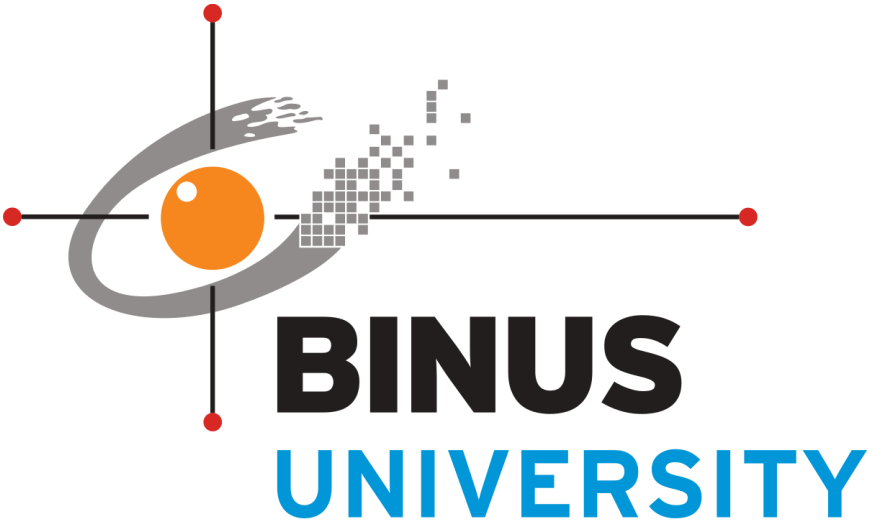
Assessing Forum-Based Asynchronous Learning's Role in Student Engagement and Performance at BINUS University (Jakarta, Bekasi, Alam Sutera)



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INTRODUCTION

This study examines the **effectiveness of asynchronous online learning** in higher education, with a specific focus on the role of **forum-based discussions** in shaping **student engagement and academic performance**. While online learning encompasses both real-time (*synchronous*) and self-paced (*asynchronous*) methods, this research deliberately narrows its scope to asynchronous forums to provide a deeper analysis of how these specific environments impact student outcomes, distinct from other tools like recorded lectures or digital course materials.

The relevance of this topic stems from the increasing integration of asynchronous learning into standard university curricula, moving it beyond an emergency measure to a **core component of modern education**. However, there are **conflicting views on its effectiveness**. On one hand, asynchronous forums offer flexibility for diverse student schedules and can foster critical thinking and collaboration. On the other hand, there are significant concerns about maintaining student motivation, the risk of passive participation, and the potential negative effects of delayed feedback and a lack of immediate instructor presence.

Given these mixed perspectives, the study aims to provide **empirical evidence** to **clarify the true impact** of forum-based discussions. By analyzing *student participation patterns*, *perceptions*, and *academic results*, the research seeks to offer **valuable insights** for **educators**, **instructional designers**, and **policymakers**. The ultimate goal is to contribute to the **development of best practices** for digital pedagogy, ensuring that online courses are designed to optimize both student engagement and academic success.

SAMPLE DESIGN

The project employed a Two-Stage Cluster Sampling method to ensure a representative sample across the university's multi-campus structure. In the first stage, the three main campuses (Kemanggisan, Alam Sutera, and Bekasi) were selected as distinct clusters based on their geographical and administrative differences. In the second stage, a random and proportional sample of students was drawn from within each campus cluster to reduce selection bias and enhance the study's generalizability.

The sample size was initially calculated using Cochran's formula, assuming a 95% confidence level, a 5% margin of error, and a 0.5 proportion for maximum variability, which yielded a base of 385 respondents. This figure was then adjusted for the cluster design using a Design Effect (DEFF) of 1.75, resulting in an ideal target sample of 674 students. However, the research ultimately proceeded with the 224 valid responses that were successfully gathered during the data collection period, a figure acknowledged as a study limitation.

The sampling frame consisted of students at the selected campuses who had experience with asynchronous online learning. The selection process began by designating the campuses as clusters. From there, individual students were randomly invited to participate through the distribution of online survey links in large student group chats and other academic communication channels. Any student within these groups who saw the invitation had an equal opportunity to respond, constituting the random selection element of the second stage.

The project's quality perspective involved addressing potential errors throughout its lifecycle. Representation errors were significant, including coverage error, as the final sample of 224 fell far short of the 674 target, with some campuses being severely underrepresented. The voluntary online distribution also introduced risks of selection bias and non-response bias, as interested students were more likely to participate. To improve measurement quality, the study addressed instrument errors identified during a pre-test, such as correcting redundant questions, clarifying ambiguous terminology, and fixing conceptual errors like the misclassification of Zoom as an asynchronous tool.

QUESTION DESIGN

Main Variables and Question Mapping

Angkatan	Demographic Variable
Fakultas	Demographic Variable
Region	Demographic Variable
Apakah Anda pernah berpartisipasi dalam forum diskusi selama perkuliahan?	Screening Variable
Saya secara aktif berkontribusi dalam diskusi forum BINUS daripada hanya membaca postingan	Student Engagement
Saya sering kembali membuka forum diskusi di Binusmaya sebelumnya ketika mempersiapkan diri untuk ujian	Academic Performance
Saya merasa topik yang dibahas di forum Binusmaya terkadang kurang relevan atau terlalu kaku untuk membuat saya tertarik	Student Engagement
Saya merasa forum diskusi Binusmaya memberi saya ruang untuk mengenal perspektif mahasiswa dari latar belakang yang berbeda	Student Engagement
Saya merasa nyaman mengungkapkan pemikiran saya dalam diskusi berbasis forum	Student Engagement
Diskusi forum membantu saya memahami konsep yang tidak saya mengerti dari perkuliahan	Academic Performance

Saya lebih nyaman berdiskusi melalui forum tulis (asinkron), seperti Binusmaya, dibandingkan pertemuan langsung (sinkron), seperti Zoom atau Microsoft Teams	Influencing Factors
Saya berpartisipasi dalam diskusi forum Binusmaya karena merasa bermanfaat dan membantu saya tetap terlibat dalam kursus saya, bukan hanya karena tugas atau absensi	Student Engagement
Forum membantu menciptakan rasa komunitas dalam perkuliahan daring	Student Engagement
Pembelajaran berbasis forum memiliki dampak positif terhadap nilai akademik saya	Academic Performance
Diskusi forum membantu saya memahami dan mengingat konsep perkuliahan dengan lebih baik	Academic Performance
Saya biasanya mendapatkan jawaban atau umpan balik yang memadai dari dosen di forum dalam waktu yang saya butuhkan	Influencing Factors
Saya menerapkan konsep dari diskusi forum dalam tugas dan ujian saya	Academic Performance
Respon dari dosen dalam forum secara signifikan meningkatkan pengalaman belajar saya	Academic Performance
Saya lebih memilih mempelajari materi melalui forum diskusi dibandingkan menonton video pembelajaran	Influencing Factors
Saya lebih memilih forum diskusi dibandingkan mengikuti online course mandiri	Influencing Factors

Certain questions within the questionnaire were intentionally included not to measure the core constructs of student engagement or academic performance, but to serve critical methodological and contextual purposes. Demographic questions (1-3) were essential for analyzing the sample's composition, enabling comparative analysis between subgroups, and providing a basis for the post-stratification weighting used to improve

representativeness. The screening question (4) was a vital methodological step to ensure data validity by filtering the sample to include only those respondents with relevant experience in using discussion forums. Finally, questions on learning preferences (21-23) were included to gather contextual data on students' general learning styles and optimal environments. This information helps to interpret the primary findings, providing insight into why students might prefer certain learning modalities over others and adding depth to the overall analysis.

DATA COLLECTION

The study's data was collected using an online survey via Google Forms, a method chosen for its convenience, broad reach, and the anonymity it provides to encourage honest responses. The process occurred over approximately five weeks from May 5 to June 11, 2025, and was conducted in two main waves. The initial effort to gather data involved a broad distribution of the survey to student group chats. After this first wave yielded a lower-than-expected response rate, a second wave was launched to boost participation. This effort involved extending the collection period and employing a more direct strategy of privately contacting individuals who were randomly selected from the large regional student groups. These efforts ultimately resulted in a final total of 252 responses. Based on an estimated 1,271 individuals invited to participate, the number of non-responses was approximately 1,019.

RELIABILITY AND QUALITY CHECK

To evaluate the quality of the survey instrument, two main analyses were conducted: validity and reliability tests. The goal is to ensure that the survey items used are consistent (reliable) and measure what they are supposed to measure (valid).

Validity Calculation and Conclusion

The validity calculation in this study was conducted to assess **construct validity**, which is the extent to which the survey instrument truly measures the underlying theoretical concept. The method used was **Exploratory Factor Analysis (EFA)**.

Validity Calculation Process:

The EFA was systematically performed through several stages using the *FactorAnalyzer* package in Python:

1. **Data Suitability Checks:** The data was tested using **Bartlett's Test of Sphericity** and the **Kaiser-Meyer-Olkin (KMO) Measure** to ensure it was suitable for EFA.
2. **Factor Extraction:** Using a common factor model, EFA identifies latent constructs (factors) that explain the shared variance among the items. This model is mathematically represented as:

   $X = AF + \epsilon$

   Where:

   - X = observed data.
   - Λ = factor loading matrix.
   - F = factor score vector.
   - ϵ = unique variance or error.

3. **Factor Retention:** The number of factors to retain was determined based on the **eigenvalue-greater-than-one** criterion and analyzed via a scree plot.
4. **Factor Rotation:** A **Varimax rotation** was applied to simplify the factor structure, making it easier to interpret.
5. **Analysis of Factor Loadings:** Items were grouped into factors based on their highest loading values.

Conclusion on Validity

Based on the process described, it can be concluded that the **construct validity of the measured variables has been systematically and comprehensively assessed**. The use of EFA with its structured steps ensures that the item groups within the survey are empirically proven to measure the same, theoretically relevant latent constructs. Therefore, the survey instrument is considered valid for use.

Reliability Analysis and Conclusion

Reliability refers to the consistency or repeatability of a measurement instrument. In the context of Likert-scale survey items, a common approach to measuring internal consistency reliability is through Cronbach's alpha (α).

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} \sigma_i^2}{\sigma_T^2}\right)$$

where :

k is the number of items in the scale,

σ_i^2 is the variance of each individual item, and

σ_T^2 is the variance of the total composite score across all items.

The analysis, performed programmatically with Python's `pingouin` package, included two key computations:

1. **Overall Alpha:** To determine the reliability of the entire set of items.
2. **Alpha-if-Item-Deleted:** To identify any inconsistent items that might reduce the scale's reliability if removed.

Before calculation, all Likert responses were treated as ordinal numeric data (typically 1–5 scale), and any reverse-coded items were re-aligned to ensure directional consistency.

Conclusion on Reliability

The survey's internal consistency was robustly evaluated using Cronbach's Alpha (α), which included "alpha-if-item-deleted" analysis. This method ensures the Likert-scale items consistently measure the same construct, yielding reliable results. Responses were pre-processed as ordinal numeric data with aligned reverse-coded items.

DATA ANALYSIS

In the analysis of the survey data, a comprehensive process was undertaken, beginning with data cleaning and descriptive analysis before moving to more complex inferential methods.

Descriptive Analysis

The initial data cleaning process addressed significant gaps in the dataset. Rows from respondents who had never participated in forums were removed, as they could not answer follow-up questions due to the survey's conditional logic. Additionally, an entirely empty column, resulting from a survey error, was also deleted from the dataset.

A descriptive analysis of the 252 initial respondents revealed a sample significantly skewed towards specific demographics. There was a heavy concentration of students from the Class of 2027, the School of Computer Science, and the Kemanggisan campus. This indicates that the sample is not fully representative of the broader student population. However, the data confirmed that forum-based learning is a widely used tool within this sample, with 88.9% of respondents having participated in forum discussions

Preprocessing Method Applied

Given the significant demographic imbalances in the sample, a critical preprocessing step was necessary before conducting inferential analysis on the Likert-scale data. To correct for these discrepancies and ensure the findings would better reflect the true student population, a post-stratification weighting method was applied. This process was essential because if certain groups are overrepresented in the responses, the overall trends could misrepresent the population as a whole.

The weighting method worked by adjusting the influence of each respondent based on their group's actual prevalence in the official Indonesian higher education database (PDDikti). The core formula used to calculate the weights for each subgroup was:

$$Weight_{group} = \frac{Proportion\ in\ Population}{Proportion\ in\ Survey}$$

To achieve more granular and precise weights, this approach was compounded across multiple demographic dimensions, including cohort year, faculty, and campus location. While this weighting is mathematically valid and necessary for improving representational accuracy, the process yielded a wide range of final weight values. Notably, some underrepresented subgroups received disproportionately high weights; in one case, the weight reached 15.81. This outcome introduces a degree of sensitivity into the analysis, as the responses from a few highly weighted individuals carry an outsized influence, which could cause any anomalies in their responses to disproportionately affect the overall weighted results.

CONCLUSION

The study concludes that while forum-based asynchronous learning is a functionally valued tool for academic support at BINUS University, student engagement is often superficial, driven more by compliance with course requirements than genuine commitment. Active instructor presence is pivotal for meaningful discourse, and a key challenge is the issue of equity, as the self-paced format may inadvertently privilege self-directed learners. The primary areas for improvement in the research process involve addressing the study's limitations, such as the low response rate (17.6%) and the skewed sample, which was heavily concentrated in the School of Computer Science and the Kemanggisan campus. Future efforts should also aim to mitigate

potential non-response bias and the volatility introduced by applying extremely high statistical weights to underrepresented subgroups.

To better address the research questions identified, the planned future analysis involves a multifaceted strategy to enhance research robustness. This includes broadening participation across faculties and campuses through coordinated outreach and potential incentives to achieve a more balanced sample. To capture a fuller range of perspectives and address non-response bias, future research will supplement survey data with qualitative methods such as interviews or focus group discussions. Additionally, weighting strategies will be managed more carefully by monitoring demographic distributions during data collection to minimize result instability, and the quality of qualitative data for NLP analysis will be improved by using clearer prompts and hybrid coding methods.

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APPENDICES

Final Questionnaire

Google Form Link : https://forms.gle/pvKtaTK925bPkaVB9

Survey Design : Survey Design [FINAL]

Sample Raw Data

Form Responses : Survey SSM Group 4 (Responses)

Code

NLP : NLPssm.ipynb

Data Cleaning and Analysis : SSM_Post_Survey_Analysis.ipynb

Question Design

Angkatan	Demographic Variable
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Region	Demographic Variable
Apakah Anda pernah berpartisipasi dalam forum diskusi selama perkuliahan?	Screening Variable
Saya secara aktif berkontribusi dalam diskusi forum	Student Engagement

BINUS daripada hanya membaca postingan	
Saya sering kembali membuka forum diskusi di Binusmaya sebelumnya ketika mempersiapkan diri untuk ujian	Academic Performance
Saya merasa topik yang dibahas di forum Binusmaya terkadang kurang relevan atau terlalu kaku untuk membuat saya tertarik	Student Engagement
Saya merasa forum diskusi Binusmaya memberi saya ruang untuk mengenal perspektif mahasiswa dari latar belakang yang berbeda	Student Engagement
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Saya biasanya mendapatkan jawaban atau umpan balik yang memadai dari dosen di forum dalam	Influencing Factors

waktu yang saya butuhkan	
Saya menerapkan konsep dari diskusi forum dalam tugas dan ujian saya	Academic Performance
Respon dari dosen dalam forum secara signifikan meningkatkan pengalaman belajar saya	Academic Performance
Saya lebih memilih mempelajari materi melalui forum diskusi dibandingkan menonton video pembelajaran	Influencing Factors
Saya lebih memilih forum diskusi dibandingkan mengikuti online course mandiri	Influencing Factors
Menurut Anda, apa saja faktor yang dapat menciptakan suasana pembelajaran yang optimal?	Influencing Factors
Lingkungan seperti apa yang paling membantu Anda untuk fokus belajar?	Influencing Factors
Apa jenis aktivitas belajar yang paling sesuai dengan gaya belajar Anda?	Influencing Factors
Apakah Anda merasa bahwa forum pembelajaran asinkron memberikan kesempatan yang setara bagi semua mahasiswa untuk terlibat, atau ada kelompok tertentu yang lebih banyak mendapat keuntungan?	Influencing Factors
Apa faktor yang menurut Anda paling berkontribusi terhadap keterlibatan Anda dalam pembelajaran berbasis forum asinkron di BINUS?	Student Engagement
Dalam pandangan Anda, bagaimana forum pembelajaran asinkron dapat ditingkatkan agar lebih menarik dan bermanfaat bagi mahasiswa?	Influencing Factors