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Does Technical Support Matter? The Impact of Blended Learning on Accounting Students' Academic Achievement

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Abstract: As blended learning becomes increasingly adopted in higher education, its effectiveness in regions with limited digital infrastructure remains insufficiently understood. This study examines the effect of blended learning on accounting students' academic achievement and investigates the moderating role of technical support. Data were collected through an online survey of 101 undergraduate accounting students from several universities in Jayapura, Papua, Indonesia, using a snowball sampling technique. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results indicate that interaction, instructor support, and course management have significant positive effects on academic achievement, whereas instruction and technology do not significantly influence students' performance. Technical support significantly strengthens the relationships between interaction and academic achievement and between instructor support and academic achievement, but it does not moderate the effects of instruction, technology, or course management. The findings suggest that the effectiveness of blended learning in Papua is primarily influenced by pedagogical and interpersonal factors rather than technological factors alone. This study extends the blended learning literature by demonstrating the selective role of technical support in strengthening human-centered dimensions of blended learning within a region characterized by digital infrastructure constraints.

Keywords: blended learning, technical support, academic achievement, accounting education.

INTRODUCTION

The rapid development of digital technology has transformed higher education worldwide, encouraging universities to adopt technology-enhanced learning approaches. (Yu, et al. 2023) (Bond, et al. 2021). One of the most widely implemented approaches is blended learning, which combines traditional face-to-face instruction with online learning activities to improve flexibility, accessibility, and learning effectiveness (Min and Yu 2023); (Florence Martin, Tianlu Sun and Westine. 2022); (Kintu, Zhu and Kagambe 2017). The adoption of blended learning has accelerated significantly in the post-pandemic era as higher education institutions seek to integrate the advantages of digital technologies with traditional classroom instruction. Recent studies indicate that blended learning has become a sustainable pedagogical approach that supports personalized learning, enhances accessibility to educational resources, and fosters collaborative learning experiences (Argyriou, Benamar and Nikolajeva 2022); (McCarthy and Palmer 2023). Furthermore, a systematic review by (Min and Yu 2023) identified blended learning as one of the most effective instructional models for promoting student-centered learning in higher education,

particularly when supported by adequate technological infrastructure and institutional support.

Blended learning has gained considerable attention because it offers opportunities for active learning, increased student engagement, and improved academic outcomes. A meta-analysis conducted by (Vo, Zhu and Diep 2017) found that blended learning positively affects student performance in higher education compared with conventional teaching methods. More recent evidence continues to support these findings. For instance, (Argyriou, Benamar and Nikolajeva 2022) demonstrated that student engagement in blended learning environments significantly predicts academic achievement. Similarly, a large-scale meta-analysis by (Yu, et al. 2023), synthesizing findings from more than 130 empirical studies, concluded that blended learning has a significant positive effect on students' learning performance across diverse educational settings.

Furthermore, (Cao 2023) reported that blended learning positively influences not only academic achievement but also student engagement, learning attitudes, and satisfaction. Most recently, (Bingölbali, et al. 2025) confirmed, through a mixed-methods meta-analysis, that blended learning practices consistently improve students' academic achievement in higher education. These findings suggest that blended learning has evolved beyond an emergency educational response and is increasingly recognized as an effective long-term instructional strategy for improving student learning outcomes.

Although the effectiveness of blended learning has been extensively examined in previous studies, most empirical evidence originates from regions with relatively well-developed digital infrastructure and stable internet connectivity. Consequently, the findings may not be fully generalizable to geographically remote and infrastructure-constrained areas. This issue is particularly relevant in Papua, Indonesia, where higher education institutions continue to face challenges related to internet accessibility, network stability, and unequal access to digital learning resources. Such conditions may affect students' ability to participate effectively in online learning activities and the overall success of blended learning implementation.

The Papua context provides a unique setting for investigating blended learning because students often experience varying levels of internet connectivity and technological access. Under these circumstances, technical support may be critical to facilitating students' engagement with digital learning platforms and overcoming technological barriers. Despite the growing body of literature on blended learning, limited studies have explored how blended learning operates in regions characterized by digital infrastructure constraints and whether technical support can enhance learning outcomes in such contexts. Therefore, examining blended learning among accounting students in Papua offers an opportunity to extend the current literature by providing evidence from an underrepresented educational setting and by identifying the factors that contribute to successful learning outcomes despite technological limitations.

Accordingly, this study aims to examine the effect of blended learning dimensions on accounting students' academic achievement and to investigate the moderating role of technical support in the context of higher education institutions in Papua, Indonesia. By focusing on a region with unique geographical and technological challenges, this study contributes to a better understanding of how blended learning can be effectively implemented in developing and remote areas. Unlike previous studies conducted primarily

in urban areas with adequate technological infrastructure, this study investigates blended learning effectiveness in Papua, a region where internet connectivity remains a significant challenge. This context enables a deeper understanding of whether technical support can compensate for infrastructural limitations and enhance students' academic achievement.

The rapid development of Information and Communication Technology (ICT) gives different views on the learning process. Changes in the learning process happen so quickly that organizational management, Lecturers, and students are asked to quickly adjust to the changes in the environment. Lecturers are expected to be drivers of learning innovations that impact learning comfort and improve the quality of teaching with various internet-based teaching media, such as email, forums, etc (Akkoyunlu and Soylu 2008) to improve the quality of learning more consistently, time efficiency, and comfort of learning locations (Brown 2003). Online learning requires adequate information technology support (Awamleh 2020), (O'Flaherty and Phillips 2015), (Finger and Trinidad 2002).

Recent empirical evidence highlights the importance of technical and institutional support in enhancing student learning outcomes. Research by (Bond, et al. 2021) found that institutional technological readiness and support services significantly influence students' engagement and academic success in blended learning environments. Similarly, studies conducted by (Rasheed, Kamsin and Abdullah 2020) found that technical difficulties, internet instability, and insufficient digital support remain major obstacles to student performance in online and blended learning settings. Furthermore, recent evidence indicates that students' perceptions of technological support significantly affect their learning satisfaction and academic achievement through increased learning engagement and self-regulated learning behaviors.

The student engagement in blended learning activities significantly predicts academic achievement (Argyriou, Benamar and Nikolajeva 2022). Beyond instructional design, recent systematic reviews emphasize that technological infrastructure, institutional support, and technical support are among the most critical success factors affecting blended learning outcomes (Min and Yu 2023); (McCarthy and Palmer 2023). Furthermore, evidence from international studies suggests that the effectiveness of blended learning is strengthened when students receive adequate technological assistance and support services that facilitate access to digital learning resources (Cao 2023). Although these studies have advanced understanding of blended learning effectiveness, limited research has specifically examined the role of technical support in enhancing academic performance among accounting students, particularly in developing-country contexts where disparities in technological readiness and support services remain prevalent.

The application of online learning, despite its existing limitations, has paved the way for the use of blended learning systems. Blended Learning has the advantage of improving competency, capability, the achievement of performance, and the improvement of teaching quality (Kenney and Newcombe 2011). This blend of approaches is an effective innovation in the teaching process (Kintu, Zhu and Kagambe 2017). While previous studies have established the positive influence of blended learning on student outcomes (Dowling, Godfrey and Gyles 2003), limited attention has been devoted to understanding the role of technical support in facilitating the effectiveness of blended learning, particularly in accounting education. Existing studies predominantly focus on instructional design, learner

characteristics, and technology quality (Kintu, Zhu and Kagambe 2017), leaving a significant gap in understanding of how technical support contributes to students' academic success.

Some previous research has shown that there are positive effects in mixed learning that can improve pedagogy, cost-effectiveness, access, and flexibility (Graham, Allen and Ure 2005), (Osguthorpe and Graham 2003). Mixed learning methods can address learning challenges and meet individual needs by integrating innovative advances and technologies from face-to-face learning into mixed learning (Alebaikan and Troudi 2010), and knowledge will be more effective as it reaches more students, researchers, and teachers (Zameni and Kardan 2011). Research shows that there are differences in satisfaction and achievement of better learners in mixed learning environments (Elfaki, Ahmad and Abdelrahim 2019).

Although previous studies have confirmed the positive effects of blended learning on student achievement, limited research has specifically examined how technical support contributes to academic performance among accounting students in geographically challenging regions such as Papua, Indonesia. Most prior studies focus on technological adoption, student satisfaction, or learning engagement without explicitly examining the role of technical support in determining academic achievement. This gap becomes particularly important in regions characterized by limited internet connectivity and infrastructure constraints. Therefore, this study seeks to examine whether technical support plays a significant role in enhancing the effectiveness of blended learning and improving accounting students' academic performance.

This study extends the blended learning literature by empirically examining the role of technical support as a critical enabling factor influencing accounting students' academic performance. Unlike previous studies that primarily focus on instructional design and student characteristics, this study highlights the importance of technical support in maximizing the effectiveness of blended learning within accounting education in a developing-country context.

THEORY AND HYPOTHESIS DEVELOPMENT

Achievement Motivation Theory

Perspective, proposed by Pintrich, focuses on the broader motivational orientations—specifically mastery and performance goals—that dictate how individuals perceive and respond to achievement situations (Juhaňák, et al. 2023) (Lisette Wijnia, et al. 2024). This perspective emphasizes that students' adoption of these goals—whether to develop competence or to demonstrate it relative to others—predicts their cognitive and affective engagement within both traditional and digital learning spaces (Ram Gopal, Varsha Singh and Arun Aggarwal 2021); (Sevim-Cirak, Erol and Baser-Gulsoy 2023). Consequently, research now aims to bridge these motivational frameworks with the unique challenges of hybrid education, where self-regulated learning capacity is essential for navigating the complex interplay between asynchronous tasks and interpersonal social goals. By examining how these overarching goal orientations interact with the demands of digital instruction, educators can better support students in organizing their behaviors and managing the motivations that influence their academic success (Yu-Chen Yeh, et al. 2019).

The Achievement Goal Theory's research on achievement in education is presented by (Pintrich 2000) as three perspectives on goal setting in the field of education, each

reflecting a somewhat different level of analysis. The first perspective is the setting of the goal target, but it has not reached the stage of presenting the reason why it should achieve that goal. At this level, social cognitive research on an individual's goals for a particular task or problem is conducted by (Edwin A. Locke and Latham 1991), (Bandura 1997) or target-setting research (John M. Tauer and Harackiewicz 1999), For example, students who take an exam or quiz may try to set a target to get 8 points out of 10 right, but do not suggest or think about why to set that target.

The second perspective is that setting more common targets is accompanied by the reason why a person/student is motivated to achieve a set achievement target (Ford 1992). Research (Wentzel 2000) discusses how the social goals of friendship between students can be linked to academic achievement. This general principle applies to all areas of life and serves to characterize what individuals want or achieve, as well as the reasons why they do something. Essentially, the tasks contained in life reflect a more general perspective and reflect the content of different goals that individuals may struggle with in many contexts, not just in the context of achievement (Ford 1992); (Austin and Vancouver 1996).

The third perspective relates to goals, achievement goals, and goal achievements, specific goals with a more global goal content approach. This third perspective is a merger of the previous two directives. Achievement objectives refer to a person's goals or reasons for pursuing achievement and are operationalized in academic learning tasks or in the context of other achievements, such as achievements in athletics or business (Pintrich 2000). Achievement goals today are building goals; there is a reason why a student pursues achievements as well as standards or criteria created to evaluate their competence and success in completing tasks. Thus, achievement goals are not only to achieve the goals that have been set but also to set standards or criteria (targets) that will be used to assess the success of their performance or achievements.

The implications of Achievement Goal Theory (AGT) have existed in various areas of education, including higher education (Bipp, Steinmayr and Spinath 2012). Students can set goals to achieve in various fields of study. Student learning achievement shows that they have undergone a learning process and changes in gaining knowledge, skills, or behavior. The process of achieving student learning goals also needs to be associated with the need to pay attention not only to the motivation of student achievement but also to pursuers/lecturers, because they are one of the prerequisites of success in the teaching process and the success of student achievement (Butler and Shibaz 2008); (Nitsche, et al. 2011), (Retelsdorf, et al. 2010).

Blended learning is a term concerned with transmitting knowledge. Previous theories expounded in the literature had defined blended learning as "the learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and found on transparent communication among all parties involved with a course". Blended learning is also used interchangeably as hybrid learning or mixed learning in academic theories. However, all these concepts broadly refer to the integration "blending" of e-learning tools and techniques. (Aleksej Heinze and Procter 2004).

Blended learning is a course that combines face-to-face classroom instruction with online learning and reduced classroom contact hours (reduced seat time) (Hartman, Dziuban and Moskal 2007). Stating that seat time is reduced and some of the course activities, such as information transfer, exchange of ideas, testing, essay-writing, etc., are distributed

throughout the semester. (Osguthorpe and Graham 2003) Defined blended Learning's relation between face-to-face (F2f) learning and online learning. Blended learning as a concept arose due to the weaknesses and advantages of online and traditional learning approaches. Students who learn in a blended learning environment involve themselves in classroom lessons and online learning (abor 2007); (Azizan 2010)

Hypothesis Development

Learning at the University is one of the contexts in which digitization has had a significant impact, with the emergence of new modalities in rapidly growing online teaching (Jon Messenger, et al. 2017); (Awamleh 2020); (Azizan 2010), in the technological age. On the other hand, climate change teaching so fast with virtual environments can bring negative effects that come from technological innovation and impact psychological disorders, such as fatigue, anxiety, and depression, and decreased performance (Cox & Griffiths, 2010), (Leka & Jain, 2010), (Stadin, Nordin, Broström, Magnusson-Hanson, Westerlund, & Fransson, 2016), (Soria-Oliver, López, Torrano, García-González, & Lara, 2019).

Some research was conducted as an experiment to provide empirical evidence that blended learning methods showed differences in student academic achievement, as shown by better performance results compared to group control (Ceylan & Elitok Kesici, 2017), (Oweis T. I., 2018,), The highest satisfaction and achievement is felt by students in the group experiment with a blended learning course compared to the group that has a fully face-to-face course. The students also feel more comfortable and more attractive when studying with a blended learning course. (Obiedat, et al. 2014) result study report that there is a significant and positive impact of blended learning on the academic achievement of the students at the University of Jordan.

Research suggests that achievement in blended courses is influenced to a greater extent by students' conceptions of learning, their ability to accept responsibility for their learning, and the degree of interactivity outside of the classroom (Ram Gopal, Varsha Singh and Arun Aggarwal 2021); (Sevim-Cirak, Erol and Baser-Gulsoy 2023) and some studies have concluded that a blended learning approach is more effective, whereas there are strong pedagogical arguments in favor of a blended learning approach, the empirical literature on the relative effectiveness of blended versus traditional learning approaches (Yu, et al. 2023).

Research conducted by (Alebaikan and Troudi 2010), testing blended learning from a gender perspective, found that blended learning had the potential to enhance the quality of learning. The advantage of facilitating interaction between lecturers and students would be more effective in blended courses taught by male lecturers in this segregated environment. In general, the students' perceptions and attitudes towards blended learning were positive, and students are encouraged to take responsibility for their own learning process. Learners can decide when and how to use the resources provided, and blended learning is as effective as face-to-face learning in developing and improving knowledge and skills (Alebaikan and Troudi 2010).

(Al-Harbi, 2010) indicates that e-learning acceptance is influenced by different factors. A student's attitude toward e-learning and students' decision to use e-learning are the most important factors in determining a student's intention to use e-learning, i.e., the

influence of the important people around them, although perceived e-learning accessibility plays a role in shaping the students' behavioral intention regarding e-learning acceptance. (Florence Martin, Tianlu Sun and Westine. 2022) Also, a similar position showed that students who preferred to enroll in online courses reported greater confidence and satisfaction in their ability to learn online than other students.

(Mahmoud Abou Naaj, Mirna Nachouki, & Ankit, 2012), Using five key factors to measure the quality of blended learning- instructor, technology, class management, interaction, and instruction- found that students were satisfied with all components, although the level of satisfaction varied according to gender, whereas (Bollinger & Martindale, 2004) used three key factors central to blended learning methods, such as instructor, technology, and interactivity. (Garrison & Anderson, 2003) Whether face-to-face or online, communities of inquiry consist of three elements: cognitive, social, and teaching presence.

Instructors/teacher presence is an important factor in the success of blended learning implementation. Instructors must be available for consultation with students and, in addition, must be flexible in teaching, that is, time- and plan-independent (Min and Yu 2023). The instructor not only becomes a facilitator of learning but also a motivator for the student to keep learners involved and motivated. Feedback on assignments must be given on time (Smith & Dillon, 1999); teacher presence can reduce the level of frustration among students (Hara & Kling, 2003). The quality and quantity of interaction and the sense of engagement in a community of inquiry and learning are achieved through the effective integration of Internet communication technology (Garrison & Kanuka, 2004).

Based on the theoretical arguments and empirical evidence presented in the previous section, this study examines the direct effects of interaction, instruction, instructor/lecturer support, course management, and technology on accounting students' academic achievement. Furthermore, this study investigates whether technical support strengthens the relationships between these blended learning dimensions and academic achievement. The proposed hypotheses are presented below:

- **H1:** Interaction positively influences students' academic achievement.
- **H2:** Instruction positively influences students' academic achievement.
- **H3:** Instructor positively influences students' academic achievement
- **H4:** Course Management positively influences students' academic achievement
- **H5:** Technology positively influences students' academic achievement

In online learning, blended learning requires technological readiness, including supporting facilities and knowledge about the use of learning applications; students need to prepare supporting facilities for online learning. Students must have access to reliable equipment (Bower & Kamata, 2000). Students with limited access are at a considerable disadvantage to learners who have unlimited access (Yu, et al. 2023). Access is one of the most important factors influencing student satisfaction (Bower & Kamata, 2000). Online learners must be familiar with the technology used in the course to be successful (Belanger & Jordan, 2000). The use of internet technologies delivers a broad array of solutions that enhance knowledge and performance (Rosenberg, 2001). Transformational blends require

students to actively construct knowledge and engage in "…intellectual activity that was not practically possible without the technology" (Graham C., 2006).

Management courses are required for the administrative management of planned and structured learning activities, from the scheduling of lectures, network links, and information related to reading sources or lecture materials. (Min and Yu 2023) Point out that administrative support is important for online learning students. Access to other resources, such as course textbooks, libraries, technical support, and a help-desk number, is also important in blended learning. Administrators ensure that personnel and time are allocated to numerous work tasks so that courses are produced on time. Suitable faculty and staff must be recruited and trained.

Interaction between lecturers and students is an important part of the learning process. The face-to-face time can be used to learn the material at a deeper level and link the content to broader topics (Collopy & Arnold, 2009). Another type of blend involves teaching the course content during class time and allowing students to think critically and discuss their views about the material through online activities (Aycock, Garnham, & Kaleta, 2002). Students are able to share viewpoints and discuss them with one another in a virtual environment, thereby gaining insights and perspectives. This type of environment allows for social interaction and creates meaningful, active learning experiences (Bonk & Cunningham, 1998).

There is a strong link between culture and learning that is reflected in how people prefer to learn and how they tend to process information (Samover, Porter, & McDaniel, 2009). Students should prepare themselves before the lecture starts by studying online learning applications, setting up their applications, and reading course materials before the lecture begins. Student readiness will be linked to student performance and positively associated with program completion rates and grade achievements (GPA) (Mahmoud Abou Naaj, Mirna Nachouki, & Ankit, 2012). (Shraim & Khlaif, 2010) Note in their research that 75% of students and 72% of teachers were lacking in skills to utilize ICT-based learning components due to insufficient skills and experience in computer and internet applications, and this may lead to failure in e-learning and blended learning.

Finally, Technical resources that are dependable and transparent are required to ensure that technology enhances the learning process rather than obstructs it. This requires having course management tools in place that can meet learning needs, are up to date, have reliable, easy-to-use technical tools, and provide the technology skills necessary to support teaching faculty new to blended learning (Yu, et al. 2023);(Garrison & Kanuka, 2004). Researchers suspect that technical support is a contributing factor to the success of blended learning, given that online learning requires reliable internet and electricity networks.

Although blended learning dimensions are expected to influence academic achievement, their effectiveness may depend on the availability of technical support. Technical support helps students overcome technological barriers, access learning resources efficiently, and maintain engagement in online learning activities. This issue is particularly relevant in Papua, where internet connectivity and digital infrastructure remain uneven across institutions and locations. Under such conditions, technical support may strengthen the positive effects of blended learning on student achievement.

Accordingly, this study proposes that technical support moderates the relationship between blended learning dimensions and academic achievement.

- **H6a:** Technical support moderates the relationship between interaction and students' academic achievement.
- **H6b:** Technical support moderates the relationship between instruction and students' academic achievement.
- **H6c:** Technical support moderates the relationship between the instructor/lecturer and students' academic achievement.
- **H6d:** Technical support moderates the relationship between course management and students' academic achievement.
- **H6e:** Technical support moderates the relationship between technology and students' academic achievement.

METHODOLOGY

Research Design and Participants

This study employed a quantitative research design using a cross-sectional survey approach to examine the effect of blended learning dimensions on accounting students' academic achievement and the moderating role of technical support. The study was conducted at three universities located in Jayapura, Papua, Indonesia, where blended learning has been implemented as part of the teaching and learning process.

The target population consisted of undergraduate accounting students who had experienced blended learning in their academic courses. A total of 101 valid responses were collected through an online survey administered at the end of the semester. The survey was distributed using a snowball sampling technique, whereby initial respondents were encouraged to share the questionnaire with other eligible accounting students within their academic networks. Of the respondents, 78 (77.2%) were female, and 23 (22.8%) were male. The participants ranged in age from 19 to 23 years old.

Papua provides unique research settings because higher education institutions in the region continue to face challenges related to internet accessibility, network stability, and digital infrastructure. Therefore, investigating blended learning and technical support within this context offers valuable insights into technology-enhanced learning in geographically remote areas.

Instrument Development and Measures

The questionnaire was developed based on established instruments used in previous blended learning studies. Measurement items were adapted from (Naaj, Nachouki and Ankit 2012), (Kintu, Zhu and Kagambe 2017) and (Obiedat, et al. 2014), and modified to fit the context of accounting education in Indonesian higher education institutions. The blended learning construct was measured through five dimensions: Interaction, Instruction, Instructor/Lecturer, Course Management, and Technology. In addition, Technical Support

was included as a moderating variable, while Student Academic Achievement served as the dependent variable.

Several contextual items were added to capture the specific characteristics of blended learning implementation in universities located in Papua, particularly concerning technological accessibility and learning support services. The final questionnaire consisted of 58 items. Fifty-one items were measured using a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree, while seven items collected demographic information through multiple-choice questions.

Pilot Testing and Instrument Validation

Before the main survey, the questionnaire underwent two stages of pilot testing to assess its clarity, relevance, and suitability for the study context. Feedback obtained from the pilot respondents was used to refine the wording, structure, and content of the questionnaire.

The measurement model was evaluated by examining indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Indicator reliability was assessed using factor loadings, while internal consistency reliability was evaluated through Cronbach's Alpha and Composite Reliability (CR). Convergent validity was assessed using the Average Variance Extracted (AVE), with values above the recommended threshold indicating adequate construct validity. Discriminant validity was evaluated using the Fornell-Larcker Criterion.

Data Analysis

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with WarpPLS version 7.0. PLS-SEM was selected because it is appropriate for exploratory and predictive research, accommodates relatively small sample sizes, and allows simultaneous assessment of measurement and structural models. The analysis was conducted in two stages. First, the measurement model was evaluated to ensure the reliability and validity of the constructs. Second, the structural model was assessed to examine the direct effects of blended learning dimensions on academic achievement and the moderating effects of technical support. Statistical significance was determined using bootstrapping procedures and p-values.

RESULTS AND DISCUSSION

Descriptive Statistics

This research will analyze the effect of blended learning on student achievement with technical support as a moderation variable. There are five blended learning dimensions to be tested, such as interaction, instructors, instruction, management course, and technology. Blended learning. Table 1 shows the descriptive statistical results of the variables tested, the general average of interaction (33,35), Instruction (27,53), Instructor (28,73), Management Course (34,34), Technology (25,34), Technology Support (25,84), and Student Achievement (46,35).

Table 1: Descriptive Statistics

Variable Name	N	Minimum	Maximum	Mean	Std. Deviation
Interaction (ITR)	101	18,00	45,00	33,3465	7,04618
Instruction (ITU)	101	15,00	35,00	27,5347	4,28617
Instructor (ITC)	101	17,00	35,00	28,7327	4,19498
Management Course (MC)	101	23,00	40,00	34,3366	4,49061
Technology (TI)	101	6,00	30,00	25,3366	4,68887
Technology support (TS)	101	7,00	35,00	25,8416	5,05714
Student Academic Achievement (SA)	101	21,00	60,00	46,3465	7,76458
Valid N (listwise)	101				

Discriminant Validity

Following the assessment of indicator reliability, internal consistency reliability, and convergent validity, discriminant validity was evaluated to ensure that each construct was sufficiently distinct from the other constructs included in the research model. Discriminant validity refers to the degree to which a latent construct is truly different from other constructs, both conceptually and empirically.

Establishing discriminant validity is particularly important in studies involving multiple dimensions of blended learning because the constructs may be theoretically related but are expected to measure different aspects of the learning environment. In this study, discriminant validity was assessed using the Fornell-Larcker criterion, which is widely recommended for evaluating construct distinctiveness in WarpPLS-SEM research.

Table 2 presents the results of the Fornell-Larcker criterion. According to Fornell and Larcker (1981), discriminant validity is established when the square root of the Average Variance Extracted (AVE) for each construct exceeds its correlations with other constructs in the model.

Table 2: Coefficients among Latent Variables

	ITA	ITU	PD	TKP	TI	PM	DT	DT*ITA	DT*ITU	DT*PD	DT*TKP	DT*TI
ITR	0.698											
ITU	0.491	0.592										
ITC	0.414	0.355	0.697									
MC	0.272	0.239	0.535	0.714								
TI	0.271	0.567	0.351	0.522	0.825							
TS	0.593	0.337	0.451	0.335	0.289	0.690						
SA	0.399	0.255	0.499	0.380	0.455	0.504	0.678					
TS*ITR	0.217	0.204	-0.043	0.089	0.070	-0.082	0.182	1.000				
TS*ITU	0.188	-0.123	0.190	0.060	-0.078	0.293	0.351	0.398	1.000			
TS*PD	-0.033	0.160	-0.258	0.080	0.024	-0.246	-0.136	0.527	0.013	1.000		
TS*MC	0.083	0.062	0.098	-0.146	0.002	0.136	0.321	0.308	0.553	0.197	1.000	
SA*TI	0.084	-0.102	0.037	0.002	-0.270	0.174	0.279	0.390	0.599	0.168	0.570	1.000

The results indicate that all constructs satisfy the recommended thresholds for discriminant validity. Therefore, each construct captures a unique aspect of blended learning and technical support, suggesting that the measurement model demonstrates satisfactory construct distinctiveness and can be used for subsequent structural model analysis.

Composite Reliability

Table 3 shows that composite reliability can be assessed using two criteria: composite reliability and Cronbach's alpha. A construct is declared reliable if the composite reliability value is > 0.70 and Cronbach's alpha > 0.60.

Table 3: Latent Variable Coefficients Output

	SA	ITR	ITU	ITC	Management Course	Technology	Technology Support
R-Squared	0,632						
Adj R-Squared	0,591						
Q-Squared	0,597						
Composite Reliability	0,913	0,889	0,785	0,863	0,892	0,927	0,850
Cronbach Alfa	0,893	0,855	0,680	0,813	0,861	0,904	0,792
Avg.Var.Extract	0,576	0,587	0,550	0,585	0,510	0,681	0,546
Full Collinearity VIF	2,407	2,083	2,491	2,316	2,534	2,974	2,270

*SA= Student Academic Achievement; ITR=Interaction; ITU= Instruction; ITC= Instructure

Based on Table 3, all variables meet the reliability criteria with composite reliability values above 0.7, AVE values greater than 0.5, and Cronbach's alpha above 0.6 (Hair, Black, Babin, & Anderson, 2010). Discriminant validity is also confirmed, as all indicators have cross-loadings greater than 0.70 on their respective constructs. The assessment of discriminant validity aims to ensure that each construct in the research model is empirically distinct from the others. The results of the study, in addition to the validity and reliability of the construct, are the values R Square 0.63 and Adj. R Square 0.53, which shows there is a significant positive influence of blended learning on academic student achievement with technical support as a moderating variable.

Structural Model (*Inner Model*) Evaluation

The Results of a model said to be fit can be seen in the general results output. The following Table 4 shows the fit *indices and p-value of the* model with 10 (ten) *fit indicators*.

Table 4: Model Fit and Quality Index

Model fit and quality indices	Index	p-value	Criteria	Conclusion
Average path coefficient (APC)	0,156	P < 0,026	P<0.05	Accepted
Average R-Squared (ARS)	0,632	P <0,001	P<0.05	Accepted
Average Adjusted R-Squared	0,169	P <0,001	P<0.05	Accepted
Average Block Variance Inflation Factor (AVIF)	0,591	≤ 5 and ideally ≤ 3,3		Accepted
Average Full Collinearity VIF (AFVIF)	2,702	≤ 5 and ideally ≤ 3,3		Accepted
Tenenhaus GoF (GoF)	0,667	small ≥ 0,1, medium ≥0,25, large ≥0,36		Large
Sympson's paradox ratio (SPR)	0,800	≥0,7 and ideally=1		Accepted
R-Squared Contribution Ratio (RSCR)	0,964	≥0,9 and ideally=1		Accepted
Statistical Suppression Ratio (SSR)	1,000	≥0,7		Accepted
Nonlinear Bivariate Causality Direction Ratio (NLBCDR)	0,750	≥0,7		Accepted

From the table above, it is evident that the values obtained from the ten criteria have been met, indicating that the model has fulfilled the prerequisites for a *fit model*.

Effect of Blended Learning on Student Achievement with Technology Support as a moderating variable

Table 5 shows the direct and indirect effect test results from the five (5)- factors blended learning: Interaction, Instruction, Instructor, Management Course, and Technology. Technology Support significantly moderates the relationship between Interactions and Student Academic Achievement. Overall, the question of interaction is related to clear and focused communication on topics discussed between students and lecturers during the learning process using blended learning methods, while questions about technology support, such as network availability, clarity of voice, and disruption, show a significant value of 0.22%. This indicates that good communication or interaction during the learning process of teaching with blended learning methods can increase student achievement or have a positive effect if supported by network availability, clear audio, and reduced technical interference (internet), and vice versa.

The presence of lecturers in online learning when using blended learning methods is more explored by students. This can be seen from the significant value shown through the relationship between instructor and student achievement, with the support of technology as a moderator. These results show that the presence of lecturers while in the online room makes students feel comfortable and can discuss the tasks or materials studied, it can be concluded that the presence of lecturers in blended learning can increase student achievement or give a positive effect if supported by the availability of networks, clear audio and reduced technical interference (internet) because with the availability of clear networks and audio students can listen well to the explanation directly from the lecturer and vice versa. Other research results shown in Table 5 are that technology support is not a moderating variable for instruction, management courses, and technology.

Table 5: Direct and Indirect Effects

Variable	*Path coefficients*	*P value*	Result
ITR → SA	0,39	0,001	*accepted*
ITU → SA	0,18	0,029	*accepted*
ITC→ SA	0,05	0,299	*rejected*
MC → SA	0,23	0,008	*accepted*
TI → SA	-0,04	0,34	*rejected*
TS*ITR → SA	0.22	0,01	*accepted*
TS*ITU → SA	0,07	0,225	*rejected*
TS*ITC → SA	0,33	0,001	*accepted*
TS*MC → SA	-0,03	0,372	*rejected*
TS*TI → SA	0,00	0,488	*rejected*

ITR (Interaction), ITU (Instruction), ITC (Instructor), MC (Management Course), TI (Technology), TS (Technology Support), SA (Student Academic Achievement.

The direct relationship shown in Table 5 illustrates that interactions, instructions, and management courses are directly related to student achievement. Questions related to instruction include clear communication and topic discussion between students and lecturers, which are key to increasing student achievement, both in face-to-face learning

(f2f) and online learning. In other words, good and focused interaction between students and lecturers has a significant positive effect on student academic achievement.

Discussion

The findings reveal that interaction is a significant determinant of accounting students' academic achievement in a blended learning environment. This result supports the argument of Constructive Learning Theory, which emphasizes that learning occurs through active engagement and social interaction among learners, instructors, and learning resources. In the context of blended learning, interaction facilitates knowledge sharing, collaborative problem-solving, and immediate feedback, all of which contribute to deeper understanding and improved academic performance. This finding is consistent with (Yu, et al. 2023). (Kintu, Zhu and Kagambe 2017), who found that interaction is one of the most influential factors in determining learning outcomes in blended learning environments. Similarly, (Argyriou, Benamar and Nikolajeva 2022) reported that higher levels of student engagement and interaction significantly enhance academic achievement. For accounting students, who are required to master both theoretical concepts and analytical problem-solving skills, meaningful interaction with peers and lecturers appears to be particularly important in supporting learning success.

The study also demonstrates that the instructor/lecturer dimension has a positive and significant effect on academic achievement. This finding suggests that despite the increasing role of technology in higher education, instructors remain central to the learning process. Effective lecturers not only provide academic guidance but also motivate students, facilitate discussions, and help learners navigate both face-to-face and online learning environments. This result supports previous studies indicating that instructor presence and support are critical success factors in blended learning (Kintu, Zhu and Kagambe 2017); (Florence Martin, Tianlu Sun and Westine. 2022). In regions such as Papua, where students may experience varying levels of internet accessibility and digital readiness, the role of lecturers becomes even more important because they often serve as the primary source of academic and technical guidance.

Furthermore, course management was found to significantly influence students' academic achievement. Effective course management ensures that learning activities, schedules, assessments, and instructional materials are well organized and easily accessible to students. A structured learning environment reduces uncertainty and enables students to manage their learning more efficiently. This finding is in line with the work of (Obiedat, et al. 2014), who emphasized that well-managed courses contribute positively to student satisfaction and learning effectiveness. Likewise, (Min and Yu 2023) identified course organization and learning management as critical success factors for blended learning implementation. For accounting students who must balance multiple assignments, practical exercises, and examinations, effective course management can improve learning efficiency and academic outcomes.

In contrast, the instruction dimension was not found to have a significant effect on academic achievement. One possible explanation is that students may perceive instructional content as relatively standardized across courses and institutions, resulting in limited variation in how instructional quality influences learning outcomes. Additionally, in blended learning environments, students often rely on multiple learning resources, including online

materials, peer discussions, and independent learning activities, which may reduce their dependence on formal instructional delivery. This finding differs from some previous studies that reported a positive relationship between instructional quality and academic performance (Kintu, Zhu and Kagambe 2017). However, it supports the argument that the effectiveness of instruction may depend on contextual factors such as students' learning autonomy, motivation, and access to supplementary learning resources.

Unexpectedly, the technology dimension did not significantly affect academic achievement. While technology is generally considered a fundamental component of blended learning, the findings suggest that the mere availability of technology does not automatically translate into improved academic outcomes. This result supports previous studies indicating that technology functions primarily as an enabling tool rather than a direct driver of learning performance (Min and Yu 2023). In the context of Papua, where internet connectivity and digital infrastructure remain uneven, students may experience limitations in accessing online learning platforms consistently. Consequently, technological tools alone may be insufficient to enhance academic achievement without adequate interaction, lecturer support, and effective course management.

The non-significant effect of technology also highlights the importance of the human and organizational dimensions of blended learning. Students appear to benefit more from meaningful interactions, lecturer engagement, and structured course delivery than from technology itself. This finding aligns with the view that successful blended learning depends not only on technological resources but also on how those resources are integrated into pedagogical practices and supported by instructors and institutions. Therefore, higher education institutions should not focus exclusively on technological investments but should also strengthen instructional support systems, lecturer involvement, and course management strategies to maximize student learning outcomes.

Overall, the findings suggest that in a developing-region context such as Papua, the effectiveness of blended learning is driven more by social, pedagogical, and managerial factors than by technological factors alone. This study contributes to the blended learning literature by demonstrating that technology is not necessarily the primary determinant of academic achievement in areas with infrastructural challenges. Instead, interaction, lecturer support, and effective course management emerge as the key mechanisms through which blended learning enhances accounting students' academic performance.

Moderating Effect of Technical Support

The findings indicate that technical support significantly moderates the relationship between interaction and students' academic achievement. This result suggests that the positive effect of interaction on academic achievement becomes stronger when students receive adequate technical support. In blended learning environments, interaction among students, lecturers, and learning resources often relies on digital platforms and internet connectivity. Consequently, technical difficulties may disrupt communication, reduce participation in online discussions, and limit access to learning materials. Technical support helps students overcome these barriers by facilitating access to learning technologies, resolving technical problems, and enhancing students' confidence in using digital learning platforms.

This finding is consistent with the Information Systems Success Model proposed by (DeLone and McLean 2003), which emphasizes the importance of support services in maximizing the benefits derived from technology systems. It also supports the findings of (Kintu, Zhu and Kagambe 2017), who highlighted the importance of learning support mechanisms in improving blended learning outcomes. Similarly, (Min and Yu 2023) identified technical support as one of the critical success factors influencing the effectiveness of blended learning. In the context of Papua, where internet connectivity remains inconsistent and students frequently encounter network disruptions, technical support becomes particularly important in ensuring that interaction can be sustained and translated into meaningful learning outcomes. Thus, technical support acts as an enabling mechanism that strengthens the contribution of interaction to academic achievement.

The results further reveal that technical support significantly moderates the relationship between instructor/lecturer support and academic achievement. This finding indicates that lecturer effectiveness in blended learning is enhanced when students have access to adequate technical assistance. Although lecturers may provide high-quality explanations, feedback, and learning guidance, the effectiveness of these activities depends on students' ability to access online platforms and participate in digital learning environments. Technical support, therefore, complements the role of lecturers by reducing technological barriers that might otherwise hinder communication and learning engagement.

This result is aligned with previous studies emphasizing the importance of instructor presence in blended learning environments (Kintu, Zhu and Kagambe 2017). However, the present study extends this literature by demonstrating that instructor effectiveness is contingent upon the availability of technical support, particularly in regions characterized by infrastructure constraints. In Papua, students often experience unstable internet connections, limited bandwidth, and varying levels of digital literacy. Under such conditions, even highly supportive lecturers may struggle to facilitate learning if students are unable to access online learning resources effectively. Therefore, technical support serves as a critical bridge that enables lecturer support to positively influence academic achievement.

In contrast, technical support was not found to moderate the relationship between instruction and academic achievement. One possible explanation is that instructional content is generally designed and delivered before students engage with the learning process. As a result, the quality of instruction may be perceived as relatively independent of the technical assistance available to students. Accounting students may also access instructional materials through multiple channels, including lecture notes, textbooks, recorded videos, and peer support, reducing the extent to which technical support influences the effectiveness of instructional delivery. This finding suggests that while technical support facilitates access to learning systems, it may not substantially alter students' perceptions of instructional quality.

Similarly, technical support did not significantly moderate the relationship between course management and academic achievement. Course management involves the organization of learning schedules, assessment procedures, learning materials, and course administration. These elements are generally structured at the course level and remain relatively stable regardless of the availability of technical assistance. Students may

therefore perceive effective course management as a function of institutional and lecturer planning rather than technical support. This finding differs from the expectation that technical support would strengthen all dimensions of blended learning, suggesting that administrative and organizational aspects of course delivery may operate independently from technological assistance.

The study also found that technical support does not moderate the relationship between technology and academic achievement. Although technology is a fundamental component of blended learning, the findings imply that the effectiveness of technology depends on factors beyond technical assistance alone. In the Papua context, challenges related to internet infrastructure, network coverage, and accessibility may limit the extent to which technical support can enhance the educational value of technology. Even when technical assistance is available, students may continue to experience connectivity issues that are beyond the control of university support services. Consequently, technical support may be insufficient to strengthen the relationship between technology use and academic achievement.

These findings provide an important contribution to the blended learning literature. Most previous studies have identified technical support as a general success factor in online and blended learning environments. However, the present study demonstrates that technical support does not uniformly strengthen all dimensions of blended learning. Instead, its moderating effect appears to be concentrated on dimensions that involve direct human interaction, particularly student interaction and lecturer support. This suggests that in regions with infrastructure limitations such as Papua, technical support functions primarily as a facilitator of communication and engagement rather than as a mechanism for improving instructional design, course organization, or technology quality itself.

Overall, the findings highlight that successful blended learning in remote and developing regions is not determined solely by the availability of technology. Rather, the combination of meaningful interaction, active lecturer involvement, and responsive technical support plays a more important role in enhancing students' academic achievement. These results underscore the need for higher education institutions in Papua and similar contexts to invest not only in technological infrastructure but also in technical support services that facilitate communication, collaboration, and student engagement within blended learning environments.

The findings extend existing blended learning theories by highlighting that technology itself is not the primary driver of academic achievement in contexts characterized by digital infrastructure constraints. Instead, interaction and lecturer support emerge as the dominant pathways through which blended learning enhances student performance, while technical support serves as a catalyst that strengthens these relationships. This challenges the technology-centric perspective commonly found in blended learning research and provides evidence that social and pedagogical factors remain more influential than technological factors in determining learning success in remote educational settings.

Overall, this study provides new evidence that the success of blended learning in geographically remote regions such as Papua is shaped not merely by the availability of technology but by the ability of institutions to support meaningful interaction between students and lecturers. The findings suggest that technical support acts as a social enabler

rather than a technological enabler, strengthening communication and engagement that ultimately contribute to improved academic achievement. This perspective offers a valuable extension to the blended learning literature, particularly in developing countries and infrastructure-constrained contexts.

CONCLUSION, IMPLICATIONS, AND LIMITATIONS

Conclusion

This study examined the effects of blended learning dimensions on accounting students' academic achievement and the moderating role of technical support in universities in Papua, Indonesia. The findings indicate that interaction, instructor/lecturer support, and course management significantly enhance students' academic achievement, whereas instruction and technology do not have significant effects.

Furthermore, technical support strengthens the relationships between interaction and academic achievement and between instructor support and academic achievement, but does not moderate the effects of instruction, course management, or technology.

These findings suggest that the effectiveness of blended learning in Papua is driven more by human-centered factors than by technology itself. In a context characterized by internet connectivity challenges and digital infrastructure constraints, technical support plays an important role in facilitating communication and engagement between students and lecturers, thereby contributing to improved academic performance.

Implication

This study contributes to the blended learning literature by showing that technical support functions as a selective moderator, strengthening interaction and instructor support rather than all dimensions of blended learning. The findings also provide evidence from Papua, an underrepresented region with digital infrastructure challenges, thereby extending the applicability of blended learning research to remote and developing contexts.

Practically, universities should focus not only on technological investments but also on enhancing student interaction, lecturer engagement, and technical support services. These factors appear to be critical for improving academic achievement in blended learning environments, particularly in regions with limited internet accessibility.

Limitations and Future Research

This study is limited by its relatively small sample size and focuses on accounting students from three universities in Papua.

Future research could involve larger and more diverse samples, compare urban and remote regions, and examine additional factors such as digital literacy, learning engagement, self-regulated learning, and internet accessibility to better understand the effectiveness of blended learning in different educational contexts.

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