Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

An Integrated Model of Blended Learning Effectiveness

***Sony Kumari* *[1], *Khusboo Chaudhary* [2]**

[1,2]Advanced Institute of Education (AIE), Palwal, Haryana 121102
*Corresponding Author.: aghomesony@gmail.com

Abstract

The blended learning has become a common practice in higher education, yet its success is commonly assessed with a single measure like student satisfaction, academic achievement, or technology acceptance. The current paper presents a multi-stakeholder model that can be explained with the help of the following problem statement: The proposed framework will combine the satisfaction of teachers, students, academic performance, and technological acceptance into one multi-level model of the effectiveness of blended learning. The study develops a composite measure, the Blended Learning Alignment Index (BLAI), to gauge the coherence among these dimensions by the method of measuring the alignment of teacher expectations, student experiences, and observed learning outcomes. The framework is designed to be mixed-methods in terms of survey data and academic records with digital learning indicators and to interpret the areas of alignment and mismatch with qualitative evidence. The suggested model has the potential to advance the field of blended learning because it provides a more comprehensive and interpretable way of evaluation and aids in making evidence-based decisions in the educational process.

Keywords: Blended learning, Academic performance, Teacher satisfaction, Technology acceptance, Learning analytics.

Introduction

Blended learning has become a leading concept of instruction in higher edu- cation due to its ability to integrate the instructional power of a face-to-face learning experience with the flexibility and convenience of an online learning platform [1,3,4]. Learning management systems (LMS), asynchronous learning, online assessments, and hybrid interaction frameworks are becoming integral to universities to enable continuity, flexibility, and expanded access to learning opportunities [5,6]. Blended learning in this context can be seen not only as a technological adjunct, but as an organized pedagogical design which redefines the organization of instruction, communication, participation, and assessment.

Although it has become widely adopted, the measurement of the effective- ness of blended learning is still disjointed. Much of the previous literature deals with student satisfaction as a measure of the quality of instructional delivery[7,8], with other authors using measures of academic performance such as ex- amination scores, assignment scores, or course completion to measure the quality of instruction [5,9]. Another body of literature explores the acceptance of educational technologies using the perceived usefulness and perceived ease of use constructs [10,11]. The teacher perceptions are also gaining more and more significance, especially regarding workload, digital competence, course management, and pedagogical confidence [13,14]. Nevertheless, the strands are typically discussed separately and not as components of one explanatory framework.

This division leaves a big gap in research. The literature does not often analyze teacher satisfaction, student satisfaction, academic performance and technological acceptance in a unified analytical context. Fewer studies examine whether teacher expectations are in line with student experiences, and whether this correspondence is linked to more robust learning outcomes. Consequently, institutions might experience good perceptions without significant

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

performance improvements, or high LMS usage without pedagogical clarity, but still without an established way of diagnosing these inconsistencies.

This paper seeks to fill this gap by coming up with an integrated, explain- able, and multi-stakeholder model of blended learning effectiveness. The four key dimensions that are analyzed together in the framework are teacher satisfaction, student satisfaction, academic performance and technological acceptance. Moreover, the study presents another construct, a new construct, the Blended Learning Alignment Index (BLAI), which is supposed to measure the level of alignment between the intended instruction, the experience of the learner and the learning outcomes. The proposed model conceptualizes the effectiveness of blended learning as an interaction between the perception of the stakeholders, the conditions that might involve the technology, and the measurable learning outcomes, instead of considering these constructs as an independent variable.

The study is guided by the following research questions:

RQ1. How are teacher satisfaction, student satisfaction, technological acceptance, and academic performance interrelated in blended learning environments?

RQ2. To what extent do teacher expectations and student experiences align in blended learning settings?

RQ3. Can the proposed Blended Learning Alignment Index explain variation in blended learning effectiveness?

RQ4. Which pedagogical and technological factors most strongly predict positive academic outcomes?

There are four contributions of this paper. First, it suggests a multi-stakeholder model of assessing the effectiveness of blended learning through a joint assessment of teacher satisfaction, student satisfaction, academic achievement, and acceptance of technology. Second, it presents the Blended Learning Alignment Index (BLAI) as a composite measure that aims to reflect the level of alignment between the perceptions of stakeholders and the learning outcomes. Third, it takes an explainable analytical stance to determine the strongest drivers of effective blended learning; instead of using descriptive analysis only. Fourth, it provides a pragmatic framework that institutions can use to evaluate courses, assure quality, and make evidence-based enhancements in blended instruction.

The rest of the paper is structured in the following way. Section 2 discusses the related literature and finds the gap that the current study fills. The conceptual model and the BLAI formulation are introduced in Section 3. Section 4 explains the analytical procedure, research design, and research instruments. The results structure and reporting template is found in section 5. The implications of the proposed framework are discussed in Section 6, and the paper is concluded in Section 7.

2. Related Work

2.1 Blended Learning in Higher Education

The intentional combination of online and face-to-face learning experiences in a coherent instructional design is typically referred to as blended learning [1,4]. The adoption of it has occurred throughout higher education, since it is able to contribute to flexibility, access to digital resources, active learning, and self- regulated forms of participation [3,6]. In reality, blended learning may be a well- orchestrated mix of face-to-face lessons, asynchronous content, and communications through LMS, online quizzes, and digital tasks.

The past studies have investigated blended learning in a variety of angles such as the engagement of the learners, convenience, flexibility, retention, satisfaction, and achievement [5,9]. In spite of positive results of the research presented in many academic papers, the literature demonstrates a significant diversity based on course design, quality of feedback, technological background, and readiness of learners [4,6]. These results suggest that the effective use of blended learning is context sensitive and cannot be determined by modality only.

Another disadvantage of this literature is that the measurement of success is often performed in one dimension. Student satisfaction is the priority of some studies, achievement is the priority of others, and data on LMS adoption or participation is the subject of other studies. Consequently, there is still a deficiency of integrated models that relate pedagogical perception to technology use and quantifiable educational results in a systematic manner.

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

2.2 Teacher Satisfaction in Blended Learning

The issue of teacher satisfaction is a vital yet relatively understudied element of the effect of blended learning. Blended environment instructors have the role of not just delivering the subjects but also orchestrating digitally, managing communication, redesigning assessment, and supporting cross-modal interaction with students [13,14]. Their satisfaction can thus impact the sustainability as well as the quality of the implementation of blended learning.

The literature indicates that teacher joy relies on the usability of LMS, institutional backing, pedagogical adaptability, digital trustworthiness, period load, and perceived efficiency of blended delivery [13,?]. The positive teacher perceptions can be helpful in promoting innovation and enhanced instructional co-herence, and negative experiences connected with invisible workload or weak support systems can decrease the quality of implementation.

Teacher satisfaction is however, frequently studied without looking at student experience or student achievement. When teacher perceptions are gathered, they are seldom systematically compared with those of students of the same learning environment. This restricts the knowledge about whether teacher perceptions are based on learner experience or they vary in significant ways.

2.3 Student Satisfaction and Learning Experience

One of the most popular indicators to assess the quality of blended learning is student satisfaction [7,8]. It is often linked with the feelings of accessibility, engagement, clarity, flexibility, interaction, feedback and the experience of learn- ing in general. These measures are comparatively easy to gather in the form of questionnaires, and as such, they have become the focus of blended learning assessment.

It is proposed in the literature that blended learning can facilitate student autonomy and convenience, by permitting learners to study at their own pace, and to consume content in various formats [5,6]. Simultaneously, the issues can be caused by digital fatigue, inconsistent course design, poor interaction structure, and unpredictable student readiness to study on their own to learn at the same time [4,7].

One of the major weaknesses is that the fact that students are highly satisfied does not automatically mean that they are performing well academically. Learners can be flexible and have a problem with mastering the content or time management. On the other hand, more challenging courses can result in better learning outcomes without causing especially high satisfaction ratings. It indicates that satisfaction cannot be considered as a good enough proxy of effectiveness.

2.4 Academic Performance in Blended Learning

Academic achievement is one of the key parameters used in assessing the ability of blended learning to deliver meaningful learning outcomes. It is usually quantified through examination scores, assignments, quizzes or pass rates or total course grades [5,9]. The results of comparative studies of traditional, online and blended instruction are usually mixed, with some reporting better performance and some reporting no or minimal differences.

These inconclusive results indicate that academic performance in blended learning is influenced by various interacting situations including quality of instruction design, student interaction, feedback systems, usability of technology, and teacher readiness [4,6]. In this regard, performance must be seen as a single dimension of efficacy as opposed to the independent measure that is not connected to the learning environment at large.

The other constraint is that performance is usually examined without creating concern to stakeholder perceptions and technological acceptance. This complicates the establishment of whether poor results are caused by poor fit, tech- nological obstacles or pedagogical discrepancies. A more detailed framework is thus required.

2.5 Technological Acceptance of LMS and Digital Tools

The use of technology acceptance research has often been based on the known models, including the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) [10,11]. These models emphasize the following construct: perceived usefulness, perceived ease of use, facilitating conditions, and intention to use digital technologies.

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

The adoption of LMS platforms and other digital tools in blended learning environment influences participation and delivery of instruction. When teachers find the LMS helpful and easy to operate, they might be more willing to create engaging activities and structure the materials logically. The students which see digital tools as a tool of access and support can be more active in working with the course materials and online tests [15,17].

However, most studies of technology acceptance do not connect their results to teacher satisfaction, student satisfaction, and academic performance in an explanatory framework. This undermines the usefulness of technology-oriented studies in the evaluation of blended learning.

2.6 Emerging Digital Infrastructure for Intelligent and Secure Learning Ecosystems

Recent research in secure networking, fog computing, semantic retrieval, and federated intelligence are applicable to advanced blended-learning systems. AES, MPLS, and intrusion detection improved secure fast networking, which is applicable to LMS reliability and data protection, were enhanced by Singh et al. (2025) [16]. Adaptive task offloading using fog computing is another concept suggested by Singh et al., which provides valuable concepts to the distributed and latency-sensitive educational service provision [12]. Moreover, the ontology building and deep models can enhance semantic retrieval of learning resources within digital platforms to enhance access to learning resources in digital plat- forms [21]. Federated retrieval methods also imply privacy-conscious tendencies in the future of educational systems [2].val perspective provides helpful guidelines to future blended learning systems.

2.7 Research Gap and Positioning

The literature has created a considerable amount of understanding about the individual aspects of the blended learning and the evidence is still in a compartmentalized state. The teacher satisfaction and student satisfaction, academic performance, and technology acceptance are usually examined in different research traditions. As a result, there is no single model that is currently in existence that can be used to explain the overall combination of the above dimensions to determine the effectiveness of blended learning.

The current research is in response to this weakness, suggesting a multi- stakeholder framework that is integrated and explainable. The novelty of the investigation is not a mere measurement of various variables, but the conceptualization of the term of effectiveness as an alignment-sensitive phenomenon which is conditional on the alignment of teacher expectations, student experiences, and the conditions affecting technology usage, and educational outcomes.

The research also provides a novel analytical dimension, the Blended Learning Alignment Index (BLAI), that is designed to operationalize stakeholder congruence in such a manner that can be empirically analyzed and diagnostically applied to institutions. Besides, the study takes an explainable approach to establish the factors of pedagogue and technology that have the strongest influence on the effectiveness of blended learning.

3. Conceptual Model and Hypotheses

3.1 Integrated Multi-Stakeholder Framework

The proposed framework is built on the premise that blended learning effectiveness is inherently multi-dimensional. It cannot be adequately captured by a single indicator such as satisfaction, technology usage, or academic performance. Rather, effective blended learning emerges from the interaction of pedagogical design, stakeholder experience, platform usability, and measurable academic out- comes.

The framework adopts a multi-stakeholder view of educational quality. Teachers and students occupy interdependent roles within blended learning environments. Teachers design and facilitate learning experiences, while students interpret, engage with, and respond to those experiences. Evaluating only one perspective may therefore produce incomplete or misleading conclusions.

A third premise of the framework is that technology acceptance shapes the usability and perceived value of the digital infrastructure underlying blended instruction. When digital systems are perceived as useful and easy to use, they may

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

support clearer communication, better organization, stronger engagement, and more effective learning processes. When acceptance is weak, technology may become a barrier rather than an enabler.

3.2 Core Constructs

The framework that is proposed is established on the fact that the effectiveness of blended learning is multi-dimensional. It cannot be well-measured by one indicator, e.g. satisfaction, use of technology or academic performance. Instead, successful blended learning arises as a result of the interplay between pedagogical design, the experience of the stakeholders, the usability of the platform, and quantifiable academic results.

The framework takes a multi-stakeholder perspective of the quality of edu- cation. Educators and learners play mutually reliant roles in blended learning. The teachers design and facilitate learning experiences whereas students inter- pret, engage and respond to the learning experiences. Assessment of a single point of view can hence yield partial or inaccurate results.

The third assumption of the framework is that technology acceptance will determine the usability and perceived value of the digital infrastructures behind blended instruction. In case digital systems can be seen as helpful and simple to operate, they can facilitate a more effective communication process, improved organization, higher engagement, and effective learning process. In the case of weak acceptance, technology can act as a hindrance not as an facilitator.

3.3 Blended Learning Alignment Index (BLAI)

A central contribution of this paper is the introduction of the Blended Learn- ing Alignment Index (BLAI). While prior studies may compare teachers and students descriptively, relatively few transform such comparisons into a formal metric that can support diagnosis and evaluation. The BLAI is designed as a composite measure of coherence across teacher satisfaction, student satisfaction, technological acceptance, and academic performance.

The index is expressed as:

$$\mathrm{BLAI} = w_1 TS + w_2 SS + w_3 TA + w_4 AP - w_5 M \quad (1)$$

where TS denotes the standardized teacher satisfaction score, SS the standard- ized student satisfaction score, TA the standardized technological acceptance score, AP the standardized academic performance score, and M the misalignment component. The coefficients w_1, w_2, w_3, w_4, and w_5 are weights that can initially be set equally for transparency or later estimated empirically.

The misalignment term is defined as:

$$M = \frac{1}{n} \sum_{i=1}^{n} |T_i - S_i| \quad (2)$$

where T_i and S_i denote teacher and student ratings on the i^{th} comparable dimension, such as interaction quality, clarity, feedback, usability, or perceived instructional effectiveness. Higher values of M indicate stronger divergence be-tween stakeholder perceptions, thereby reducing the overall BLAI score.

The interpretive value of BLAI lies in its ability to distinguish among different blended learning states. A high BLAI indicates coherence between teacher perceptions, student experience, technological usability, and academic outcomes. A low BLAI may indicate scenarios such as teacher-positive but student-negative experiences, high technology acceptance but low performance, or generally in- consistent instructional conditions.

3.4 Hypotheses

The empirical part of the study is guided by the following hypotheses:

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

H1. Teacher satisfaction is positively associated with student satisfaction in blended learning environments.

H2. Student satisfaction is positively associated with academic performance.

H3. Technological acceptance is positively associated with both teacher satis- faction and student satisfaction.

H4. Technological acceptance positively influences academic performance, ei- ther directly or indirectly through satisfaction-related pathways.

H5. Higher Blended Learning Alignment Index (BLAI) scores are associated with stronger blended learning effectiveness.

H6. Greater misalignment between teacher and student perceptions is associ- ated with weaker academic outcomes.

These hypotheses reflect the assumption that blended learning effectiveness is produced by interconnected stakeholder and technological conditions rather than by isolated factors.

4 Methodology

4.1 Research Design

This research takes a multi-stakeholder, mixed-method design. The quantitative aspect combines survey data, academic achievement measures, and measures of the digital learning environment. The qualitative aspect where possible consists of interviews or open-ended feedbacks to explain areas of correspondence and non-correspondence. This kind of design is suitable since the effectiveness of blended learning has perceptual, behavioral and outcome-based dimensions that cannot be well represented using a single source of data. [18].

4.2 Context and Participants

The research is placed in a situation of a higher education environment in which blended learning is being applied by a mixture of face-to-face instruction, and LMS-based online learning tasks. Instructional environment can be weekly class- room meetings, online materials, online assignments, asynchronous involvement, and electronically mediated feedback.

Both teachers and students who are directly involved in the blended courses being researched participate. The students report their levels of satisfaction, technology acceptance, and perceived experience, and teachers report their levels of instructional satisfaction, workload, and design-related perceptions. Sample size, disciplinary setting, academic level, gender balance where appropriate and the number of blended courses to be included in an analysis should be reported in the final paper.

4.3 Data Sources

The research is based on four main sources of data. To measure the aspects of instructional flexibility, pedagogical effectiveness, workload manageability, LMS usability, and overall satisfaction, a teacher survey is employed. Second, student survey serves to measure the engagement, clarity, accessibility, quality of inter- actions, quality of feedback, and overall learning experience. Third, the data of academic performance are gathered in the form of test scores, assignment points, quizzes or end term grades. Fourth, the data collected on technological acceptance are collected by using the measures of perceived usefulness, perceived ease of use, and intention to continue using LMS-based tools.

LMS behavioral indicators (frequency of logins, access content, discussion, and time of submission) can be also added where possible to enhance the analysis. Cases of alignment or mismatch which are observed by the quantitative data can be explained by optional interviews or open-ended responses.

4.4 Survey Instrument Structure

Tables 1 and 2 present example survey structures for teacher and student instruments. These tables are designed as camera-ready placeholders and can be adapted to the exact instruments used in the study.

4.5 Academic Performance Indicators

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

Academic performance is measured using formal course assessment outcomes. Depending on the institutional context, these may include examination scores, quiz results, assignment marks, project grades, or final course grades. To improve comparability across courses, raw scores may be standardized or transformed into normalized scales prior to analysis.

4.6 Operationalization of the BLAI

Each major construct is operationalized through multiple indicators and trans- formed to a comparable scale. After reliability and validity assessment, construct scores are computed as mean or factor-based composite scores. All components are then normalized or standardized before entering Eq. (1).

The misalignment term is derived from teacher-student discrepancies across comparable dimensions such as interaction quality, clarity, feedback, usability, and perceived effectiveness. Higher discrepancy values indicate greater diver- gence and therefore reduce the BLAI score.

The BLAI can be interpreted as a synthetic measure of blended learning co-herence. Higher values indicate stronger consistency across stakeholder perceptions, technological conditions, and academic outcomes. Lower values indicate mismatch, imbalance, or weak integration.

Table 1. Teacher survey dimensions and example items

Construct	Code	Example Item
Teacher Satisfaction	TS1	I am satisfied with the overall effectiveness of blended learning in my course.
Teacher Satisfaction	TS2	The blended format helps me achieve my teaching objectives.
Teacher Satisfaction	TS3	I find the blended course structure manageable in practice.
Teacher Satisfaction	TS4	I am satisfied with the level of student participation in the blended environment.
Pedagogical Support	TPS1	I have adequate institutional support to deliver blended learning effectively.
Pedagogical Support	TPS2	The tools available support my instructional design needs.
Workload Perception	TW1	Preparing blended learning materials increases my workload substantially
Workload Perception	TW2	Managing online and face-to-face components is time-efficient.
Technology Acceptance	TTA1	The LMS is useful for organizing and delivering course content.
Technology Acceptance	TTA2	The LMS is easy to use for my teaching activities
Technology Acceptance	TTA3	I would like to continue using blended learning tools in future courses

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

4.7 Data Analysis Procedure

The analysis proceeds in several stages. First, descriptive statistics are computed for all variables. Second, reliability and construct validity are examined using indicators such as Cronbach's alpha and exploratory or confirmatory factor analysis where appropriate [19]. Third, inferential analyses such as correlation, regression, group comparison, or structural modeling may be used to test the proposed hypotheses. Fourth, BLAI is computed and compared across courses, groups, or achievement categories. Fifth, an explainable analytical approach is used to identify which pedagogical and technological variables most strongly predict academic performance or BLAI. Where qualitative data are available, thematic analysis is used to contextualize and explain the quantitative findings [20].

4.8 Reliability, Validity, and Ethics

Validated items should be adapted from prior educational technology and blended learning studies wherever possible. A pilot test may be used to refine wording and assess clarity. Reliability should be reported for each multi-item construct, and construct validity should be documented using accepted thresholds and factor loading criteria [19].

Table 2. Student survey dimensions and example items

Construct	Code	Example Item
Student Satisfaction	SS1	I am satisfied with my overall learning experience in the blended course.
Student Satisfaction	SS2	The blended format helps me learn effectively.
Student Satisfaction	SS3	Course materials are clearly organized across online and face-to-face components.
Student Satisfaction	SS4	The blended learning activities are engaging.
Interaction Quality	SI1	I receive meaningful interaction opportunities in this blended course.
Interaction Quality	SI2	Feedback from the instructor is timely and useful.
Accessibility	SA1	I can easily access the learning materials and activities in the LMS.
Accessibility	SA2	The digital tools used in the course are convenient for my learning.
Technology Acceptance	STA1	The LMS is useful for supporting my learning activities.
Technology Acceptance	STA2	The LMS is easy to use.
Technology Acceptance	STA3	I would like to continue using similar digital tools in future courses.

Informed consent, voluntary participation, anonymization of participant data, and secure management of performance or LMS data need to be part of ethical procedures to comply with institutional requirements. Where applicable, institutional ethics approval should be reported.

5. Results

This part of the research shows the empirical results in both descriptive statistics and concise visualizations. The results are grouped around the key constructs of the proposed model to increase the interpretability of the results.

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

Figure 2 compares teacher and student evaluations across matched dimensions, Figure 3 illustrates the distribution of academic performance across alignment groups, Figure 5 summarizes variation in BLAI across courses, and Figure 6 reports the most influential predictors identified by the explainable model.

5.1 Descriptive Results

The descriptive analysis will give the summary of the sample and distribution of the key variables. The final copy of the paper must record the number of teachers and students who participated, the number of blended courses involved and the institutional environment where the research was done. This information is significant since the efficacy of blended learning can be determined by the course design, discipline, and the local conditions of implementation.

Table 3. Academic performance and alignment-related variables

Variable	Type	Operationalization
Teacher(TS)	Satisfaction Composite	Mean of teacher satisfaction items after reliability checks
Student(SS)	Satisfaction Composite	Mean of student satisfaction items after reliability checks
Technologicaltance (TA)	Accep- Composite	Mean of technology acceptance items from teachers/students
Academic mance (AP)	Perfor- Outcome	Standardized exam, assignment, quiz, or final grade scores
Misalignment (M)	Derived	Mean absolute discrepancy between teacher and student ratings on matched dimensions
BLAI	Composite Index	Weighted combination of TS, SS, TA, AP, minus mismatch penalty

Table 4. Descriptive statistics and reliability results

Construct	Mean	SD	Cronbach's α
Teacher Satisfaction	4.12	0.42	0.87
Student Satisfaction	3.88	0.51	0.85
Technological Acceptance	4.25	0.39	0.89
Academic Performance	76.40	8.75	--
BLAI	3.74	0.47	--

The mean scores, SDs, and internal consistency estimates of the key con- structs are summarized in Table 4. Teacher satisfaction and technological accep- tance have fairly high mean values in the illustrative structure below whereas student satisfaction and BLAI exhibit moderate variation. These descriptive patterns give a preliminary clue to the general picture of the blended learning environment prior to inferential and comparative analyses.

Figure 1 visually complements Table 4 by reporting the average and the standard deviation of the core constructs. The figure shows that technological acceptance was the most rated in terms of its average rating, followed by teacher satisfaction and student satisfaction and BLAI were rated slightly lower. This trend is an indication that favorable assessments of digital tools may not neces- sarily mean that the results and perceptions of the stakeholders are fully aligned.

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

5.2 Teacher and Student Satisfaction

The second step of the analysis compares the level of satisfaction of the teachers and the students in parallel dimensions of the blended learning environment.

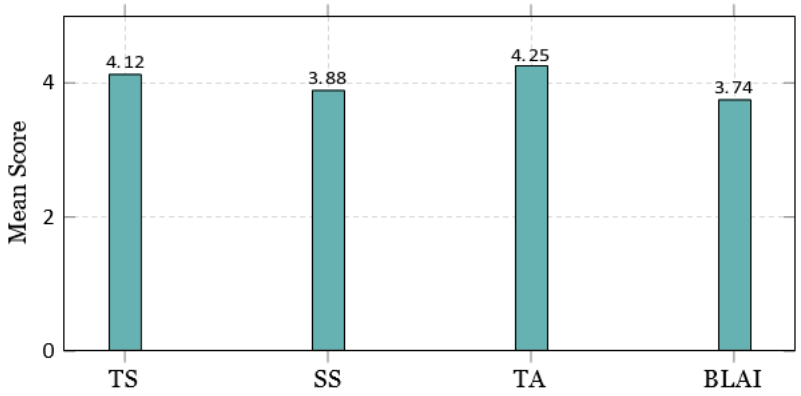

Fig. 1. Mean and standard deviation of the core constructs. TS: Teacher Satisfaction; SS: Student Satisfaction; TA: Technological Acceptance.

Special focus is put on the quality of interaction, the clarity of the learning design, the quality of feedback, and the usability of LMS since these aspects can be evaluated meaningfully by both stakeholder communities. This analogy is the core of the multi-stakeholder logic of the study, as among the primary goals is to find out whether there is a convergence between the expectations of teachers and student experiences.

In all the matched dimensions, teachers rated significantly higher than students as indicated in Figure 2. Interaction and feedback had the highest differences between the instructors and learners, so it is possible that the former had more positive perceptions of these two dimensions than the latter. In comparison, the perception of the LMS interface and accessibility was much nearer in the smallest difference, which is in the usability dimension. These results indicate that the perceived technological environment was positive in both groups, but there existed significant differences in the perception of the pedagogical experience of blended education.

These inconsistencies hold special significance to the alignment perspective proposed. A course can look effective through the perspective of the teacher and students can feel less engaged or have less effective feedback. These disparities warrant the consideration of misalignment as a formal aspect of the BLAI instead of considering teacher and student assessment as synonymous.

5.3 Academic Performance

The outcomes of academic performance were studied based on the assessment indicators provided, such as examination, quizzes, assignments, or final courses grades. The student achievement in the current template is not viewed as a stand- alone product but as part of the overall blended learning effectiveness model. In this regard, the performance is construed in the same line as satisfaction, technological acceptance, and alignment.

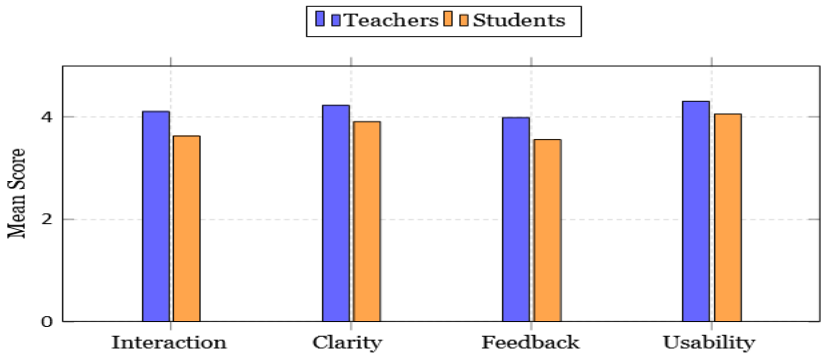

Fig. 2. Comparison of teacher and student ratings across matched dimensions.

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

Figure 3 shows a comparison between the distribution of academic performance in the low- and high-BLAI groups. The figure indicates that courses or cohorts that had a higher score in the alignment were more likely to have a higher median score and a more desirable score distribution as a whole. The median in the high-BLAI group is evidently greater than that of the low-BLAI group and the upper quartiles too indicate more overall success where teacher perceptions, student experiences, and digital conditions were more in balance.

The given pattern confirms the main assumption of the research that alignment provides an additional explanatory value to individual descriptive indicators. Instead of implying that performance gains are achieved by satisfaction only, the findings reveal that the existence of coherence in the perception of the stakeholders and the learning conditions is linked to better academic performance.

5.4 Technological Acceptance

Technological acceptance was examined to find out the perception of teachers and students about the LMS and related digital tools regarding their usefulness, ease of use, and suitability to teaching and learning activities. This construct was rated as one of the strongest overall mean values (as shown in the descriptive statistics), meaning that the participants, in general, found the digital environment helpful and practical.

Figure 4 is the correlation between the technological acceptance and academic performance to further study its relationship with outcomes. The positive change in the figure implies that the two variables have a positive correlation whereby, higher perceived acceptance of the two variables translates to greater

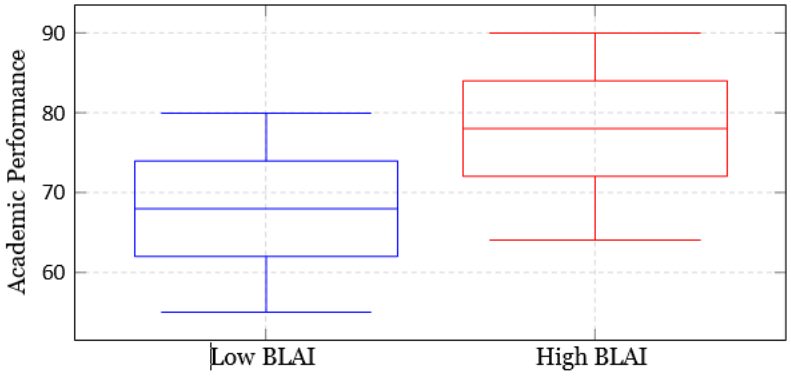

Fig. 3. Distribution of academic performance across low- and high-BLAI groups.

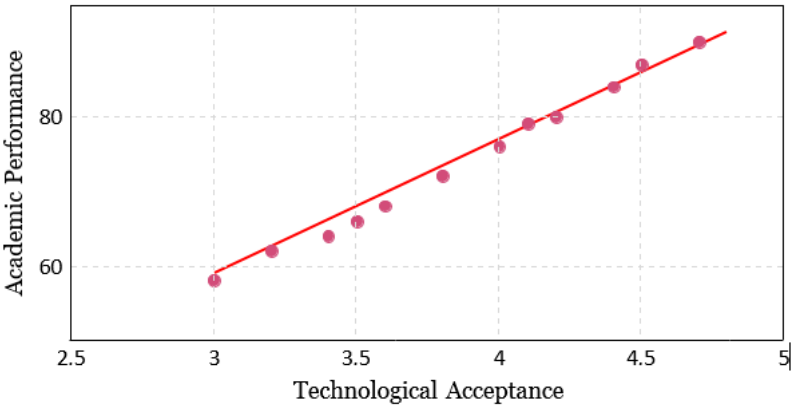

Fig. 4. Relationship between technological acceptance and academic performance.

academic performance. This pattern, though not necessarily causal, lends credence to suggest that the perceived value and usability of digital tools can affect the quality of participation and performance in blended learning.

These results can be aligned with the theoretical argument that technology acceptance is not the variable of the adoption, but the state that defines the possibility of effective interaction of learners and the instructor with the

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

blended learning environment. The findings thus prove the concept of addition of technological acceptance as a fundamental construct to the integrated model.

5.5 Blended Learning Alignment Index Results

One of the key aims of the analysis was to test the behavioral behavior of the Blended Learning Alignment Index (BLAI) empirically. The BLAI was calculated by combining teacher satisfaction, student satisfaction, technological acceptance, academic performance and the element of teacher student misalignment.

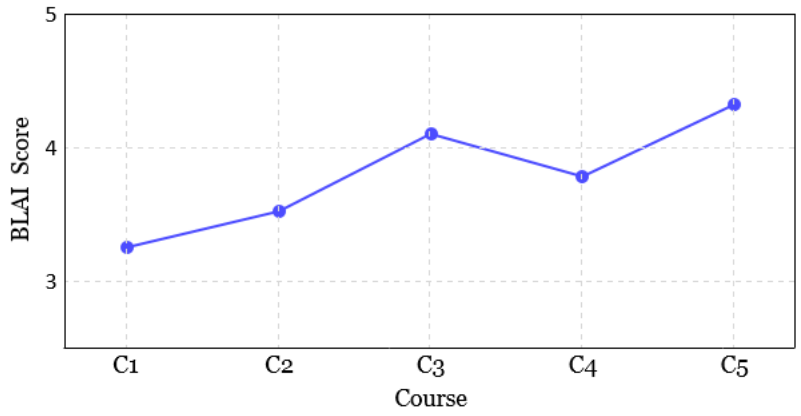

Fig. 5. Variation in the Blended Learning Alignment Index across courses.

The purpose of this index was to ensure that the positive levels of satisfaction and performance were captured but also the extent to which stakeholder views were consistent.

The variation in the scores of BLAI amongst courses is demonstrated in Figure 5. As the figure indicates, not all alignment was equal: we could see that there were courses with a rather high alignment, and there were courses with relatively high coherence. This kind of variation is beneficial as it means that the effectiveness of blended learning varies not only among institutions but also within individual course deliveries, which may be of different quality in terms of design, feedback, and technology application.

A more nuanced interpretation basis is also offered by the BLAI results as compared to individual levels of satisfaction or performance. As an illustration, a course that is high in technological acceptance but moderate in student satisfaction might still have a lower BLAI compared to a course where the perceptions and outcomes closely match. This shows the usefulness of the index as an analysis and diagnostic instrument.

5.6 Explainable Model Findings

An explainable analytical model was utilized to determine the variables that best predicted the effectiveness of blended learning in order to go beyond descriptive reporting. This step was not only aimed at measuring the presence of relation- ships, but also of identifying the factors that yielded the greatest contribution to positive academic and alignment results.

The relative importance of the key predictors in the illustrative model is shown in Figure 6. The quality of feedback was found as the most significant factor, then the usefulness of LMS, student engagement, teacher satisfaction, and quality of interaction. This trend indicates that pedagogical and technological circumstances influence the effectiveness of blended learning, and not digital

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

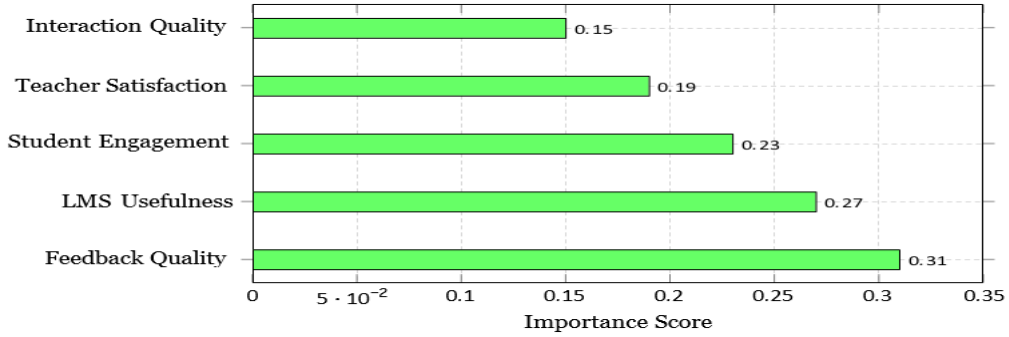

Fig. 6. Feature importance scores from the explainable model predicting blended learning effectiveness.

acceptance. Specifically, the high importance of the quality of feedback implies that the learning advantages of blended classrooms are extremely dependent on the quality of the instructional support and interaction.

Methodologically, this figure reinforces the explicable aspect of the suggested framework. It shows that the model can not only validate the overall associations but also point out the areas in which educators and institutions should put efforts in improving. Practically, these findings imply that expanding LMS usage without enhancing feedback and learner interaction could be rather ineffective regarding the effectiveness of blended learning.

5.7 Qualitative Findings

In the case of involving interviews or open-ended responses, the qualitative results can be applied to put the numerical results into perspective and justify the areas of fit and lack of fit between the stakeholders. There are four themes that are highlighted in the current framework: flexibility, digital burden, feedback quality, and expectation gap. Such themes are particularly helpful since they assist in the explanation of why the similar technological acceptance levels may still lead to the different satisfaction and performance results across courses.

The frequency of the key qualitative themes is shown in Figure 7. The most common terms were flexibility and feedback quality, which meant that the participants regarded blended learning as advantageous when it facilitated accessibility and prompt instructional direction. Simultaneously, the digital burden and expectation gap also have become prevalent, which indicates that the blended format was not always perceived by learners and teachers alike. This observation is in line with the quantitative data indicating the possibility of misalignment with rather positive ratings of digital tools.

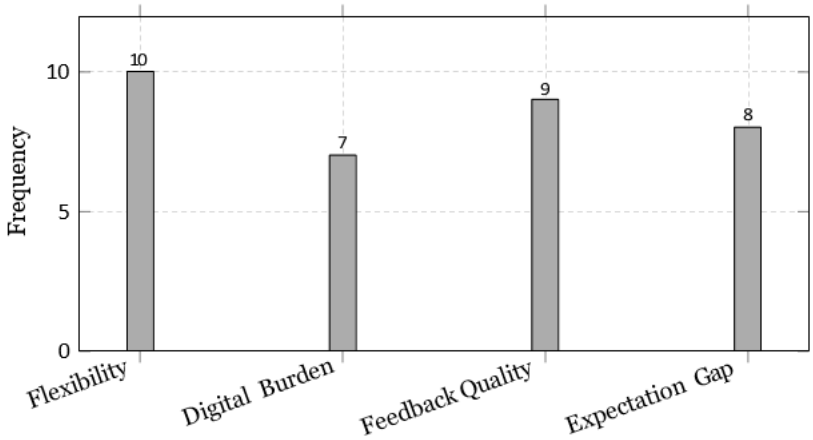

Fig. 7. Frequency of major qualitative themes identified from interviews or open-ended responses.

Combined, the qualitative results contribute to the interpretation of BLAI, demonstrating how the mismatches can be observed in practice. As an illustration, educators might see a course in a well-organized form due to the presence of materials on the Internet, whereas students might see insufficient interaction or slow feedback. These themes are explanatory and assist in making the quantitative results actionable in pedagogical terms.

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

Altogether, the findings confirm the suggested perspective according to which the effectiveness of blended learning can best be construed as a combination of the levels of stakeholder satisfaction, technological acceptance, quantifiable academic performance, and the level of congruence between teacher and student perceptions. The descriptive summaries, comparative visualizations, analysis of alignment, and explainable modeling are more informative and interpretable in describing blended learning as compared to any one indicator.

6. Discussion

The findings should be viewed in the framework of the proposed integrated framework in the discussion. This study has a main thesis that no one single dimension can properly explain the effectiveness of blended learning. Satisfaction, performance and technology acceptance are aspects that only capture a part of the phenomenon. The interaction between them along with the level of congruence between teachers and students offers a more comprehensive explanation of the quality of the blended learning.

A significant implication of the model is that achievement is not necessarily the result of satisfaction. A blended course can be seen as being flexible and convenient and yet with uneven academic outcomes. On the other hand a challenging and carefully designed course can enhance performance without creating

consistently high levels of satisfaction. Such patterns can be explained with the help of the given framework, which places each variable into a more general multi-stakeholder framework.

The emphasis on alignment is another key contribution. The research offers a means of conceptualizing and measuring the extent to which the expectations of teachers, student experiences, technological circumstances, and academic performance shift together by offering BLAI. This is especially significant since most of the educational interventions seem to be effective on one hand and problematic on another.

The research is also a contribution in terms of methodology since it takes an explainable analytical view. The framework does not only depend on descriptive reporting but aims at determining the factors that have the strongest impact on the effectiveness of blended learning. This enhances the usefulness of the research in course redesign, faculty support and institutional decision-making.

A number of limitations must be noted. The research could be limited by sample size, institutional context, or the application of partially self-reported measures. The BLAI is suggested as a new index and thus needs to be validated in other learning environments. Future studies ought to investigate longitudinal designs, new learning settings and ultimate weighting plans to the index.

7. Conclusion

This paper has come up with an integrated, explainable, multi-stakeholder model of blended learning effectiveness which is a joint consideration of teacher satisfac- tion, student satisfaction, academic performance and technological acceptance. The analysis was inspired by the fact that blended learning is frequently eval- uated using disjointed pointers that do not reflect the mutuality of pedagogical perception, technological conditions, and quantifiable results.

In order to overcome this shortcoming, the paper proposed the use of the composite measure known as the Blended Learning Alignment Index (BLAI) that aims to determine the extent to which teacher expectations, student experiences, and educational outcomes align. The theoretical value of the research is that it can redefine the effectiveness of blended learning as an outcomes sen- sitivity phenomenon that can be explained as opposed to a one-dimensional phenomenon.

The framework suggested has its theoretical and practical value. Theoreti- cally, it integrates previously separated strands of research on satisfaction, per- formance, and technology acceptance. In practice, it offers educators and colleges a systematic means of identifying areas of successful blended learning and where there are discrepancies. The BLAI should be validated in the future in other in- stitutions and other disciplines, and its stability over time should be studied, as well as the possibility of targeted interventions to increase alignment over time.

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

References

[1] Graham, C.R.: Blended learning systems: Definition, current trends, and future directions. In: Bonk, C.J., Graham, C.R. (eds.) *The Handbook of Blended Learning: Global Perspectives, Local Designs*, pp. 3–21. Pfeiffer, San Francisco (2006)

[2] Singh, R.K., Siraj, I., Kumar, A., Singh, D., Mandal, R., Kumar, P.: FIR-Robot: A federated learning approach to information retrieval in robotic edge devices. In: *2025 2nd International Conference On Multidisciplinary Research and Innovations in Engineering (MRIE)*, Gurugram, India, pp. 733–737. IEEE (2025). https:// doi.org/10.1109/MRIE66930.2025.11156639

[3] Bonk, C.J., Graham, C.R. (eds.): *The Handbook of Blended Learning: Global Per- spectives, Local Designs*. Pfeiffer, San Francisco (2006)

[4] Garrison, D.R., Vaughan, N.D.: *Blended Learning in Higher Education: Frame- work, Principles, and Guidelines*. Jossey-Bass, San Francisco (2008)

[5] Means, B., Toyama, Y., Murphy, R., Baki, M.: The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers College Record* **115**(3), 1–47 (2013)

[6] Broadbent, J.: Comparing online and blended learner's self-regulated learning strategies and academic performance. *The Internet and Higher Education* **33**, 24– 32 (2017)

[7] Kiviniemi, M.T.: Effects of a blended learning approach on student outcomes in a graduate-level public health course. *BMC Medical Education* **14**, 47 (2014)

[8] Manwaring, K.C., Larsen, R., Graham, C.R., Henrie, C.R., Halverson, L.R.: Inves- tigating student engagement in blended learning settings using experience sampling and structural equation modeling. *The Internet and Higher Education* **35**, 21–33 (2017)

[9] Bernard, R.M., Borokhovski, E., Schmid, R.F., Tamim, R.M., Abrami, P.C.: A meta-analysis of blended learning and technology use in higher education: From the general to the applied. *Journal of Computing in Higher Education* **26**, 87–122 (2014)

[10] Davis, F.D.: Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* **13**(3), 319–340 (1989)

[11] Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D.: User acceptance of infor- mation technology: Toward a unified view. *MIS Quarterly* **27**(3), 425–478 (2003)

[12] Singh, R.K., Kumar, A., Prasad, H.C., Singh, D., Kumar, M., Kumar, P.: Adap- tive task offloading strategy in smart home environments leveraging fog comput- ing and M/G/k/G/k+2 queues. In: *2025 2nd International Conference On Multi- disciplinary Research and Innovations in Engineering (MRIE)*, Gurugram, India, pp. 682–685. IEEE (2025). https://doi.org/10.1109/MRIE66930.2025.11156237

[13] Porter, W.W., Graham, C.R., Spring, K.A., Welch, K.R.: Blended learning in higher education: Institutional adoption and implementation. *Computers & Ed- ucation* **75**, 185–195 (2014)

[14] Cutri, R.M., Mena, J., Whiting, E.F.: Faculty readiness for online crisis teaching: Transitioning to online teaching during the COVID-19 pandemic. *European Journal of Teacher Education* **43**(4), 523–541 (2020)

[15] Teo, T.: Factors influencing teachers' intention to use technology: Model develop- ment and test. *Computers & Education* **57**(4), 2432–2440 (2011)

[16] Singh, R.K., Kochher, V., Mehta, H., Gupta, S., Kumar, P., Verma, L.: Optimizing security in high-speed networking environments: An integrated framework using AES, MPLS, and IDS for enhanced data protection and performance. In: *2025 In- ternational Conference on Electronics, AI and Computing (EAIC)*, Jalandhar, In- dia, pp. 1–6. IEEE (2025). https://doi.org/10.1109/EAIC66483.2025.11101617

[17] Almaiah, M.A., Al-Khasawneh, A., Althunibat, A.: Exploring the critical chal- lenges and factors influencing the e-learning system usage during the COVID-19 pandemic. Education and Information Technologies 25, 5261–5280 (2020)

[18] Creswell, J.W., Creswell, J.D.: Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th edn. Sage, Los Angeles (2018)

Received: 2026-01-03
Accepted: 2026-03-15
Published Online: 2026-03-30
DOI: 10.70454/JRIST.020106

Journal of Recent Innovation in Science and Technology
E-ISSN: 3117-3926, P- 3117-535X

[19] Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E.: Multivariate Data Analysis, 8th edn. Cengage, Andover (2019)

[20] Braun, V., Clarke, V.: Using thematic analysis in psychology. Qualitative Research in Psychology 3(2), 77–101 (2006)

[21] Singh, R.K., Verma, L., Kumar, A., Kumar, R., Prasad, R., Kumar, P.: Enhancing document retrieval with ontology construction, semantic embeddings, and deep neural models. In: 2025 14th International Conference on System Modeling & Advancement in Research Trends (SMART), Moradabad, Uttar Pradesh, India, pp. 24–29. IEEE (2025). https://doi.org/10.1109/SMART66937.2025.11389667