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Virtual Laboratory: An Alternative Method of Practicum Learning in Higher Education during the Covid-19 Pandemic

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ABSTRAK

Laboratorium praktikum merupakan salah satu faktor krusial dalam perkuliahan yang praktiknya masih banyak mengalami kendala pada masa pandemi di Indonesia. Hal ini dikarenakan adanya regulasi pembelajaran daring yang mengharuskan mahasiswa untuk tidak aktif di ruang laboratorium kampus. Penelitian dengan pendekatan R&D ini bertujuan untuk menghasilkan produk e-learning berbasis virtual laboratory, serta untuk memenuhi keterbatasan akses laboratorium praktikum. Penelitian ini melibatkan 101 yang dijadikan sebagai responden sekaligus subjek penelitian. Dengan pendekatan R&D serta menggunakan model pengembangan Rowntree, produk disempurnakan secara levelitas. Pada tahap pertama tim peneliti mengadakan studi pendahuluan untuk memotret model pembelajaran mahasiswa di era industry 4.0 di tengah pandemi COVID-19. Tahap kedua yaitu membuat model e-learning berbasis virtual laboratory dengan Zoom pada mata kuliah metode penelitian kuantitatif dengan menggunakan software SPSS. Dalam penelitian ini, tim peneliti merancang 2 versi model pelatihan yang dikonsultasikan kepada expert yang kemudian direvisi berdasarkan hasil konsultasi tersebut. Pengujian produk skala kecil dan skala besar dilaksanakan oleh tim peneliti, sehingga pada akhirnya diperoleh produk virtual laboratory secara final. Pada penilaian post-test, hasil penelitian secara positif membuktikan bahwa 99% mahasiswa setuju dengan adanya e-learning berbasis virtual laboratory. Karena itu, virtual laboratory harus segera dibuat pembelajaran daring yang didukung dengan pendekatan active learning, agar mahasiswa mampu mempraktikan analisis data kuantitatif secara maksimal dengan menggunakan SPSS.

ABSTRACT

The practicum laboratory is one of the crucial factors in lectures whose practice is still experiencing many obstacles during the pandemic in Indonesia. Due to online learning regulations that require students not to be active in campus laboratories. This research with an R&D approach aims to produce e-learning products based on virtual laboratories and meet the limited access to practicum laboratories. This study involved 101 students who were used as respondents and research subjects. With an R&D approach and using the Rowntree development model, the product is refined at a level. In the first stage, the research team conducted a preliminary study to photograph student learning models in the industrial 4.0 era amid the COVID-19 pandemic. The second stage is to create an e-learning model based on a virtual laboratory with Zoom in quantitative research methods courses using SPSS software. In this study, the research team designed two versions of the training model, which were consulted with experts and then revised based on the consultation results. Small-scale and large-scale product testing was carried out by the team research so that, in the end, the virtual laboratory product was obtained in the final. In the post-test assessment, the research results positively prove that 99% of students agree with the existence of virtual laboratory-based e-learning. Based on these results, a virtual laboratory must be immediately created through e-learning or online learning supported by an active learning approach so that students will be able to practice quantitative data analysis optimally using SPSS.

1. INTRODUCTION

A virtual laboratory in quantitative research methods is crucial for improving numeracy competence in students' logical thinking, which still often experiences obstacles in several educational institutions in Indonesia (Beatty et al., 2021; Maghfiroh et al., 2021). In this regard, every educational institution is expected to encourage its students to have stable competence in numeracy (Lechner et al., 2021; Rahmiati, 2019). Individuals are declared competent in numeracy if they have systematic, valid, reliable logic and can prove hypotheses scientifically (Apriliawan & Parmiti, 2021; Ott et al., 2018). To achieve this achievement, universities must

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produce a generation with good predictive and analytical skills. One of these competencies is the ability in terms of quantitative research. Ability in quantitative research is the individual's competence in proving causality with the support of numbers or numeration to critically measure the validity and reliability of a hypothesis (Creswell & Creswell, 2018; Hartatik, 2020). On the other hand, to improve students' quantitative critical thinking, software tools are needed (Gómez & Suárez, 2021; Lim, 2021), such as the Statistical Package for Social Sciences (SPSS), which assists researchers in analyzing valid and reliable data (Creswell & Creswell, 2018; Sugiyono, 2016). The campus facilitates a practicum laboratory for practice to support this achievement. Unfortunately, these activities are often hindered due to the COVID-19 pandemic, which requires campus activities in Indonesia to be carried out online (Agustino, 2020; Sondakh et al., 2022).

Distance learning with technology is the main alternative in overcoming the impact of the Coronavirus (Oktari et al., 2020; Safi'i et al., 2021). However, the results of other studies confirm that practicum learning is complicated to replace with only online learning, especially in Indonesia (Liu et al., 2022; Sukendro et al., 2020); therefore, virtual classrooms are needed in higher education (Lacka et al., 2021). From the educational aspect, virtual technology is used as a media focus to support student inquiries through demonstrations of the material presented (Liu et al., 2022; Vergara et al., 2022). There are so many virtual technology products that can replace the role of face-to-face classes, such as Zoom, Google Meet, and other virtual technologies that support dialectics and learning demonstrations during the COVID-19 pandemic (Firmandani et al., 2021; Vergara et al., 2022). Although virtual technology has developed rapidly, obstacles are still often found in pandemic situations, especially teaching and learning (Clemmons et al., 2022; Soliman et al., 2021). In line with this statement, based on the results of interviews with students of the Education Administration Study Program, Faculty of Administrative Sciences, Universitas Brawijaya, who have taken practicum courses. It was found that several obstacles were encountered during the quantitative research method practicum. First, online learning, which was explained during the COVID-19 pandemic, hampered the implementation of practicum course learning. Second, the limitations of practicum strategies with online learning. Third, the implementation of face-to-face practicum in the computer laboratory often fights with the class or other study programs that do the practicum. Every semester, a computer laboratory is used for practicum of research method courses from 3 other study programs (Public Administration Study Program, Library Science and Educational Administration) within the Brawijaya University. So the entire class that uses a computer laboratory is 15 classes from three study programs.

Research on virtual laboratories has dominated in times of Corona Virus disruption, such as other research studies stating that students who carry out learning activities with virtual laboratories are a form of manifestation of the push factor (supporting factor) in understanding the teaching material delivered, even though they are in a threatening environment (Abumalloh et al., 2021). The subsequent research conducted by Lopez in his study stated that students who use virtual reality show better demonstration performance in identifying and describing the subject matter than those using traditional education systems (Lopez et al., 2021). While in Indonesia itself, research on the effectiveness of virtual laboratories has been carried out but only focuses on comparing results between offline and online, not on developing a product (Astuti et al., 2021). Similarly, another research did not lead to product development but only to the results of students' scores in junior high school and not at university (Sumarno, 2021). In contrast to previous research, this study focuses on developing virtual laboratory products that can help students understand and use SPSS software tools. In product development, this kind of research is considered necessary because it can contribute to e-learning products to quantitative research method lectures. Furthermore, the findings obtained can be used as a basis for creating and developing products carried out in quantitative research courses. On the other hand, the results of this study can be used as a reference by lecturers in the creation and enrichment of virtual laboratory products. Therefore, this study aims to analyze how the need and development of e-learning based on a virtual laboratory with the Zoom platform in the quantitative method of data analysis practicum course with SPSS can replace the role of laboratories at universities.

2. METHOD

This study uses a Research and Development (R&D) approach by applying the Rowntree development model (Sugiyono, 2019). With stages: Analysis (Need Assessment and Front-End Analysis); Design; Development; Implementation; and Evaluation (Hartman et al., 2020; Sugiyono, 2019). Respondents or subjects in this study were taken from 101 students of the Education Administration study program, Faculty of Administrative Sciences, Universitas Brawijaya in the odd semester of the 2021/2022 academic year, of which 28 were male and 72 female. Before the product trial was held, after the research team created an e-learning model based on a virtual laboratory with Zoom and a data analysis module with SPSS, the product was consulted with three experts consisting of one subject expert in quantitative research methodology, one learning expert, and one statistical practitioner of quantitative data analysis with SPSS. After receiving input from experts, the product was revised by the development team (Abumalloh et al., 2021; Vergara et al., 2022). There are several

cycles of system development delivered by experts. There are several steps of the evaluation capacity building model (ECB): planning, implementation, evaluation, dissemination, questionnaire, and analysis (Hartman et al., 2020). There is also another opinion to maintain innovation consisting of five steps: assessment, development, implementation, evaluation, and modification. Another development cycle has ten steps, including research and information collecting; planning; develop a preliminary form of the product; preliminary field testing; main product revision; main field testing; operational product revision; operational field testing; final product revision; and dissemination and implementation (Hartman et al., 2020).

In this Research and Development, the validation of learning media is carried out through several phases. The first trial stage has been taken from 10 students to provide input about the products that have been made. After receiving input from students, the development team revised the product made. The second trial of the research team took 25 students to provide input about the products made. After receiving input from students, the development team revised the product made. The data collection technique used is the walkthrough. A lecturer makes the walkthrough process or validator notes of Education Administration, Brawijaya University. This process is carried out to find out an overview of the validity of the product being developed. The validation carried out for learning media consists of three aspects such as, material aspects, media aspects, and learning design aspects. The number of indicators used to assess each aspect depends on each aspect and its needs. Furthermore, data collection was carried out using a closed questionnaire with a Linkert scale in the form of a five-scale checklist (Guo et al., 2020). The instrument uses 14 indicators that have been consulted with experts in media, materials, and users, as well as an open questionnaire that can be written in the questionnaire column. Meanwhile, information is obtained from data processed with quantitative and qualitative approaches. Quantitative results were obtained from calculating the assessment and responses of validators and research subjects (Creswell & Creswell, 2018; Sugiyono, 2019).

On the other hand, qualitative data were obtained from expert interviews in the form of suggestions, criticisms, and comments relevant to virtual laboratory products (Vergara et al., 2022). While the open questionnaire, the research team did not provide answers, and respondents were expected to provide answers according to the respondent's circumstances. The open questionnaire provides flexibility for experts and students to provide input for product improvement, taking into account the following aspects: ease of use of the product; usefulness or functionality for users of the product; attractiveness (look) of the product; product up-to-date; language clarity; content display; compatibility or interrelationships between parts of the product; product completeness; product content depth; product content depth; product effectiveness; product efficiency. From the aspect of the feasibility indicator, it is determined by the following criteria: Very Unsatified (0%-20%); Unsatisfied (21%-40%); Neutral (41%-60%); Satisfied (61%-80%); Very Unsatisfied (81%-100%) (Sugiyono, 2019).

3. RESULT AND DISCUSSION

Result

The first trial in this study was students of the Education Administration Study Program FIA UB to be given a quantitative data analysis practicum with SPSS via Zoom as a virtual laboratory. The trial at this stage was taken from 10 students to provide input about the products that have been made. After receiving input from students, the development team revised the product made. In the second trial, the research team took 25 students to provide input about the products made. After receiving input from students, the development team revised the product made. The final result is that the model is made after the trial, and dissemination and implementation are carried out. The product is applied by holding practicum learning for undergraduate students of the Education Administration Study Program at the Faculty of Administrative Science, Brawijaya University.

From the results of calculations and analysis using the Research and Development approach, the researchers found very positive results regarding planning a virtual Laboratory-based e-learning model, as the results of the data analysis described in Table 1.

Table 1. Results of the Analysis of the Virtual Laboratory-Based E-learning Planning Stage

No.	Indicators	Descriptions	Frequency	%
1.	Student opinion about virtual laboratory-based e-learning	Agree	99	98.0
		Neutral	2	2.0
		Disagree	0	0.0
2.	Experience in following virtual laboratory-based e-learning	Never	56	55.4
		Ever	44	43.6
		No Answer	1	1.0
3.	Learning Models	Approaches to Training and development	27	26.7

No.	Indicators	Descriptions	Frequency	%
		Subject matter analysis	12	11.9
		Training needs assessment	28	27.7
		Do not know	34	33.7
4.	Learning Goals	Affective learning	9	8.9
		Practice skill/behavioral learning	69	68.3
		Cognitif learning	8	7.9
		Others	9	8.9
		Choose all	6	5.9

Based on the summary of Table 1 from the results of the analysis of the planning stage of the virtual laboratory-based e-learning training, students agree 99 (98.0%) if the university promotes practicum with virtual laboratory-based e-learning. The reasons students agreed were First, increasing the competence of quantitative data analysis with SPSS; second, making it easier for students to participate in quantitative data analysis practicum in the pandemic and industry 4.0 era; and last, students practicing quantitative data analysis directly and independently.

The experience of participating in research methods training with a virtual laboratory has detected a significant differentiation between participants and non-participants. The presence of non-participants is due to the following reasons that are the unavailability of a virtual laboratory-based e-learning practicum in the pandemic era provided by study programs or faculties, and the COVID-19 pandemic disaster. Therefore, we need an e-learning material based on a virtual laboratory in the quantitative research methods course by SPSS, with the following specifications: (1) Descriptive Statistics: Frequency, Tabulation, and Description; (2) Bivariate Statistics: T-test, ANOVA, and correlation; (3) Prediction: Regression Analysis; and (4) Group Identification: Factor Analysis.

Other findings describe that the media needed by students in virtual laboratory-based e-learning include laptop or computer, Zoom application, SPSS application, Internet network, and non-electronic media such as data analysis learning module by SPSS. Moreover, the human resources needed are mentors or presenters and participants or students. Furthermore, the second stage, namely the analysis of the implementation of e-learning based on virtual laboratory uses training methods by considering the right place, right time, number of hours, and number of days expected by students is described in Table 2.

Table 2. Results of the Analysis of the Implementation Phase of Virtual Laboratory-Based E-learning in the Quantitative Research Method Course with SPSS

No	Indicators	Descriptions	Frequency	%
1	Methods	Demonstration	53	52.5
		Case study	24	24.8
		Guided teaching	25	24.8
		Group inquiry	9	8.9
		Information search	22	21.8
		Study group	18	17.8
		Jigsaw learning project	9	8.9
		Learning tournament	8	7.9
		Experiment	44	43.6
		Role playing	26	25.7
		Games and simulations	29	28.7
		Observation	24	23.8
		Mental imagery	13	12.9
		Writing tasks	5	5.0
		Action learning	38	37.6
		Others	1	1.0
2	Places to study	Laboratory	32	31.7
		Virtual Laboratory	59	58.4
		Others	7	6.9
		No answers	3	3.0
3	The right time for training	Active time for college	33	32.7
		Holiday	37	36.6
		Holiday other than Saturday-Sunday	1	1.0
		Semester break	12	11,9

No	Indicators	Descriptions	Frequency	%
		Graduation waiting period	15	14.9
		No Answers	3	3.0
4	Number of hours	One hour	3	3.0
		Two hours	31	30.7
		Three hours	33	32.7
		Four hours	7	6.9
		Five hours	7	6.9
		Six hours	4	4.0
		Eight hours	3	3.0
		Twelve hours	2	2.0
		Sixteen hours	1	1.0
		Twenty-one hours	1	1.0
		Twenty-four hours	1	1.0
5	Number of days	One day	35	34.7
		Two days	22	21.8
		Three days	17	16.8
		Four days	2	2.0
		Five days	5	5.0
		Six days	1	1.0
		One week	8	7.9
		Eight days	1	1.0
		Two weeks	1	1.0
		No answers	9	8.9

Based on Table 2, the expected methods during virtual laboratory-based e-learning training in the quantitative research methods course by SPSS are dominated by demonstration, experimental, and action learning methods. Regarding the place of training, most of which are carried out in virtual laboratories, which are carried out on campus, and the last one is in other places. The right time expected by students is the first to choose a Saturday-Sunday holiday, the second to choose an active period of study, and the waiting period for graduation. The number of hours for implementation is about 2-3 hours in 1-2 days. Based on the results of the analysis of the virtual laboratory-based e-learning evaluation stage in the quantitative research method subject by SPSS, the expected outcomes or abilities of students are to practice data analysis with SPSS: (1) Descriptive Statistics: Frequency, Tabulation, and Description; (2) Bivariate Statistics: T-test, ANOVA, and correlation; (3) Prediction: Regression Analysis; and (4). Group Identification: Factor Analysis. According to students at the evaluation stage, respondents' answers are shown in Table 3.

Table 3. Results of the Analysis of the Evaluation Stage of Virtual Laboratory-Based E-learning Training in Quantitative Research Methods Courses with SPSS

No	Indicators	Descriptions	Frequency	%
1	Pre-test	No answers	3	3.0
		Unsatisfied	2	2.0
		Neutral	15	14.9
		Satisfied	31	30.7
		Very satisfied	50	49.5
2	The subject	No answers	3	3.0
		Unsatisfied	0	0.0
		Neutral	5	5.0
		Satisfied	27	26.7
		Very satisfied	66	65.3
3	Post-test	No answers	4	4.0
		Unsatisfied	2	2.0
		Neutral	7	6.9
		Satisfied	29	28.7
		Very satisfied	59	58.4
4	Evaluation program	No answers	3	3.0
		Unsatisfied	2	2.0
		Neutral	5	5.0

No	Indicators	Descriptions	Frequency	%
5	Evaluation categories	Satisfied	34	33.7
		Very satisfied	57	56.4
		No answers	3	3.0
		Unsatisfied	1	1.0
		Neutral	3	3.0
		Satisfied	20	19.8
		Very satisfied	74	73.3

Based on the calculation of Table 3, it describes that the pre-test assessment of the most answers is "very satisfied," then the answer "satisfied." However, before students are given training materials, the development team already has a practical competency test tool for understanding quantitative data analysis by SPSS. This tool detects the initial understanding of activities before being given practicum or learning material. The respondents' answers produced an answer that a virtual laboratory was needed. In the post-test assessment, respondents' answers also have two variations, namely " very satisfied" and " satisfied." At the end of the activity, respondents answered "very satisfied" and "satisfied" to assess the training program that had been implemented. Based on the overall evaluation category, respondents answered it was essential, as explained in Figure 1 and Figure 2.

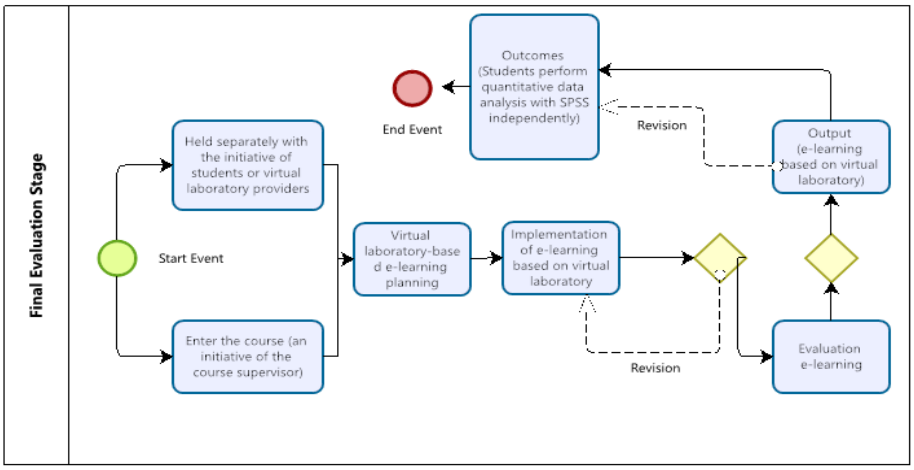

Figure 1. Final Evaluation Stage

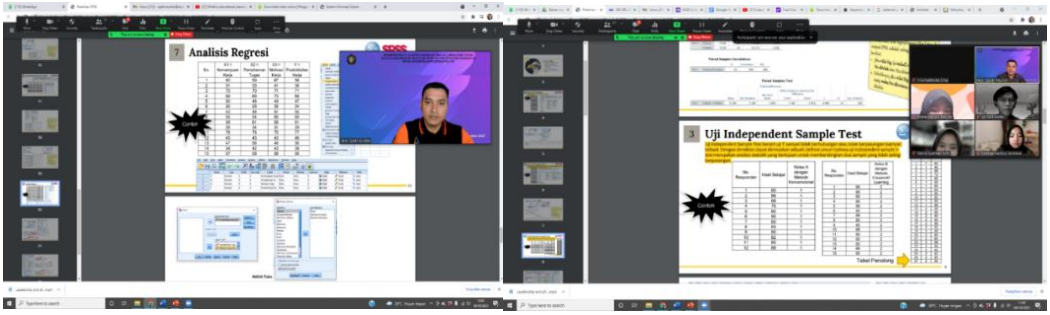

Figure 2. A Small-Scale and Big-Scale Product Test

Discussion

The Need for a Virtual Laboratory-Based E-learning Model in Quantitative Research Methods Courses by SPSS

Based on the planning stage analysis (Table 1), almost all students agree with the existence of virtual laboratory-based e-learning in quantitative research methods courses. In this regard, the previous result studies which analyzed the effect of these variables on the need for a substitute laboratory for students in the quantitative field, especially in Indonesia, have not been found. However, the use of a virtual laboratory has been researched to help improve the better meaning of the learning process, especially in the formation of the character of students (Rahmiati, 2019; Susilawati, 2019). The implementation of the virtual laboratory was also investigated

and found to have the potential to produce more significant benefits during the pandemic. Furthermore, this factor is because the virtual laboratory used is exciting and easy to understand, even in the COVID-19 situation (Liu et al., 2022).

From several virtual laboratory lectures conducted via Zoom by Universitas Brawijaya at Education Administration students during the disruption period, it was obtained that using SPSS in a virtual laboratory increased students' motivation to apply SPSS and demonstrate the results of their analysis. It is in line with the results of previous study, which shows that 93% of students agree with the virtual laboratory because the virtual laboratory activities that have been carried out are also believed to make it easier for students to learn (Yu, 2022). This finding is also in line with the statement of several studies proving that the virtual laboratory is an aspect of learning activities that influence students to construct their curriculum by calculating and analyzing the data they have processed (Carvalho & Santos, 2022; Yu, 2022).

Developing a virtual laboratory is a conscious effort to improve student competence in practice (Qian et al., 2020; Reeves et al., 2021). Another study informs that virtual laboratories in the teaching and learning process have good cognitive and psychomotor competencies. This evidence can strengthen the crucial factor of virtual laboratory-based e-learning, especially in increasing student participation in active learning, because studying quantitative data analysis with SPSS requires practical skills or active learning that is not just abstract understanding (Carpenter et al., 2022; Moustapha et al., 2022). On the other hand, the practice can significantly support students' social skills and emotional intelligence. This progress is due to the support obtained through a collaborative learning approach and has implications for encouraging students to be active (Moustapha et al., 2022; Tautz et al., 2021). So it can be concluded that social skills in the virtual laboratory are needed to help students understand and practice the presented material (Moustapha et al., 2022; Tarchi et al., 2022; Tautz et al., 2021).

As previously known, the majority of respondents agree that the study program implements virtual laboratory-based e-learning models in quantitative research methods courses by SPSS: the first increasing the competence of quantitative data analysis with SPSS; the second, making it easier for students to participate in quantitative data analysis practicum in the pandemic and industry 4.0 era; the last students can practice quantitative data analysis directly and independently. Table 2 itself shows that the method with the demonstration approach (52.5%) is more needed than other methods, this is because the existence of student curiosity is constructed by learning media, which is believed to be able to eradicate online dynamics in coursework practicum, furthermore because the virtual laboratory used is reasonably exciting and easy to understand, even in the COVID-19 situation (Liu et al., 2022).

Learning strategies by e-learning models based on virtual laboratories in quantitative research methods courses by SPSS are expected to include: (1) seminars/workshops; (2) continuous training; (3) individual approach; and (4) hands-on practice independent. However, other research findings state that the expected methods during virtual laboratory training are better dominated by demonstration, experimental, and active learning methods (Carvalho & Santos, 2022; Moustapha et al., 2022). Because it helps students easily understand and practice SPSS. On the other hand, the demonstration method is essential because it is a significant contributor in psychomotor, which shows the occurrence of an event either artificially or real. This experimental method is carried out independently in which trainees are directly involved in using SPSS without having to be in the lab (Moustapha et al., 2022; Tautz et al., 2021).

According to this rationalization, the researcher affirms that the active learning method in a virtual laboratory is a learning strategy that allows small groups to work consistently and together in solving problems and taking action. Other researchers also agree through research results that active learning strategies play a significant role in internalizing the character (caring, intelligent, independent, and responsible) of students in learning (Carvalho & Santos, 2022; Kian et al., 2020; Zheng et al., 2019). On the other hand, time is also must be considered in conducting practicals in a virtual laboratory. The right time expected by students is the first to choose a Saturday-Sunday holiday, the second to choose an active period of study, and the waiting period for graduation. According to them, the three opinions, the most appropriate time to conduct learning with an e-learning model based on virtual laboratory in quantitative research methods by SPSS is during semester five or before the preparation of thesis proposals because it will be a provision in analyzing student research data.

The evaluation stage of learning with an e-learning model based on virtual laboratory in quantitative research method courses by SPSS, from the output results or abilities expected by students is to know quantitative data analysis on cognitive, affective, and psychomotor aspects (skills) as the basis for assessment (Radmehr & Drake, 2018). Knowledge criteria in the cognitive field are measured based on students' ability to remember, understand, apply, analyze, evaluate, and create (Matsumoto-Royo & Ramírez-Montoya, 2021). Meanwhile, from the perspective of the affective domain, it is measured based on the student's acquisition of receiving, responding, appreciating, organizing, and characterizing based on course grades. Furthermore, from a psychomotor perspective, students can be successful if they can imitate, manipulate, perform precision, articulation, and naturalization (El Soufi & See, 2019; Hammond & Brown, 2021). In addition, an assessment is

also carried out based on reality to obtain coherence about something that has been taught, evaluated, and how to evaluate a material subject that has been explained so that the assessment can represent the gains obtained by participants (Matsumoto-Royo & Ramírez-Montoya, 2021; Tran et al., 2020).

Based on the results of the sex-based comparative test data analysis, all of them stated that they accepted the null hypothesis (H0), which means that they have good experience in participating in a virtual laboratory, such as virtual laboratory ideas, opinions, goals, models, place, time, and evaluation. There is no difference (there are similarities) between male and female students participating in virtual laboratory-based SPSS training. The results of the comparative analysis distinguish the experiences, ideas, and needs of students' virtual laboratory-based e-learning training based on the class that almost all of them stated that they accepted H0, except for the experience of participating in training, primarily virtual laboratories. It means that both virtual laboratory experience, virtual laboratory ideas, opinions, goals, models, places, times, hours, days, and evaluations are no different between 2018 and 2019 students to take virtual laboratory-based e-learning training. While the experience of participating in training, especially virtual laboratories, there is a difference between the 2018 class and the 2019 class.

Virtual laboratory-Based E-learning Model in Quantitative Research Methods Courses by SPSS

Several previous studies have shown that virtual-based e-learning during the COVID-19 disruption period can significantly increase competency capacity. Among these virtual learning models include the use of virtual writing during the pandemic (Payant & Zuniga, 2022), virtual experiential education (Clemmons et al., 2022), virtual microscopy (J. Y. F. Chang et al., 2021), intelligent virtual laboratory (Deepika et al., 2021), virtual chemical laboratories (Chan et al., 2021; Kumar et al., 2021), virtual and remote laboratories, virtual testing laboratory (Lopes et al., 2021), and virtual reality. In addition to using virtual-based e-learning, lecturers or course supervisors must also have good evaluation skills. The evaluation competence is needed so that the assessments made to students are limited to outputs and outcomes. This form of virtual laboratory-based e-learning design for students is designed with the following considerations: (1) identifying training needs; (2) developing training design; (3) developing a training curriculum; (4) compiling study materials; and (5) conducting training preparations. Evaluation form: posttest and evaluation questionnaire. Outputs and outcomes, including students, can independently practice quantitative data analysis with SPSS. By holding training based on student needs, the training will run better and more effectively. Training organizers are not just guessing, but there is a basis for action (C. Y. Chang et al., 2022; Wolf et al., 2022). It is hoped that the training will improve and increase the knowledge and skills of someone in their area of responsibility (Kumar et al., 2021). At this momentum, this research is directed to help form a conceptual tool for understanding the impact of information, communication, and new technologies on the adaptation period in higher education (Morélot et al., 2021; Qian et al., 2020).

If examined in detail, the results of the validity and reliability tests carried out do not guarantee the perfection of this research. The limitations of the results of this research report should also be considered carefully. Although the research sample has passed several stages of testing, the product being tested only involves students of Educational Administration at Brawijaya University. Large-scale trials are needed in this development research, considering the development of technology and its use in each university is different. The implication limitation also indicates that the development of this product cannot be generalized to every student due to the different complexity of each campus. Therefore, the subsequent research is expected to involve respondents from various majors and other universities so that the heterogeneity in the population can be scientifically justified.

4. CONCLUSION

The study results show that the virtual laboratory in the quantitative research methodology course can meet the needs of a quantitative data analysis practicum laboratory during the COVID-19 pandemic. This series of virtual laboratory activities also improve students' ability to use SPSS software. Considering that virtual laboratories in universities are crucial during the pandemic, the development of e-learning products based on virtual laboratories must be a significant concern in the discourse, both from the academic community and among practitioners and researchers in developing learning products in Indonesia. Contributions in this research can also be an alternative to computer practicum laboratories in increasing the practical capacity of students in analyzing quantitative data. In addition, this research can be used to solve the limitations of laboratory facilities in practicum courses for each university. From the aspect of content and design, assessment should also be pursued in a virtual laboratory. On the other hand, this study is also expected to be used as a reference in the development of virtual laboratories, as well as the primary basis for conducting further and perfect virtual laboratory analysis, so that researchers in Indonesia are expected to be able to answer the needs of student practicum laboratories.

5. REFERENCES

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