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ANALYSIS OF OLC SYSTEMS IN THE PERSPECTIVES OF RELEVANT COST AND CARBON EMISSION COST

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Abstract

This research raises the topic of online learning and aims to identify and analyze online learning in terms of relevant costs. Online learning is a learning method that utilizes the internet and connected media to connect and learn. This research is qualitative with a case study method. The tools used in this research are Microsoft Excel and the GoGreener application to recapitulate and manage research sample data. The results of this study state that online learning in the midst of the COVID-19 pandemic situation is a great learning method. It is because by applying the online learning method, the costs incurred can be reduced (relevant) compared to the costs incurred during face-to-face or onsite learning, and the carbon costs that need to be paid can also be reduced.

Keywords : *Online Learning, Relevant Costs, Carbon Costs, COVID-19 Pandemic.*

1. INTRODUCTION

Learning with an online class system is a learning model being used recently. It is a type of learning that utilizes a number of technology-based supporting devices and is student-centered, which is fun and in accordance with the activities and development processes of students during the era of the Industrial Revolution 4.0 and the recent pandemic in Indonesia. There are two models of online learning: synchronous and asynchronous. In the synchronous learning model, teachers and students learn at the same time virtually via the Zoom or Google Meeting application. Meanwhile, in asynchronous learning, students and teachers study at different times; for example, students get an assignment to make a video of explanatory text at home and then send it to the WhatsApp study group (Kustiah, 2020).

However, in practice, it is not easy to take part in online learning because it requires a device and an internet connection. It can be difficult for underprivileged families who do not have the adequate devices required. During the pandemic, apart from online learning as a decision from the government, the implementation of the Large-Scale Social Restrictions (PSBB) Policy in a number of regions in Indonesia had an impact on the economic decline at all levels of society. Many companies are unable to continue their business operations and have to lay off their employees Data from the Indonesian Ministry of Manpower noted that there were around 2.8 million victims of layoffs during the COVID-19 pandemic era. Even the Minister of Finance Sri Mulyani said there were more than 5 million workers who were laid off. The Indonesian Chamber of Commerce and Industry, or Kadin, even recorded a fantastic number of 15 million people who were laid off in Indonesia.

The situation that occurs every day during the pandemic is getting worse, and online learning activities and WFH (work from home) for workers who have survived layoffs are experiencing ups and downs. Even though expenses may decrease due to fewer expenses incurred compared to when life was still normal, are they covering the costs incurred, or are the costs relevant to meeting daily needs? Talking about relevant costs, according to Anggriawan and Setiawan (2018), costs are relevant when the cost is not a cost that will occur but differs in the future between one alternative and another.

However, costs can be said to be irrelevant and have no influence on future decisions when they occur in more than one alternative. The government is aware of and understands the conditions that occur, quoting from Tribunnews (2021), and such a situation encourages the government to make policies. One of the policies is the Enforcement of Community Activity Restrictions (PPKM), both in micro and macro sizes. In addition, in order to support the community during the PPKM period, the government distributed a number of social assistance programs, ranging from assistance in the form of cash, data package subsidies, and electricity power subsidies to 10 kilograms of rice. President Joko Widodo also said during a visit to the Bulog Warehouse on Wednesday (21/7/2021), "Apart from rice, there is also assistance in the form of electricity subsidies, cash social assistance, BLT (Direct Cash Assistance), and subsidies for internet data package.

On the other hand, the implementation of a lockdown might bring good things, such as reduced emissions produced by humans, which leave a carbon footprint. A carbon footprint is the amount of gas emissions (CO2) that are left behind from various human activities over a certain period of time and have a negative impact on the lives of all living things on earth, such as drought and decreased sources of clean water, extreme weather, and natural disasters, changes in the course of the food chain, and other various natural damages (Utami, 2019).

However, reducing emissions in Indonesia does not always bring good news. The results of the 2021 Climate Transparency Report stated that although Indonesia has proposed increasing the latest energy in the fields of electricity, transportation, and industry, it has no strategy to gradually stop using coal energy, as well as policies that can encourage competition for new energy with coal. The Climate Transparency Report 2021, which is the most comprehensive annual record in the world and releases the results of a comparison of climate actions for G20 countries, even projects that Indonesia's post-pandemic GHG emissions will increase beyond emission levels in 2019 as economic activity recovers (Simanjuntak, 2021).

Learning activities have pros and cons. Versteijlen et al.'s (2017) study revealed the pros of online education as an opportunity to personalize education to the needs of students and to expand the learning environment with digital media. As cons, they expressed their concern about the non-committal behavior of students staying at home and the worsening of social processes between students and lecturers or fellow students. Thus, the purpose of this research is to discover the perspective of relevant costs incurred and carbon costs generated in the lives of private university students, which in this study refers to suggestions for further research from Manapu et al. (2020). This empirical study took samples of students in North Jakarta and West Jakarta who carried out online or in-person learning during a pandemic in Indonesia.

Research Thinking Framework

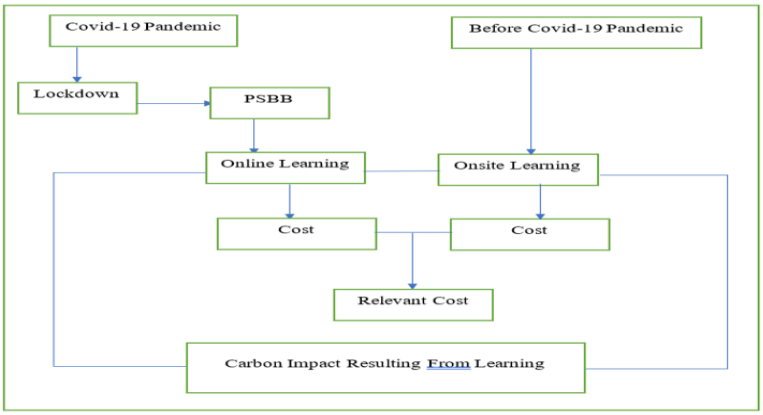

Figure 1. Research Thinking Framework Chart
Source: Data Processed, 2023.

Based on Figure 1, the COVID-19 pandemic is a case and phenomenon that occurred at the end of 2019 in the city of Wuhan, China. It is an infectious disease that can affect anyone, with victims experiencing

different effects, and the worst can cause death. In response to this case, the Chinese government imposed a lockdown, a rule for residents not to leave their houses, and stopped all activities except for health workers. If the residents want to go out for something crucial, such as getting food, they are only allowed to take one person with them. A lockdown is implemented until the infectious COVID-19 disappears completely. This bad disease caused panic all over the world. Many people scrambled and bought everything they needed and stockpiled it until shopping malls were crowded due to the lockdown that was going to be imposed to break the spread of the disease that had occurred almost evenly throughout the world.

In Indonesia, the news suddenly appeared that two people were infected with the COVID-19 virus in early March when previously there were no reports of the spread of the virus. The cases continued to increase, and the number of victims increased to thousands, which finally made the government establish a PSBB (large-scale social restrictions) policy, which is regulated in a government regulation (PP) signed by the president on March 31 (Nuraini, 2020). The PSBB policy, in addition to limiting community activities, includes rules for WFH (work from home) and online learning methods for schools and lectures.

2. RESEARCH METHODS

The research subject, according to Arikunto (2016), is an object, thing, or person to which the data for the research variable is attached and which is at issue. Thus, it can be concluded that the research subject is a variable that can be a human or an object to be explored in research. The research subjects used in this study were private university students domiciled in North Jakarta and West Jakarta, including Bunda Mulia University, Trisakti University, and Krida Wacana University (Ukrida). The subject was chosen because the researcher wanted to know and understand how online learning is seen from the perspective of relevant costs and carbon costs in small and main groups, namely fellow students on the same campus in North and West Jakarta.

This research uses qualitative methods, so the objects included in the research are variables that are measured and controlled with questions in order to explain the contents of the variables within the scope of the research. The basis for determining the object is explained by Sugiyono (2021): the object of research is a study of a person, object, or activity that has certain variations that have been determined by the researcher to study and draw conclusions. Based on an explanation of the background and problems, this research uses qualitative methods with the approach of case studies. Prihatsanti (2018) explains that a case study is research that aims to examine research questions and problems, which cannot be separated between phenomena and the context in which these phenomena occur.

The sampling method used in this study is a probability sampling technique of the disproportionate stratified random sampling type since the sample taken has a semester level, but the number of students recorded on the questionnaire is not evenly distributed. Samples in the research are students at Bunda Mulia University, Trisakti University, and Krida Wacana University (Ukrida) in the accounting study program.
This study uses primary data, or direct data obtained from the field, in the following ways:

1. Distribution of Questionnaires

The online questionnaire uses a Google form that has 2 parts. In the first part, the respondents will answer questions related to expenses when they study in person and when they change to the online method. The questions are arranged as well as possible so that when the respondents answer, they can imagine the comparison of the costs they spent on the same thing but different alternatives or events occur. In the second part, the questions are directed at what activities are carried out and how much is produced from both in-person and online learning. Questionnaires were distributed to students of the accounting study program in the morning classes at Bunda Mulia University, Trisakti University, and Krida Wacana University.

2. Data Analysis

After the data was obtained from the respondents, the researchers made a summary of the data in Excel and then calculated how much was spent on online learning compared to in-person learning. As a support program for managing carbon data, the Go Greener application will calculate respondents' answers, resulting in output data in the form of the number of trees and costs, which will be compared when students do in-person and online learning.

3. RESULT AND DISCUSSION

This study used primary data from questionnaires that had been distributed to research subjects, namely morning-class accounting students at Bunda Mulia University, Trisakti University, Krida Wacana University, and Tarumanagara University. This questionnaire began to be distributed from December to January 2023, and 120 questionnaires addressed to the three universities mentioned above became samples in this study. The results showed there were only 99 pieces of data that could be used out of a total of 101 answers received from 120 questionnaires distributed to respondents as samples in this study.

Respondent Identification

Table 1
Respondent Criteria Data

University	UBM	USAKTI	UKRIDA	UNTAR	Total
Number of Respondents	39	33	12	15	99
Motorcycle User	13	15	8	10	46
Car User	6	9	2	3	20
Non-Users of both Vehicles	20	9	2	2	33
Total	39	33	12	15	99
Parking Subscription:					
Motorcycle	9	7	5	7	28
Car	1	1	0	1	3
No Subscription	29	25	7	7	68
Total	39	33	12	15	99

Source: Data Processed by Researchers (2023)

Relevant Cost Analysis in Onsite and Online Learning Systems

This study tests and analyzes the relevant costs of the on-site and online learning system using primary data taken from several campuses as samples of this study, such as Bunda Mulia University, Usakti, Ukrida, and Untar. Descriptive data analysis was carried out in processing the results of this study. In this section, the data obtained from the respondents' answers will be described in table form, along with an explanation of the table contents of the onsite and online learning.

Table 2
Expenditures Per Week

Semester	UBM	USAKTI	UKRIDA	UNTAR	Total
Cost (weekly)	Onsite	Onsite	Onsite	Onsite	Onsite
Rp0,00	3	2	1	0	6
<Rp50.000,00	15	11	2	5	33
Rp50.001 - 149.999	10	17	5	8	40
Rp150.000 - 299.999	9	2	3	1	15
>Rp300.000,00	2	1	1	1	5
Total	39	33	12	15	99
Total	39	33	12	15	99

Source: Data Processed by Researchers (2023)

Data in Table 2 is obtained from 99 respondents of private university students in West and North Jakarta, namely Bunda Mulia University, Trisakti University, Krida Wacana University, and Tarumanagara University, who pay fees for their online learning tuition activities and fuel costs per week for onsite learning. The following is a description of the table above. There are expenses per week at Bunda Mulia University, and

three students do not spend anything at all: 15 students spend less than IDR 50,000; 10 students spend IDR 50,001–149,999; 9 students spend IDR 150,000–299,999; and 2 students spend more than IDR 300,000. At Trisakti University, there are expenses per week, and 3 students do not spend anything at all; 11 students spend less than IDR 50,000 for their expenses per week; 17 students spend IDR 50,001–149,999; 2 students spend IDR 150,000–299,999; and 1 student pays more than IDR 300,000 per week. At Krida Wacana University, there are expenses per week, and 1 student does not spend anything at all; 2 students pay expenses per week for less than IDR 50,000; 5 students spend IDR 50,001–149,999; 3 students spend IDR 150,000–299,999; and 1 student pays more than IDR 300,000 per week. Meanwhile, at Tarumanagara University, there are expenses per week, and 0 students do not spend anything at all; 5 students spend expenses less than IDR 50,000; 8 students spend IDR 50,001–149,999; 1 student spends IDR 150,000–299,999; and 1 student pays more than IDR 300,000 per week.

Table 3
Vehicle Fuel Expenses Per Week

Semester	UBM		USAKTI		UKRIDA		UNTAR		Total	
Fuel costs (Weekly)	Online	Onsite	Online	Onsite	Online	Onsite	Online	Onsite	Online	Onsite
Rp0,00	3	5	2	3	2	1	1	0	8	9
<Rp50.000,00	23	28	27	20	5	2	3	6	58	56
Rp50.001 - 149.999	10	5	3	6	1	5	8	5	22	21
Rp150.000 - 299.999	2	1	0	3	3	3	3	3	8	10
>Rp300.000,00	1	0	1	1	1	1	0	1	3	3
Total	39	39	33	33	12	12	15	15	99	99

Source: Data Processed by Researchers (2023)

Based on table 3 above, 99 respondents of private university students at Bunda Mulia University, Trisakti University, Krida Wacana University, and Tarumanagara University pay for fuel costs in their learning activities, either online or onsite.. The following is a description of the content of the table above. There are 8 students who pay for fuel per week during online learning. This number consists of 3 students from Bunda Mulia University, 2 students from Trisakti University, 2 students from Krida Wacana University, and 1 student from Tarumanagara University. There are also students who do not pay fuel costs per week during onsite learning: 5 students from Bunda Mulia University, 3 students from Trisakti University, 1 student from Krida Wacana University, and 1 student from Tarumanagara University. This study finds that 58 students of online learning pay their vehicle fuel expenses per week below IDR 50,000, which consist of 23 students from Bunda Mulia University, 27 students from Trisakti University, 5 students from Krida Wacana University, and 3 students from Tarumanagara University. Meanwhile, there are 56 students enrolled in onsite learning who pay vehicle fuel expenses per week below IDR 50,000, which consist of 28 students from Bunda Mulia University, 20 students from Trisakti University, 2 students from Krida Wacana University, and 6 students from Tarumanagara University. 22 students in online learning spend fuel costs per week for IDR 50,001–149,999, which consist of 10 students from Bunda Mulia University, 3 students from Trisakti University, 1 student from Krida Wacana University, and 8 students from Tarumanagara University. 21 students in onsite learning spend IDR 50,001–149,999 for fuel costs, consisting of 5 students from Bunda Mulia University, 6 students from Trisakti University, 5 students from Krida Wacana University, and 5 students from Tarumanagara University. 8 students in online learning spend on fuel for a week for IDR 150,000–299,999, consisting of 2 students from Bunda Mulia University, 0 people from Trisakti University, 3 people from Krida Wacana University, and 3 people from Tarumanagara University. Meanwhile, 10 students in onsite learning spend IDR 150,000–299,999 for fuel costs, consisting of 1 student from Bunda Mulia University, 3 students from Trisakti University, 3 students from Krida Wacana University, and 3 students from Tarumanagara University. 3 students in online learning pay vehicle fuel costs per week above IDR 300,000, consisting of 1 student from Bunda Mulia University, 1 student from Trisakti University, 1 student from Krida Wacana University, and 0 student from Tarumanagara University. In addition, this study also finds that 3 students in onsite learning pay vehicle fuel

expenses per week above Rp 300,000, consisting of 0 students from Bunda Mulia University, 1 student from Trisakti University, 1 student from Krida Wacana University, and 1 student from Tarumanagara University.

Table 4
Monthly Data Package Expenses

Semester	UBM		USAKTI		UKRIDA		UNTAR		Total	
Data Package Material (Per Month)	Online	Onsite	Online	Onsite	Online	Onsite	Online	Onsite	Online	Onsite
Rp 0,00	0	1	0	0	0	0	0	0	0	1
<Rp 50.000,00	12	10	10	10	8	6	3	3	33	29
Rp50.00-149.999	23	20	15	17	3	5	7	6	48	48
Rp150.000-299.999	3	5	6	5	1	1	3	5	13	16
>Rp300.000,00	1	3	2	1	0	0	2	1	5	5
Total	39	39	33	33	12	12	15	15	99	99

Source: Data Processed by Researchers (2023)

Based on table 4 above, 99 respondents pay for monthly data package costs for learning activities in both online and onsite learning systems. The following is a description of content in the table above.

Data from this study shows there are 0 students who do not pay a monthly data package fee during online learning, and 1 student does not pay a monthly data package fee during onsite learning (from Bunda Mulia University). Those who spend monthly data package fees under IDR 50,000 are 33 students of online learning, consisting of 12 students from Bunda Mulia University, 10 students from Trisakti University, 8 students from Krida Wacana University, and 3 students from Tarumanagara University. In addition, 29 students of onsite learning spend data package fees under IDR 50,000, consisting of 10 students from Bunda Mulia University, 10 students from TrisaktiUniversity, 6 students from Krida Wacana University, and 3 students from Tarumanagara University..

There are also 48 students in online learning who spend on monthly data packages that cost IDR 50,001–149,999, consisting of 23 students from Bunda Mulia University, 15 students from Trisakti University, 3 students from Krida Wacana University, and 7 students from Tarumanagara University. Meanwhile, 48 students in onsite learning who spend on monthly data packages that cost between IDR 50,001–149,999 are 20 students from Bunda Mulia University, 17 students from Trisakti University, 5 students from Krida Wacana University, and 6 students from Tarumanagara University.

Thirteen students in online learning spend on monthly data packages that cost IDR 150,000–299,999, consisting of 3 students from Bunda Mulia University, 6 students from Trisakti University, 1 student from Krida Wacana University, and 3 students from Tarumanagara University. As for onsite learners, 16 students spend on monthly data packages that cost IDR 150,000–299,999, consisting of 5 students from Bunda Mulia University, 5 students from Trisakti University, 1 student from Krida Wacana University, and 5 students from Tarumanagara University.

Five students in online learning spend monthly data packages above IDR 300,000, consisting of 1 student from Bunda Mulia University, 2 students from Trisakti University, 0 student from Krida Wacana University, and 2 students from Tarumanagara University. 5 students in onsite learning spend monthly data packages above IDR 300,000,consists of 3 students from Bunda Mulia University; 1 person from Trisakti University; 0 people from Krida Wacana University and 1 person from Tarumanagara University.

The practical implications of this research include analyzing relevant costs for each existing learning system, both onsite and online at each university that is included in the sample of this study. The relevant costs incurred are more costly for learning with the online system than those of onsite learning, as can be seen in the table above regarding daily costs, fuel costs, and credit for data packages. This provides a basis for consideration for education providers that the existence of an online learning system will provide many advantages and savings in terms of operational costs and increased income for education providers, which are usually in the form of educational foundations.

Carbon Analysis Resulting from Online and Onsite Learning

Testing and analyzing the carbon emissions of the onsite and online learning systems are carried out using primary data taken from several campuses that are sampled in this study, such as Bunda Mulia University, Usakti, Ukrida, and Untar. Descriptive data analysis is also conducted in processing the results of this study. In this section, the carbon data generated by the respondents will be compared between online and offline learning. The carbon footprint will be calculated using the Go-Greener app from Go-Jek, which will be interpreted in the data interpretation section.

Table 5
Average Distance Traveled By Private Vehicles

No.	University		UBM (39)		USAKTI (33)		UKRIDA (12)		UNTAR (15)	
			Online	*Onsite*	*Online*	*Onsite*	*Online*	*Onsite*	*Online*	*Onsite*
1	Distance with private vehicle	Total	123	331	169	399	65	121	35	98
		Average	3	10	5	12	5	10	3	8
2	air conditioning (hours)	Total	196	121	235	167	98	73	85	62
		Average	5	3	6	5	8	6	7	5
3	HP battery charging (hours)	Total	119	39	71	35	28	13	33	15
		Average	3	1	2	1	2	1	2	1
4	Laptop usage (hours)	Total	237	123	201	67	63	11	91	33
		Average	6	3	6	2	5	1	6	2

Source: Data Processed by Researchers (2023)

From the table 5 above, it is apparent that there has been a decrease in the total and average distance traveled by private vehicles during onsite and online learning. The results of processing data show that at Bunda Mulia University, which has 39 students as respondents for this study, in onsite learning, the distance traveled by private vehicle is 331km per day, which drops to 123 km, and the average also drops from 10km to 3km. At the time of online learning, the decline also occurred for 33 students at Trisakti University, from 399km to 169 km, and the average changed from 12 km to 5 km. Next, for Krida Wacana University students, there is a decrease from a total of 121 km to 65km and an average of 10 km to 5 km. For 12 students at Tarumanagara University, there is also a decrease from a total of 98 km to 35 km and an average of 8 km, with a decrease during the online learning system to 3 km.

However, the decrease did not occur in the total and average of AC usage, cellphone battery charging time, and laptop usage time. The total use of AC by Bunda Mulia University students increased from a total of 121 hours to 196 hours, and on average, there was an increase in hours of use of AC of 3 to 5 hours. The number of AC users at Trisakti University was 33 students in onsite learning, which increased from 167 hours to 235 hours during online learning. This also happened to 12 Krida Wacana University students who experienced an increase in a total of 73 hours to 98 hours for using air conditioning and an average of 6 hours during onsite learning to 8 hours during online learning. For Tarumanagara University students, there was also an increase in total from 62 hours to 85 hours and an average from 5 hours to 7 hours.

The battery charging time increased for 39 students at Bunda Mulia University from a total of 39 hours to 119 hours, with an average of 1 hour to 3 hours. 33 students at Trisakti University students also had an increase in battery charge from 45 hours during onsite learning to 71 hours during online learning, with an average of 1 hour to 2 hours. Meanwhile, 12 students at Krida Wacana University also experienced a change from a total of 13 hours to 28 hours, with an average of 1 hour to 2 hours. This also happened to 15 Tarumanagara University students, who experienced a change from a total of 15 hours to 33 hours, with an average of 1 hour to 2 hours.

Moreover, the most significant increase occurred in laptop usage time for 39 students at Bunda Mulia University, from a total of 123 hours to 237 hours, with an average of 3 to 6 hours. This also happened to 33 Trisakti students who had an increase from a total of 67 hours to 201 hours, with an average of 2 hours to 6 hours during online learning. 12 students at Krida Wacana University experienced the same thing, where they also had an increase from a total of 11 hours to 63 hours, with an average of 1 hour to 5 hours. Meanwhile,

Tarumanagara students had an increase from a total of 33 hours of onsite learning to 91 hours of online learning, with an average of 2 hours of onsite learning to 6 hours of online learning.

This study has practical implications for reducing carbon emissions from online learning system activities carried out by campus students who study in West Jakarta and North Jakarta. In the onsite learning system, more carbon costs are incurred by each student at each university sampled in this study compared to the online learning system. This can be seen in the research data processing table for mileage using private vehicles when the onsite learning system is implemented, which is almost double compared to the online learning system. This can help support government programs to reduce carbon emissions.

4. CONCLUSION

Based on the results and analysis of the comparison of onsite and online learning seen from the perspective of relevant costs and carbon costs, the following conclusions can be drawn:

a. There has been a change, namely a reduction in costs incurred (relevant) in online learning activities compared to in-person or onsite learning. Due to the change in learning methods to an online system, expenses on public transportation costs, fuel for private vehicles, parking fees, meals, and drinks can be reduced, and some are converted to data packages.
b. There is a reduction in the carbon cost generated by the online learning method compared to in-person or onsite learning. The efforts to combat the COVID-19 virus resulted in the lockdown and PSBB (large-scale social restrictions) phenomenon, which made most activities outside the home have to be reduced and changed; this also happened with the change in face-to-face learning methods to online.

The reduction of emissions occurs during online learning because the things that are done in face-to-face learning, such as using public transportation and private vehicles to go to campus, become the biggest emitters of greenhouse gases.

Suggestions

Based on the results of the analysis and conclusions obtained, the researchers have suggestions for further research as follows:

a. It is hoped that future researchers will add or change the sample to be larger because this research is very closely related to human activities and makes people more aware of their environment.
b. It is hoped that future researchers will implement the findings for the people around them and the community. This is not something to be underestimated but a serious matter because when the COVID-19 pandemic case ends, CO2 will rise again.
c. It is hoped that further research will increase the incidence so that there are 3 periods in the study: before the COVID-19 pandemic, during the COVID-19 pandemic, and after the COVID-19 pandemic ended. Thus, the suggestion on point 2 can be proven.

Research Limitations

This research has limitations:

a. This study only took samples of students studying at private universities in the cities of West Jakarta and North Jakarta.
b. Respondents answered not seriously; sometimes they found the same answer/pattern when answering.
c. The validity and reliability test was not carried out on the questionnaire because it used descriptive analysis of the data collected and obtained from the questionnaires filled out by the respondents.

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