The Role of Learning Environment, Instructor Feedback, and Class Size on Students' Engagement in Online

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ABSTRACT

Student engagement in online learning is influenced by well-structured environments that facilitate collaboration, resource accessibility, and meaningful interactions with peers and instructors. Engagement encompasses emotional, cognitive, and behavioural aspects, all of which contribute to student motivation and academic success. This study examines the impact of the learning environment, instructor feedback, and class size on student engagement in online learning. A self-administered questionnaire was utilized, targeting students from the Diploma in Mathematical Sciences program at UiTM Kelantan selected through a simple random sampling method. Multiple Linear Regression analysis was employed to evaluate the data. The results indicate that only instructor feedback (β=0.568) has a statistically significant effect (p-value < 0.05) on student engagement in online learning, while the learning environment and class size show no significant influence. These findings provide valuable insights for strategic planning aimed at fostering an interactive and inclusive environment to enhance student engagement in online learning.

Keywords: Student Engagement, Class Size, Online Learning, Instructor Feedback, Learning Environment

INTRODUCTION

Student engagement in online learning is shaped by several key factors, including the learning environment, instructor feedback, and class size. The learning environment, which comprises technological tools and virtual classroom dynamics, plays a crucial role in either facilitating or hindering student interaction (Kahn et al., 2017). A well-structured online environment that incorporates clear instructions, intuitive navigation, and interactive features has been found to enhance student engagement and motivation as well (Zamani, 2022). Positive perceptions of the learning environment, particularly those emphasizing community-centered and learner-focused approaches, contribute to improved educational experiences and outcomes (Zamani, 2022). Instructor feedback is another significant determinant of engagement, as timely and constructive responses provide students with guidance, motivation, and clarification of course material, all of which directly influence their level of engagement (Martin et al., 2018). Conversely, delayed or ambiguous feedback has been shown to result in frustration and disengagement, thereby negatively impacting the overall learning experience (Martin et. al., 2018).

Class size also constitutes a critical factor in determining student engagement levels. Smaller class sizes are associated with increased opportunities for personalized interaction between students and instructors, thereby fostering an interactive and participatory learning environment (Kim, 2013). In contrast, larger classes may restrict individual contributions and limit meaningful engagement due to reduced opportunities for direct interaction with instructors and peers (Bettinger, 2017). Collectively, these factors influence the overall quality and effectiveness of online learning, highlighting the necessity of understanding student-instructor interactions

and their role in sustaining engagement.

Student engagement itself is recognized as a fundamental psychological construct and is widely regarded as a key predictor of academic success, student achievement, and retention (Wong & Liem, 2021; Fredricks et al., 2004). Scholars continue to investigate the factors that influence engagement and explore how learning environments can be structured to enhance student participation and motivation (Vo & Ho, 2024). While extensive research has explored student engagement, further investigation is needed to identify the specific factors influencing engagement in online learning, particularly in higher education. Thus, this study aims to assess the impact of the learning environment, instructor feedback, and class size on student engagement in online education. As technological advancements continue to reshape the educational landscape, online learning has become a prevalent instructional method. Addressing these gaps in the literature will offer valuable insights into how these elements interact and collectively shape student participation in virtual learning environments.

METHODOLOGY AND DATA COLLECTION

Study Design, Sample and Instrumentation The study framework is depicted in Figure 1. This research uses a cross-sectional design and a quantitative approach to evaluate how independent variables such as Learning Environment, Instructor Feedback, and Class Size influence the dependent variable, Students' Engagement in online learning. Instructor Feedback assesses the impact of timely and constructive responses on student performance and satisfaction. The Learning Environment focuses on how peer communication and collaboration enhance engagement, while Class Size examines the effects of varying student numbers on interaction, participation, and academic outcomes.

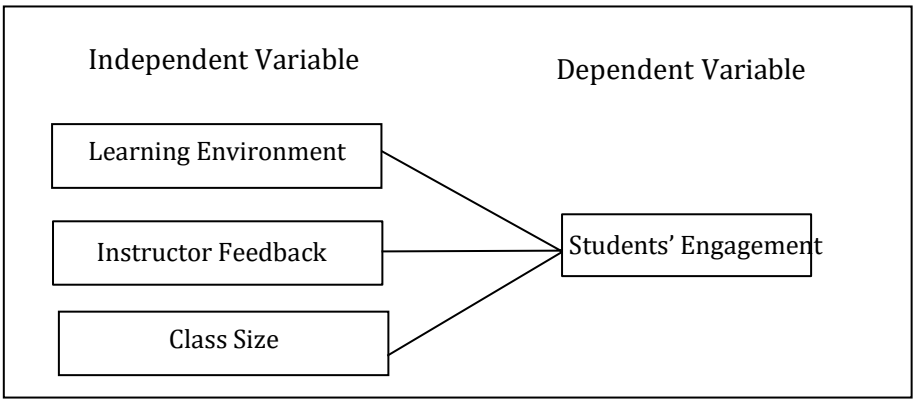

Figure 1 Conceptual Framework

Primary data collection was conducted using a self-administered questionnaire. A sample of 76 students from the Diploma in Mathematical Sciences program at UiTM Kelantan was selected through a simple random sampling technique. The questionnaire comprises two sections: Part A collects demographic information, while Part B consists of items measuring both dependent and independent variables. Responses are recorded using a five-point Likert scale: Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD). Table 1 provides a summary of the number of items and sources of the instrumentation used in the study.

Table 1: Instrumentation

Variables	Source
Students' Engagement	(Vo & Ho, 2024)
Learning Environment	(Nur Diana Zamani, et al, 2022)
Instructor Feedback	(Gopal, Ram, et al, 2021)
Class Size	(Ake-Little, E. et al, 2020)

Method of Analysis

Descriptive statistics were employed to outline the demographic profiles of the respondents. Multiple Linear Regression (MLR) was used to identify the relationships between Students' Engagement and the independent variables. MLR helps to understand how changes in the independent variables are associated with changes in the dependent variable. The general formula for Multiple Linear Regression is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \in \quad (1)$$

Where, Y is the dependent variable, β_0 is the y-intercept (constant term), β_1, β_1,…, β_k are the coefficients of the independent variables of $X_1, X_2, \ldots, X_k$. $\in$ is the error term or residual, representing the difference between the observed and predicted values of Y. MLR estimates the coefficients (β values) that minimize the sum of the squared differences between the observed and predicted values of the dependent variable.

The Ordinary Least Squares (OLS) method is commonly used to estimate the parameters in Multiple Linear Regression (MLR). The OLS method uses matrix algebra to simplify the estimation process. Represent the model in matrix form:

$$Y = X\beta + \epsilon \quad (2)$$

Where, Y is $n \times 1$ vector of dependent variable values. X is an $n \times (k+1)$ matrix of independent variables (including a column of ones for the intercept). β is a $(k+1) \times 1$ vector of parameters and ϵ is an $n \times 1$ vector of errors. The OLS estimate of the parameter vector β is obtained using the formula:

$$\hat{\beta} = (X^T X)^{-1} X^T Y \quad (3)$$

Where, X^T is the transpose matrix of X and $(X^T X)^{-1}$ is the inverse of the matrix $X^T X$.

RESULTS

Demographics of respondent

Table 2 presents the respondents' profiles, categorized by age, academic level, and preference for online learning. The majority of respondents were 20 years old, accounting for 47.4%, followed by 18-year-olds at 32.1% and 19-year-olds at 20.5%. Regarding academic level, most respondents were in Part 5 (43.6%), while 33.3% were in Part 1, and 23.1% were in Part 3. In terms of preference for online learning, a significant majority (62.8%) expressed a positive preference, whereas 37.2% did not. These findings highlight the predominance of older students and those in higher academic levels, as well as an overall favorable attitude toward online learning.

Table 2: Descriptive Table of Respondents Demographic

Variables	Category	Frequency (N=78)	Percentage (%)
Age	18	25	32.1
	19	16	20.5
	20	37	47.4
Parts	1	26	33.3
	3	18	23.1
	5	34	43.6
Do you like online learning?	Yes	49	62.8
	No	29	37.2

Model Adequacy Checking

Model adequacy checks include the assumption of linearity between independent and dependent variables, normality of residuals, homoscedasticity, and multicollinearity (Lee & Lee, 2022; Olive, 2017; Roback & Legler, 2021; Von & Schuster, 1998; Yang et al., 2019).

Linearity

Table 3 indicates a noteworthy linear association between Learning Environment (r=0.543, p-value < 0.05), and Instructor Feedback (r=0.591, p-value < 0.05) with Students' Engagement in online learning. While, the Class Size (r=0.009, p-value < 0.391) did not show a significant linear relationship with the dependent variable.

Table 3: Pearson Correlation

Dependent variable	Independent variable	Pearson correlation	p-value
Students' Engagement	Learning Environment	0.543	<0.05
	Instructor Feedback	0.591	<0.05
	Class Size	0.009	0.391

Normality

In Figure 2, the plot aligns with a straight line, signifying that the residuals are normally distributed and, consequently, meet the assumption of normality of the residuals.

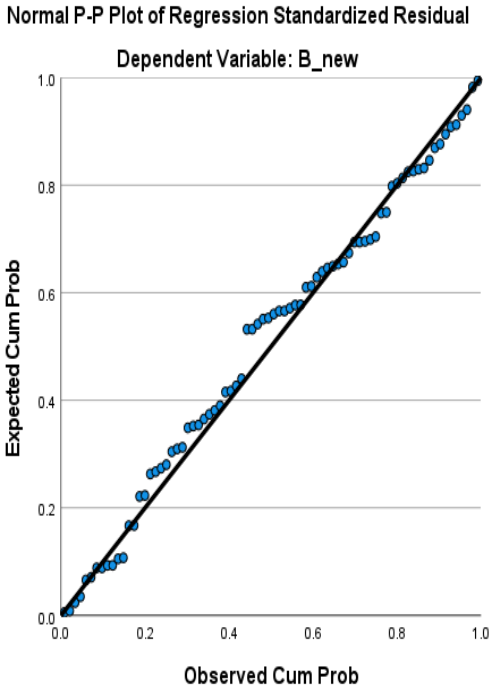

Figure 2 Distribution of Residual

Homoscedasticity

Figure 3 shows that the residuals are randomly dispersed without any discernible pattern, suggesting the fulfilment of homoscedasticity, where residuals exhibit constant variance and lack bias.

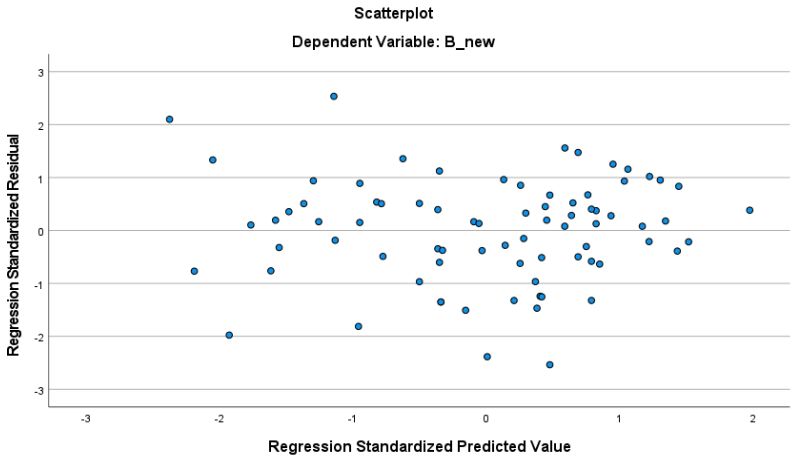

Figure 3 The Scatter Plot of Residual by Predicted Value

Multicollinearity

The multicollinearity test aims to ascertain the degree of interrelation among the independent variables in the model. Table 4 reveals no indication of multicollinearity for all variables, given that the tolerance values for Learning Environment (0.693), Instructor Feedback (0.731), and Class Size (0.936) surpass the threshold of 0.1. The VIF values are also below 10, specifically 1.444, 1.368, and 1.069. Consequently, this model does not exhibit multicollinearity issues.

Table 4: Coefficients form multicollinearity assumption

Variables	Collinearity Statistics		Findings
	TOL	VIF	
Learning Environment	0.693	1.444	
Instructor Feedback	0.731	1.368	No Multicollinearity
Class Size	0.936	1.069	

Significant of model

Table 5 presents the results of the Test of Significance Regression (F-Test), which evaluates the overall effectiveness of the regression model. The Analysis of Variance (ANOVA) produced an F-statistic of 18.473 with a significance value (p-value) of less than 0.001. Since the p-value is below the conventional threshold of 0.05, the results indicate that the regression model is statistically significant, meaning that the predictors collectively account for a substantial portion of the variation in the dependent variable. Furthermore, the R Square value of 0.428 suggests that the model explains 42.8% of the variance in the dependent variable, demonstrating a moderate level of explanatory power. These findings confirm the robustness and validity of the regression model.

Table 5: Analysis of Variance

Model	ANOVA	F	Sig	R Square
1	Regression	18.473	<0.001	0.428

Significant of independent variable

Table 6 presents the regression analysis results, evaluating the significance of each independent variable using a t-test. Among the variables examined, only Instructor Feedback (β=0.568) exhibits a statistically significant

impact, with a p-value below the 0.05 threshold. This finding indicates that Instructor Feedback plays a crucial role in influencing student engagement in online learning. In contrast, the Learning Environment and Class Size have p-values exceeding 0.05, suggesting that their effects on the dependent variable are not statistically significant.

Table 6: Coefficient for MLR test

Variable	Unstandardized coefficient	p-value	95% confidence interval	
			Lower	Upper
Constant	2.037	0.802	0.575	3.499
Learning Environment	0.147	<0.001	-0.057	0.350
Instructor Feedback	0.568	<0.001	0.333	0.802
Class Size	-0.90	<0.001	-0.260	0.081

SUMMARY OF THE FINDINGS

The results of the entire study are summarized in Table 10.

Table 10: Summary of The Findings

Relationships	Findings
There is a significant influence of Learning Environment on Students' Engagement in online learning	Not Supported
There is a significant influence of Instructor Feedback on Students' Engagement in online learning	Supported
There is a significant influence of Class Size on Students' Engagement in online learning	Not Supported

CONCLUSION

The findings of this study highlight the crucial role of instructor feedback in shaping student engagement in online learning. The regression analysis results indicate that among the independent variables examined, only instructor feedback demonstrates a statistically significant impact (β=0.568, $p < 0.05$), underscoring its importance in fostering student participation and motivation. In contrast, the learning environment and class size did not exhibit statistically significant effects, suggesting that while these factors may contribute to the online learning experience, their influence on student engagement is not as pronounced. These results emphasize the necessity of timely and constructive feedback from instructors as a key strategy for enhancing student engagement in virtual learning environments. Future research could explore additional variables or contextual factors that may further explain variations in student engagement.

The study suggests that future investigations should incorporate additional independent variables to explore the potential influences on Students' Engagement in online learning comprehensively. To enhance the understanding of Students' Engagement in online learning and its causes, a recommended approach involves employing a longitudinal design in subsequent studies, as it can yield more relevant information over time.

Conflict of Interests

The authors disclosed no conflicts of interest in this work and declared no potential conflicts related to this article's research, authorship, or publication.

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