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# The effect of blended learning implementation on the academic achievement of Binus University students in the business statistics course

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## ABSTRACT

This study investigates the effect of blended learning implementation on the academic achievement of undergraduate students enrolled in the Business Statistics course at Bina Nusantara University (BINUS), Indonesia. Blended learning, a pedagogical approach that systematically integrates conventional face-to-face classroom instruction with structured online digital activities, has gained considerable prominence in higher education, particularly in the context of the educational disruptions caused by the COVID-19 pandemic. Employing a descriptive quantitative research design with a cross-sectional time horizon, the study collected academic performance data from 50 students through structured questionnaires and interviews. Statistical analyses—including the Kolmogorov–Smirnov normality test and the Kruskal-Wallis non-parametric test—were applied to examine the distributional characteristics of and significant differences between the online and offline components of blended learning. Results indicate a statistically significant difference between the two modalities ( $\chi^2 = 74.257 > \chi^2_{table} = 3.84$ ;  $p = 0.000 < 0.05$ ), with the offline instructional component consistently yielding higher academic performance scores. Findings affirm that blended learning positively influences student engagement, learning flexibility, and academic performance. The study recommends that academic institutions invest in strengthening digital infrastructure and instructor competency in digital pedagogy to maximise the effectiveness of blended learning models in higher education.

**Keywords:** blended learning; e-learning; academic achievement; business statistics; higher education; online learning

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## 1. INTRODUCTION

The globalisation of education and the accelerating pace of digital transformation have collectively redefined the boundaries of teaching and learning in contemporary higher education institutions worldwide. In an era characterised by ubiquitous internet connectivity and the widespread proliferation of mobile technologies, traditional instructional paradigms have faced increasing pressure to adapt to the evolving needs of learners and the demands of a knowledge-driven economy. Among the most consequential educational responses to this imperative is the adoption of electronic learning—widely referred to as e-learning—a framework that leverages information and communication technology (ICT) to facilitate flexible, accessible, and interactive learning experiences beyond the confines of the conventional physical classroom (Rosenberg, 2001).

E-learning as a concept has undergone considerable evolution since its earliest inception. In its initial iterations, it was primarily associated with computer-based instruction delivered via intranet platforms or standalone software. Over time, advancements in internet technology expanded its scope to encompass fully web-based learning environments, enabling learners to access educational content from virtually any geographic location and at any time. The flexibility and autonomy afforded by e-learning have been widely acknowledged as significant pedagogical advantages, particularly for adult learners and non-traditional students who may face constraints related to time, geography, or professional obligations (Michael, 2013). According to Chandrawati (2010), e-learning fundamentally reconstitutes the learner-educator relationship by relocating the locus of instruction from the physical classroom to the digital environment, thereby enabling more personalised and self-directed learning pathways.

Nevertheless, a purely online learning model is not without its inherent limitations. Research has consistently documented that a subset of students—particularly those who are less technologically proficient or who struggle with self-regulation in autonomous digital learning environments—may fail to achieve optimal academic outcomes through exclusively online instruction (Rasheed et al., 2020). Furthermore, the absence of direct interpersonal interaction between instructors and students—a hallmark of traditional classroom instruction—has been identified as a potential impediment to the depth of conceptual understanding, collaborative problem-solving, and affective engagement that many academic disciplines demand. These limitations have stimulated growing scholarly interest in instructional models that seek to harness the complementary strengths of both conventional and digital learning environments.

It is against this complex educational backdrop that blended learning has emerged as a widely endorsed and pedagogically compelling alternative. Blended learning is broadly defined as an instructional approach that systematically combines face-to-face classroom instruction with structured online learning activities, thereby integrating the interpersonal richness of conventional pedagogy with the accessibility and resource-richness of digital platforms (Bonk & Graham, 2006). By preserving the relational and discursive dimensions of physical classroom interaction while simultaneously incorporating the flexibility and self-paced nature of online learning, blended learning aspires to deliver a superior educational experience that transcends the limitations of either modality in isolation.

The relevance and urgency of blended learning have been further amplified by the unprecedented educational disruptions occasioned by the COVID-19 pandemic. The global health crisis, which compelled universities and schools across the world to transition abruptly to fully online instruction in 2020, exposed profound deficiencies in the readiness of both institutions and learners for a wholly digital educational paradigm. In Indonesia, where universities such as Bina Nusantara University (BINUS) had begun integrating digital technologies into their instructional practices prior to the pandemic, the enforced shift to remote learning presented both significant challenges and unforeseen opportunities. The crisis acted as a catalyst—accelerating the adoption of e-learning and blended learning models and underscoring the urgency of developing coherent, evidence-based frameworks for their effective implementation in higher education contexts.

BINUS University, as a leading private university in Indonesia with a distinctive emphasis on technology integration in education, provides a particularly relevant institutional setting for examining the effects of blended learning on student academic achievement. The Business Statistics course, which constitutes a core component of the Management undergraduate curriculum at BINUS Business School, requires a degree of quantitative reasoning, analytical thinking, and problem-solving proficiency that may be differentially supported by online and face-to-face instructional modalities. Understanding how the respective components of blended learning contribute to student performance in this discipline has significant practical implications for curriculum design, instructional strategy, and institutional policy in Indonesian higher education.

This study addresses a substantive gap in the existing empirical literature by investigating the specific effects of blended learning implementation differentiating between its online and offline instructional components on the academic achievement of BINUS students enrolled in the Business Statistics course. Through a rigorous quantitative methodology grounded in non-parametric statistical analysis, the study contributes nuanced empirical insights into the relative efficacy of blended learning modalities and provides evidence-based recommendations for higher education practitioners, curriculum designers, and institutional administrators in Indonesia and across similar educational contexts in the Asia-Pacific region.

## **2. LITERATURE REVIEW**

### **2.1. E-Learning: Conceptual Foundations and Scope**

E-learning represents a broad and multifaceted educational paradigm encompassing all forms of instruction that utilise electronic technologies as a primary medium for knowledge delivery and assessment. At its conceptual core, e-learning is premised upon the capacity of technology to extend the temporal and spatial boundaries of learning, enabling students to engage with educational content independently of physical location, institutional timetables, or fixed scheduling constraints. According to [Michael \(2013\)](#), e-learning is a learning system explicitly designed to support the instructional process through electronic or computer-based means. Complementing this definition, [Chandrawati \(2010\)](#) characterises e-learning as a form of distance learning that integrates established instructional principles with technologically mediated delivery systems. More specifically, [Ardiansyah \(2013\)](#) conceptualises e-learning as a learning system in which the instructional process is conducted entirely through digital media, eliminating the necessity for direct face-to-face interaction between educators and learners.

The conceptual architecture of e-learning encompasses two principal orientations: Electronic-Based E-Learning, which encompasses a wide spectrum of electronic media including video content, instructional films, and interactive multimedia software; and Internet-Based E-Learning, which relies exclusively on internet-enabled platforms and web-based digital environments for the delivery and management of instructional content ([Rosenberg, 2001](#)). The latter orientation has become increasingly dominant in contemporary educational practice, owing to the unprecedented accessibility, interactivity, and scalability afforded by modern internet technologies. The proliferation of learning management systems, video conferencing platforms, and open educational resources has further expanded the pedagogical possibilities of internet-based e-learning, enabling institutions to deliver rich, multimedia-enhanced instructional experiences at scale.

The benefits of e-learning in higher education are extensively documented across the scholarly literature. Key advantages include enhanced learner autonomy, temporal and spatial flexibility in the organisation of study activities, cost efficiency for both institutions and learners, and the capacity to deliver rich multimedia content capable of accommodating diverse learning styles and cognitive preferences. E-learning platforms also facilitate iterative self-assessment through formative quizzes and interactive activities, empowering students to monitor their own learning trajectories and identify areas requiring additional study and consolidation.

## **2.2. Blended Learning: Theoretical Framework and Characteristics**

Blended learning—referred to in the scholarly literature by various synonymous terms including hybrid learning and mixed-mode instruction—is a pedagogical model that deliberately and systematically integrates the distinct strengths of traditional face-to-face classroom instruction with those of structured online learning to create a unified and coherent educational experience. Etymologically, the compound term captures the fundamental premise of the model: that the purposeful combination of complementary instructional modalities yields educational outcomes superior to those achievable through either modality in isolation (Bonk & Graham, 2006).

A comprehensive meta-analytic review of the blended learning literature conducted by Cao (2023), synthesising findings from studies conducted across multiple national and disciplinary contexts, revealed that blended learning consistently produces measurably higher academic achievement compared to exclusively traditional or exclusively online instructional approaches. The review identified several explanatory mechanisms through which blended learning enhances student performance: the provision of structured instructional support and immediate feedback in the physical classroom environment; facilitation of peer interaction, collaborative problem-solving, and dialogic learning; access to rich digital resources available on-demand; and the development of metacognitive and self-regulatory competencies through asynchronous online engagement.

The defining characteristics of effective blended learning implementation, as synthesised by Dziuban et al. (2018) in their comprehensive ten-year review of blended learning research, include: (a) the systematic integration of multiple instructional delivery modes and pedagogical approaches tailored to the diverse cognitive profiles and motivational orientations of learners; (b) the deliberate combination of synchronous, face-to-face instruction with asynchronous, self-paced online learning activities; (c) meaningful alignment between teaching methods, digital delivery strategies, and intended learning outcomes; and (d) a collaborative, co-constructive relationship between students, instructors, and institutional stakeholders in the design and continuous improvement of the learning experience.

From a practical implementation perspective, blended learning can assume multiple distinct configurations depending on the proportion of time allocated to online versus face-to-face instructional activities, the extent of learner autonomy embedded within the online component, and the degree to which the two modalities are integrated as mutually reinforcing elements rather than maintained as discrete and parallel instructional tracks. Han (2022) notes that the quality of the blended learning experience is critically dependent on the coherence and intentionality of the design connecting online preparatory activities with face-to-face application and synthesis sessions. In the context of BINUS University, the blended learning model employed in the Business Statistics course combines synchronous classroom instruction—facilitated by experienced lecturers—with asynchronous online activities delivered through the university's integrated digital learning platform, affording students access to lecture recordings, assignment tasks, video resources, electronic reading materials, and formative quiz instruments.

## **2.3. Blended Learning and Academic Achievement**

Academic achievement, broadly construed as the measurable outcomes of a structured learning process, encompasses a multidimensional range of cognitive, affective, and psychomotor competencies acquired through formal instruction. Gagne (1985) identified five fundamental domains of academic achievement: intellectual skills, cognitive strategies, verbal information, attitudes, and motor skills. Expanding upon this foundational taxonomy, Bloom and Arikunto (1990) proposed a tripartite classification of educational objectives encompassing the cognitive domain (knowledge, comprehension, application, analysis, synthesis, and evaluation), the affective domain (values, attitudes, and motivational orientations), and the psychomotor domain (physical skills and procedural competencies). This hierarchical framework has

profoundly influenced the design of instructional objectives, assessment instruments, and quality assurance mechanisms across higher education systems globally. Djamarah (1994) further defines academic achievement as the concrete, measurable outcomes produced by an individual or group through a structured process of learning and application, serving as the primary index of educational effectiveness.

The empirical relationship between blended learning implementation and academic achievement has been the subject of extensive and growing scholarly inquiry. The meta-analytic study conducted by Cao (2023), encompassing multiple studies from diverse national and disciplinary settings, documented that blended learning environments were consistently associated with significantly higher academic achievement when compared with purely traditional face-to-face instruction, with effect sizes ranging from moderate to substantial depending on contextual variables including subject matter complexity, quality of instructional design, and student population characteristics. Critically, the analysis highlighted the irreplaceable role of interactive, personalised face-to-face instructional experiences in reinforcing and consolidating the conceptual foundations established through online learning activities.

Complementing these meta-analytic findings, Halasa et al. (2020) conducted a quasi-experimental comparative study examining student academic achievement under traditional instruction versus a combined blended and flipped learning approach in a higher education nursing programme. Their findings demonstrated that students in the blended learning condition achieved significantly superior post-test performance compared to their counterparts in the conventional instruction group, providing compelling evidence that the integration of self-directed online preparatory activities with interactive face-to-face application sessions generates synergistic positive effects on academic performance—effects explicable through the constructivist theoretical framework, which posits that learning is most productive when learners actively engage with content and construct knowledge through purposeful, contextualised activity.

The motivational and attitudinal dimensions of blended learning also merit substantive consideration in the analysis of academic outcomes. López-Pérez et al. (2011) conducted an empirical investigation of the relationship between student perceptions of blended learning and academic performance outcomes in a higher education context, revealing statistically significant positive associations between favourable student attitudes toward the online learning component and superior academic results. This finding underscores the importance of learner motivation and perceived self-efficacy as significant mediating variables in the relationship between instructional modality and achievement outcomes. When students perceive blended learning as a relevant, accessible, and enabling educational experience, their academic engagement and attainment are correspondingly enhanced.

Conversely, Rasheed et al. (2020) conducted a systematic review identifying several recurrent challenges in the online component of blended learning that may attenuate its academic effectiveness, including: technological access barriers and unreliable internet connectivity; insufficient learner self-regulatory skills and time management capacities; limited digital literacy among less technologically experienced students; inadequate formative feedback from instructors in asynchronous settings; and a perceived sense of social isolation and reduced academic accountability in the absence of physical classroom presence. These findings collectively highlight the critical importance of proactive institutional support structures, comprehensive student orientation programmes, and thoughtful instructional design as prerequisites for maximising the academic benefits of the online dimension of blended learning.

#### **2.4. Advantages of Blended Learning in Higher Education**

The scholarly literature converges on several compelling and empirically supported advantages of blended learning as an instructional model for higher education institutions. These advantages collectively position blended learning not merely as an alternative to either fully traditional or fully online instruction, but as a qualitatively superior pedagogical approach capable of simultaneously addressing the intellectual, motivational, and practical needs of contemporary university students.

First and foremost, blended learning substantially enhances accessibility and scheduling flexibility, enabling students to engage with instructional content at their own pace and in alignment with their individual circumstances. This is particularly significant in the Indonesian higher education context, where many students navigate competing demands related to part-time employment, family obligations, and significant commuting distances. Second, blended learning diversifies the learning experience by providing instruction through multiple channels and formats—including synchronous video lectures, interactive digital simulations, collaborative online discussion forums, and structured face-to-face application sessions—thereby accommodating a broader spectrum of learning styles, cognitive preferences, and motivational profiles than any single instructional modality alone (Dziuban et al., 2018).

Third, blended learning has demonstrated particular effectiveness in enhancing the academic engagement and participatory behaviour of students who may be inhibited or marginalised in conventional classroom settings. Cao (2023) noted that learners who are reluctant to contribute verbally in large face-to-face group discussions may exhibit significantly greater engagement in asynchronous online discussions and written academic activities, suggesting that the blended model can democratise participation and foster more equitable distribution of academic engagement across diverse learner populations. Fourth, the data-enabled formative assessment capabilities of digital learning platforms—including real-time tracking of student engagement metrics, automatic grading of formative exercises, and systematic identification of at-risk learners—equip instructors with unprecedented capacity for responsive, data-informed instructional adaptation (Han, 2022). Finally, blended learning supports the development of digital literacy, independent learning competencies, and critical information management skills that are not only fundamental to academic success in digitally mediated learning environments, but increasingly valued by contemporary employers across all industry sectors.

### **3. METHOD**

#### **3.1. Research Design**

This study adopts a descriptive quantitative research design, which is well-suited to the overarching objective of characterising and measuring the academic achievement outcomes associated with blended learning implementation at BINUS University. Descriptive quantitative research is defined as a systematic form of empirical inquiry that aims to describe the observable characteristics of a phenomenon as it exists in its natural or naturally occurring state, without experimental manipulation of independent variables or random assignment of participants to conditions (Sugiyono, 2013). The quantitative orientation of the research design reflects the researchers' commitment to employing systematic statistical methods for data analysis and to drawing defensible, generalisable inferences from numerical data regarding group differences in academic performance outcomes.

The study employs a *cross-sectional* time horizon, meaning that data collection and analysis were conducted within a defined single period, thereby providing a reliable snapshot of student academic achievement outcomes under the prevailing blended learning conditions at the time of the study. This design is appropriate given the study's descriptive and comparative rather than longitudinal or experimental objectives, and it enables efficient data collection without the participant attrition, historical confounds, or temporal validity threats typically associated with longitudinal research designs.

#### **3.2. Research Variables**

The independent variable in this study is Blended Learning, which refers to the combination of online and offline instructional modalities delivered through the BINUS integrated e-learning platform alongside conventional classroom sessions. The dependent variable is Academic Achievement, which is measured by

students' quantitative performance scores in the Business Statistics II course, including separate assessments from both the online and offline components of the blended learning programme.

### **3.3. Population and Sample**

The target population for this study comprises undergraduate Management students at BINUS Business School, Universitas Bina Nusantara, who were enrolled in and actively participating in the Business Statistics course during the study period. A purposive sample of 50 students was selected based on their direct participation in the blended learning programme, with sampling criteria designed to ensure that the sample adequately represented the full spectrum of academic performance levels within the enrolled student cohort, from high-achieving to lower-performing learners.

### **3.4. Data Collection Instruments and Procedures**

A structured questionnaire was administered to the 50 participating students to systematically collect quantitative data on their academic performance scores in both the online and offline components of the blended learning programme. The questionnaire instrument was designed to capture objective, verifiable academic performance data rather than subjective self-report assessments.

Structured in-depth interviews were conducted with selected students and academic staff members to obtain qualitative contextual insights into the perceived effectiveness, practical challenges, and comparative advantages of the blended learning approach as implemented in the Business Statistics course. Interview data were subjected to systematic thematic reduction and interpretive analysis to contextualise and enrich the quantitative findings.

### **3.5. Data Analysis Methods**

Prior to the application of inferential statistical procedures, the Kolmogorov–Smirnov goodness-of-fit test was applied to both the online and offline academic score datasets to assess their distributional properties and determine the suitability of parametric or non-parametric testing approaches.

Following the normality test, which revealed mixed distributional characteristics—with the online data conforming to a normal distribution and the offline data departing significantly from normality—the non-parametric Kruskal-Wallis test was identified as the most statistically appropriate procedure for hypothesis testing. The Kruskal-Wallis test is a rank-based non-parametric alternative to the one-way analysis of variance (ANOVA) that does not presuppose normality of the underlying data distribution, rendering it the preferred analytical choice when parametric assumptions cannot be fully and simultaneously satisfied.

*Conclusion Drawing and Verification:* Preliminary analytical conclusions were drawn provisionally and subjected to systematic iterative verification against the accumulated empirical evidence, in accordance with the rigorous inductive logic of qualitative and mixed-methods data reduction and triangulation (Sugiyono, 2013).

## **4. RESULTS AND DISCUSSION**

### **4.1. Descriptive Statistics of Blended Learning Academic Performance Data**

The dataset utilised in this study comprised 50 academic performance score observations drawn from both the online and offline components of the Business Statistics blended learning programme at BINUS University. [Table 1](#) below presents the complete dataset, illustrating the distribution of academic performance scores across both instructional modalities for each of the 50 participants in the study sample.

**Table 1. Academic Performance Scores Under Online and Offline Blended Learning Modalities (N = 50)**

No.	Online Score	Offline Score
1	27.34	40.33
2	27.50	40.76
3	27.92	41.14
4	29.25	41.31
5	29.79	41.47
6	30.77	41.99
7	30.87	42.20
8	31.00	42.54
9	31.17	42.86
10	31.25	43.30
11	31.53	43.58
12	31.79	44.00
13	31.93	44.03
14	31.96	44.25
15	32.00	44.58
16	32.17	45.00
17	32.33	45.33
18	32.37	45.38
19	32.39	46.94
20	33.25	47.24
21	33.28	47.62
22	33.59	47.72
23	34.17	47.98
24	34.23	48.13
25	35.00	48.52
26	35.09	48.84
27	35.38	50.10
28	35.43	50.27
29	35.59	50.40
30	35.63	50.77
31	35.98	51.01
32	36.09	51.47
33	36.15	51.80
34	36.63	51.93
35	37.14	52.05
36	37.19	52.23
37	37.27	52.29
38	37.32	52.47
39	37.50	52.84
40	37.60	54.01
41	38.42	54.26
42	38.46	55.10
43	38.67	55.18
44	38.81	55.97
45	39.67	56.02
46	39.85	56.56
47	39.90	57.22
48	40.00	57.53
49	40.19	57.60
50	40.25	57.72

Visual inspection and descriptive analysis of the data presented in [Table 1](#) reveal a consistent and pronounced pattern whereby offline academic performance scores (ranging from 40.33 to 57.72,  $M = 49.23$ ) are substantially and uniformly higher than corresponding online academic performance scores (ranging from 27.34 to 40.25,  $M = 34.88$ ). The mean difference between offline and online performance scores is approximately 14.35 score points, representing a substantively significant educational performance gap between the two instructional modalities. This initial descriptive observation provides a compelling prima facie indication of the differential efficacy of the online and offline components of the blended learning programme—a relationship that was subsequently subjected to rigorous formal inferential statistical testing.

#### 4.2. Normality Testing

In order to identify the appropriate inferential statistical procedure for hypothesis testing, the Kolmogorov–Smirnov normality test was applied to both the online and offline academic performance score datasets. The test was conducted at a conventional significance level of  $\alpha = 0.05$ , with results presented in [Table 2](#) below.

**Table 2. Normality Test**

Variable	Blended Learning	Kolmogorov-Smirnov Statistic	Kolmogorov-Smirnov df	Kolmogorov-Smirnov Sig.	Shapiro-Wilk Statistic	Shapiro-Wilk df	Shapiro-Wilk Sig.
Student Learning Outcomes	Online	0.11	50	0.178	0.962	50	0.113
Student Learning Outcomes	Offline	0.532	50	0	0.13	50	0

**Table 3. Kolmogorov–Smirnov Normality Test Results**

Variable	Sig.	Sign	$\alpha$	Decision
Online Learning Score	0.178	>	0.05	$H_0$ Retained (Normal Distribution)
Offline Learning Score	0.000	<	0.05	$H_0$ Rejected (Non-Normal Distribution)

The normality test in [Table 3](#) results indicate that the online academic performance data (Sig. = 0.178,  $p > 0.05$ ) did not depart significantly from a normal distribution; accordingly, the null hypothesis of normality was retained for this variable. In contrast, the offline academic performance data (Sig. = 0.000,  $p < 0.05$ ) exhibited a statistically significant and marked departure from normality, necessitating rejection of the normality null hypothesis for this variable. As the conditions required for the full application of parametric statistical procedures—specifically, normality of the data distribution across all groups—were not simultaneously satisfied, the non-parametric Kruskal-Wallis test was confirmed as the analytically appropriate and statistically defensible procedure for hypothesis testing in this study.

#### 4.3. Kruskal-Wallis Test Results

The Kruskal-Wallis non-parametric test was applied to determine whether statistically significant differences existed between the distributions of academic performance scores in the online and offline blended learning modalities.

**Table 4. Kruskal-Wallis Test**

Variable	Blended Learning	N	Mean Rank
Student Learning Outcomes	Online	50	25.5
Student Learning Outcomes	Offline	50	75.5
Student Learning Outcomes	Total	100	

**Table 5. Test Statistics**

Variable	Kruskal-Wallis H	df	Asymp. Sig.
Student Learning Outcomes	74.257	1	0

**Decision Criteria:**

If Sig.  $\geq \alpha$  (0.05): Retain  $H_0$  | If Sig.  $< \alpha$  (0.05): Reject  $H_0$

If  $\chi^2_{\text{calculated}} < \chi^2_{\text{table}}$  (3.84): Retain  $H_0$  | If  $\chi^2_{\text{calculated}} > \chi^2_{\text{table}}$  (3.84): Reject  $H_0$

**Test Results:**

$\chi^2_{\text{calculated}} = 74.257 > \chi^2_{\text{table}} = 3.84 \rightarrow$  **Reject  $H_0$**

Sig. = **0.000**  $< \alpha = 0.05 \rightarrow$  **Reject  $H_0$**

The Kruskal-Wallis test in Table 4 and Table 5 yielded a chi-square statistic of  $\chi^2 = 74.257$ , a value that substantially and unambiguously exceeds the critical value of  $\chi^2_{\text{table}} = 3.84$  at the 0.05 significance level with one degree of freedom. This result was independently corroborated by an associated significance probability of 0.000, which is markedly below the pre-established significance threshold of  $\alpha = 0.05$ . On the basis of these convergent statistical results, the null hypothesis ( $H_0$ ) was rejected and the alternative hypothesis ( $H_a$ ) was accepted. It is therefore concluded, with high statistical confidence, that a significant difference exists between the online and offline modalities of blended learning implementation in terms of their respective effects on student academic achievement in the Business Statistics course at BINUS University.

**4.4. Discussion of Findings**

The empirical findings of this study contribute substantively to and are broadly consistent with the growing international body of scholarly literature attesting to the differential effectiveness of online and offline instructional components within blended learning frameworks. The statistically significant academic performance advantage of the offline instructional component over its online counterpart is explicable through multiple complementary theoretical and empirical lenses.

From a constructivist pedagogical perspective, the face-to-face classroom environment provides students with immediate access to expert instructor guidance, structured peer discourse, and real-time corrective feedback all of which are well-established facilitators of deep, durable conceptual understanding in quantitatively demanding subjects such as Business Statistics. Han (2022) emphasises that the quality of the learning experience in blended environments is critically contingent upon the degree to which face-to-face and online components are meaningfully integrated into a coherent, mutually reinforcing instructional design, rather than operated as isolated and parallel tracks. The performance superiority of the offline component observed in this study may therefore reflect the higher degree of structured, metacognitively scaffolded engagement available in the physical classroom relative to the more autonomous and self-directed nature of the online learning component.

Furthermore, the findings resonate strongly with the theoretical framework of Gagne (1985), who identified a sequence of nine essential instructional events including gaining learner attention, stimulating recall

of prior learning, presenting instructional content, providing learning guidance, eliciting and observing performance, and providing informative feedback as prerequisite conditions for effective learning. These instructional events are more readily and fully operationalised within the face-to-face classroom setting, where instructors maintain continuous observational access to student comprehension and behavioural cues and can dynamically adapt their instructional approach in response to emerging misunderstandings or motivational challenges.

The performance differential also resonates with the systematic review conducted by [Rasheed et al. \(2020\)](#), which identified several practical and cognitive barriers to effective online learning in blended environments. These include insufficient learner self-regulation and metacognitive skills, variable digital literacy and technological access, and the attenuated sense of academic accountability in the absence of direct instructor presence. In the Indonesian higher education context, where digital literacy levels and internet access quality may vary considerably across the student population, these barriers may be particularly salient and could account, at least partially, for the observed performance gap between online and offline modalities.

Notwithstanding the quantitative superiority of offline performance scores, it is important to contextualise these findings within a holistic appraisal of the blended learning model as an integrated pedagogical system. The data indicate that academic performance across the student cohort remained reasonably consistent and above threshold levels even within the online component, suggesting that the blended learning model at BINUS has succeeded in maintaining a baseline level of academic engagement and instructional effectiveness across both modalities. These findings are broadly consonant with the meta-analytic evidence presented by [Cao \(2023\)](#), which documented positive net effects of blended learning on student achievement relative to conventional classroom-only instruction.

The qualitative data gathered through structured interviews with students and academic staff provided important complementary evidence supporting these quantitative findings. Students generally reported that the blended learning model enhanced their overall engagement with the Business Statistics curriculum, providing them with greater flexibility to review and consolidate complex quantitative content at their own pace through online resources, while simultaneously benefiting from the explanatory clarity and interactive problem-solving opportunities available in face-to-face sessions. These interview findings are consistent with the conclusions of [López-Pérez et al. \(2011\)](#), who documented robust positive associations between favourable student attitudes toward blended learning and superior academic outcomes, underscoring the significance of motivational and perceptual factors as mediating variables in the blended learning–achievement relationship.

## **5. CONCLUSION**

### **5.1. Summary of Findings**

The findings of this study provide robust empirical evidence for the existence of statistically significant differences between the online and offline components of blended learning in terms of their respective effects on student academic achievement in the Business Statistics course at BINUS University. The Kruskal-Wallis non-parametric test results ( $\chi^2 = 74.257$ ,  $p = 0.000$ ) confirm, at a high level of statistical confidence, that offline instructional activities are associated with markedly superior academic performance scores compared to online instructional activities within the blended learning framework. This finding has immediate and important implications for the design, sequencing, and relative weighting of online and offline components in blended learning programmes across comparable higher education disciplines.

Notwithstanding the performance advantage associated with offline instruction, the blended learning model as an integrated pedagogical system is affirmed by the broader evidence of this study as an effective, relevant, and educationally valuable approach for the contemporary Indonesian higher education context. The integration of face-to-face and online learning modalities has demonstrably enhanced the flexibility,

accessibility, and motivational quality of the academic learning experience for BINUS Business Statistics students, consistent with the extensive and growing international literature on blended learning effectiveness (Cao, 2023; Dziuban et al., 2018; Han, 2022).

## **5.2. Recommendations**

For Academic Practitioners, lecturers and course instructors are strongly encouraged to adopt blended learning as a standard and thoughtfully structured component of their pedagogical practice, paying particular attention to the quality, coherence, and functional integration of online and offline instructional components. The design of online learning activities should prioritise their function as meaningful pre-class preparatory exercises and post-class consolidation tasks, creating a substantive and intellectually productive dialogue between the two modalities.

Students are encouraged to proactively and consistently engage with the online learning resources made available through the university's e-learning platform, treating online activities not as ancillary or optional additions to classroom instruction, but as integral and indispensable components of the blended learning experience. Developing robust self-regulatory learning strategies, digital literacy competencies, and independent study habits will be essential prerequisites for maximising academic performance in blended learning environments.

Universities and colleges are strongly urged to invest substantively in the continuous development of high-quality digital learning infrastructure, reliable and equitable internet connectivity, comprehensive lecturer development programmes focused on digital pedagogy and technology-enhanced instructional design, and student-facing academic support services designed to address the practical and cognitive challenges associated with online learning.

Future studies should explore the longitudinal effects of sustained blended learning exposure on academic achievement trajectories, investigate the role of specific instructional design features such as the quality and timing of formative feedback, the alignment of assessment instruments across modalities, and the degree of instructor presence in the online component on student performance outcomes, and examine the moderating effects of individual learner characteristics such as digital self-efficacy, prior academic achievement, and motivational orientation on the effectiveness of blended learning.

## **Ethical Approval**

This study employed a descriptive quantitative research design involving human participants, specifically undergraduate students enrolled in the Business Statistics course at BINUS University. Data were collected through structured questionnaires and interviews, ensuring that all participants were informed about the purpose of the study and their voluntary involvement. Confidentiality and anonymity of participants were strictly maintained throughout the research process. Therefore, ethical considerations were observed in line with standard academic research practices, although formal institutional ethical approval was not explicitly stated in the study.

## **Informed Consent Statement**

Informed consent was obtained from all participants involved in the study prior to data collection. Participants were provided with clear information regarding the purpose of the research, the procedures involved, and their rights, including the right to withdraw at any time without any consequences. Participation was voluntary, and all responses were treated with strict confidentiality and used solely for academic research purposes.

## **Authors' Contributions**

Conceptualization, AT; methodology, AS; formal analysis, CW; data curation, EA; writing – original draft preparation, FSA; writing – review and editing, HGR; resources, MFAT; validation, ZL.

### **Disclosure Statement**

The author declares no potential conflict of interest.

### **Data Availability Statement**

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The dataset consists of academic performance scores collected from students participating in the blended learning programme, as described in the methodology section of the study.

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