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THE EFFECT OF VIRTUAL LEARNING THROUGH ONLINE LEARNING SYSTEM (SPADA) ON STUDENTS' LEARNING OUTCOMES IN ALGEBRAIC STRUCTURE COURSE IN DEPARTMENT OF MATHEMATICS EDUCATION, MUHAMMADIYAH UNIVERSITY OF MAKASSAR

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Abstract:
This study aims to determine the effect of treatment on student learning outcomes in the algebraic structure course at the Department of Mathematics Education of the University of Muhammadiyah Makassar in virtual learning through the online learning system (SPADA). This study is a quasi-experimental design with a post-test-only control group whose results were analyzed using descriptive analysis and inferential analysis (mann whitney test). The population is the class of 2019 who is programming an algebraic structure course consisting of 3 classes, then a sample consisting of 2 classes was selected, namely, one experimental class taught through SPADA, and one control class taught in addition to using SPADA, namely, zoom meeting, google meet, email, and whatsApp groups. The instrument used is a test of student learning outcomes. The results obtained are that the average learning outcomes of students who are taught through SPADA are higher than the average learning outcomes of students who are taught other than through SPADA, but the results of the Mann Whitney test show that there is no significant difference from the learning outcomes of students who have been taught through SPADA or other than SPADA. Researchers suggest that providing virtual learning not only relies on one learning media but also on the synergy between one media and another, which will further optimize virtual learning.

Keywords: Virtual Learning, SPADA, Learning Outcomes, Algebraic Structure

PENGARUH PEMBELAJARAN VIRTUAL MELALUI SISTEM PEMBELAJARAN DARING (SPADA) TERHADAP HASIL BELAJAR MAHASISWA MATA KULIAH STRUKTUR ALJABAR PADA PRODI PENDIDIKAN MATEMATIKA UNIVERSITAS MUHAMMADIYAH MAKASSAR

Abstrak:

Penelitian ini bertujuan untuk mengetahui pengaruh perlakuan terhadap hasil belajar mahasiswa mata kuliah struktur aljabar pada prodi pendidikan matematika Universitas Muhammadiyah Makassar dalam bentuk pembelajaran virtual melalui sistem pembelajaran daring (SPADA). Penelitian ini merupakan eksperimen semu dengan desain post test only control group yang hasilnya dianalisis menggunakan analisis deskriptif dan analisis inferensial (uji mann whitney). Populasi merupakan angkatan 2019 yang sedang memprogram mata kuliah struktur aljabar yang terdiri dari 3 kelas, kemudian terpilih sampel yang terdiri dari 2 kelas yaitu satu kelas eksperimen yang diajar melalui SPADA dan satu kelas kontrol yang diajar selain menggunakan SPADA, yaitu, zoom meeting, google meet, email, dan whatsapp group. Instrumen yang digunakan adalah tes hasil belajar mahasiswa. Hasil penelitian yang diperoleh adalah rata-rata hasil belajar mahasiswa yang diajar melalui SPADA lebih tinggi dari pada rata-rata hasil belajar mahasiswa yang diajar selain melalui SPADA, namun pada hasil uji Mann Whitney terlihat tidak ada perbedaan yang signifikan dari hasil belajar mahasiswa yang telah diajar melalui SPADA maupun selain SPADA. Peneliti menyarankan agar dalam memberikan pembelajaran virtual tidak hanya mengandalkan satu media pembelajaran namun sinergitas antara media yang satu dan lainnya akan lebih mengoptimalkan pembelajaran virtual.

Kata Kunci: Pembelajaran Virtual, SPADA, Hasil Belajar, Struktur Aljabar

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INTRODUCTION

Everything has been difficult since Covid-19 appeared in various countries, including Indonesia, and was declared a pandemic, so like it or not, all people are ready or not ready to accept the government's policy to implement Large-Scale Social Restrictions (PSBB), especially in big cities that are red zones such as Makassar. The impact of this pandemic is felt

in various sectors of life, one of which is the education sector. Students must stop face-to-face activities and conduct virtual learning from kindergarten to college.

From the results of the researcher's observations on students of the 2019 mathematics education class at Muhammadiyah Makassar University, namely class A, class B, and class C, of the three classes that have been powerful researchers, on average they complain about online learning because these students come from various regions, some are in cities, but some are in rural areas. This greatly affects the condition of their network, which is sometimes unstable. The problem increases when certain lecturers use video conferencing applications, such as zoom meetings or google meet, which requires large quotas and a stable network during the lecture. Difficulties like this will, of course, impact student learning outcomes. This can be seen from several Academic Assistance (PA) students whom researchers guide, their GPAs have decreased since virtual learning. According to the PA students, it was very difficult for him and his classmates to virtually understand the lecture material, especially for mathematics courses with a high material difficulty.

Things that affect distance learning using zoom meetings cannot be carried out properly are (1) frequent obstacles such as poor signals for students who do not use wifi, (2) there are 30% of students who have practicum courses find it difficult because the quality of the video in zoom meetings is not so good so, these students find it difficult to observe the practicum, (3) often there are strange sound disturbances that interfere with learning activities when is turning on the sound (Haqien & Rahman, 2020: 54).

To prevent the spread of the Covid-19 virus, through a circular letter, the Ministry of Education and Culture of Higher Education has prepared several applications that can be utilized and used en masse by universities to share courses online, starting from PJJ, Inherent, iD-Ren, SPADA. The application is held in collaboration with content providers such as Indonesia Cyber Education, Google Suite, Amazon web services, and Nvidia-Artificial Intelligence Courses and urges university leaders to open access to distance learning on each university so that it can be accessed by other college campuses (Wijayanti, Yunita, & Dharmanto, 2020: 36).

These things are a source of thought for researchers to find solutions to these problems. According to the researcher, one of the effective efforts to optimize virtual learning during this pandemic is to use SPADA Unismuh Makassar, which is e-learning that was officially proposed by the University of

Muhammadiyah Makassar and is specifically intended for virtual learning within the scope of the relevant agencies. Another reason why researchers choose SPADA is because of the many features that support lecturers in providing more varied lectures. The researchers said that it was varied because it was possible to communicate with students both synchronously and asynchronously using SPADA.

Since tablets, smartphones, and other applications are being used, this provides new changes and interesting potential to complement the learning environment with multimedia content systems. It is time to focus on multimedia learning systems with digital tools for science learning (Becker, Klein, Gossling, & Kuhn, 2020: 1).

"Students who live in the millennial era spend more free time reading news, chatting, stalking, instagram, whatsapp, facebook, twitter, and many more using smartphones. Contemporary-era students are more interested in living in cyberspace than in real life. This habit is also carried away in the teaching and learning process. Present-day learners like to be in control, do not want to be bound by an additional schedule, they do not really like sitting in the classroom to study, do not like one-way communication, do not like conventional reading such as books, and know more about technology than parents including teachers. Instead, they prefer to use technology to study anytime, day or night and do telecommunications from anywhere" (Khairani, Rajagukguk, & Derlina, 2020: 752).

When students use e-learning in a blended learning system for lectures, they directly learn patterns in its use by paying attention to things that have been done before assignment time and due time for exams. Based on the survey of student responses, they concluded that the perception of e-learning is beneficial and enhances the student's learning experience. They also discussed the many advantages of e-learning, including active demonstration of material, flexibility, and bridging between the lecture method and the given homework (Setiawan, Mardapi, Pratama, & Ramadan, 2019: 150).

The benefits of e-learning can be seen from 2 things, namely, for students with this e-learning, they are able to access teaching materials at any time and repeatedly and are able to communicate with lecturers at any time so that they can deepen their mastery of learning materials, while for lecturers relatedly, e-learning provides many advantages for lecturers where it is easier for lecturers to update teaching materials, control student learning activities and even lecturers can also find out when students are studying, what topics

are being studied and can track whether students have worked on practice questions after studying specific topics, checking student answers and informing students of the results (Rahmawati, 2017: 92). The results of a similar study were also presented by Hudha, Chaeruman, Aji, Huda, Yusro, Kumala, Wartono, Nandiyanto, and Abdullah (2018: 1): "SPADA, which is a MOODLE-based e-learning can be used by Kanjuruhan University Malang and PGRI Madiun University in Basic Physics courses because it is easy to use by all lecturers."

Despite the many advantages of using virtual learning through SPADA, this does not necessarily make lecturers within the Muhammadiyah University of Makassar switch to using e-learning. This is because there are still very few lecturers who attend the SPADA training or special technical guidance held by the campus, and there are still many lecturers who are not interested in pursuing the use of e-learning because it takes time to learn it. In addition, this research is new research within the scope of the research institution, namely the S1 mathematics education department at the Muhammadiyah University of Makassar, because the previous SPADA was only intended for distance classes or PPG programs. The general appearance of SPADA Unismuh Makassar and its online learning support features can be used for asynchronous and synchronous communication, as shown in figure 1.

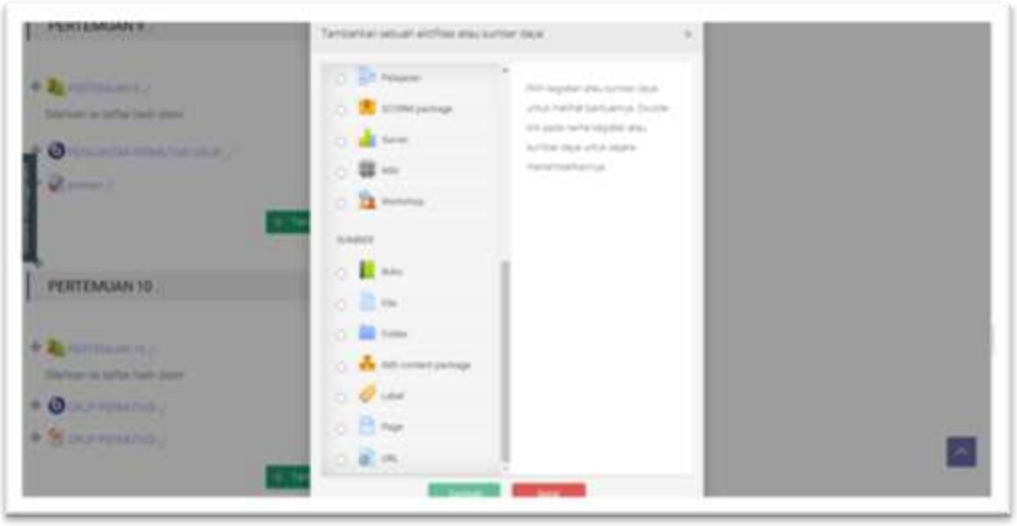

Figure 1. Display of Learning Features on SPADA

Based on the description of the background above, it is necessary to examine how much influence the application of virtual learning using SPADA has on student learning outcomes in the algebraic structure course in

mathematics education at the Muhammadiyah University of Makassar. The limitations of this study are that it only uses SPADA media, zoom meetings, google classroom, email, and WhatsApp groups which lecturers generally use in the mathematics education department at the Muhammadiyah University of Makassar. Also, giving of tests cannot be observed directly due to the ongoing pandemic conditions that require researchers to give online tests so that there is a bias in the test results obtained because both researchers and lecturers are very dependent on network stability and also the algebraic structure material is given only on the topic of group permutations.

METHODS

This research is a quasi-experimental (quasi-experimental) research, an experimental method that does not allow researchers to cover experimental variables and conditions thoroughly. This study aims to determine the effect of treatment on student learning outcomes in the algebraic structure course at the Mathematics Education Department, the Muhammadiyah University of Makassar in the form of virtual learning through the online learning system (SPADA) both synchronously with the big blue button feature or asynchronously through the assignment, materials, quizzes, chat, and other features. This study was divided into two groups, the experimental and the control group. The research procedure includes the planning, implementation, and data analysis stages. The design of this study used a post-test-only control group design involving two classes, which were selected from three sample classes. The object of research is the class of 2019 students. They are in the 2020/2021 academic year and are programming the algebraic structure course at the Mathematics Education Department, the Muhammadiyah University of Makassar, obtained in class A as many as 21 students and 24 students in class B. One class is used as an experimental class and one class as a control class.

In this study, the research instrument used was a test of students learning outcomes. This test was designed to determine the effect of virtual learning through the online learning system (SPADA) on student learning outcomes in the algebraic structure course at the Mathematics Education Department, Muhammadiyah University of Makassar. This test consists of essay questions on algebraic material, with the topic of permutation groups consisting of the meaning of permutations, how to notate them, the composition of permutations, permutation groups, and cyclic permutations.

The written test instrument in this study was validated by the validator team and tested to obtain a valid and reliable instrument.

Then the experimental group was given special treatment by using virtual learning through SPADA, while the control group was treated using virtual learning other than SPADA, a combination of using zoom meetings, google meet, email, and WhatsApp group. Each class is taught in 4 meetings with the same material, namely group permutations. After that, both groups were tested with the same test as the final test (post-test) and then compared to find out how much influence the treatment had.

The next stage is to analyze the research data, namely the data obtained by testing student learning outcomes. The data analysis stage consists of two stages, namely the descriptive analysis stage and the inferential analysis stage. The descriptive analysis stage is used to describe the characteristics of the research subject scores for categorizing student learning outcomes scores obtained based on the assessment rubric in the RPS for the algebraic structure course that has been compiled by the teaching team of the Mathematics Education Department at the University of Muhammadiyah Makassar, as shown in table 1.

Table 1. Categorization of Student Learning Outcomes

Predicate	Score	Category
A	> 80	Very Good
B	65 – 80	Good
C	55 – 64	Enough
D	20 – 54	Poor
E	<20	Very Poor

Furthermore, the test data were analyzed by making a frequency distribution table, looking for the mean, median, mode, variance, and standard deviation. Next, the inferential analysis stage consists of the requirements analysis test (normality test) and the hypothesis testing stage (mann whitney test).

RESULTS AND DISCUSSION

1. Descriptive Analysis Results

The results of the descriptive analysis consist of statistical tables, namely table 2 and the frequency and percentages distribution in table 3, both from the experimental class and the control class.

Table 2. Descriptive Statistics Results

Statistics	Experiment Class	Control Class
Sample size	21	24
Average	70.86	62.17
Median	73.00	66.50
Mode	93.00	37.00
Variance	396.83	529.80
SD	19.92	23.02
The highest score	93	100
The lowest score	26	20

Table 3. Frequency and Percentage Distribution

Score Interval	Category	Frequency		Percentage	
		Experiment Class	Control Class	Experiment Class	Control Class
> 80	A	8	7	38%	29%
65 – 80	B	5	5	24%	21%
55 – 64	C	5	2	24%	28%
20 – 54	D	3	9	14%	38%
<20	E	0	1	0%	4%

2. Inferential Analysis Results

a) Test Requirements

Before moving on to the hypothesis testing stage, whether to use parametric statistical tests (t-test) or non-parametric tests (Mann Whitney test), the assumption that must be met is whether the data from the two samples are normally distributed or not. Table 4 shows the result of the normality test of the two samples.

Table 4. Results of Normality Test

	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Learning Outcomes	Experiment	.150	21	.200*	.898	21	.032
	Control	.157	24	.130	.930	24	.098

The condition in determining which normality test results to choose is to look at the amount of data used from the two samples because the samples from the control class and the experimental class are both small in size, namely n < 30, so the column used is the column that uses the

Shapiro-Wilk technique. The condition that the normal determination of the data from the two samples is if the value of sig. < 0.05; it turns out that only the experimental class data is normally distributed from the table while the control class data is not, so the next hypothesis testing is no longer using the t-test but the method chosen is a non-parametric statistical using the Mann Whitney test.

b) Hypothesis Testing

The hypothesis to be tested in this study are as follows:

- H_0: There is no significant difference in student learning outcomes taught through SPADA, and student learning outcomes taught other than SPADA
- H_1: There is a significant difference in student learning outcomes taught through SPADA, and student learning outcomes taught other than SPADA

The results of hypothesis testing obtained with statistical software assistance can be seen in table 5.

Table 5. Results of Hypothesis Testing

	Learning Outcomes
Mann-Whitney U	194.500
Wilcoxon W	494.500
Z	-1.309
Asymp. Sig. (2-tailed)	.190

From table 5, the test criteria used are:

- Accept H_0 and reject H_1 if the Asymp value. Sig. (2-tailed) > 0.05)
- Accept H_1 and reject H_0 if the Asymp value. Sig. (2-tailed) < 0.05)

The discussion of the results of this study both descriptively and inferentially are as follows:

a) Discussion of the results of descriptive analysis

Table 2 shows the difference in the average learning outcomes of experimental class students and control class students, where the average experimental class learning outcomes are 70.86 while the control class is 62.17. So, it can be concluded that students learning outcomes taught through SPADA are better than those taught other than using SPADA in this algebraic structure course, although the difference does not appear to be that big. Even

though the highest score in the experimental class was 93 and the control class was 100, if we look at the number of students who got that score, it is clear that only one student got 100 in the control class. On the contrary, although it was slightly lower in the experimental class, five students got a score above 90. Generally, if we look further by paying attention to table 3, the difference in students' abilities taught through SPADA and others than SPADA can be seen. In the table, 3.38% of the experimental class students taught using SPADA were in category A for their learning outcomes.

On the contrary, 38% of control class students taught other than using SPADA were in category D, and even 4% of students are in category E. From the observations of the researchers, students from the experimental class seemed more enthusiastic when learning than the control class because the big blue button feature on SPADA was equipped with the option to quickly conduct surveys or polls so that at the beginning and at the end of learning the lecturers were easier to test the average knowledge of students then provide discussion and motivation. The polling menu looks like on SPADA is shown in figure 2.

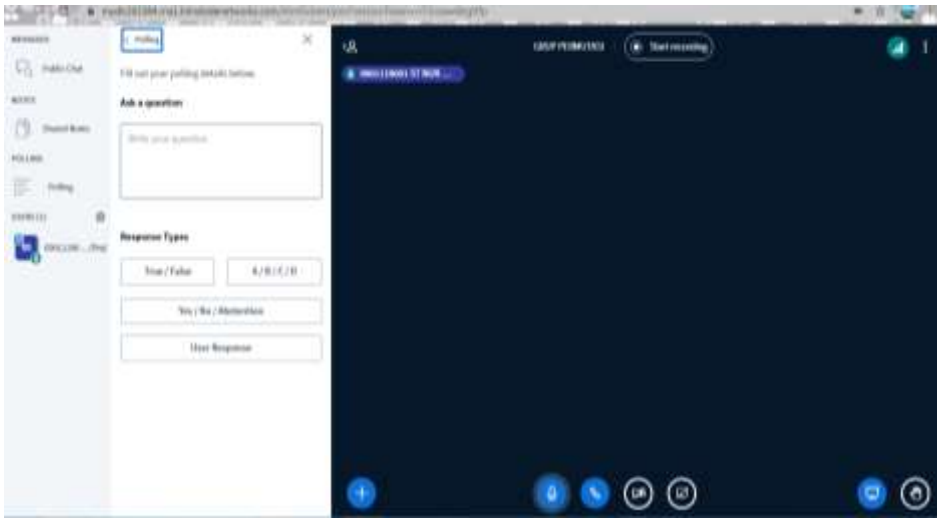

Figure 2. Polling Menu on the Big Blue Button Feature in SPADA

Another advantage of SPADA is that students can also directly download the material files taught in the big blue button feature without leaving the room. In addition, the display of material for each meeting and other activities is more neatly and systematically arranged in SPADA, making it easier for students to access it. This is different from the control class taught using zoom meetings or google meet, whose features are only limited to face-to-face learning, while to download materials, assignments, and so on,

students have to leave the room and use google forms or WhatsApp groups that are not systematically arranged.

Online learning through SPADA will encourage students to participate in face-to-face activities (direct synchronous) and online activities (asynchronous independent and collaborative) to increase lecturer and students interactions. The existence of teaching materials, practicum modules, animated videos can make it easier for students to understand the material presented by lecturers to improve student learning outcomes which can be seen through the acquisition of quiz scores and midterm exams (Rahmawati, 2017: 94).

b) Discussion of the results of inferential analysis

By the criteria for testing the hypothesis described previously, then when viewed from table 5, the Asymp value is obtained. Sig. (2-tailed) of 0.190, which means > 0.05, the accepted hypothesis is H_0, that there is no significant difference in student learning outcomes taught through SPADA and student learning outcomes taught other than SPADA.

This is by the results of research obtained by Santoso and Istiqomah (2021: 14), namely the results of students' mathematics learning using the G-Form and Quizizz media that there are no significant differences. The relevant study results were also obtained by Ilmiyah and Sumbawati (2019: 46), namely the PowerPoint and Kahoot media testing obtained a value of 0.225 > 0.05, meaning that there was no significant difference in learning outcomes. In addition, the research results from Sakkir, Dollah, and Ahmad (2021: 14) show that the use of E-learning media in the Covid-19 pandemic era, according to students' responses, is less effective. Most of the students gave a negative perception about it. This is indicated by students' perceptions of the use of E-learning in this era. The variety of E-learning applications does not guarantee that students enjoy the learning process. Several factors influence students' perceptions of the use of E-learning media in the era of the Covid-19 pandemic, such as signals and network connections; quota limits and expensive quota; lack of lecturer methods; lack of student motivation; time limit; and lack of interaction."

So, in general, it can be seen that the use of different online learning media does not affect learning outcomes. If explored further, it turns out that the technological aspects that affect success in implementing virtual learning are not solely based on the readiness of the learning media. This can be seen

from the results of research obtained by Mosa, Naz'ri bin Mahrin, and Ibrrahim (2016: 113), which states that:

"We, therefore, note that the most important factor among the technological aspects of e-learning readiness is the internet. The internet factor is further subdivided into access, bandwidth, broadband, and speed and reliability components. The assessment of the importance and significance of the internet in the evaluation of e-learning readiness indicates that the affordability, availability, reliability, and speed of the internet are the main factors that determine the overall readiness of individuals to accept e-learning."

Several factors influence the selection of e-learning media, namely: accessibility, supported media devices, communication features provided, process and type of assessment, design, and price. In addition, there are several shortcomings in using e-learning, namely uneven internet access, limited types of assessments available, and interactions between lecturers and students becoming more distant, which results in distant relationships and communication between students and lecturers (Damayanti, 2020: 76).

Meanwhile, according to Leonard (2013: 282), the shortcomings of e-learning that must be known include: 1) Students must have computer and internet access. 2) Students must also have computer skills, such as internet browser, email, and office applications. 3) A good internet connection is necessary for taking the subject matter. 4) In the absence of a routine in class, students may stop learning or are confused about learning activities and assignment deadlines, which will make students fail. 5) Students will feel very distant from the instructor. Because instructors are not always there to help students, students must be disciplined and do assignments independently without the help of an instructor. 6) Students must also have good writing and communication skills because teachers and students do not meet face-to-face, thus allowing misunderstandings in several ways.

Similarly, the results obtained indicate that internal constraints arise on students, namely the ability to use Information Technology (IT) and students' ability to understand the material are not the same. Meanwhile, the external constraints faced by students include: (a) network constraints, (b) limited quota constraints, and (c) uneven facility constraints (Hartono, Tinungki, Hartono, Simanjuntak, & Muchtar, 2021: 436). Meanwhile, according to Dillon (Pangondian, Santosa, & Nugroho, 2019: 58) to make online learning successful, the key is effectiveness, based on previous studies showing that

three things can have an effect related to online learning, namely technology (access and synchronous-asynchronous communication), teacher characteristics and student characteristics. From some of the results of these studies, it can be concluded that the flexibility or ease of accessing the internet greatly affects virtual learning.

This is also what researchers experience when teaching and when giving post-tests to students who use SPADA or not. Their problem is the same: the need for a stable network under any conditions. Of the four learning meetings given, both the experimental class and the control class, what students complain about is when the material is delivered in synchronous or real-time so that if the material given has been going on for a while, the average student will find it difficult to reaccess it. This condition has also been acknowledged by the Ministry of Education and Culture since 2020 regarding the use of SPADA in distance learning at the university level through the Jawa Pos electronic newspaper that "The obstacles such as affordability and network stability, sometimes voices are lost in the middle of lectures or disconnected," explained the Executive Duties (Plt) Director General of Higher Education (Dirjen Dikti) Kemendikbud Nizam in an official statement, Friday (26/6).

CONCLUSION

The average learning outcomes of students taught through SPADA are higher than those taught other than through SPADA. However, the Mann-Whitney test results show no significant difference from the learning outcomes of students who have been taught through SPADA or other than SPADA. Researchers suggest that providing virtual learning does not just depend on one learning media, but the synergy between one media and another will further optimize virtual learning.

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