

# The Impact of Virtual Learning Process on The Assessment Results at Environmental Chemistry Laboratory Course

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**ABSTRACT:** The impact of advanced technology is perceived in every sector, including education. As the Ministry of Education and Culture program, distance learning has become applied in Indonesia, especially with this pandemic COVID-19. The learning model used in the course will affect student understanding in this situation, especially for an experimental study that aims to enhance student skills in the laboratory. The virtual laboratory practice is an additional learning model used in Environmental Chemistry Laboratory Course. Before, the Environmental Laboratory Course used only video to deliver learning materials. This research is experimental research that aims to evaluate the additional virtual laboratory practice's impact on student grades compared to the previous method. The research result was obtained by comparing the practical course's assessment results in 2019/2020 to 2020/2021. A questionnaire was also used to collect student opinions about the new learning method. The number of samples in this research was 395 students. The results show that the average students' grades using explanatory video only is 89, then with additional virtual laboratory practice are 88. From the questionnaire, 46% of the respondent said the application increased their understanding of the learning materials, and they also enjoyed using the application. It could be concluded that the virtual laboratory practice did not improve the assessment result of the course but enhanced the student interest.

**Keywords:** distance learning, laboratory course, virtual laboratory practice

## INTRODUCTION

Advanced technology impacts a broader aspect of people's lives, no exception for the learning process. Industrial revolution 4.0 is called technology disruption that changed people's culture. Through The Ministry of Education and Culture (The Ministry of Research Technology and Higher Education at that time), the Indonesian government issued a policy regarding blended learning. This policy in higher education aims to facilitate the learning process from the educator as an instructor to the student in a more exciting way, global connections in fast time, and all profit could be reached from the integration of technology. In blended learning, learning methods are used face-to-face in class and in the online learning process. In 2018, Universitas Islam Indonesia, higher education in Indonesia, applied a blended learning process in their community. Suciati [1] reported that the virtual learning process was not conducted intensively in Indonesia. Department of Environmental Engineering, as part of Universitas Islam Indonesia, implemented blended learning for most of their course in 2019. The Covid-19 pandemic forced this process to take place rapidly. The whole learning process must be implemented to be online for safety reasons. The online course is also applied globally for maintaining the learning process [2]. The Ministry of Education and Culture issued Circular Number 4 of 2020 about distance learning applied to all levels of education in Indonesia.

The situation then makes educators look for the best learning models to convey the learning process

differently without diminishing the benefits for the student. Some educators still use the same method, such as discussion, assignment, and answer and question models [3]. There are several Learning Management Systems (LMS) that contribute to distance learning, such as Google Classroom, Zoom, WhatsApp Group (WAG), Youtube, and other media [3–5]. A Combination of LMS platforms is needed to facilitate the learning process because of their limitation. A platform like Google Classroom enables the educator to deliver materials and collect assignments from the student. Still, more minor in interactive communication. Then, WhatsApp Group and Zoom are more interactive and facilitate discussion but can not be arranged, cost consuming, and are not flexible in time [4].

Practicum is an experimental learning process that effectively brings education materials to students because they learn them directly and independently [6, 7]. Practicum is one course that needs more attention than a general course to choose suitable models. Sometimes it requires more combination platforms than a general course to help the student understand; mainly, the focus in the practicum course is the student's skill laboratory. As one of the laboratory courses in Environmental Engineering, the Environmental Chemistry Laboratory course aims to make students understand laboratory testing used to determine environmental quality. In 2019, to implement rules about distance learning in pandemic conditions, the Environmental Chemistry Laboratory course was conducted as an online course with a limited delivery method. As an evaluation, there is an additional method for delivering the course in the next period. Therefore, it is necessary to evaluate the combination platform used in the Environmental Chemistry Laboratory course in Environmental Department, Universitas Islam Indonesia.

## METHOD

### Method of Qualitative Analysis

This research evaluates the different models used to deliver materials at the Environmental Chemistry Laboratory course conducted in the Environmental Engineering Department, Universitas Islam Indonesia, from 2019 to 2020. The model that has been evaluated is the combination method used in the topic of Chloride Testing. This research is experimental, and the data used comes from the practical class only.

The combination model used were: Google Classroom, Zoom, Video, and also virtual laboratory practice. In 2019 (2019/2020 period), the combination model used was Google Classroom, Zoom, and Video; then, in 2020 (2020/2021 period), virtual laboratory practice was used as an additional method. The review used was the assignment result of the student (consisting of pre-test and post-test in the form of multiple-choice, this test to determine the student's ability after attending the course) and a questionnaire given to the student (to describe the student's interest and collect student's suggestions and critics for the learning process).

The subject research was students of Environmental Chemistry Practice in the Environmental Engineering Department in the 2019/2020 and 2020/2021 period with a total student were 395 students.

## RESULTS AND DISCUSSION

Environmental Chemistry Laboratory course is the experimental course studied in Environmental Engineering, Universitas Islam Indonesia. This course contains six laboratory testing topics used to determine environmental quality. In studying environmental engineering, the student should learn many aspects of environmental quality and how to determine it. Indonesian National Standard is a primary method used as a reference in this course.

The learning models used in the online course for Environmental Chemistry Laboratory course in 2019/2020 are a combination of Google Classroom, Zoom, and Video. Google Classroom is used as media to upload materials from the teacher and receive student answers. The discussion process will be held through the Zoom platform on the day of the course. Handayani [3] reported that a zoom meeting could replace a face-to-face meeting, so this platform synchronizes process learning. The video contains two videos that explain the theory of the experiment, and the other video is a practical video carried out in the laboratory about the procedure of the experimental topic. Asih [8] said that a lecture is a facilitator for the learning process, then a video could help a lecturer carry out the materials to the student in an exciting way. Even though Bahasoan [9] reported that WhatsApp would be the student's preference regarding its cheaper and commonly used, WhatsApp is used as a complement application to communicate in this course.

In 2020/2021, the virtual laboratory practice is an additional method used in delivering materials. This method aims to make students understand every step used in the experimental process. The virtual laboratory practice is an alternative for the student who cannot enter the laboratory to do the practice.



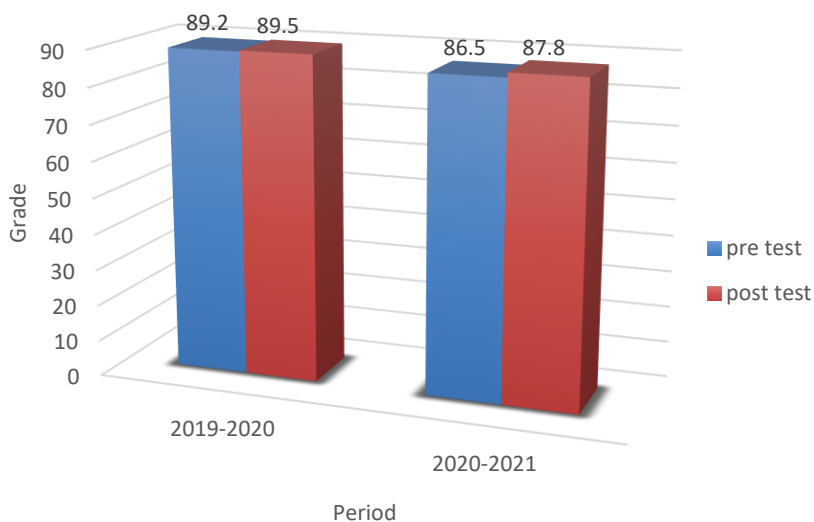
FIGURE 1. The appearance of the virtual laboratory practice

In this virtual laboratory practice, the student will be doing the procedural step used in the experimental topic. Before experimenting, the first step in the laboratory is to prepare the tools and materials needed; in this virtual laboratory practice, students are also directed to prepare the right tools and materials. After that, the student could do the testing as seen in the procedure. If they make a mistake in chosen tools and materials or do not perform the right step as seen in the procedure, the application will not work, and this will be a reminder for the student to correct their action.



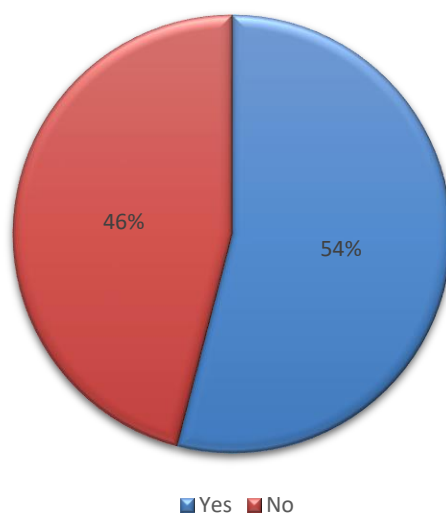
FIGURE 2. The Steps in the experimental

The assessment used in this course was pre-test and post-test. The pre-test contains a question that describes students' preparation for the course, such as the fundamental theory implemented in the topic. The post-test will be mainly about the procedure and data processing. From this description, the virtual laboratory practice will impact the post-test result.



**FIGURE 3.** The Assessment Result

As seen in figure 3, the assessment result describes no significant difference after virtual laboratory practice has been applied to the experimental course. This result is equal to the questionnaire result from the student.

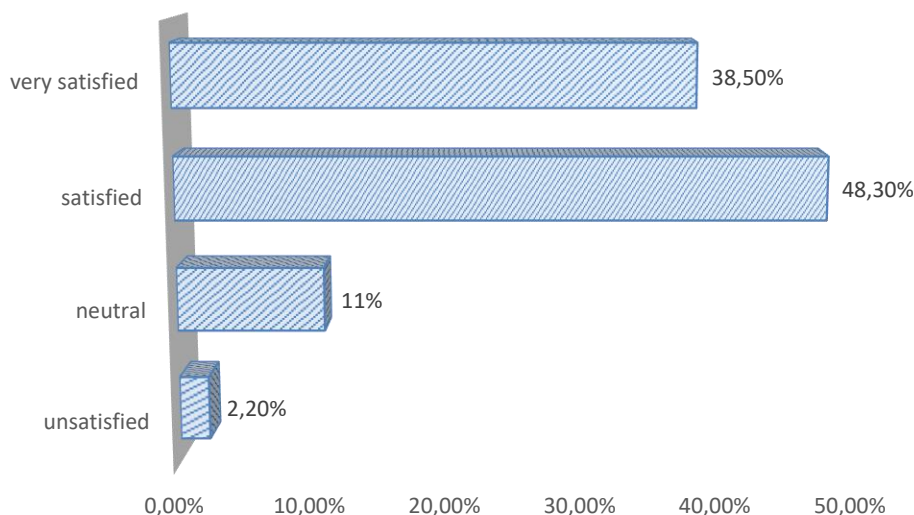


**FIGURE 4.** The Questionnaire Result

The questionnaire is given to the student in 2020/2021 to evaluate the learning process. There are questions about the need for an independent practice that could be done in their home to complement the learning process to get information about the impact of the additional application to the understanding materials. Through the questionnaire, around 46% of students feel that the application increases their understanding of the course then they do not need additional independent practice. But, there are 54% of students still need independent practice. The reason for this result is various. Sometimes the student can not enjoy the application because it stops working as the connection result. Another reason came from the explanation when face-to-face through zoom. Students said that the explanation was too fast, sometimes the audio was too low, and the connection interrupted the process. The problem in online courses usually comes from technical or the different devices from one person to another, which will impact the learning process [10]. This problem could reduce student attention and influence their understanding of the lesson.

Students feel the virtual laboratory practice could increase their understanding, especially in the procedural step, because when they make a mistake in the step, the application does not work. Then, they should repeat the steps until it's right.

An exciting animation attracts students' attention, increasing student understanding. It could be related to the other question about students' satisfaction with the application. In the questionnaire, students have to choose a scale of 1 to 4, defined as unsatisfied, neutral, satisfied, and very satisfied, to illustrate students' satisfaction with this application. The results show students' satisfaction with this application in level 3,2, which is why most students are satisfied.



**FIGURE 5.** Students' satisfaction response to the application

The student is interested in this additional application even though the assessment result is similar to the 2019/2020 period. The student advises improving the application's quality and animation based on the questionnaire to increase students' interest. Discussion through zoom is the other factor in enhancing students' understanding of the materials. The students suggest not to hurry in explaining materials when zoom meeting and prepare technical materials (signal, audio and or video) so it does not interfere with the discussion process, leading to reduced student attention. Students also suggest enhancing the quality of the video because the sound of the video is too weak.

The colleague's opinion is the application complemented the explanation of the material to the student, especially on the procedure. They also suggest making the same virtual laboratory for the other materials topic. But, the application needs to be upgraded because it does not run smoothly, and the animation used is not the good one. Pradibta and Nurhasan [11] reported that virtual reality using a three-dimensional environment could bring the real world to the digital world and, more precisely, be applied in the practicum course.

## CONCLUSION

The additional virtual laboratory practice did not change the assessment result of the course. But, students are still satisfied with this application. Even if the application increases student interest, it still needs an upgrade. The combination of indirect explanation through video, practice through virtual laboratory, and direct discussion through zoom are good models for implementing the practicum course in distance learning.

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