agree	Moderately Practiced
I am asked to think about the evidence for statements in this class.	3.80	Agree	Moderately Practiced
I carry out investigations to answer questions during the activities in this class.	3.79	Agree	Moderately Practiced
I carry out investigations to answer questions that puzzle me in this class.	3.77	Agree	Moderately Practiced
I carry out investigations to test my ideas in this class.	3.74	Agree	Moderately Practiced
I explain the meaning of statements, diagrams, and graphs during activities in this class.	3.61	Agree	Moderately Practiced
Overall Mean	3.78	Agree	Moderately Practiced

Legend:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

Table 10 presents the students learning environment in terms of investigation. The table reveals an overall mean score of 3.78 indicating "Moderately Practiced" in the following indicators, namely: "I find out answers to questions by doing investigations in this class.", (3.88); "I carry out investigations to answer the teacher's questions in this class," (3.85); "I solve problems by using information obtained from my own investigations in this class.", (3.85); "I am asked to think about the evidence for statements in this class.", (3.80); "I carry out investigations to answer questions during the activities in this class." (3.79); "I carry out investigations to answer questions that puzzle me in this class." (3.77); "I carry out investigations to test my ideas in this class." (3.74); ". I explain the meaning of statements, diagrams, and graphs during activities in this class." (3.61). the result of the study signifies the investigative approach in the virtual laboratory in the improvement of students' performance and analytical thinking skills.

Students obtain a comprehensive comprehension of the science subject, as well as an understanding of the nature of science, scientific attitudes, and scientific reasoning abilities through laboratory investigations [12]. The investigative laboratory approach was reported as having higher content knowledge and science process skill gain students taught using the prescriptive laboratory approach [13].

Learning Environment: Differentiation

Table 11: Learning Environment in Virtual Laboratory Class in terms of Differentiation

INDICATORS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
I work at my own speed regarding the activities I do in this class.	3.90	Agree	Moderately Practiced
Students who work faster than me in these activities move on to the next task.	3.75	Agree	Moderately Practiced
I am given a choice of tasks regarding the activities I do in this class.	3.53	Agree	Moderately Practiced
I am given work that suits my ability.	3.40	Not Sure	Fairly Practiced
I use different materials from those used by other students.	3.23	Not Sure	Fairly Practiced
I am assessed in a different manner from other students in this class.	3.10	Not Sure	Fairly Practiced
I do work that is different from other students' work in this class.	2.99	Not Sure	Fairly Practiced
I am given tasks that are different from other students' tasks.	2.84	Not Sure	Fairly Practiced
Overall Mean	3.34	Not Sure	Fairly Practiced

Legend:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

The data obtained from the learning environment in virtual laboratory class in terms of differentiation is shown in Table 11. The table reveals an overall mean of (3.34) indicating "Fairly Practiced." Three indicators scored "Moderately Practiced," namely: "I work at my own speed regarding the activities I do in this class" (3.90); "Students who work faster than me in these activities move onto the next task.", (3.75); "I am given a choice of tasks regarding the activities I do in this class" (3.53). And six indicators scored "Fairly Practiced" namely: "I am given work that suits my ability" (3.40); "I use different materials from those used by other students," (3.23);"I am assessed in a different manner from other students in this class," (3.10); "I do work that is different from other students` work in the class," (2.99); "Iam given a task that is different from other students` tasks," (2.84). The result of this study implies that the significance between the learning environment in virtual laboratory classes and differentiation needs to be improved.

Differentiated education improves the student learning environment. Differentiated instruction best practices include gathering information about students' interests, learning profiles, and readiness; cultivating a community in the classroom; grouping students into groups that can be easily changed based on the activity; and using formative assessment for learning.

Formative assessments are used by teachers in differentiated classrooms to establish student readiness, interest, and learning profile in order to access a student's knowledge, skill, and/or understanding during a learning experience [14].

Summary of the findings for Learning Environment

Table 12: Summary of the findings for Learning Environment

DIMENSIONS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
Task Orientation	4.18	Agree	Moderately Practiced
Integration	4.15	Agree	Moderately Practiced
Teacher Support	3.86	Agree	Moderately Practiced
Investigation	3.78	Agree	Moderately Practiced
Material Environment	3.70	Agree	Moderately Practiced
Differentiation	3.34	Not Sure	Fairly Practiced
Overall Mean	3.84	Agree	Moderately Practiced

Legend:

Scale	Interval	Description	Qualitative Interpretation
5	4.21 – 5.00	Strongly Agree	Highly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Not Sure	Moderately Acceptable
2	1.81 – 2.60	Disagree	Fairly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

Table 12 presents the summary of the findings in six dimensions of the learning environment. The combined scores of all the dimensions in the learning environment are 3.84, indicating "Moderately Practiced" in the dimensions, namely: task orientation (4.18), integration (4.15), teacher support (3.86), investigation (3.78), and material environment (3.70). Only the differentiation scored "Fairly Practiced" among the dimensions. This implies that learning environment is an important component for engagement and motivation of the students in virtual laboratory class.

The learning environment is one of the most important factors that affect student's learning. Studies reveal that children absorb all they observe around them and that they learn best when they feel comfortable enough in their learning environment. Learners show their authentic curious selves, explore beyond the box, and to light up the world with their unique and individual talents [2].

Correlation Between Learning Environment and Attitudes

Table 13 shows that each learning environment scale correlated significantly ($p<0.01$) and positively with each of the students' attitudes, indicating that a positive perception in the learning environment is aligned with the improved students' attitude in virtual laboratory classes. In terms of the learning environment and attitude, the association between investigation and inquiry showed the highest correlation, which is 0.45, and the association between integration and enjoyment showed the highest correlation of 0.57. The scale of differentiation showed the lowest correlation with both attitude scale inquiry (0.23) and enjoyment (0.12). The result of the study implies that there is a significant relationship between the learning environment and students' attitudes. Thus, rejecting the null hypothesis of this study which stated "There is no significant relationship between students' learning environment and their attitude."

Table 13: Correlation between learning environment and attitudes using Pearson correlations (r)

Learning Environment	**Attitude**	
Scale	Inquiry	Enjoyment
	r	*r*
Integration	0.34**	0.57**
Material Environment	0.26**	0.44**
Teacher Support	0.31**	0.32**
Task Orientation	0.30**	0.46**
Investigation	0.45**	0.48**
Differentiation	0.23**	0.12**

** Correlation is significant at the 0.01 level (2-tailed)

The learning environment is one of the keys to the improvement of student'sacademic, emotional, and attitudes. An efficient and conducive learning environment is an important component of promoting the positive attitude of the students. Interaction of the students in a positive learning environment will exhibit positive behaviors and attitudes [7].

CONCLUSIONS AND RECOMMENDATIONS

Based on the results and findings in the study, the following conclusions were drawn:

The students' attitudes in virtual laboratory class in terms of inquiry and enjoyment were acceptable and highly acceptable, respectively, among the science education students in College of Education, Central Mindanao University. Most of the students have more or less the same attitude towards virtual laboratory classes.

The learning environment in virtual laboratory class in terms of integration, material environment, teacher support, task orientation, and the investigation were moderately practiced by the science education students. Most of the science students have more or less the same learning environment in a virtual laboratory class. On the other hand, differentiation in virtual laboratory classes was fairly practiced among science education students. Most of the students have fair experience in differentiated instruction.

There is a significant relationship that exists between learning environment and students' attitude in virtual laboratory classes.

There is a need to innovate the strategies promoting inquiry in virtual laboratory classes. The strategies always provoke curiosity towards scientific inquiry. The instructors need to monitor the student-centeredness in their virtual laboratory classes. The instructors may involve interactive platforms to stimulate students, such as tutorial videos and visual effects to increase the enjoyment in the class.

The instructors in lecture and laboratory classes need to have the same pacing in terms of content so that the learning will be integrated. The integration of lecture and laboratory is the key to maximizing the retention of the concepts that are strengthened by experience in the virtual laboratory. The instructors may regularly assess the technological materials and hand- on materials available at home to check whether the activity/experiment is suitable for a virtual laboratory class. A virtual laboratory needs to function suitably with the students in order to minimize disruptions in experimentation.

Enhanced communication and clear instruction are the efficient way to attain good teacher support in a virtual class. Instructors may establish an active channel where students can raise their questions concerns about the activities. Additionally, establishing a clear goal of the activities and clear deliverables of the task will help the students to increase their motivation in doing the activities/experimentations. Despite the absence of in-situ experimentation, the virtual laboratory class needs to maintain good engagement and involve elements of a scientific investigation that are likely to increase in the investigation.

There is a need to improve in terms of differentiation in virtual laboratory classes. The instructors may conduct profiling to its students to understand them better. With this, the instructors can anchor their instruction and activities according to their abilities, rates of learning, and interests. With this, they can maximize the growth of the students in the course content.

For the curriculum makers, they need to consider the significant relationship between the learning environment and students' attitude in formulating objectives, doing need analysis, designing classroom activities, and the appropriate assessment methods.

For future studies, they may use other dimensions for attitude and learning environment as variables for their studies.

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REFERENCES

1. Rashidovna, M. (2020). Virtual laboratories in teaching and education.Science Index. https://www.elibrary.ru/item.asp?id=42658979
2. Oclarit, G. (2017). Effectiveness of virtual laboratory as innovative strategy in improving student's learning outcomes in physics the problem and its setting. Academia. https://www.academia.edu/35865624/EFFECTIVENESS_OF_VIRTUAL_LABORATORY_AS_INNOVATIVE_STRATEGY_IN_IMPROVING_STUDENTS_LEARNING_OUTCOMES_IN_PHYSICS_THE_PROBLEM_AND_ITS_SETTING_Background_of_the_Study.
3. Wahyun, T., and Analita, R. (2017). Guided-inquiry laboratory experiments to improve students analytical thinking skills. AIP Conference.https://aip.scitation.org/doi/pdf/10.1063/1.5016010#:~:text=Overall%2C%20students%20can%20increase%20their, others%20%5B16%2C%2 017%5D
4. Ural E. (2016). The effect of guided-Inquiry laboratory experiments on science education students` chemistry laboratory attitudes, anxiety, and achievement.Redfame Publishing. https://files.eric.ed.gov/fulltext/EJ1095156
5. Bulunuz, M. (2015). Role of playful science in developing positive attitudes towards teaching science in a science teacher preparation program. Erusian Journal of Education Research, 58, 67-68. https://files.eric.ed.gov/fulltext/EJ1112479.pdf
6. Hofstien, A. and Lunetta, V. (2004). The laboratory in science education foundations for the twenty-first century. Research gate. https://www.researchgate.net/publication/227503715_The_Laboratory_in_Science_Education_Foundations_for_the_Twenty-First_Century
7. Loveless, B. & Betz, A. (2021) Strategies for building a productive and positive learning environment. Education Corner https://www.educationcorner.com/building-a-positive-learning- environment.html
8. Finn, K.E., FitzPatrick, K., & Yan, Z. (2017). Integrating lecture and laboratory in health sciences courses improves student satisfaction and performance: Journal of College Science Teaching, 47(1), 66-75. https://scholarworks.merrimack.edu/health_facpubs/59
9. Pareek, R.B. (2020). An assessment of availability and utilization of laboratory facilities for teaching science at secondary level: International Council of Association for Science Education, Vol. 30. https://files.eric.ed.gov/fulltext/EJ1209309.pdf
10. Duban, N., Aydoğdu, B., & Yüksel, A. (2019). Classroom teachers' opinions on science laboratory practices. Universal Journal of Educational Research 7(3): 772-780.
11. https://files.eric.ed.gov/fulltext/EJ1207702.pdf
12. Halverson, L. R., & Graham, C. R. (2019, June 1). Learner engagement in blended learning environments: a conceptual framework. https://olj.onlinelearningconsortium.org/index.php/olj/article/view/1481
13. Gamage, K. A., Wijesuriya, D. I., Ekanayake, S. Y., W. Rennie, A. E., Lambert, C. G. & Gunawardhana, N. (2020, October 19). Online delivery of teaching and laboratory practices: continuity of university programs during COVID-19pandemic. MDPI. https://www.mdpi.com/2227-7102/10/10/291.
14. National Science Teachers Association. (2004). The integral role of laboratory investigations in science instruction. https://www.nsta.org/nstas-official-positions/integral-role-laboratory- investigations-science-instruction
15. Beck, D., & Beasly, J. (2020). Identifying the differentiation practices of virtual school teachers. PubMed Central (PMC). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7544401/.