The Relationship Between Challenges E-Learning and Interaction with Motivation and Satisfaction Amongst Student During Covid-19 Pandemic

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Abstract

The mental health of students has become an important concern since the COVID-19 pandemic. However, the research on the influence of mental impact on students' achievement in online learning is still very limited, especially in relation to the motivation of students. This study which was conducted from July to August 2021, examines the relationship between e-learning challenges and limited interaction during online lectures on student motivation and satisfaction. Respondents came from 3 Universities in Banten Province, Indonesia, totaling 425 students consisting of 280 males (65.9%) and 145 females (34.1%). Respondents who reported their perceptions during online learning varied in grade, range from grade 1 to 4. Descriptive analysis shows that satisfaction level of respondents taking online lectures is 3.36 which is categorized fairly satisfied. From Structural Equation Modeling (SEM) analysis it is indicated that there is an effect of challenge e-learning on students' learning motivation, but on the contrary there is no interaction effect on students' learning motivation. An interesting finding was that there was no direct effect of e-learning challenge, interaction or motivation on student satisfaction. However, research shows that there is an effect of e-learning challenge and interaction on student satisfaction through intermediate variable motivation. Thus, it is important to consider the factors affecting student motivation, namely internet connection, learning environment, and development of interactive electronic content as the leverage for the improvement of the effectiveness of online learning.

Keywords
Covid-19 pandemic, Online learning, Motivation, Satisfaction

1. Introduction

The COVID-19 pandemic is an important factor that has serious impact on education today. More than 190 countries have implemented lockdowns, thus affecting the learning system for more than 90% of the world's student population (UNESCO, 2013). COVID-19 pandemic of course has bigger impact on the learning system of developing countries, including Indonesia. The lack of readiness and infrastructure in developing countries in dealing with new learning systems has significant impact on the teaching and learning system. Since the Covid-19 pandemic hit, the Indonesian government has set a policy of study from home. The Indonesian government facilitates schools in order to make them to be able to conduct e-learning in their educational service. E-learning and online learning are often used interchangeably. Online learning is also known by other terms such as blended learning, online education, web-based education, web-based instruction and online courses (Singh andThurman, 2019). In this study online learning means uploading material on online platforms to teach the students by using various software applications such as Zoom and Google Meet (Miller, et al, 2017).

Online education has lower quality stigma than face-to-face. In order to improve the quality of online learning, it is necessary to consider 4 important factors, namely: communication dynamics, e-learning-environmental factors, organizational factors and personality/situational factors (Yunusa and Umar, 2021). Online learning has more challenges than face-to-face learning, among others are technical difficulties (Yeung, 2021), efforts to stay focused during lectures (Richardson et al, 2017), assessment and evaluation problems.

Inadequate interaction between teacher and students as well as among students and also the content during online learning have significant impact on students. The limited opportunities for interaction and collaboration creates feelings of isolation for students (Eom 2016), so there is possibility that practical skill development in several subjects will be affected as result of the lack of interaction. Interaction is very important, especially teacher-student interaction because it can increase students' interest in learning and motivation (Moore 1989).

In order to motivate learners in an online learning environment, lecturers need to consider the needs and preferences of learners in providing online teaching materials (Hettiarachchi et al. 2021). One of the roles of lecturers in online teaching is to provide encouragement and guidance so that the students can be independent and have independent learning motivation. Thus the teacher factor and teacher-student interaction in online learning are important. Although student motivation is related to student satisfaction, it basically has some practical implications in higher education (Hettiarachchi, et al. 2021). The students who are involved in online learning are generally assumed to be independent and motivated (Muthuprasad, 2021), although not all them have these characteristics.

Student satisfaction in online learning has three main variables, namely: challenges of e-learning, interaction and motivation (Hettiarachchi S, et al, 2021). Instructor, interaction, and technology factors also play important roles in influencing student satisfaction (Kurucay and Inan, 2017). Therefore, student satisfaction in online learning is influenced by several various factors. In this study, student satisfaction factor was viewed from the aspect of e-learning challenges and interactions, while motivation became an intermediate variable affecting student satisfaction. Motivation is an important factor for student success and satisfaction in online learning (Wang, 2013). The purpose of this study was to find out how e-learning challenges, and interactions affect student motivation and satisfaction in online learning system during the Covid-19 pandemic. The research is the case study in 3 universities in Banten Province, Indonesia. Through this research, lessons can be learned from the shift from classroom-based education to online-based ones, which have been implemented during the Covid-19 pandemic.

2. Literature Review
2.1. Challenge of e learning
Internet connectivity facility is an important aspect influencing reliability in the learning process. Reliability aspect has a positive relationship with student satisfaction (Theresia and Bangun 2017). As many as 70% of students in Sri Lanka stated that poor internet quality is a challenge for online learning (Hayashi et al. 2020). Inadequate hardware is also a challenge (Chung 2020), especially when students have mobile devices for online learning which are not compatible with some of the software needed for learning that requires their participation (Hayashi et al., R, 2020), and limited opportunities for collaboration are also other challenges (Means 2020). This is different from face-to-face learning, which allows students to interact between teacher-student; student-student; student-content. The students may feel isolated in online learning and this becomes one of the main challenges faced by students. (Huang et al. (2020). The ability to focus is also a problem in online learning, with 57% of American undergraduate students have more difficulty staying focused during online sessions than face-to-face learning (Means 2020). Likewise, the difficulty of maintaining concentration when studying online is higher than in online learning (Yeung and Yau 2021). These challenges are important to note because they affect student satisfaction (Means 2020).

2.2. Interaction
There are three types of interaction, namely: student-content interaction, student-instructor interaction and student-student interaction (Moore 1989). Interaction is important in face-to-face lectures and becomes a principle that needs to be considered, especially when designing a curriculum in higher education. The culture of building interaction among students and the interaction between student and teachers in face-to-face learning are not found in online learning. This certainly affects student motivation, because study of Theresia et al. (2018) shows that motivation was significantly affected by culture.

Student interaction with peers, can have an impact on increasing motivation in online learning (Bernard, 2009), which also has an impact on student satisfaction (Sher 2009). Whereas, Kuo et al. (2013) found the opposite finding. Interaction also occurs between students and the media technology used in the learning process (Thurmond and Wambach 2004). As many as 65% of university students in America stated that the opportunity to collaborate is worse in an online learning environment (Means 2020). The absence of interaction and collaboration creates feelings of isolation and impact on the level of student satisfaction (Richardson 2007). Therefore, it is very important to design an online learning system that pays attention to interaction, because in online learning higher student satisfaction is influenced by higher interaction (Dinh and Nguyen 2020). In online learning, student-content

interaction is the most important factor among all forms of interaction that influence student satisfaction (Bervel et al, 2019). Student satisfaction will increase as the access to electronic content is easier. Moreover, electronic content which is interactive such as infographics, video clips, forums, and quizzes are important components in enhancing online learning quality by increasing the interest of students toward online learning (Kumar 2021).

Student-teacher interaction is important in the educational process because teachers can immediately provide assistance, and can understand student needs (Kauffman, H, 2015). The student-teacher interaction becomes a facilitator of online learning (Amir, 2020), enhancement of student motivation to learn (Moore, 1989) and is a major determinant of student satisfaction (Zeng and Wang 2021). Student-teacher interaction has a positive impact because with the presence of the teacher there is rapid feedback (Arbaugh, Hornik, 2006), thus affecting student satisfaction (Dinh, 2020).

2.3. Motivation

Motivation is an important factor for the success and satisfaction of students in online learning (Wang, 2013). Learning motivation positively affects learning satisfaction (Huang, 2021) and motivation will encourage students to improve their performance. Motivation is an important factor for students to participate in learning regardless any learning environment. Motivation either could be either extrinsic (related to external rewards) or could be intrinsic (related to self-satisfaction) (Zimmerman, 2000). High motivation, and self-discipline are important characteristics needed for students to be successful in online learning (Threlkeld and Brzoska, 1994). Motivation can be expressed as a process which describes the intensity, direction and persistence of efforts to achieve a goal (Robbins and Judge, 2015). Theresia (2018) found a positive relationship between motivation and job satisfaction. Various studies have shown that a large number of extrinsic motivation factors affect satisfaction. The findings confirm a positive relationship between four extrinsic motivation factors (remuneration, quality of work life, supervision and team work) and work satisfaction (Mafin and Dlodlo, 2014). The motivational factor is an important factor that must be managed to improve performance (Theresia et al., 2018). The increase of student motivation has an impact to enhance satisfaction in attending online lectures, which in turn gives good performance for student in the learning process.

2.4. Student Satisfaction

One indicator of educational effectiveness is student satisfaction (Zeng, Wang, 2021), whether learning is carried out online or face-to-face in class. Student satisfaction is one of important factors in higher education in order to improve student performance, to increase the effectiveness of online learning, and to enhance student retention in academic programs (Cole, et al, 2013). Student satisfaction can be expressed as to what extent the students feel their needs, goals, and desires are fulfiled (Sanchez and Franco, 2009). Student satisfaction in e-learning consists of four factors, namely: communication dynamics (e.g., interaction, information quality), e-learning environmental factors (e.g., course structure, content), organizational factors (e.g., technology support, service quality). and personality and situational factors (autonomy, self-efficacy, motivation) (Yunusa and Umar, 2021). Based on many studies, student satisfaction can be a complex phenomenon because it integrates various different dimensions. Student satisfaction is influenced by: e-learning challenges, student motivation, and interaction (Hettiarachchi, et al. 2021).
From previous research (Hettiarachchi, et al., 2021) student satisfaction is influenced by: e-learning challenges, student motivation, and interaction. In this study, the factor of student satisfaction is seen from the aspects of e-learning challenges and e-learning interactions, while motivation is an intermediary variable that affects student satisfaction. The level of interaction with the media greatly influences students' motivation to attend online lectures (Stoney and Wild, 1998). Student-teacher interaction becomes an important facilitator in online learning (Amir, 2020), which can increase student learning motivation (Moore, 1989). In addition, good learning pedagogy can increase students' motivation to attend online sessions regularly, whereas poor internet connectivity disorders and unfriendly home environment can increase students' demotivation. This is in line with research by Wagner (1997) which states that student motivation can increase as a result of interactions that occur in online learning. Thus, the interaction affects the motivation of students to take online lectures. Online lectures have various challenges related to the use of computers and other media in delivering material. Each individual has different preferences in e-learning challenges (Hills, 2003), where these individual differences also affect individual motivation for achievement, control, and anxiety (Pintrich and Schunk, 1996). Therefore, interactions and challenges e-learning seem to have influence on students' motivation to attend online lectures. Various prevous studies have shown that motivation factors affect satisfaction. Research done by Theresia et. al., (2018) found a positive relationship between motivation and job satisfaction. Therefore, the purpose of this study was to find out how e-learning challenges, and interactions affect student motivation and satisfaction in online learning systems during the Covid-19 pandemic.
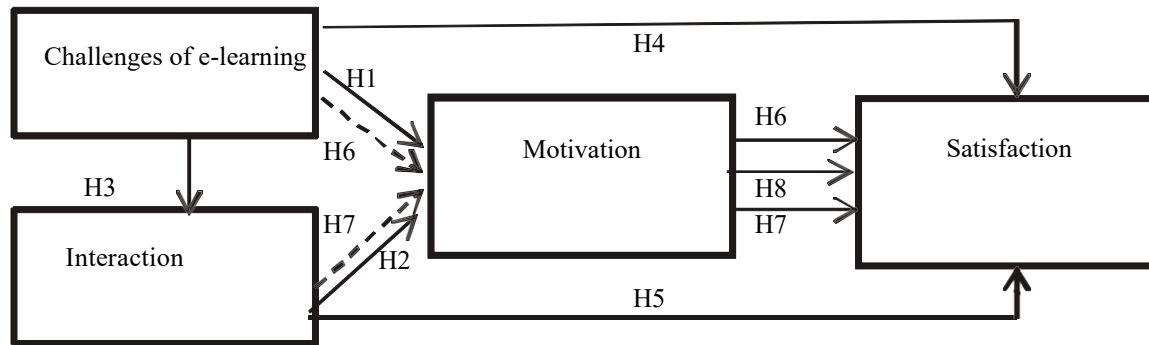
The conceptual model is presented in Figure 1.

Figure 1. Conseptual model

The hypothesis that is built is as follows:

Hypothesis 1 (H1): Challenges of e-learning affect motivation
Hypothesis 2 (H2): Interaction affects motivation
Hypothesis 3 (H3): Challenges of e-learning affect interactions
Hypothesis 4 (H4): Challenges of e-learning affect satisfaction
Hypothesis 5 (H5): Interaction affects perceived satisfaction
Hypothesis 6 (H6): Challenges of e-learning affect satisfaction through intermediate variable motivation
Hypothesis 7 (H7): Interaction affect satisfaction through intermediate variable motivation
Hypothesis 8 (H8): Motivation affects satisfaction

3. Methods
This research can be grouped as explanatory research. The problem-solving framework of the study is described in terms of the causal relationship between e-learning challenges and interactions that affect student motivation and satisfaction, which will be examined in this research. The independent variable in this study is the challenge of e-learning and interaction, and the dependent variable is satisfaction. While the intermediate variable is learning motivation.

The questionnaire contains 11 items to measure the relationship between e-learning challenges and interactions that affect student motivation and satisfaction, using a Likert scale. E-learning challenges, interactions, motivation each consist of 3 items, the satisfaction dimension with 2 items is adopt from Hettiarachchi, et al. (2021). Multivariate Regression Analysis method was used to examine the relationship between e-learning challenges and interactions that affect student motivation and satisfaction.

4. Data Collection
Respondents came from 3 universities in Banten Province, Indonesia, namely Institut Teknologi Indonesia, Universitas Pamulang and Universitas Sultan Ageng. This study which was conducted from July to August 2021, where 450 questionnaires were circulated valid and 425 questionaires were valid, consisting of 280 males (65.9%), and 145 females (34.1%). There are 47 first year students (11.1%), 131 second year students (30.8%), 167 third year students (39.3%), 80 fourth year students (18.8%).

5. Results and Discussion
5.1. Description Analysis
This research is a case study in 3 universities in Banten Province, Indonesia. Descriptive data processing is shown in the Table 1.

Tabel 1. Descriptive data

No	Variabel	Indicator	Index
1	Challenges e-learning (X1)	I'm having trouble adaptation in online learning (X1.1)	3.26
		I'm not focused during online lectures (X1.2)	3.38
		The use of current communication tools in online learning is as effective as face-to face lecturer (X1.3)	3.01
2	Interaction (X2)	In online session, I have limited opportunity to interact with lecturer (X2.1)	3.48
		In online learning, I have limited oppurtunities to interact with resources for learning (X2.2)	3.18
		In online learning, I have limited opportunities to interact with my college friends (X2.3)	3.61
3	Motivation (Y1)	Poor internet connectivity makes me lose motivation to attend online sessions (Y1.1)	3.71
		My home environment motivates me to attend online sessions (Y1.2)	3.55
		The physical absence of my classmate makes me lose motivation to attend online sessions (Y1.3)	3.26
4	Satisfaction (Y2)	Online learning method motivates me to take online session (Y2.1)	3.47
		No practical experience gained during online learning (Y2.2)	3.25

Respondents' values were grouped in classes. To find the limit of each class, the average or mean value of each class was incorporated into classes. Interval 1-1.80 is categorized as very low; the interval from 1.81 to 2.60 is in the group of low category; interval 2.61-3.40 is included in the medium category; the interval 3.41-4.20 is grouped in the high category while the interval 4.21-5.00 is assigned in the very high category.

Table 1 shows the most influencing e-learning challenge factor is not being focused during online lectures. While the interaction factor that has the most influence on student satisfaction during online lectures is limited interaction with friends. This shows that interaction with friends has greater influence than the interaction with lecturers. While the greatest factor decreasing students' motivation to take online lectures are mainly poor internet networks.
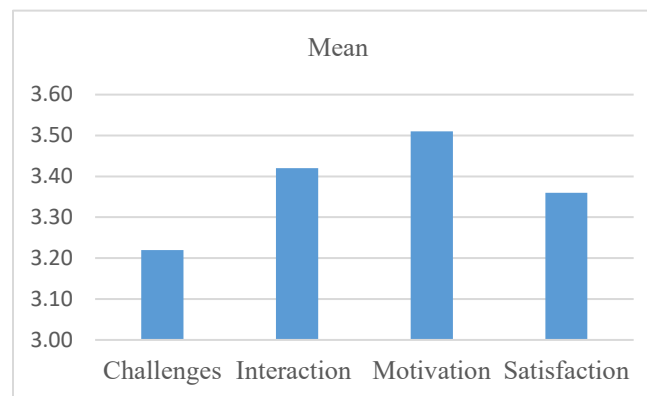

Figure 2. Variable

Figure 2 shows that the latent variable for e-learning challenges built from indicators X11-X13 is in the interval 3.01 – 3.38 with an average of 3.22. This shows that the challenge factors for e-learning are in the medium category. Interaction latent variables are in the interval 3.18 – 3.48 with an average of 3.42. This shows that the interaction factor is in the high category. The latent variable of motivation is in the interval 3.26 – 3.71 with an average of 3.51. This shows that motivation is counted as high category. While the latent variable satisfaction is 3.36, the level of satisfaction falls in the medium category.

The factor that most influences the challenges of e-learning is not being focused during online lectures. This is in line with research conducted by Means (2020) which states that the ability to stay focused during online sessions is much more difficult than face-to-face learning. While the most important factor of interaction in online learning is student-student interaction. This is not in line with the research of Bervel et al. (2019) which reported that student-content interaction was the most important factor among all forms of interaction in online learning. Furthermore, the factor that most influences motivation is internet connection (3.71) This shows the importance of an internet connection to motivate students to participate in online lectures. This is in line with the research of Theresia (2017) which states that an internet connection is an important aspect of reliability for students.

5.2. Multivariate Regression Analysis
5.2.1. Confirmatory Factor Analysis.

If the construct measurement model cannot be measured directly, then in order to test unidimensionality, validity and reliability we can do confirmatory factor analysis. Confirmatory factor analysis is used to confirm the factors that have been formed, that is to evaluate whether the predetermined factor model provides a good fit with the data. The operationalization of research variables or constructs into measurable indicators are formulated in the form of certain equations and/or path diagrams. The result of feasibility test for confirmatory factor analysis model for the construct: e-learning challenges, interaction, motivation and satisfaction is presented in Table 2.

Tabel 2. The result of feasibility test on confirmatory factor analysis model

Contruct	Goodness of fit Index	Cut off Value	Result	Model Evaluation
Challenges of e-learning	Chi Square		124,300	
	Probability	≥0,05	0,001	poor fit
	RMSEA	≤0,08	0,330	good fit
	GFI	≥0,09	0,997	good fit
	AGFI	≥0,90	0,000	poor fit
	CMIN/DF	≤2,00	0,000	good fit
	TLI	≤0,90	0,000	good fit
	CFI	≥0,90	0,987	good fit
Interaction	Chi Square		0,000	
	Probability	≥0,05	0,000	poor fit
	RMSEA	≤0,08	0,145	good fit
	GFI	≥0,09	1,000	good fit
	AGFI	≥0,90	0,000	poor fit
	CMIN/DF	≤2,00	0,000	poor fit
	TLI	≤0,90	0,000	good fit
	CFI	≥0,90	1,000	good fit
Motivation	Chi Square		0,000	
	Probability	≥0,05	0,000	poor fit
	RMSEA	≤0,08	0,264	good fit
	GFI	≥0,09	1,000	good fit
	AGFI	≥0,90	0,000	poor fit
	CMIN/DF	≤2,00	0,000	good fit
	TLI	≤0,90	0,000	good fit
	CFI	≥0,90	1,000	good fit
Satisfaction	Chi Square		0,000	
	Probability	≥0,05	0,000	poor fit
	RMSEA	≤0,08	0,000	good fit
	GFI	≥0,09	1,000	good fit
	AGFI	≥0,90	1,000	good fit
	CMIN/DF	≤2,00	0,000	good fit
	TLI	≤0,90	0,000	good fit
	CFI	≥0,90	0,000	poor fit

Based on the results of the analysis above, it can be seen that the RMSEA and AGFI values do not meet the fit criteria and the Chi-square value is still too large, so modifications are needed. The smaller the Chi-Square value indicates the better model generated. The ideal value is <3, or if the p-value <= 0.05 then the indicator variable is significant.

5.2.2. Analysis of Structural Equation Modeling (SEM)

SEM analysis using full model is conducted after confirmatory factor analysis is done. Analysis of processed data at the stage full SEM model. SEM analysis was conducted by conformation tests and statistical tests. The result of SEM analysis using modified full model can be seen in Figure 2.

The results of data analysis with the empirical data shows that the statistical value and the fit criteria of the model met the criteria of the theoretical model. Because the model with empirical data is in accordance with theoretical model, then validity and reliability checks can be carried out (Figure 3).
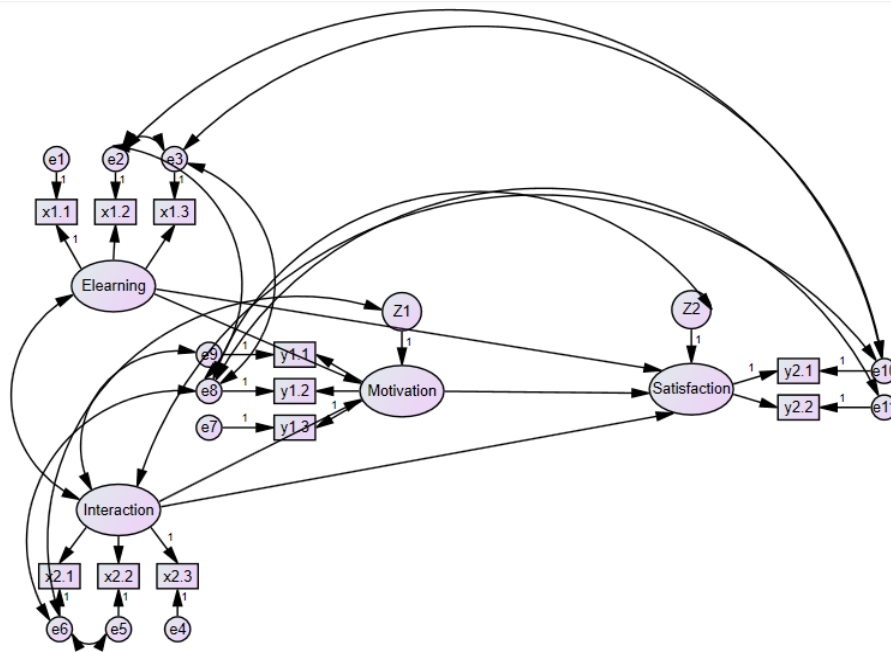

Figure 3. SEM model

The results of data analysis indicate that the statistical values and criteria that fit the model are met. Because the theoretical model is in accordance with empirical data then validity and reliability checks can be carried out.

Table 3. SEM modified feasibility test result

Goodness of fit Index	Cut off Value	Result	Model Evaluation
Chi Square		26,770	
Probability	ŷ 0,05	0,421	good fit
RMSEA	ŷ 0,08	0,008	good fit
GFI	ŷ 0,09	0,989	good fit
AGFI	ŷ 0,90	0,972	good fit
CMIN/DF	ŷ 2,00	1,030	good fit
TLI	ŷ 0,90	0,999	good fit
CFI	ŷ 0,90	0,999	good fit

Based on the results in Table 3, it can be seen that the model used is acceptable, because the chi-square value obtained is 26,770 with a probability value of 0.421. Thus the structural equation model is quite good, as indicated by the RMSEA, GFI, AGFI, CMIN/DF, TLI and CFI measurement indices that have met the required criteria.

5.3. Hypothesis Testing

Hypothesis testing to prove the causality of the relationship H1, H2, H3, H4, H5 and H8 based on the Critical Ratio (CR) value from SEM analysis, can be seen in Table 4. Hypothesis testing H6 and H7 using standardized indirect effect measurements, can be seen in Table 5.

Table 4. Hypothesis testing based on critical ratio (C.R) value

Variable			Estimate	S.E.	C.R.	P	Notes
Motivation	<---	Challenges e-learning	0,555	0,166	3,342	***	Significant
Motivation	<---	Interaction	0,279	0,172	1,615	0,106	Not Significant
Interaction	<---	Challenges e-learning	0,439	0,053	8,318	***	Significant
Satisfaction	<---	Challenges e-learning	0,144	0,091	1,584	0,113	Not Significant
Satisfaction	<---	Interaction	0,019	0,025	0,763	0,445	Not Significant
Satisfaction	<---	Motivation	-0,04	0,04	-0,999	0,318	Not Significant

Hypothesis testing presented in Table 4 shows that there is an effect of e-learning challenges on motivation with a standardized coefficient of 0.555. This shows that if the e-learning challenge variable increases by 1.0 then motivation will increase by 0.555. The test also shows that there is no interaction effect on motivation. This is because the probability value is well much greater than 0.05 (P = 0.106). Likewise, there is no effect of e-learning challenges, interactions and motivation on student satisfaction, which is indicated by the probability value is greater than 0.05. But there is an effect of e-learning challenges on interaction with a standardized coefficient of 0.439. This means that if the e-learning challenge variable increases by 1.0, the interaction will increase by 0.439. The results showed that there was no effect of interaction on motivation.

Table 5. Standardized indirect effect

Variable			Direct Effect	Indirect Effect	Total Effect
Challenges Elearning	--->	Satisfaction	0,144	-0,022	0,122
Interaction	--->	Satisfaction	0,019	-0,011	0,008

The research findings show that there is an effect of e-learning challenges on satisfaction through motivation. The magnitude of the estimated coefficient of the e-learning challenge variable on satisfaction through motivation with an indirect effect is -0.022. The magnitude of the estimated coefficient of the e-learning variable on student satisfaction through motivation with a direct effect of 0.144 and a total effect of 0.122. The results also show that there is an effect of interaction on satisfaction through motivation. The magnitude of estimated coefficient of interaction variable on student satisfaction through motivation with a direct effect of 0.019 and an indirect effect of -0.011, where the total effect is 0.008. This shows that there is an effect of interaction on satisfaction through motivation. Thus the motivation variable is an important intermediate variable in order to achieve student satisfaction.

5.4. Discussion
Research findings indicate that the challenge of e-learning significantly affects motivation. Challenges are things or objects that inspire determination to improve problem-solving abilities. The challenge becomes optimal when the individual involved in the challenge considers the challenge is both not too difficult and not too easy. The level of challenge can give different results for each individual. When students are given a challenge and think they don't have enough skills to face, frustration arises. On the other hand, when students' skills are high but the activities at hand are not challenging, the result is boredom. The new learning model with e-learning contains different challenges for each individual and certainly affects student motivation. Technology which is intended to facilitate the learning process in order to arouse student interest can become an obstacle to learning motivation when adaptation to technology is not easy to use. If the e-learning learning process only presents teaching and learning that is monotonous and at a time there is no interaction with the learning resources, it causes students to get bored quickly and not focus. The research findings show that the level of e-learning challenges has not been fully managed optimally by students so that it has an impact on their motivation. Thus, the challenge of e-learning is an important element in determining student motivation.

Next research findings show that the interaction does not significantly affect motivation. Although students have limited interaction with lecturers, content and friends, this does not affect their motivation to take online lectures. This finding is not in line with previous findings (Pelikan, 2021) which stated that in an online learning

environment, when teachers and peers are physically absent, this will affect their motivation. Although the student-content interaction in online lectures showed a moderate level (3.18), it did not affect their motivation to participate in e-learning. This also shows that the tools used in online learning, although not the same effective as offline learning, does not affect students' motivation to participate in e-learning. An interesting thing of the findings in this study is that although there are limitations to student-friend interaction, students- teachers and especially the limitations of student-content interaction, it turns out that this does not affect students' motivation to take online lectures. Thus, student motivation to take e-learning courses is influenced by: difficulty focusing, difficulty adapting with tools. While motivation to take e-learning lectures is not affected by student-student, student-teacher and student content interactions.

This study shows that there is an effect of e-learning challenges on satisfaction through motivation. This shows that the e-learning challenge variable does not directly affect student satisfaction, but through the intermediate variable motivation. This implies the important role of independent learning which is characterized by motivation, where the learner's motivation has the strongest effect on student satisfaction (Hettiarachchi, 2021). This study has implications for ensuring that students are highly motivated as independent learners, so that various challenges do not become obstacles to achieve online learning satisfaction. Therefore, it is necessary to create an effective student-friendly learning model. The quality online learning experience is much influenced by the presence of interactive electronic content such as video clips, forums, and quizzes which is very important (Kumar, 2021).
The results also show that there is an interaction effect on satisfaction through motivation. Factors that influence student satisfaction are the role of the instructor and teacher-student interaction. Higher interaction in online learning leads to higher student satisfaction (Dinh and Nguyen, 2020). This is in line with research (Chen, 2020), which states that student-content interaction is important in online lectures, where easy student access to electronic content is a major determinant of student satisfaction in online learning (Bervel et al., 2019). Overall this interaction affects satisfaction through motivation.

6. Conclusions
The research findings show that there is an effect of e-learning challenges on motivation. Difficulty in adapting, difficulty in focusing during online lectures and the use of technological tools during online lectures which are less effective than physical meetings, apparently affect the motivation of students to take online lectures. This shows that the level of e-learning challenges has not been fully managed optimally by students so that it has an impact on their motivation. When students are faced with a new learning process (online), students still need time to reach the steady state stage on their learning curve, in order to understand and adapt to online learning.
Subsequent research findings indicate that there is no interaction effect on motivation. Although students have limited interaction with lecturers, content and friends during e-learning, this does not affect their motivation to take online lectures. Mainly, although student-content interaction is low, it does not affect their motivation to attend online lectures.

An interesting finding is that there is no direct effect of e-learning challenges, interactions on student satisfaction. In addition, the research findings also show that there is no direct effect of motivation on student satisfaction. These results are in accordance with the findings of the research done by Amabile et al. (1994) which states that people can be simultaneously intrinsically and extrinsically motivated, but it may or may not have a relationship with job satisfaction. Likewise, research by Deci and Ryan (1985) found that intrinsic or extrinsic motivation may or may not have a relationship with job satisfaction.

However, the research shows that there is an effect of e-learning challenge on student satisfaction through the intermediate variable motivation, and there is an interaction effect on student satisfaction through intermediate variable motivation. This shows the motivation variable is an important intermediate variable in order to achieve student satisfaction. Therefore, it is important to notice the factors that influence motivation, especially connections and the home environment. Thus, the leverage factors for student motivation are internet connection, learning environment, and the development of interactive electronic content.

The findings contribute to universities in Indonesia to see the impact of the shift from classroom-based education to online-based ones, which have been implemented during the pandemic of Covid-19. Nevertheless, this study also has some limitations. First, the research design is cross sectional, where the questionnaires are collected at a certain

time. In fact, students' perceptions of e-learning satisfaction can change over time and as students become fluent in using technology in e-learning. Second, a larger number of respondents will be better to represent the findings.

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References

Amir, L.R.; Tanti, I.; Maharani, D.A.; Wimardhani, Y.S.; Julia, V.; Sulijaya, B.; Puspitawati, R. Student perspective of classroom and distance learning during COVID-19 pandemic in the undergraduate dental study program Universitas Indonesia. *BMC Med. Educ.*, 20, 1–8, 2020.

Amabile, T. M. The work preference inventory: Assessing intrinsic and extrinsic motivational orientations. *Journal of Personality and Social Psychology*, 66 (5), 950-967, 1994.

Arbaugh, J.B.; Hornik, S. Do chickering and gamson's seven principles also apply to online MBAs? *J. Educ. Online*, 3, 1–18, 2006. [CrossRef]

Bernard, R.M.; Abrami, P.C.; Borokhovski, E.; Wade, C.A.; Tamim, R.M.; Surkes, M.A.; Bethel, E.C. A Meta-analysis of three types of interaction treatments in distance education. *Rev. Educ. Res.*, 79, 1243–1289, 2009. [CrossRef]

Bervell, B.; Umar, I.N.; Kamilin, M.H. Towards a model for online learning satisfaction (MOLS): Re-considering non-linear relationships among personal innovativeness and modes of online interaction. *Open Learn. J. Open Distance E-Learn.*, 35, 236–259, 2020. [CrossRef]

Chung, E.; Subramaniam, G.; Dass, L.C. Online learning readiness among university students in Malaysia amidst COVID-19. *Asian J. Univ. Educ.*, 16, 45–58, 2020. [CrossRef]

Cole, M.T.; Shelley, D.J.; Swartz, L.B. Academic integrity and student satisfaction in an online environment. In Cases Online Learning Communities and Beyond: Investigations and Applications; IGI GLOBAL: Hershey, PA, USA, pp. 1–19, 2013.

Deci, E. L., & Ryan, R. The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, 19, 109-134, 1985.

Dinh, L.P.; Nguyen, T.T. Pandemic, social distancing, and social work education: Students' satisfaction with online education in Vietnam. *Soc. Work Educ.*, 39, 1074–1083, 2020. [CrossRef]

Eom, S.B.; Ashill, N. The determinants of students' perceived learning outcomes and satisfaction in university online education: An update. Decis. *Sci. J. Innov. Educ.*, 14, 185–215, 2016. [CrossRef]

Hayashi, R.; Garcia, M.; Maddawin, A.; Hewagamage, K.P. Online Learning in Sri Lanka's Higher Education Institutions during the COVID-19 Pandemic. *Asian Dev. Bank*, 5, 12, 2020. [CrossRef

Hettiarachchi, S.; Damayanthi, B.; Heenkenda, S.; Dissanayake, D.; Ranagalage, M.; Ananda, L. Student Satisfaction with Online Learning during the COVID-19 Pandemic: A Study at State Universities in Sri Lanka. *Sustainability*, 13, 11749, 2021. https:// doi.org/10.3390/su132111749

Hills, H., Individual preferences in e-learning. Burlington, T:Gower, 2003.

Huang, C.-H. Using PLS-SEM Model to Explore the Influencing Factors of Learning Satisfaction in Blended Learning. *Educ. Sci.*, 11, 249, 2021. https:// doi.org/10.3390/educsci11050249

Kauffman, H. A review of predictive factors of student success in and satisfaction with online learning. *Res. Learn. Technol.*, 23, 1–13, 2015. [CrossRef]

Kumar, P.; Saxena, C.; Baber, H. Learner-content interaction in e-learning- the moderating role of perceived harm of COVID-19 in assessing the satisfaction of learners. *Smart Learn. Environ.*, 8, 1–15, 2021. [CrossRef]

Kuo, Y.-C.; Walker, A.E.; Belland, B.R.; Schroder, K.E.E. A predictive study of student satisfaction in online education programs. *Int. Rev. Res. Open Distance Learn.*, 14, 15–39, 2013. [CrossRef]

Mafini, C., & Dlodlo, N., The relationship between extrinsic motivation, job satisfaction and life satisfaction amongst employees in a public organisation. *SA Journal of Industrial Psychology*/SA Tydskrif vir Bedryfsielkunde, 40(1), Art. #1166, 13 pages. http://dx.doi.org/10.4102/ sajip.v40i1.1166, 2014.

Means, B.; Neisler, J. Suddenly Online: A National Survey of Undergraduates During the COVID-19 Pandemic; *Digital Promise*: San Mateo, CA, USA, 2020.

Miller, A.; Topper, A.M.; Richardson, S. Suggestions for Improving IPEDS Distance Education Data Collection; NPEC, *U.S. Department of Education*: Washington, DC, USA, 2017.

Moore, M.G. Three types of interaction. *Am. J. Distance Educ.*, 3, 1–7, 1989. [CrossRef]

Muthuprasad, T. and Aishwarya, S., Students perception and preference for online education in India during covid-19 pandemic, *Social Sciences & Humanities*, 3(1), 2021.

M. Kurucay and F. A. Inan, "Examining the effects of learner-learner interactions on satisfaction and learning in an online undergraduate course," *Computers & Education*, vol. 115, pp. 20–37, 2017.

Pelikan, E.R.; Lüftenegger, M.; Holzer, J.; Korlat, S.; Spiel, C.; Schober, B. Learning during COVID-19: The role of self-regulated learning, motivation, and procrastination for perceived competence. *Z. Erziehungswiss*, 24, 393–418, 2021. [CrossRef]

Pintrich, P. R., & Schunk, D. H., Motivation in education. Theory, research, and applications (2nd. ed). *Upper Saddle River*, NJ: Merrill Prentice Hall, 1996.

Richardson, J.C.; Maeda, Y.; Lv, J.; Caskurlu, S. Social presence in relation to students' satisfaction and learning in the online environment: A meta-analysis. *Comput. Hum. Behav.*, 71, 402–417, 2017. [CrossRef]

Robbins, S. P. and Judge, T. A., Organizational Behavior 16th edition, Pearson Global Edition.

Sanchez-Franco, M.J. The moderating effects of involvement on the relationships between satisfaction, trust and commitment in e-banking. *J. Interact. Mark.*, 23, 247–258, 2009. [CrossRef]

Singh, V.; Thurman, A. How many ways can we define online learning? A systematic literature review of definitions of online learning (1988–2018). *Am. J. Distance Educ.*, 33, 289–306, 2019. [CrossRef]

Sher, A. Assessing the relationship of student-instructor and student-student interaction to student learning and satisfaction in Web-based Online Learning Environment. *J. Interact. Online Learn.*, 8, 102–120, 2009.

Stoney, S., & Wild, M., Motivation and interface design: Maximising learning opportunities. *Journal of Computer Assisted learning,* 1), 40-50, 1998.

Threlkeld, R.; Brzoska, K. Research in distance education. In Distance Education: Strategies and Tools; *Educational Technology Publications: Englewood Cliffs*, NJ, USA, pp. 41–66, 1994

Theresia L. and R. Bangun, Service quality that improves customer satisfaction in a university: a case study in Institut Teknologi Indonesia, *IOP Conf. Ser.: Mater. Sci. Eng*. 277 012059, 2017.

Theresia, L. et al., The Influence of Culture, Job Satisfaction and Motivation on the Performance Lecturer / Employees, *Proceedings of the International Conference on Industrial Engineering and Operations Management*, Indonesia, 2018.

Thurmond, V.; Wambach, K. Understanding interactions in distance education: A review of the literature. *Int. J. Instr. Technol. Distance Learn*. 2004, 1. Available online: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.101.9189&rep=rep1 &type=pdf#page=17.

UNESCO, EFA GMR Teaching and learning for development: An overview. *Glob. Monit. Rep.*, 1, 1–6, 2013.

Wang, C.-H.; Shannon, D.M.; Ross, M.E. Students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning. *Distance Educ.*, 34, 302–323, 2013. [CrossRef]

Wagner, E.D., Interactivity: From agents to outcomes. In T. E. Cyrs (Ed), Teaching and learning at a distance that it takes to effectively design delive and evaluate programs (pp.19-26). San Fransisco, CA: Jossey-Bass, 1997.

Yeung, M.W.L.; Yau, A.H.Y. A thematic analysis of higher education students' perceptions of online learning in Hong Kong under COVID-19: Challenges, strategies and support. *Educ. Inf. Technol.*, 1–28, 2021. [CrossRef]

Yunusa, A.A.; Umar, I.N. A scoping review of Critical Predictive Factors (CPFs) of satisfaction and perceived learning outcomes in E-learning environments. *Educ. Inf. Technol.*, 26, 1223–1270, 2021. [CrossRef]

Zeng, X.; Wang, T. College student satisfaction with online learning during COVID-19: A review and implications. *Int. J. Multidiscip. Perspect. High. Educ.*, 6, 182–195, 2021.

Zimmerman, B.J. Attaining self-regulation: A social cognitive perspective. In Handbook of Self-Regulation; Academic Press: Cambridge, MA, USA, pp. 13–39, 2000.

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