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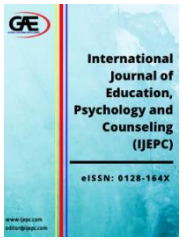

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IMPLEMENTATION OF ONLINE ASSESSMENT FOR PSYCHOMOTOR DOMAIN IN ENGINEERING PROGRAM: AN INSIGHT FROM STUDENT'S PERSPECTIVE

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Abstract:

Assessment plays an essential role in learning and must be designed to measure the student's learning and align with the intended learning outcomes. Prior to the pandemic, most of the assessments were performed face-to-face. However, during the pandemic, the assessment could not be conducted as face-to-face activities, which caused challenges to the assessment that required face-to-face implementation. This study seeks to critically examine the implementation of the online assessment conducted during the COVID-19 pandemic to assess the psychomotor learning domain. The study used a qualitative case study that utilized document analysis and interview protocol. Purposive sampling was adopted, and the sample population consists of 60 students taking the course during the March – July 2020 semester. The data collection procedure was separated into Stages 1 and 2, Document Analysis and Semi-structured in-depth interviews analyzed using thematic analysis. The findings show that certain conducted assessments are unsuitable for assessing the psychomotor

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learning domain due to the nature of the assessment and the criteria adopted to assess the students. It is suggested that the implementation of assessment in assessing students' psychomotor skills through online be re-examined. This study also found that the students had to face four main challenges in conducting the online assessment that could affect the students' performance: internet connectivity, accessibility to a decent device to complete the assessment, lack of explanation on the assessment and the environment while conducting the assessment.

Keywords:

Online Assessment, Psychomotor Domain, Psychomotor Assessment, Engineering Assessment

Introduction

Malaysia enforced a Movement Control Order (MCO) on the 18th of March 2020 to break the chain of infected cases of COVID-19 (Shah et al., 2021). The enforcement of MCO has directly impacted and caused a significant disruption in many areas, including the educational system. All educational premises are instructed to close during the MCO, and no face-to-face activities are allowed (Shah et al., 2021). It has caused significant shifts in educational practice. The teaching-learning activities changed from conventional to remote settings. Many instructional methods have been modified and re-designed to fit the remote implementation. Products from multinational technology companies such as Google Meets, Microsoft Teams, Zoom, Webex, Skype, and many more have been widely used as a platform for remote teaching during the enforcement of MCO.

Even though there are a lot of alternatives available for remote teaching, the circumstances are not similar for the implementation of assessment. Only some available tools or platforms are developed to enable remote assessment to be conducted effectively. It has caused a cancellation or postponement of the major examinations at a certain level. For example, in Malaysia, the Ministry of Education has postponed the Malaysia Certificate of Education (MCE) examination and cancelled the Form Three Assessment (PT3) for 2020.

A similar situation occurred in many countries worldwide where they have also cancelled or postponed their major examination. The UK has cancelled the A-level examination for the entire cohort; examinations in India for various state levels, including recruitment and entrance university exams, were also cancelled. The other major examination is also cancelled or rescheduled due to pandemics, such as the Birla Institute of Technology and Science Admission Test (BITSAT), National Association of Testing Authorities (NATA), Common Law Admission Test (CLAT), Management Aptitude Test (MAT) and AIMS Test for Management Admissions (ATMA) (Pokhrel & Chhetri, 2021). Most final examinations are cancelled and re-designed to become coursework assessments and remotely conducted in higher learning institutions due to a lack of tools developed to conduct student assessments.

Problem Statement

Before Covid-19, students' cognitive, affective, and psychomotor learning domains were measured face-to-face. However, during the initial period of the pandemic, the government

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of Malaysia instructed the closing of all the facilities in higher learning institutions and not allowing for face-to-face activities. It caused challenges to the educator in conducting the assessment. In conducting assessments online, not many tools support conducting assessments effectively, and during the pandemic, assessment has become much more critical; other than monitoring students' learning, it is also used to determine the effectiveness of remote teaching (Senel & Senel, 2021). UNICEF (2021) suggested a few different types of assessment that can be conducted online during the pandemic, such as written assessment, portfolio, project, presentation, peer and self-assessment, debate, and adaptive quiz. Guangul et al. (2020) have also suggested online assessments, such as open-book quizzes, presentations, take-home tests, annotated bibliographies, fact sheets, and the e-portfolio.

The suggested assessment by UNICEF (2021) and Guangul et al. (2020) is in line with the activities listed by Kasilingam et al. (2014) in assessing student's cognitive and affective ability. Even though many suggestions have been given for the assessment conducted online during the pandemic, none has outlined the online assessment in the psychomotor domain. The situation has given challenges to the program in higher learning institutions such as medical, dental, nursing, culinary, engineering and all the vocational programs in which the programs are required to assess the student's psychomotor domain in utilizing tools and machines in a laboratory setting.

In a study conducted on dentistry education, Abdul Fatah et al. (2021) mentioned that dental education is struggling during the pandemic to coup with the psychomotor component that includes practical and clinical sessions, which are the main course component represent 45% – 50% of the total SLT. The components can only be conducted face-to-face and will cause an extension of study if the students postpone their practical and clinical. The same issues occurred for the vocational students who take tourism and hospitality programs with a 25% to 90% curriculum organized as Work-Based Learning (WBL). During the pandemic, most tourism and hospitality program students could not complete their practical assessment due to the closing of hotel operations and many countries' suspended tourism industries (OECD, 2020). Gamage et al. (2020) also mentioned the difficulties in conducting practical experimental work for the chemical, physics and biology laboratories since the laboratory uses expensive and complicated instruments and machines unavailable in students' homes. The engineering programs also faced a similar situation in implementing remote assessment for the psychomotor domain.

In engineering programs, the psychomotor domain is generally embedded into the laboratory or computer software courses. The courses mainly address the Modern Tool Usage in skills and attributes established by the Engineering Accreditation Council (EAC). The students must demonstrate their ability to conduct experiments and coordinate their motor skills in handling tools and machines in a laboratory setting. Due to the restrictions during the pandemic, all the experiment activities and the assessment were remotely conducted. According to the Engineering Accreditation Standard 2020, the students must attain the intended skills and attributes upon graduation (EAC, 2020). If the assessment were not conducted in a means of conduct, there is a possibility that students will not attain the intended learning outcomes; therefore, it would affect the incoming accreditation process, and the students who graduated from the program will not be recognized as certified engineers.

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Hence, this study aims to critically review the implementation of remote assessment for the psychomotor domain in the engineering program. The study is conducted regarding the following research questions:

RQ1: How is the remote assessment conducted to assess psychomotor skills during the pandemic for the laboratory courses?

RQ2: What are the challenges the students face in conducting an assessment to assess their psychomotor skills during the pandemic?

RQ3: What is the student's point of view regarding the psychomotor assessment conducted during the pandemic in preparing the students for industrial training or engineering fieldwork?

Literature Review

Psychomotor Learning Domain For Engineering Courses

In the technical field, such as engineering courses, evaluating the psychomotor skills of students is essential to determine their ability to handle the tools and machines, experiment in the laboratory and conduct hands-on activity on the site work. These skills are vital for engineering graduates to enter the industry and become competent engineers. Many technologies requiring tools and machinery were invented to accelerate work, and these technologies change dynamically; hence, graduates are expected to master psychomotor skills upon graduation.

In the engineering program, the psychomotor learning domain proposed by Simpson (1972) is mainly used to measure engineering students' psychomotor skills. The psychomotor learning domain generally focuses on developing motor or movement skills that an individual requires to practice. The skills are evaluated in speed, accuracy, applying methods or skills in implementation. In the early development of the psychomotor learning domain, Simpson (1972) mentioned that the earlier two sections of taxonomy, cognitive and affective, have a severe lack of a classification system for educational objectives related to the psychomotor domain that can be useful for education in general and in a specialization such industrial, agriculture, physical education, and homes economic. Simpson later refined the exploratory taxonomy for the psychomotor learning domain by characterizing the psychomotor learning domain into seven levels of learning. Other than Simpson, there are variations of the psychomotor learning domain proposed by Dave (1970) and Harrow (1972).

Compared to Simpson, Dave (1970) introduced five levels in the psychomotor learning domain, while Harrow (1972) proposed six levels for the psychomotor learning domain. Dave's psychomotor domain is the simplest way to measure psychomotor skills compared to Simpson's, which is much more comprehensive. It is suggested that the Simpson taxonomy is appropriate for adult development (Alobaidi, 2020); on the other hand, the taxonomy proposed by Harrow is much more suitable to measure for the development of physical fitness, agility, and control of sensor motor (Alobaidi, 2020). For the Simpson domain, the lowest level of learning is perception. The students are expected to be able to guide the motor activity by using sensory. The second level is Set, followed by Guided response, Mechanism, Complex overt response, and Adaptation, and the highest level of learning is Origination, where the students are expected to develop a new movement pattern to suit the problems.

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For undergraduate engineering students, the highest level of learning for the psychomotor domain lies between Mechanism and Adaptation. For Mechanism, the students are expected to have an intermediate level of complex skills and be confident and proficient in demonstrating psychomotor skills. For Adaptation, the students must demonstrate well-developed skills and modify the patterns to fit the requirements.

Challenges Faced During The Pandemic In Conducting Assessments

Conducting assessments can be challenging during the pandemic, either as an educator or student. The most significant challenge faced by the educator during the implementation of the assessment is redesigning the assessment to ensure it can be conducted remotely and equivalent to the assessment conducted before the pandemic in obtaining the intended learning outcomes. Other than that, during the pandemic, the instructors have faced difficulties implementing remote assessments due to sudden changes in the curriculum. No training is provided, and all the educators are given to decide how to conduct the remote assessment to be equivalent to the assessment conducted before the pandemic (OECD, 2020). There is also a need for more support by the institution in providing a platform to conduct the assessment effectively. Even though the issues listed come from the educator, they will eventually impact the students performing the assessment.

As for students, the frequent challenges faced in completing the assessment during a pandemic include needing a proper device to complete the assessment (UNICEF, 2020). Even most students in higher learning institutions have smartphones; however, in completing the assessment, they need a suitable device with a much bigger screen to have a clear view of the questions. There is also an issue with the device; for example, certain smartphones cannot be appropriately used for online presentations, and it causes significant problems for the students if the presentation has been adopted as a summative assessment.

Another issue the students frequently need help with in conducting the remote assessment is the need for a better internet connection (UNICEF, 2020). The poor quality of internet connection affects not only teaching-learning activities but also the assessment. The poor quality of the internet connection has caused the student not to be able to access the assessment and be unable to finish it within the given time. The poor internet connection quality will also affect whether the students must present, discuss, or be assessed for their communication skills. The students are also unable to submit huge file sizes, such as a video record, for being assessed by the instructor.

Another issue related to remote assessment during a pandemic is the students' environment when conducting the assessment. During the pandemic, students conduct remote assessments at home; sometimes, they need to be in a better environment, supporting student learning and performing better in their assessment. This situation mainly occurred for the students living in rural areas and those from low-income families. With many external factors contributing to the outcomes from remote assessment implementation, it has triggered doubt about the assessment outcome. Does the outcome obtained by the student truly reflect their cognitive, affective, or psychomotor capability?

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Research Methodology

Research Design

The study used a qualitative case study approach that utilizes document analysis and interview protocol. The qualitative case study approach is used in this study to discover the experiences within the context by adopting various data sources to make certain the issues are explored; instead of having one side of view, it has multiple views of the experiences to be discovered and identified (b & Jack, 2008). The approach was also adopted to gather the initial knowledge and examine phenomena in implementing a remote assessment to assess the student's psychomotor learning domain for the laboratory course. This study was conducted within a limited time, and the data collection procedures are managed over a sustained duration (Stake, 1995; Yin, 2011). The data collection was carried out over a sustained duration, which this study focuses on during the whole semester of Mac – July 2020 during the initial COVID-19 pandemic.

Sampling Design

This study is conducted using purposive sampling. A particular method in identifying and selecting the individuals or groups with knowledge or experience with the phenomena is applied to determine the elements in the sample (Lavrakas, 2008; Creswell & Clark, 2017; Black, 2021). The sample population comprises 60 students taking the Structural Laboratory course during the March – July 2020 semester. The students in the population were selected since they fulfilled the criteria as individuals who have experienced remote assessment in assessing the psychomotor learning domain during the COVID-19 pandemic. The sample size is nine numbers of students, comprising three numbers of students who have attained 100 – 80 marks (classified as the highest range marks), three numbers of students who have attained 79 – 50 marks (classified as medium-range marks), and another three numbers of students who have attained for 50 – 0 marks (classify as the lowest range marks) in the psychomotor assessment. In this study, the sample size was decided based on the availability of the samples, and the decision made is in line with the suggestion made by Creswell (2021), Yin (2015) and Dworkin (2012).

Instrumentation

This study adopted two different instruments for data collection: document analysis and interview protocol. The different instruments were adopted in this study because it wanted to have 'method triangulation' where various data sources or techniques were applied to build a wide-ranging insight into the phenomena (Patton, 1999; Carter et al., 2014), to develop the trustworthiness of the research (Salkind, 2010) and to interrogated in different ways to understand the research problem (Nightingale, 2020). In this study, document analysis was conducted systematically in examining and evaluating the documents, either imprinted or electronic (Bowen, 2009), to elicit meaning and develop understanding and empirical knowledge in the study area (Corbin & Strauss, 2014).

The document analysis was done on the official syllabus document for the Structural Laboratory course and the document record for the changes made in the syllabus during the pandemic. For the interview protocol, this study employed semi-structured in-depth interviews to gather data from a significant individual with experience with the topic. It can also be triangulated with the document analysis to validate the findings. The semi-structured in-depth interview involved conversing with the interviewee by adopting the flexible interview protocol and adding probes, comments, and follow-up questions (DeJonckheere & Vaughn,

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2019).

Data Collection Procedure

The data collection procedure in this study is separated into two stages: Stage 1 for Document Analysis and Stage 2 for Semi-structured in-depth interviews. Document analysis is conducted at Stage 1 to systematically review and evaluate the documents, providing preliminary information about the course before conducting Stage 2. The activities involved in document analysis are skimming, reading, and interpreting the course syllabus, which includes the learning outcomes, the content, teaching-learning activities, and the assessment. Skimming, reading, and interpreting the document also extended to the record that presented changes in the course assessment and teaching-learning activities during the COVID-19 pandemic. The faculty representative provided the documents required in this study to ensure the document's authenticity, credibility, accuracy, and representativeness toward the conducted study.

Stage 2 involved the semi-structured in-depth interview. The interview was performed using the approved interview protocol. The interview session was conducted individually, and each session was conducted for about 30 – 45 minutes at their convenience through an online platform and digitally recorded before transcribing and analysis. This study chose the online platform due to the restrained availability of students to have face-to-face sessions and avoid contagious outbreaks of COVID-19. The interview session started with establishing trust and rapport with the interviewees before entering the questions session.

In this semi-structured, in-depth interview, the questions were made open-ended. During the interview, the condition was prepared naturally and conducted using the native language to avoid misinterpreting the question and encourage a great response from the interviewee. After establishing trust and rapport with the interviewee, the question started with an easy-going question before going to the more complicated and in-depth question. The probing technique (Bernard, 2012; DeJonckheere & Vaughn, 2019) was applied in the interview, as shown in Table 1. All the data from the document analysis and the semi-structured in-depth interview were collected and recorded for the data analysis.

Table 1: Probing Technique For Semi-Structured Interview (Adopted From Bernard, 2012; Dejonckheere & Vaughn, 2019)

Probing technique	Activities Detail
Wait time	Allowing the interviewee to think about the response and encourage to speak by remaining silent after asking a question.
Echo	Repeat and summarize the interviewee responses to encourage the interviewee to get into further details response.
Verbal agreement	Using acknowledging words to nurture the interviewee to keep on response.
Expansion	Ask the interviewee to explain more on the specific response.
Explanation	Ask the interviewee to clarify the certain thing relate to their response.
Leading	Ask the interviewee to explain their reasoning.

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Data Analysis Procedure

This study uses thematic analysis to analyze the data gathered from the Document Analysis in Stage 1 and semi-structured in-depth interviews in Stage 2. Thematic analysis is considered the foundation technique in qualitative analysis since it can be used throughout epistemology and research questions (Braun & Clarke, 2006). Thematic analysis technique was used to identify, organize, evaluate, and report the themes within the gathered data. The process was done in six stages, starting with familiarizing the data, generating initial codes, searching for themes, reviewing the themes, defining and naming the themes and finally producing the report. However, since the interview was conducted in the native language, the transcript went through the translation process before the thematic analysis was conducted. In the translation process, the transcript is translated by the author and verified by a fluent Malay-English bilingual person to eliminate misinterpretation and distorted meanings.

Ethics

The Research Ethics Committee Universiti Teknologi MARA has reviewed and approved the research. All the participants in this study were informed of the study's aims and objectives. The participants are volunteers. They signed the consent form and were informed of the level of confidentiality for this study.

Findings

RQ1: How Is The Remote Assessment Conducted To Assess Psychomotor Skills During The Pandemic?

Document analysis is used to answer the RQ1. In this study, the document analysis was conducted systematically to examine and evaluate the official syllabus of the Structural Laboratory course and the document that shows a record of changes made during the pandemic. In the Structural Laboratory course, the students must conduct experiments to demonstrate the mechanics of structure and materials theories. Other than conducting experiments, the students are expected to produce a laboratory report to relate the experiment to the learned theory by interpreting the experimental result and synthesizing the findings from the experimental work. The course has about twelve experiments to be conducted by the students. Three-course learning outcomes (CLO) are outlined in the syllabus: 1.) Analyze results of the experimental work and theoretical solutions to validate findings in providing a justifiable conclusion to solve structural engineering problems (CLO1), 2.) Organize laboratory experiments on structural elements and materials (CLO2), and 3.) Conduct and perform experiments effectively individually and as a team member (CLO3).

Each learning outcome was evaluated for different skills and attributes and assessed using all three domains: cognitive domain for CLO1, affective domain for CLO3 and psychomotor for CLO2. Before the pandemic, the student's psychomotor skills were evaluated through two different assessments: practical tests and laboratory reports. In the practical test, the students must perform individually the experiment selected by the lecturer. The students will be evaluated based on the four criteria: 1.) the ability to design and conduct the experiment; 2.) demonstrate the correct procedure and experimental set-up; 3.) collecting and recording the data, and 4.) the originality and creativity in performing the experimental work.

For the laboratory report, the students need to prepare a detailed report related to the experimental work done in the laboratory. The laboratory report is carried out in a group. The students are evaluated based on the six criteria: 1.) the ability to design and conduct a research-

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based experiment; 2.) the ability to perform the experiment safely; 3.) the ability to demonstrate handling the equipment set-up, 4.) complete the experimental work without guidance, 5.) ability to collect and record the experimental data and 6.) ability to illustrate the experimental work and manipulating data leading to findings. In general, before the pandemic, the students carried out the experimental work in a laboratory setting and submitted the laboratory report after completing the experiment. However, the syllabus changed during the pandemic, including the teaching delivery method, student learning activities, psychomotor assessment types, and the conducted method for psychomotor assessment— the summary of changes is shown in Table 2.

As shown in Table 2, instead of two types of assessment, they have changed into three types: practical test, laboratory report and article review. For the practical test, the students need to carry out any selected experiment to show their ability and skills in the psychomotor domain. The conducted practical test is evaluated on the same criteria as a practical test before the pandemic; the only difference is the setting environment. During the pandemic, the practical test is conducted in a home setting, and students need to prepare and use any appropriate material or tools for the practical test. The practical test is done asynchronously, where the students need to record and submit their recorded video for the practical test to their lecturer for evaluation. For the laboratory report, previously, the students were required to prepare the report based on the data collected during the experiment and the activity done in the laboratory.

However, during the pandemic, the laboratory report is prepared based on the data and the experimental work done by the lecturer in the pre-recorded video. The changes also were made to the criteria used to evaluate students' psychomotor skills through the laboratory reports during the pandemic: 1.) ability to design and conduct a research-based experiment; 2.) successfully perform the experiment without guidance; 3.) ability to manipulate the data leading to findings, and 4.) ability to adapt the obtained result with logic justification. An additional assessment of psychomotor skills was also formed during the pandemic, which produced an article review. The students must write an article review related to the experiment by referring to the journal articles and books.

Table 2: Summary Of Changes Made In Syllabus For Structural Laboratory Course During Pandemic And Method Of Conduct For The Psychomotor Assessment

Item	Before pandemic	During pandemic
Course Learning Outcomes	Three course learning outcomes.	Maintain and no changes made.
Teaching Delivery method	Face-to-face. The lecturer will give a short brief on the experiment procedure and the related theory.	Synchronous lecture using Microsoft Teams platform and video record.
Student learning activities	Students carry out the experiments in the laboratory setting. Students submitted laboratory reports based on the activities done in the laboratory.	Students watch the video provided by the lecturer to learn how to conduct the experiment. Students need to submit laboratory reports based on the pre- record video provided by the lecturer.
Types of assessments	1. Practical Test	1. Practical Test

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	2. Laboratory report	2. Laboratory report 3. Article Review
Method of assessment conduct to assess students' psychomotor skills	1. Practical Test – Students need to carry out any selected experiment, and students are evaluated on how they demonstrated their psychomotor skills in the laboratory setting. 2. Laboratory report – Students need to prepare a lab report, and an evaluation is made on how the student writes on the laboratory's conducted activity.	1. Practical test - Students need to carry out any selected experiment to show their psychomotor skills using suitable materials or tools in a home setting. 2. Laboratory report – students prepare a lab report based on the experiment conducted in the video recorded provided by the lecturer. The evaluation was made on the student ability to interpret and analyses the data. 3. Article review – students need to write an essay on the related experiment by reviewing the books or journal articles—the evaluation focuses on the students' ability to develop the methodology used in the experimental work.

Several criteria are used to evaluate the student's psychomotor skills in this assessment: 1.) the ability to demonstrate literacy in finding information, 2.) developing the methodology, 3.) incorporating data that leads to the findings and 4.) understanding in summarizing the paper. The rubric criteria of each assessment for psychomotor skills are shown in Table 3.

Table 3: Rubric Criteria Use To Evaluate Psychomotor Skills For Each Conducted Assessment During Pandemic.

Type of assessment	Criteria	Rubric Criteria
Practical Test	Ability to design and conduct the Experiment.	Successfully complete the experiment independently with high level of confidence.
	Demonstrate the correct procedure and experimental set-up.	All equipment is accurately set-up in an organized way.
	Ability to collect and record the data.	Successfully record the experimental data.
	Originality and creativity in performing the experimental work	Original idea with high creativity.
Laboratory Report	Ability to design and conduct research-based experiment.	Independently designed / identified the idea / task of the experiment with additional supporting references. Show an outstanding

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		ability in conducting research-based experiment.
	Successfully perform the experiment without guidance.	Successfully complete experiment independently.
	Ability to manipulate the data leading to findings.	All the results have been interpreted correctly, with sufficient support of important trends or data comparisons.
	Ability to adapt the obtained result with logic justification.	Show excellent understanding between the results to adapt with logical justification.
Article review	Ability to demonstrate literacy in finding information.	All information selected directly relate to topic reviewed.
	Develop the methodology.	All methodology reviewed are clear and thorough.
	Incorporate data that leads to the findings.	All data collection is coordinated and aligned to findings.
	Understand in summarizing the paper.	Demonstrated a high level of knowledge in writing review papers.

RQ2: What Are The Challenges The Students Face In Conducting An Assessment To Assess Their Psychomotor Skills During The Pandemic?

The semi-structured interview with students found several challenges they faced in assessing their psychomotor skills during the pandemic. The first challenge faced is related to internet connectivity. During the Mac – July 2020 semester, due to the increasing number of COVID-19 cases, all the students are instructed to return to their homes, and classes are conducted remotely. Students joined the class from their homes, and those who lived in the rural area have been severely affected by internet connectivity issues. Their internet connectivity is slow and unstable, and sometimes, this has caused a lost connection. Good internet connectivity is vital since the laboratory is conducted using an online platform. The students need to watch the pre-recorded video provided by their lecturer using an online platform and download all the data to include in their laboratory report.

"I have to wait until midnight to download all the material given by the lecturer to assist in writing the laboratory report. Even at midnight, downloading the learning material takes a long time. Sometimes, during the process, I have experienced a lost connection, and I have to repeat the download process from the beginning, which makes me stressed." – (Interview No. 3)

Another challenge the students face while completing the assessment, related to the internet connectivity, is when they have to upload the recorded video for the Practical Test. In the Practical Test, they must record the activities and submit them to their lecturer for online evaluation. It has a large file size, and a high-strength internet connection required to upload the recorded video. A similar issue and challenges are faced in uploading the recorded video to an online platform, which is time-consuming. In worse situations, the connection is lost, and they must re-upload the video and start the process from the beginning.

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"The video file is large, and it takes almost an hour to complete the upload process due to slow internet connectivity, especially during the peak time. We do not have any option since the submission for the practical test was set during the peak time." – (Interview No. 5)

The second challenge the students face while conducting the assessment is accessibility to a decent device to complete the assessment. During the Mac – July 2020 semester, the MCO was unexpectedly announced, and most students reported being unprepared for the online classes. Some of the students do not even have a laptop or desktop computer. The situation worsened when all the computer retailers were closed due to MCO, which left a smartphone as the only option for device use in completing the assessment. Before the pandemic, the laptop or desktop computer was optional and insignificant; most of the assessment was conducted face-to-face and can be completed using handwriting. If the assessment needs a laptop or desktop computer usage, they borrow from their friends or use the service from a computer lab in the university. However, during the pandemic, at their home, they have no option for the device except to use the smartphone only.

"I have to use my phone to complete my part in the laboratory report and then pass my part to my friend to correct the report format. It is quite challenging, and I must thank my friend for helping me. We have once submitted our laboratory report using handwriting, but the lecturer had asked us to resubmit the report and use of Microsoft Word." – (Interview No. 7)

"I have difficulties recording my video for practical tests because my phone does not support big files due to limited memory. I partially transferred the file before starting to record again, then combined all the files before submitting the assignment" – (Interview No. 3)

"I do not contribute much to preparing laboratory reports since I do not have a laptop. I am lucky because my group members understand my situation. Most of the time, I only calculate the data by hand, snap the picture, and then give it to my friend to include in the laboratory report." – (Interview No. 6)

The third challenge faced by the students while conducting the assessment was the need for more explanation by the lecturer on the experiment and assessment to conduct. In producing the laboratory report, the students have to watch the pre-recorded video prepared by the lecturer showing how the experiment was conducted in a laboratory setting. However, the video needed to show the details of the experiment, and students faced difficulties observing how to set up the apparatus for the experiment. It has caused difficulties in writing the experimental procedure in the laboratory report.

"We are having difficulties putting in writing the procedure since the provided video does not focus on the setup; it just shows in general how the setup should be done" – (Interview No. 8)

"I am not very clear with the explanation given in the video; the lecturer did not give very much explanation on each experiment; they just asked us to watch the video and submit the report" – (Interview No. 2)

Other than that, the students need clarification on the instruction given for the assessment, such as the Article Review, and must fully understand the rationale for conducting the assessment. In the Article Review assessment, students must produce an article related to the experiment in

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a heavy lab structure. The topics that need to be reviewed include Concrete Mix, Concrete Testing, and Retrofitting of Damaged Concrete.

"I do not know why we are doing the article review. We are not explaining the rationale of doing the article review, and the lecturer asks us to produce the article and give us a few examples of the article." – (Interview No. 9)

"We are not very clear to do the review. We do whatever we think is correct" – (Interview No. 4)

"Among the assignments that we have done, I do not know why we are doing the article review; our lecturer did not explain very much on this assignment; instead, he just gave us a few examples of an article and asked us to make a writing similar to the article format" – (Interview No. 7)

The fourth challenge the students face is the environment while conducting the assessment. Since the assessment was conducted in a home setting, the environment has become vital to the student's performance. This factor has significantly impacted students who come from middle to lower-income families. Since all the educational facilities are closed and all learning is conducted remotely, all the students learn from home, which causes cramps at home when online classes occur simultaneously. They must share the space and room, and sometimes, it has caused disturbances when hearing the voices of others during the online session. A similar situation occurred when conducting the assessment, especially for the Practical Test.

"I have to re-take the video for the Practical Test so many times because there are many interruptions during the record session. I have recorded the video in the living room because that is the only place in my house suitable to record and conduct the practical test." – (Interview No. 3)

"I prefer doing my assignments at college since I did not have a proper place to study and do my assignments. It is quite challenging for not having a proper place to study with all my siblings at home" – (Interview No. 1)

"I live in the village; hence, I have to wait until midnight so I can record the video without any disturbance from the surrounding sound like chicken and duck sound" – (Interview No. 4)

In conclusion, the students face four main challenges while conducting the assessment to assess their psychomotor skills: internet connectivity, accessibility to decent devices to complete the assessment, and lack of explanation on the assessment and the environment while conducting the assessment. The challenges faced by the students could affect the student's performance not only for this course but also for the overall performance in the program.

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RQ3: What Is The Student's Point Of View Regarding The Psychomotor Assessment Conducted During The Pandemic In Preparing The Students For Industrial Training Or Engineering Fieldwork?

The structural laboratory course is intended to provide the students with the technical capability to conduct testing for structural elements on-site and produce a report when they are in the industry. The purpose of the assessment is to experiment, produce a report, and assess psychomotor skills for this course. Conducting a laboratory course during a pandemic can be challenging for students and the lecturer. They have to review and redesign the curriculum so that the teaching-learning activities and assessments can evaluate the skills and knowledge intended for students to master. As for this course, three assessments are conducted to evaluate students' psychomotor skills: a Practical Test, Laboratory Report and Article Review, conducted remotely during the Mac – July 2020 semester. There are no activities conducted in the laboratory during the semester Mac – July 2020, and they never have any experience using the laboratory's tools and machinery. The students also have no experience setting up the experiment and preparing the samples to test. It is such a significant loss for the students, and they feel that the conducted method for this course during the pandemic does not benefit them in the long run.

"I come from a matrix program, so I never have any experience in setting up the laboratory; I never had a chance to use such a compression testing machine, so I do not know if I conduct the testing if I am required to do so" – (Interview No. 2)

"I hope the faculty can allow us to do face-to-face activities in the laboratory after the pandemic to have hands-on experience handling the tools and conducting testing in a laboratory setting. In my opinion, the conducted activities during the pandemic did not benefit us; we did not learn very much from the pre-recorded video" – (Interview No. 5)

The students also feel that the assessment conducted does not benefit them, and they need to be more confident in conducting any experiment if asked to do so, even if they obtain a good result for the course. They feel no meaningful learning since the laboratory was conducted remotely; hence, they must complete the assessment without understanding the cause and essence of the assessment conducted.

"I do not know the benefit of doing an article review. We do it for the sake of marks. We divide the work and make the review individually before we compile all the reviews to become one and submit" – (Interview No. 1)

"Honestly, I only watched the video related to my practical test. I do not feel it necessary for me to watch all the videos since I feel that it does not make sense for technical subjects conducted online" – (Interview No. 4)

"I did not learn very much from the assessment; we just try to complete the assessment following the rubrics given and hope for the best" – (Interview No. 6)

"I think I need assistance from an experienced person on site if I am being asked to do testing on concrete. I am not confident to do it by myself" – (Interview No. 5)

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From the feedback of students through the interview session, it can be concluded that the students feel that the conducted assessment for Structural Laboratory during Mac – July 2020 did not benefit them in the long run, including during the industrial training and to work in the industry. They also feel this course's method is unsuitable since it involves psychomotor skills; the course must be conducted face-to-face in the laboratory setting. They need hands-on training in preparing the sample, setting up for the experiment, and experience handling the tools and machines in the laboratory.

Discussion

Assessment is an essential part of the learning cycle. Therefore, the assessment design must be precise to attain the intended learning outcomes. Other than that, the assessment method must be accurate to suit the nature of the learning domain. Suppose we are assessing for the psychomotor learning domain; the conducted assessment must allow students to demonstrate their ability in motor skills, and the criteria used in evaluation must be addressed for the psychomotor skills. For example, if we wanted to evaluate a person's writing ability, the assessment criteria must be assessed: How does the person hold the pen? Is the method of holding the pen is correct? How does a person utilize the tools to write? Does the person operate the tools correctly as it is supposed to be? How many paragraphs can a person write per minute? How well is the writing done? These are the criteria that are supposed to be applied in assessing psychomotor skills.

In deciding the correctness of the conducted assessment, the assessment will focus on the assessment's ability to attain the learning outcomes and the assessment method. The cognitive domain is related to the ability of students to process and utilize knowledge, and it can be measured through writing examinations, quizzes, and project-based assessments (Kasilingam et al., 2014). The affective domain is related to students' ability to demonstrate the attitude, feeling, emotions and value of what is being learned, and it can be measured through activities such as presentations, group discussions, debates, and workgroups (Kasilingam et al., 2014). The psychomotor domain is related to the ability of a student to perform an activity using their motor skills and ability to coordinate them, and it can be measured through the activity conducted in the laboratory, kitchen, physical activities, on-site activities, training using specific equipment such computers, projectors and performing arts. The psychomotor assessment is best assessed face-to-face (Kasilingam et al., 2014).

As for the Structural Laboratory course, they have implemented three different assessments to evaluate the students' psychomotor skills during the pandemic. For the Practical Test, the students need to record a video of experimenting with a home setting for the Practical Test. They are using any available tools and material at home to replicate the setup in the lab and explain the procedure to experiment. No data was recorded during the process of the Practical Test; hence, the criteria used to evaluate the student's psychomotor partially do not reflect the activity conducted in the Practical Test. The other issue related to the conducted Practical Test is the level of learning addressed for the assessment. In this course, students are expected to attain a Complex Overt Response (P5) level of learning, where they are expected to perform a complex movement pattern using skillful motor performance, and this level of learning can only be attained with the actual setup in the laboratory using tools and machinery. The current method for the Practical Test does not allow the students to attain the P5 level of learning since they need to perform the actual experimental setup and replicate the setup in the laboratory. The level of learning that precisely addresses the Practical Test conducted during a pandemic

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is Guided Response (P3), where, at this level, the students are expected to demonstrate the initial stage of learning for a complex skill that involves simulation and trial and error.

The other two assessments, Laboratory Report and Article Review, are considered unsuitable for adoption as instruments to evaluate students' psychomotor skills due to the nature of the assessment. For both assessments, the students are required to produce a report and article in writing which does not reflect their ability and skills for the psychomotor learning domain. The criteria adopted in the evaluation are not reflected in the evaluation of psychomotor skills; the students are evaluated based on their writing content, which reflects their cognitive ability. Other than that, laboratory report criteria must reflect the activities conducted. In conducted activities, based on the data from the document analysis and interview with students, it is found that the students only watch for the pre-recorded video of the lecturer showing how to conduct the experiment, and later, the students produce lab reports based on the video. In the assessment criteria, the students were evaluated on their ability to experiment without guidance, which does not reflect any conducted activities.

Students and lecturers have different perspectives on the assessment. As shown in Figure 1, from the lecturer's perspective, the assessment is the endpoint in the teaching-learning activities. However, from the student's perspective, the assessment is at the beginning of the teaching-learning activities (Biggs & Tang, 2011). From the student's point of view, *assessment* is defined as the actual curriculum, focusing on what will be included in the assessment. In other words, the assessment determines what and how the students learn in one topic more than what the curriculum does. Hence, considering the point of view of students related to the assessment, it is vital to align the assessment to the knowledge and skills that we intend students to master. In this course, conducting Laboratory Reports and Article Reviews is not aligned with the intended knowledge and skills, which are psychomotor skills. Therefore, the implementation of assessment to assess psychomotor skills for the Structural Laboratory course during the pandemic should be reviewed and revised, either changing the criteria to assess the students or changing the learning domain for the assessment.

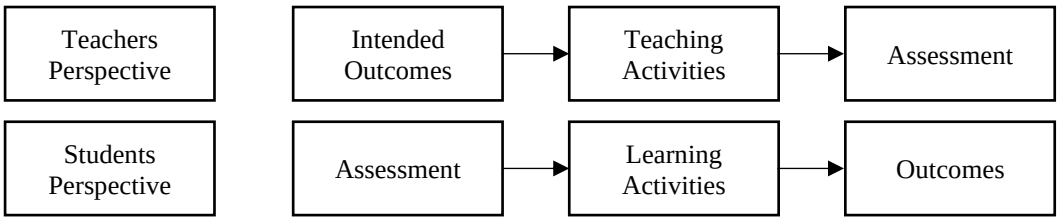

Figure 1: The Difference Between Teachers And Students' Perspective On Assessment

Conclusion and Recommendations

This study aims to critically review the implementation of the Structural Laboratory course during the pandemic for semester Mac – July 2020. It used a qualitative case study approach with document analysis and semi-structured interviews. The document analysis has systematically examined the syllabus and the document recorded for syllabus changes during the pandemic. The semi-structured, in-depth interview was conducted with the nine students who took the Structural Laboratory course in the semester Mac – July 2020. The findings show that during the pandemic, assessing students' psychomotor learning domains has added up to three assessments: Practical Test, Laboratory Report and Article Review. The laboratory report and article review assessment were considered unsuitable for assessing the psychomotor

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learning domain due to the nature of the assessment and the criteria adopted to assess the students. In considering students' views on the assessment, it is essential to align the assessment to the knowledge and skills we intend students to master. The implementation of assessment to assess students' psychomotor skills for Structural Laboratory courses during the pandemic should be reviewed and revised, either changing the criteria to assess the students or changing the learning domain for the assessment. Other than that, implementing the assessment should also consider the challenges and issues the students face while conducting the assessment. It is suggested that instead of video recording, the implementation can be enhanced using the simulation related to the structural element and testing for the incoming remote implementation of the Structural Laboratory. Other than providing meaningful learning to students, it can also be used to assess the students' psychomotor skills. The students can be asked to develop a model using open-source software and analyze the model based on the condition given to the student. They also can compare the results from the laboratory conducted by the lecturer. It is more precise in assessing the students' psychomotor skills than Laboratory Report and Article Review. In future studies, it is recommended that a study be conducted to observe the implementation of the remote laboratory during the pandemic from the lecturer's perspective. It is also essential to include the curriculum implementer's perspective to have a balanced view of the implementation.

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