

## Negative Emotions and e-Learning Academic Performance of Engineering Students in a Private University

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### ABSTRACT

One of the early pandemic COVID-19 effects on the educational sector is that learning activities need to be conducted fully online (e-learning). This circumstance can trigger negative emotions that contribute to students' academic performance. This study aimed to find empirical data regarding the relationship of negative emotions and students' academic performance in this particular situation. The study was a cross-sectional quantitative method. Questionnaire of negative emotion (DASS-21) Indonesian version was deployed using google form to students of Industrial Engineering and Information Systems class of 2020 using convenience sampling. 292 questionnaires were returned and used. Findings: All three negative emotions (depression, anxiety, and stress) were experienced by students at different levels. Negative emotions had different correlations to academic performance. There were no significant differences between anxiety and depression to students' academic performance (anxiety:  $F(3) = 2.202$ ,  $\rho = 0.088$ , depression:  $F(2) = 1.397$ ,  $\rho = 0.249$ ). Two-way ANOVA showed that students who experienced mild stress performed better than those with normal stress category ( $F(1) = 3.933$ ,  $\rho = 0.048$ ). Female students significantly had better academic performance compared to male students ( $\rho(0.001) < \alpha = 0.05$ ) and that students experienced mild stress, performed better than those with normal stress category. Managing stress at a moderate level is beneficial and can be done by media or counseling or other catharsis methods. Further study using larger samples from non engineering majors and randomized sampling is needed for generalization as well as identifying factors that contribute to e-learning performance in a special situation.

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## 1. Introduction

The illness caused by the coronavirus disease-19 (COVID-19) was first identified in Wuhan in December 2019. This virus has infected a number of people in the world quickly which caused a pandemic [1]. Disruption ripples in every aspect of our lives and the adjustment to the situation is still an ongoing process. In educational sectors, the pandemic has put nearly 1,6 billions students out of conventional schools [2, 3] and force the corresponding parties to take necessary actions.

The impact of this pandemic is also experienced by the academic community at a private university in Bandung. The university took steps that were in line with government directives: arrangement of work (work from home or work from office as see fit considering the situation, socializing the health protocols, and online educational activities). All the educational activities were conducted online, including teaching and learning activities. This online learning method during the pandemic was even suggested for younger students [4]. COVID-19 pandemic can be categorized as one of the stressors in which this situation is seen as a severe condition that exceeds the ability of individuals to overcome it [5]. Negative emotions are common in this situation [6, 7]. Aside from stress there are other negative emotions such as anxiety and depression that are experienced by college students due to Covid pandemic-19 in America [8], China [9] some even increased [9,10,11]. Online study that is fully implemented can be a source of negative emotions for its students that can contribute to students' academic performance [12]. On the other hand, it is known that face to face learning brought better results than online learning [13].

The pandemic also brings another alarming psychological consequence in general among university students including depression and anxiety [14,15]. Previous studies showed that emotions did exist even in online learning [16,17]. Emotions have been known to play a central role in learning where they contribute to one's perceptions, attention, and memory [18]. Emotions also contribute to students' engagement in the e-learning process where positive or negative emotions resulted in different outcomes [19]. In an online learning environment students experienced anxiety, boredom, anger and less enjoyment [20]. Negative emotion (stress) was reported to interfere in adults' e-learning process [21]. These two situations served as context around academic activities that negative emotions had been realized as few among many others in academic performance [17, 22] and anxiety was known to be one type of emotion that was salient in e-learning [23].

In Indonesia, full and wide scale e-learning activity is relatively new and it takes some adjustment, be it from the lecturers/teachers or the students as well. Full online learning demanded all parties involved to improve their capabilities on the related aspects, to mentions some of them are: the digital learning contents and finding out which digital platforms are best fitted, digital skills of the students and teacher, and considering connectivity coverage [24] or economic factor to buy the internet quota [25]. Previous studies showed that some students prefer classroom learning more than online learning despite the advantages and disadvantages of online learning [26] or perceived it as ineffective and unpleasant learning activities even though there were positive benefits too [27]. Regarding the media, there was a study that said that the WhatsApp Group was the most effective learning media during the early pandemic [28].

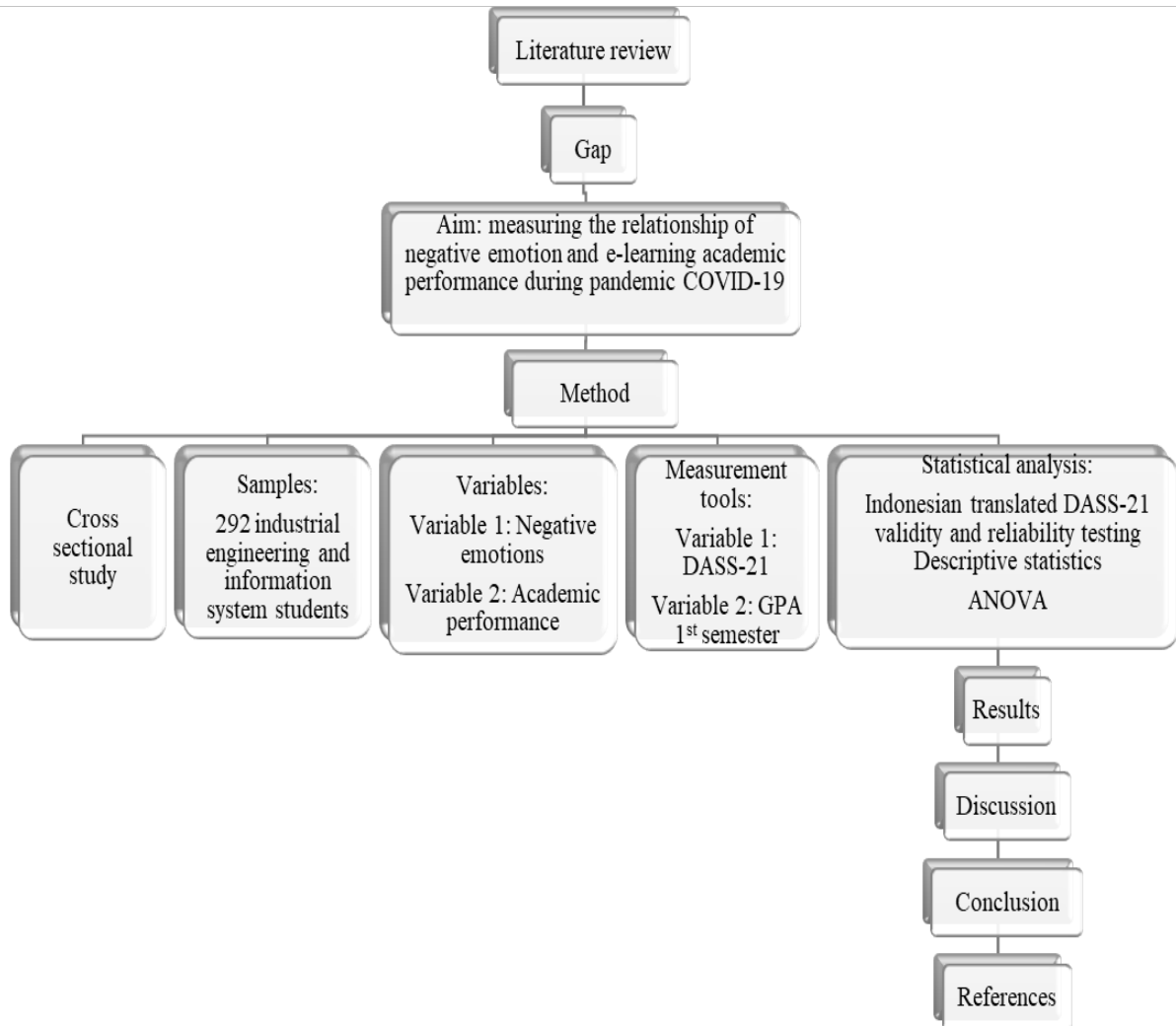
Aside from the various perspectives on online learning during the pandemic, the need for evaluation of students' results of online learning is inevitable to evaluate the effectiveness of online learning methods. There was a study showed that e-learning contributed positive impact on students motivation [29] even an increased of cumulative GPA detected during pandemic on Nursing Students at Minahasa Utara [30] but did not yet addressed the emotions experienced by students and its contribution to academic performance especially in full e-learning activities that had been issued as the situation in this private university where the study had been conducted. Those mixed feelings can interfere with students' performance. The research regarding negative emotions and e-learning academic performance in the pandemic situation on undergraduates is still scarce. Engineering students academic performance is important as can be seen from studies to address factors contributing to it [31-35]. This study takes part to ascertain the contribution of negative emotions to engineering students e-learning academic performance driven by pandemic. The result can be used as a consideration for students, or educational institutions to take necessary action to maintain students' academic performance at optimum level. Do negative emotions really influence academic e-learning performance in this special situation? This study aimed to fill the gap by seeking empirical data regarding the relationship of negative emotions and academic e-learning performance among undergraduates students in a private university in Bandung during pandemic COVID-19 situation.

## II. Methods

This study was a cross-sectional quantitative type where data only taken once at a specific time during the study.

**Research variables:** variable 1: negative emotions, variable 2: academic performance. **Samples:** samples used were students of Industrial Engineering and Information System class of 2020 of a private university in Bandung. They were specially chosen since they were the ones who had a full e-learning experience since the beginning of the semester.

Samples were gathered using convenience sampling techniques. **Tools:** To assess variable 1 (negative emotions), DASS-21 questionnaire [36] was administered online, translated into Indonesian language and tested for its validity and reliability using Statistical Package for Social Science version 21 (SPSS 21). Total there were 292 questionnaires returned and calculated with two-way ANOVA and descriptive statistics using SPSS 21. Variable 2 (academic performance) measured by GPA [37] of first semester. Visualization of research flowchart was summarized in Figure 1:



**Figure 1. Research Flowchart**

The research started by conducted literature review to find the gap especially on the correlation of negative emotions (depression, anxiety, and stress) and e-learning academic performance amongst university students, triggered by pandemic situation. It was a special situation that none of us willingly or well prepared to do it and yet it was a necessity due to the pandemic. Results showed that there was a gap on how to measure the effectiveness of e-learning, viewed from academic performance or GPA per se. The method of the study consists the information as follow: 1) the type of the study which was cross sectional quantitative study, 2) sampling and samples used that were 292 convenience samples of industrial engineering and information system students class of 2020, 3) variables of the study were: a) negative emotions which were depression, anxiety and stress, b) e-learning academic performance which was represented by the students' first semester GPA, 4) statistical operation used: descriptive statistics, ANOVA, Pearson Correlation, and Cronbach Alpha were used in the study to calculate the data. The results were used as the bases of analysis, this lead to the conclusion, identification of study limitation, and further research that sealed with information of references used in this study.

### III. Results and Discussion

The following were results of the study after data were processed using suitable statistical method using SPSS version 21. First, questionnaire DASS-21 was translated to Indonesian and was tested for its reliability and validity to 70 engineering students samples using SPSS 21, with the following results:

Reliability analysis was conducted using Cronbach's Alpha correlation and came out with 0, 841 correlation.

**Table 3.1- Reliability Test**

Reliability Statistics	
Cronbach's Alpha	N of Items
0.841	21

The correlation was fall within acceptable range of alpha values [38]. It means that the translated DASS-21 questionnaire considered to be reliable to measure negative emotion (depression, anxiety, and stress).

**Table 3.2 Summary of DASS 21 Items Validity Testing**

		Correlations							
		Item 01	Item 02	Item 03	Item 04	Item 05	Item 06	Item 07	
Total	Pearson Correlation	.392**	.375**	.495**	.305*	.471**	.415**	.475**	
	Sig. (2-tailed)	0,001	0,001	0,000	0,010	0,000	0,000	0,000	
	N	70	70	70	70	70	70	70	
		Item 08	Item 09	Item 10	Item 11	Item 12	Item 13	Item 14	
Total	Pearson Correlation	.663**	.521**	.662**	.544**	.494**	.570**	.293*	
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000	0,000	0,014	
	N	70	70	70	70	70	70	70	
		Item 15	Item 16	Item 17	Item 18	Item 19	Item 20	Item 21	Total
Total	Pearson Correlation	.632**	.584**	.617**	.341**	.452**	.568**	.474**	1
	Sig. (2-tailed)	0,000	0,000	0,000	0,004	0,000	0,000	0,000	
	N	70	70	70	70	70	70	70	70

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*.. Correlation is significant at the 0.01 level (2-tailed).

DASS-21 consists of 21 items that measure three negative emotions (depression, anxiety, and stress). Each emotion is measured by seven items placed randomly in the questionnaire. The variables shown in Table 3.2 represent the item numbers in SPSS called variables. The item was tested for internal validity by using Pearson Correlation. Table 3.2 showed that all the 21 items were valid. Thus the translated questionnaire of DASS-21 can be used as a reliable and valid tool to measure depression, anxiety, and stress in the Indonesian version for those given samples.

Descriptive statistics were conducted to categorize samples major, gender and age. Samples in the study were 292 students (male = 174, female = 118) with average of age = 18,11 years old (Table 3.3). Of those were 115 students from Information Systems and 177 from Industrial Engineering majors.

**Table 3.3 – Summary of Sample Characteristics**

Categories			Age		Sum of samples	
			Mean	Count		
Major	Information System	Gender	Male	18.29	76	115
			Female	18.13	39	
	Industrial Engineering	Gender	Male	18.09	98	177
			Female	17.96	79	
			Mean age	18.11		
Total samples					292	

The average age of the samples falling into the adolescents age range [39] with special characteristics is heightened emotional amongst others be it negative or positive.

Next, two-way ANOVA were run to find out if GPA differed across gender. Table 3.4 showed that female students significantly had better academic performance compared to male students ( $p(0.001) < \alpha = 0.05$ ). Mean of female GPA = 3.67 and mean of male GPA = 3.52, average GPA of both genders was = 3.58.

**Table 3.4 – Two-Way ANOVA Gender-GPA**

Tests of Between-Subjects Effects					
Dependent Variable:	GPA				
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.590 <sup>a</sup>	1	1.590	11.793	.001
Intercept	3618,481	1	3618.481	26839.774	.000
Gender	1.590	1	1.590	11.793	.001
Error	39.097	290	.135		
Total	3776.492	292			
Corrected Total	40.687	291			

a. R Squared = .039 (Adjusted R Squared = .036)

This result could be explained by differences in motivation since females have a tendency to be more of an internal locus of control that served as internal sources of motivation [40]. The gender differences exist even since early education where females gained more social and behavioral skills compared to males [41]. Those two factors drive female students to put more effort on academic activities [42] and commitment thus they were able cope better with difficulties they encountered along the academic life.

DASS-21 differentiated negative emotions (depression, anxiety, and stress) into five categories: normal, mild, moderate, severe, and extremely severe with different norms for each emotion [36]. The following were results from each negative emotion and its categories:

Depression is a negative affective state that is considered to be one among other symptoms of mental health condition [43]. Depression symptoms can be similar to stress' but depression usually is more intense and long-lasting.

**Table 3.5 – Depression Categories Amongst Gender**

Depression Categories	Male	Female
Normal	61.0%	26.4%
Mild	44.8%	55.2%
Moderate	100.0%	0.0%

Severe	0.0%	0,0%
Extremely Severe	0.0%	0.0%

There were three categories of depression experienced by samples in this study: normal, mild, and moderate where all male samples experienced moderate depression and majority of 55.2% mild depression experienced by female samples. There were no samples based on gender experienced severe or extremely severe depression. It means that depression in these samples was still at a manageable level, even though male students with moderate levels of depression need to start seriously seeking out help or find a way to lower the depression level. Depression can diminish one's quality of daily life if left untreated. Professional help as a psychologist or psychiatrist can be used as reference to deal with depression properly. Issues of mental health should be enough for one to seek help needed without being negatively labeled by the environment.

Anxiety is a reaction to stress, usually has no clear cause but evokes feelings of uneasiness to a diffuse threat [44]. Four categories were found in anxiety experienced by samples in this study: normal, mild, moderate, and severe.

**Table 3.6 – Anxiety Categories Amongst Gender**

Anxiety Categories	Male	Female
Normal	46.6%	28.4%
Mild	62.9%	37,1%
Moderate	42.4%	57.6%
Severe	60.0%	40.0%
Extremely Severe	0.0%	0.0%

Majority of male samples experienced mild anxiety level, and female samples mostly experienced moderate level of anxiety and yet severe anxiety was experienced by both genders mostly by male. It means that anxiety was more commonly experienced by samples in the context of e-learning due to COVID-19 pandemic with various categories.

Stress is a feeling experienced when one feels that the situation or external demands exceed his/her capability to cope with [5].

**Table 3.7 – Stress Categories Amongst Gender**

Stress Categories	Male	Female
Normal	58.9%	39.4%
Mild	0.7%	1.0%
Moderate	0.0%	0.0%
Severe	0.0%	0.0%
Extremely Severe	0.0%	0.0%

In the case of negative emotion named stress (Table 3.7), there were only two categories experienced by students: normal and mild categories, dominated by male samples on normal stress level and female slightly higher on mild stress categories than male samples.

Negative emotions (depression, anxiety and stress) had different correlations to academic performance. There were no significant differences between anxiety and depression to students' e-learning academic performance (anxiety:  $F(3) = 2.202$ ,  $\rho = 0.088$ , depression:  $F(2) = 1.397$ ,  $\rho = 0.249$ ). The result of anxiety and academic performance was different from the study conducted by Vitasari, et.al. where there was a significant negative correlation between level anxiety and academic performance among engineering students, where anxiety was rooted in lack of future job opportunity [23]. During the early pandemic, there are more immediate things to be dealt with than job opportunities. Students were exposed to many things (restricted immobility, internet access) and with themselves that needed to be dealt with. Most of them were dealing with self-management (43.5%) and adjusting to new situations [45]. The average GPA 3.58 could be the result from subjects taken in the first semester that were mostly similar to those of high schools'. On the other hand, these students were exposed to e-learning platforms so it became natural for them to use and did not serve as a source of negative emotions. Using e-learning became habitual for them since they were past at least 66 days to form a

new habit [46]. It could be that they had more time to learn the online materials (video, presentation etc.) where they can be revisited, relearn anytime as needed so students had better comprehension that lead to better grades. The result was similar to previous studies that academic performance increased after online learning due to COVID-19 effects [46, 47].

The result of this study on anxiety and depression that did not correlate with academic performance was similar to the result those of Teh, et., al. study [48]. In their study, the consequences of pandemic COVID-19 did not significantly influence students' e-learning academic performance because the pandemic had been experienced around a year that gave time to make necessary adjustment that did not develop further to disadvantage effects of anxiety and depression. Other study showed that emotions especially worry, and confusion tended to lower after 6 months [49]. The samples in this study also experienced e-learning throughout the semester. So, adaptation may have taken place.

Depression, anxiety and stress categories experienced by students did not influence by their gender (gender-depression:  $\chi(2) = 4.2911$ ,  $\rho = 0.117$ , gender-anxiety:  $\chi(3) = 2.119$ ,  $\rho = 0.548$ , gender-stress:  $\chi(1) = 0.811$ ,  $\rho = 0.368$ ). Depression in the previous studies was more prevalent in females due to combinations of factors [50, 51]. In this study, the role that was upheld by students dominantly was the role of students, so gender did not play a significant difference in depression. As in the case of anxiety, previous studies also showed that women were more vulnerable to anxiety due to many reasons [52, 53]. In this study, one probable explanation was that as a student where the ultimate role of interest is to do all the obligations and activities as student, gender did not play a significant influence. Different results varied for gender in stress disorder. APA [54] and Song, et.al. in China [55] showed that stress differed significantly by gender. Other studies showed that it was the reactions to stress that differed among gender [56, 57]. Recent study in China showed there were no significant differences in gender and stress disorder among undergraduates [58]. In this study, there was no firm explanation why there was no significant effect of gender on stress. One likely explanation was that all students from the same major needed to complete the same academic activities regardless of their gender and the load of academic performance was considered equal amongst the two engineering majors.

Two-way ANOVA performed to test the effect of stress categories to GPA.

**Table 3.8 – Two Way ANOVA Stress Categories-GPA**

Tests of Between-Subjects Effects					
Dependent Variable:	GPA				
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.544 <sup>a</sup>	1	.544	3.933	.048
Intercept	274.605	1	274.605	1983.814	.000
Stress categories	.544	1	.544	3.933	.048
Error	40.143	290	.138		
Total	3776.492	292			
Corrected Total	40.687	291			

a. R Squared = .013 (Adjusted R Squared = .010)

Two-way ANOVA (Table 3.8) showed that students who experienced mild stress performed better than those with normal stress category ( $F(1) = 3.933$ ,  $\rho = 0.048$ ). When it comes to stress it is mostly associated with negative emotion. In-fact, there is a positive stress called eustress. Eustress is a type of cognitive response that is associated with positive emotion [59] also known as positive stress reaction that can promote better performance [60]. Students with mild stress category, were driven to bring the best result despite various problems during the pandemic. They managed to turn the non-ideal situation to fulfill all the jobs related to academic obligations.

#### IV. Conclusion

Negative emotions such as depression, anxiety, and stress were experienced by students in this study but not all of the negative emotions significantly correlated to e-learning academic performance as predicted. It turned out that stress was one emotion significantly correlated with students' e-learning academic performance in the COVID-19 pandemic situation. Different factors as mentioned in the discussion explain why the results emerged. Institutions could promote various preventive and curative practices such as counseling and other catharsis methods to reduce the effects of negative emotions, for unattended negative emotions might lead to counter productive consequences. In pandemic situations,

mindfulness, physical distancing, and self-isolation practices are proven to reduce anxiety. Adaptation to the new normal is another factor that can ease the transition and leave students' academic performance undisturbed despite the learning methods. Limitation in this study due to non-randomized sampling thus cannot be generalized to all engineering students. Further research using larger engineering students samples and non engineering majors need to be conducted to see if the results remain the same or varied. This is important since the hybrid or full online learning method might become a new trend in the near future to come in the educational sector. Research on factors related to e-learning academic performance in engineering majors are needed to identify dominant contributing aspects to students' academic performance.

## Disclaimer

The authors whose names are written certify that they have no conflict of interest

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## Appendix A: DASS-21 Items Indonesian Version

- Saya merasa sulit untuk beristirahat (S).
- Saya cenderung over reaktif terhadap suatu kejadian (S).
- Saya merasa energi saya terkuras karena cemas (S).
- Saya mudah tersinggung (S).
- Saya sulit untuk bersantai/relaks (S).
- Saya tidak dapat mentoleransi hal-hal yang mengganggu pekerjaan/aktivitas yang sedang saya lakukan (S).
- Saya sangat perasa (mudah tersentuh persaanannya) (S).
- Saya merasa rongga mulut saya kering (A).
- Saya mengalami kesulitan bernafas (nafas cepat padahal tidak melakukan aktivitas fisik yang berat) (A).
- Otot saya bergetar tanpa sadar (misalnya pada otot tangan) (A).
- Saya cemas mengenai situasi dimana saya mungkin akan panik dan memermalukan diri sendiri (A).
- Saya sepertinya merasa panik (A).
- Saya merasakan perubahan jantung saya (merasa detak jantung meningkat, atau tidak merasakan detak jantung) padahal tidak melakukan aktivitas fisik yang melelahkan (A).
- Saya merasa takut tanpa alasan (A).
- Saya sama sekali tidak dapat memerasakan perasaan positif (gembira, bangga dll) (D).
- Saya sulit menemukan inisiatif untuk melakukan sesuatu (D).
- Saya merasa tidak mempunyai harapan (D).
- Saya merasa sedih dan tertekan (D).
- Saya tidak merasa optimis mengenai apapun (D).
- Saya merasa menjadi orang yang tidak berharga (D).
- Saya merasa hidup itu tidak bermakna (D).

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