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Blended Learning Effectiveness the Relationship between Students Characteristics and Outcomes

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Abstract

The research investigated the correlation between student attributes and outcomes in blended learning settings to elucidate how personal aspects influence the efficacy of this educational method. Blended learning, integrating conventional in-person instruction with online elements, has gained prominence in numerous educational institutions owing to its flexibility and accessibility. The efficacy of blended learning can fluctuate considerably based on students' particular characteristics, including self-regulation, motivation, learning style, and digital competence.

Aim: The study seeks to examine the impact of these traits on student performance, engagement within blended learning environments.

Methodology: The primary data were collected through structured questionnaire (Google form). Secondary data was collected by referring several books, official records of the organization, visiting websites, magazines, and journals.

Sampling Size/Design - For the purpose of achieving the objectives of the study, the present study selects 120 respondents through random sample technique. The article will enhance the understanding of how student-specific factors influence blended learning outcomes through the analysis of survey data and performance measures.

Findings: The model has a cumulative total variance extraction of 77.84%. The results will offer significant insights for educators and instructional designers to enhance blended learning experiences for varied student demographics.

Keywords: *Blended learning, student characteristics, self-regulation, digital literacy, motivation, learning outcomes, instructional design, and educational technology, engagement, and student satisfaction.*

Introduction

Blended learning—a pedagogical method that integrates conventional in-person instruction with online learning elements—has acquired significant popularity in educational environments worldwide. This hybrid paradigm offers the advantages of both in-person instruction and the flexibility and accessibility of digital resources. The efficacy of blended learning might differ significantly among students, shaped by several features. Comprehending these elements can yield significant insights for instructors seeking to enhance learning results. This paper examines the impact of student characteristics on the efficacy of blended learning and delineates solutions to improve the educational experience for varied student demographics. A primary advantage of personalized learning paths is their capacity to accommodate various learning styles. Certain students may excel in visual or aural modalities, whereas others may favour tactile, kinesthetic learning experiences. Personalized learning paths cater to individual preferences by providing diverse multimedia resources, such as films, interactive simulations, and reading materials, enabling students to interact with content in a manner that aligns with their learning style. Furthermore, it promotes increased autonomy and self-directed learning, enabling students to assume responsibility for their educational experience. Besides accommodating various learning styles, personalized learning pathways allow students to progress at their own speed. Conventional classroom environments typically adhere to a rigid timetable, posing difficulties for students who require additional time to comprehend a concept or those who are prepared to advance. Motivation is a pivotal element that affects the efficacy of blended learning. It pertains to a student's intrinsic motivation to interact with course material, persevere in educational endeavors, and attain academic objectives. In a mixed learning setting, where students frequently assume increased responsibility for their own education, motivation becomes a more critical role. Motivation may be intrinsic, fuelled by personal interest and fulfillment, or extrinsic, propelled by external benefits such as grades or accolades. Blended learning settings provide flexibility; yet, this advantage can also provide challenges. The flexibility enables students to learn at their own pace, but it necessitates a greater degree of self-discipline to maintain motivation. Educators can enhance student motivation by linking learning to real-world applications, establishing clear objectives, and delivering consistent feedback. The integration of gamified components, interactive exercises, and choices in assignments can enhance engagement and motivation by fostering a sense of ownership in students towards their learning experience. Self-regulation denotes a student's capacity to oversee, govern, and navigate their own learning process, encompassing goal-setting, time management, and strategy adjustment to attain academic achievement. In blended learning, where students frequently must balance online assignments with in-person activities, robust self-regulation abilities are crucial for sustaining focus and remaining on course. Self-regulated students are more inclined to participate in active learning, solicit assistance when needed, and modify their study practices to accommodate the requirements of both online and classroom settings. They excel at establishing pragmatic objectives and diligently pursuing them without necessitating continual external supervision. Nonetheless, not all students exhibit robust self-regulation abilities, resulting in procrastination, missed deadlines, or disengagement from the learning process. To facilitate self-regulation, educators may include organized activities including progress monitoring, self-reflective tasks, and peer support frameworks. They can instruct pupils on establishing clear, quantifiable objectives and furnish tools such as calendars and task lists to assist with time management. Effective time management is essential for success in blended learning, since students must individually coordinate their study schedules, balancing online and in-person coursework. In a hybrid environment, students must dedicate adequate time to attending in-person sessions, engaging in online conversations, completing assignments, and studying course materials.

Background of the study

Efficient time management entails strategizing, prioritizing, and assigning suitable durations to each educational task. Students who experience difficulties with time management may become inundated by the autonomy provided in blended

learning, resulting in procrastination, missed deadlines, and unfinished assignments. Instructors can facilitate the development of time management skills in students by offering explicit timetables, comprehensive timelines for assignments, and regular reminders of impending duties. Providing resources like digital planners or time-tracking applications can be advantageous. Motivating students to develop individualized learning schedules, decompose extensive work into manageable components, and establish self-imposed deadlines helps enhance their time management skills. Motivation, self-regulation, and time management are essential competencies that profoundly influence student achievement in a blended learning context. By cultivating these skills through deliberate design and support measures, educators can enhance students' autonomy and efficacy as learners, resulting in better academic performance. Evaluation and feedback are essential components of organized educational settings. Consistent evaluations, both official and informal, enable educators to measure student comprehension and pinpoint areas requiring further assistance. Feedback is sent swiftly and consistently, aiding students in identifying their strengths and areas for enhancement. Structured educational settings frequently utilize formative assessments, such quizzes, peer evaluations, or reflective diaries, to provide students with numerous chances to enhance their abilities and knowledge prior to final tests. This ongoing feedback mechanism promotes self-enhancement and ensures students remain responsible for their education. In a structured learning context, the teacher's function is to act as a facilitator and guide. The structure offers a framework, but it is the instructor who directs the learning process, adjusting to students' requirements while preserving order. Educators in organized environments utilize several pedagogical approaches, such as direct instruction, collaborative activities, and personalized assistance, tailored to the requirements of the class. They also guarantee an inclusive learning environment by offering support to students with varied learning needs through differentiated instruction and accommodations.

Student Characteristics and Blended Learning

1. **Learning Styles and Preferences**: One of the most significant factors affecting blended learning outcomes is students' learning styles and preferences. Some students thrive in a self-directed online environment, appreciating the ability to learn at their own pace and revisit materials as needed. Others may struggle with the autonomy required for online learning and benefit more from structured, face-to-face instruction. Blended learning models that offer a range of resources and support can cater to these diverse preferences, ensuring that students receive the type of instruction that best suits their individual needs.

2. **Technological Proficiency**: Technological proficiency is another crucial factor in the effectiveness of blended learning. Students who are comfortable with digital tools and platforms are more likely to engage effectively with online components of their courses. Conversely, those with limited experience or technical skills may find online learning challenging and may require additional support. Educational institutions can address this disparity by providing introductory training sessions on digital tools and offering ongoing technical support to ensure that all students can fully participate in the blended learning experience.

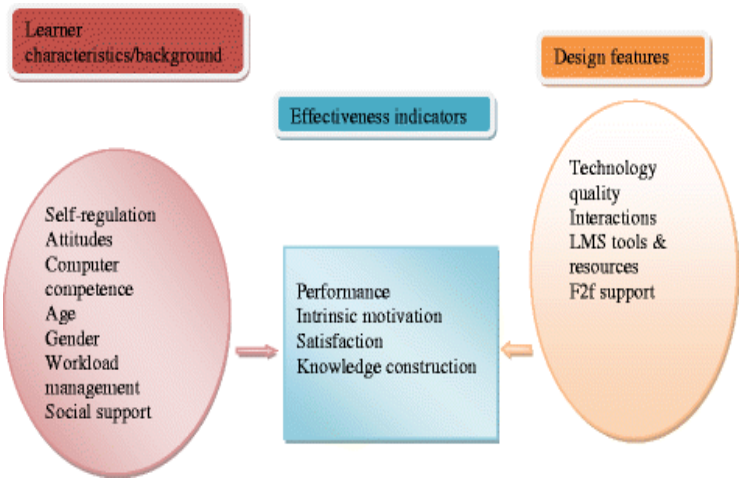
3. **Motivation and Self-Regulation**: Motivation and self-regulation play a critical role in the success of blended learning. Students who are intrinsically motivated and have strong self-regulation skills are more likely to excel in a blended learning environment, where self-directed online work is a significant component. For these students, the flexibility of blended learning can be a powerful motivator. On the other hand, students who struggle with motivation or self-discipline may benefit from additional structures, such as regular check-ins, deadlines, and accountability measures, to help them stay engaged and on track.

4. **Prior Knowledge and Experience:** A student's prior knowledge and experience with the subject matter can also impact blended learning outcomes. Students with a strong foundational understanding of the material may find that blended learning offers a valuable opportunity to deepen their knowledge and apply concepts in new ways. Conversely, students who lack a solid base may find the online components overwhelming without adequate support. Tailoring the online content to build on students' existing knowledge and providing supplementary resources can help bridge these gaps and support all learners.

5. **Socio-economic Factors**: Socioeconomic factors can influence students' access to necessary technology and learning environment. Students from lower socioeconomic backgrounds may face challenges such as inadequate access to high-

speed internet, reliable devices, or a quiet study space. These barriers can hinder their ability to fully engage with online components of blended learning. Educational institutions can mitigate these challenges by providing resources such as loaner devices, internet subsidies, or access to on-campus study spaces.

Figure: 01



Source: https://media.springernature.com/lw685/springer-

Personalized Learning Pathways: Empowering Students through Tailored Educational Experiences

Personalized learning pathways denote an educational methodology that tailors the learning experience to the distinct requirements, strengths, interests, and preferences of each individual student. Instead of adhering to a uniform curriculum, personalized learning enables students to go at their own speed, investigate subjects thoroughly according to their interests, and interact with resources in manners that align with their learning preferences. This methodology is progressively being used in global educational systems because of its capacity to enhance student engagement, motivation, and overall academic achievement. Central to personalized learning paths is the conviction that students are not uniform. Every student possesses distinct prior knowledge, skill sets, and cognitive skills, necessitating that instructors implement adaptable ways to accommodate these variations. Advancements in educational technology and data analytics have facilitated the assessment of students' specific learning needs and the provision of customized learning experiences. Educators can utilize digital resources to establish adaptive learning environments that modify content delivery, pacing, and feedback according on students' performance in real-time. Personalized learning allows students who encounter difficulties with specific subjects to dedicate additional time to studying the content without pressure, while those who succeed can progress at an accelerated pace and delve into more intricate concepts. This adaptability not only alleviates student frustration but also fosters mastery learning, wherein students attain a profound comprehension of content prior to progressing to new subjects. Additionally, a crucial element of personalized learning pathways is the integration of student interests and objectives into the educational process. By connecting instructional content with students' interests and ambitions, instructors can foster more significant and pertinent learning experiences. This method encourages students to immerse themselves in the topic, as they may observe the immediate relevance of their learning to practical situations or prospective jobs. A student pursuing environmental science may be motivated to investigate ecological subjects within their curriculum, enhancing the engagement and significance of their educational experience. However, the implementation of personalized learning pathways has several problems. It necessitates a transformation in pedagogical theory, when educators transition from being the primary purveyors of knowledge to acting as facilitators of learning. Moreover, it requires substantial investment in technology, as adaptive learning systems and data analytics tools are essential for monitoring student progress and delivering personalized feedback. Nevertheless, the enduring advantages, including heightened student engagement, improved academic achievement, and the development of lifelong learners, render learning pathways a promising trajectory for the future of education. Personalized learning paths signify a revolutionary method in education, prioritizing adaptability, individuality, and

student autonomy. This method addresses the distinct needs and interests of each learner, enhancing engagement, facilitating mastery, and equipping students for success in a complicated environment.

Extensive Technical Assistance: An Essential Component for Uninterrupted Operations

Extensive technical support is crucial in the contemporary digital and technology-oriented landscape, serving as the foundation for organizations, enterprises, and individuals to operate effectively. As technology increasingly permeates daily operations, the necessity for dependable and prompt technical support escalates, including many services including troubleshooting, system maintenance, network security, and hardware or software upgrades. Comprehensive technical support guarantees system functionality, reduces downtime, and boosts productivity, while delivering prompt solutions to workflow disruptions. Fundamentally, it encompasses three primary categories: preventive maintenance, problem resolution, and optimization. Preventive maintenance emphasises the upkeep of systems to ensure they remain current, secure, and operationally efficient through regular inspections, software upgrades, and security patches. This proactive strategy facilitates the identification of potential issues prior to their escalation into substantial difficulties, hence mitigating the risk of system failures and assuring uninterrupted user operations. Preventive maintenance is essential in technology-dependent industries, such as healthcare, banking, and manufacturing, where system downtime can result in significant losses. Problem resolution is also a vital component of technical assistance. It entails identifying and resolving problems as they occur, including hardware failures, software errors, or network disruptions. Timely and efficient problem resolution is essential for mitigating the effects of technical issues on daily operations. Organizations benefit from extensive support, gaining access to proficient specialists who provide answers through many channels—telephone, email, live chat, or in-person assistance as required. Technical support services can substantially minimize downtime and ensure uninterrupted business operations by delivering prompt responses. Furthermore, comprehensive technical support encompasses not only problem resolution and system maintenance but also system optimization. Optimization aims to enhance system performance, bolster security standards, and maximize the efficacy of technology investments for enterprises. This may entail suggesting hardware or software enhancements, streamlining workflows with contemporary tools, or assimilating new technology into current systems. In a progressively cloud-centric and data-oriented environment, technical support services frequently aid companies in migrating to cloud infrastructure, ensuring a seamless and secure transition while enabling users to optimize the advantages of cloud computing. A paramount challenge confronting organizations today is cyber security. As cyber threats evolve in sophistication and prevalence, complete technical assistance must priorities safeguarding sensitive data and enforcing robust security measures. This includes the routine upgrading of antivirus software, vigilance for potential attacks, and instructing personnel on optimal methods for safeguarding digital security. Technical support teams can reduce cyber-attacks through real-time monitoring and rapid reaction capabilities before significant damage occur. Additionally, an emerging facet of technical support is its function in facilitating remote work settings. As telecommuting and flexible work arrangements proliferate, organizations must guarantee that their employees have the necessary technical resources and assistance to work remotely. Comprehensive technical support encompasses assistance with VPN configurations, cloud services, collaborative tools, and remote troubleshooting to maintain employee productivity outside of conventional office environments. The significance of comprehensive technical support transcends business applications, also proving vital in the education, healthcare, and government sectors. In education, dependable technological support guarantees the continuous accessibility of learning platforms, digital classrooms, and educational resources for students and educators. In healthcare, where electronic health records and telemedicine are gaining prominence, technological assistance guarantees the confidentiality and accessibility of patient data and essential health systems. In government institutions, technical support guarantees the seamless and secure delivery of public services, thereby fostering trust in digital infrastructure. In conclusion, comprehensive technical support is essential for the efficient operation of contemporary activities across diverse sectors. Its diverse functions—encompassing routine maintenance, cyber security, system optimization, and problem resolution—enable organizations to remain efficient, safe, and productive in a progressively digital landscape. By offering dependable and prompt assistance, organizations may more effectively manage technological complications and concentrate on their primary functions without being impeded by technical difficulties.

Organized Learning Environments: Establishing Foundations for Efficient Education

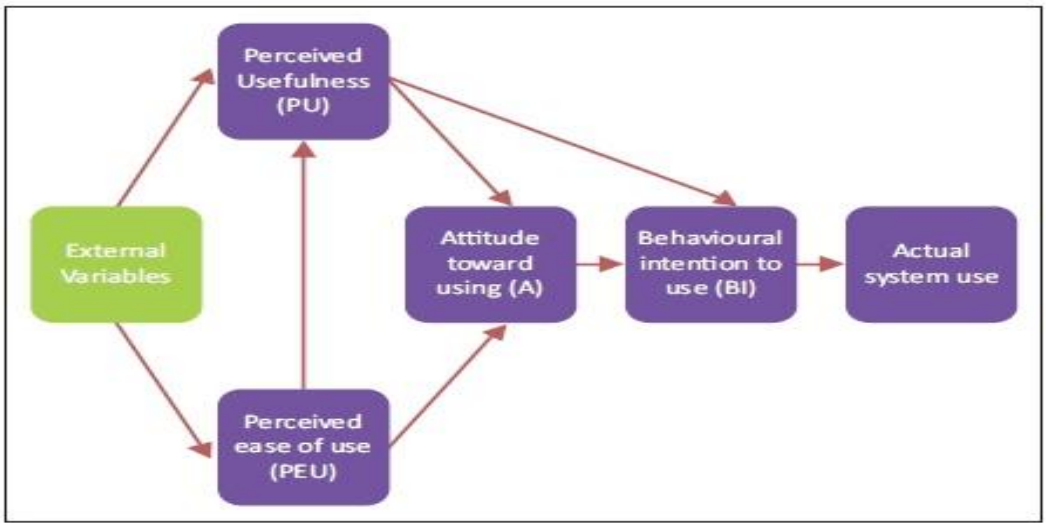
A structured learning environment is an educational context where teaching and learning are systematically organized, featuring well defined norms, expectations, and instructional methodologies. These environments are engineered to ensure stability and predictability, facilitating student concentration on learning by reducing distractions and fostering discipline. Structured learning transcends physical classrooms, encompassing online and blended settings, where organisation, explicit objectives, and consistent routines are crucial for student success. Central to structured learning environments are well-defined expectations and guidelines. When students comprehend the expectations for behaviour, participation, and academic performance, they are more inclined to remain focused and involved. This clarity cultivates a sense of security, as students understand how to navigate the learning process, the resources accessible, and the methods to seek assistance when necessary. In a structured classroom, educators establish clear regulations from the beginning, including guidelines for discussion participation, appropriate collaboration with peers, and the procedures for assessments. This diminishes uncertainty and confusion, enabling students to focus on acquiring and utilizing knowledge. Routine and consistency are essential elements of organized learning settings. Implementing a consistent schedule or sequence of activities aids pupils in cultivating habits that enhance effective learning. Commencing each class with a review of the preceding lesson and concluding with a summary enhances retention and comprehension. Consistent routines assist students, particularly those with learning disabilities or behavioral issues, in managing their time and duties more efficiently. In virtual or blended learning environments, organized schedules and explicit communication channels are essential for maintaining student progress, ensuring deadline adherence, and fostering comprehensive engagement with the material. In structured learning settings, curriculum design is meticulously crafted to facilitate incremental learning. Instruction is structured to build upon students' existing knowledge, ensuring a comprehensive understanding of core concepts before advancing to more complicated ideas. Scaffolding strategies, including task decomposition and the provision of leading questions, facilitate learners' advancement through complex material while enhancing critical thinking and problem-solving abilities. This instructional design fosters mastery learning, enabling students to attain profound comprehension prior to progression, thus enhancing long-term retention and application of knowledge.

Supplementary Resources: Augmenting the Educational Experience

Supplemental resources denote supplementary materials or tools offered to students to augment and enrich their educational experience beyond the primary curriculum. These resources enhance comprehension, solidify concepts, and provide alternative interpretations or viewpoints on a subject. In a progressively diverse and dynamic educational environment, supplemental resources have emerged as essential tools for enhancing student engagement, accommodating diverse learning styles, and ensuring that students with varying abilities receive the necessary support for success. A key advantage of supplemental resources is their provision of extra learning opportunities beyond conventional classroom instruction. These resources may encompass books, articles, online tutorials, videos, practice activities, interactive simulations, and additional materials. Supplemental tools provide targeted practice and explanations to reinforce learning for students need further assistance with hard concepts. Conversely, for advanced learners, these materials offer chances for profound exploration and enrichment, enabling them to expand their knowledge beyond the fundamental curriculum. Behavioural management is a vital component of organised learning environments. Explicit behavioural standards and uniform rule enforcement foster an environment of respect and cooperation. This minimises interruptions and facilitates seamless transitions between tasks, enhancing a more concentrated and effective learning experience. Structured environments integrate positive reinforcement strategies that acknowledge and reward commendable behaviour and academic efforts, thereby motivating students to comply with established norms. Furthermore, these environments promote the cultivation of essential life skills, including time management, self-discipline, and personal responsibility. Through the adherence to routines and fulfillment of expectations, students acquire the ability to manage workloads, establish objectives, and confront challenges—skills vital for success beyond the academic environment. Organized educational settings are crucial for establishing the conditions that facilitate effective instruction and learning. By establishing clear expectations, consistent routines, structured curricula, and significant assessments, these environments furnish kids with the stability and direction essential for their success. Structured learning, whether in conventional

classrooms or digital platforms, enhances student engagement, fosters key skill development, and facilitates academic achievement.

Figure: 02



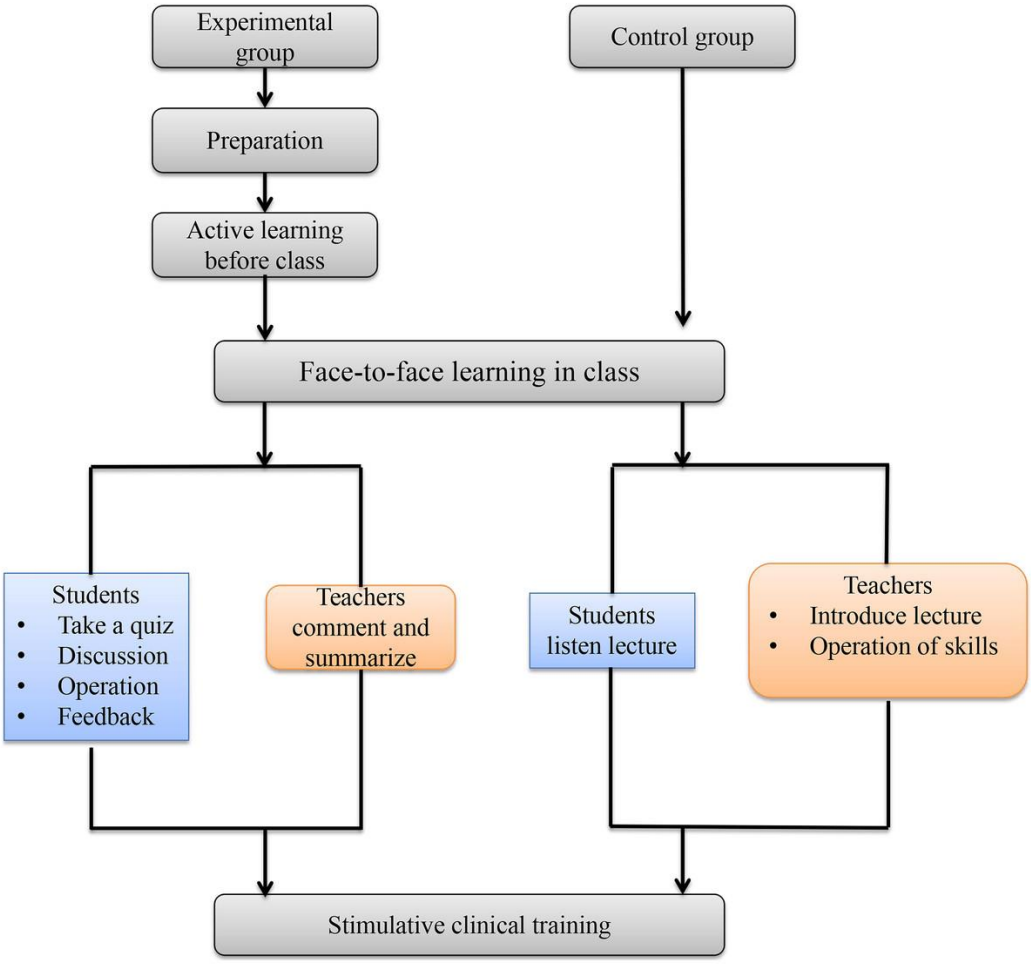
Source: Davis, F.D., Bagozzi, R.P. & Warshaw, P.R., 1989, 'User acceptance of computer technology: A comparison of two theoretical models', *Management Science* 35(8), 982–1003. http://dx.doi.org/10.1287/mnsc.35.8.982

FIGURE 1: Technology Acceptance Model.

Differentiation is a primary rationale for instructors utilizing extra resources. Each student possesses a distinct learning style, and some may have difficulties with conventional instructional approaches. Supplemental materials enable educators to customize instruction by offering alternative explanations or supplementary practice according to the specific requirements of particular pupils. Visual learners may find info graphics and films advantageous, whereas auditory learners could like podcasts or lectures. Learners may participate in interactive simulations or tasks necessitating physical manipulation. Supplemental materials accommodate various learning styles, ensuring that all students can comprehend the subject in a manner that aligns with their preferences. Supplemental resources are essential for fostering self-directed learning while accommodating various learning styles. These resources enable students to assume responsibility for their educational experience, facilitating the exploration of topics of interest, the review of challenging concepts, or the practice of skills at their own speed. This sense of ownership can enhance motivation and autonomy, prompting students to cultivate the habits of lifelong learners. In a structured educational setting, educators may designate supplementary materials for homework or independent study, while students are also encouraged to proactively explore and utilise these resources to augment their learning. Supplemental resources, such as case studies, news articles, movies, or guest lecturers from industry professionals, effectively connect theoretical knowledge with practical application. These tools assist students in recognizing the applicability of their learning to real-world contexts, thereby improving their comprehension and recall of topics. For instance, a science class may feature a documentary about contemporary space research, but a management course can employ case studies from successful enterprises to exemplify fundamental ideas. This linkage to real-world circumstances renders learning more captivating and significant. Students requiring additional assistance, including those with learning disabilities or language obstacles, might benefit from supplemental resources that offer essential accommodations and scaffolding. Educators may present adapted or streamlined curriculum, or supply supplementary practice resources aimed at assisting pupils in meeting grade-level standards. In language acquisition, supplementary resources may encompass flashcards, grammar exercises, language applications, or conversation practice tools to facilitate learning. Students with learning difficulties can benefit from resources like audio books, visual organizers, or specialized learning software to deconstruct complex knowledge into manageable segments. Educators can also gain from supplementary resources as they improve instructional efficacy. Educators can utilise these resources to strengthen instruction, present supplementary examples, or furnish additional

exercise for pupils requiring assistance. By selecting high-quality materials, educators can conserve time while ensuring that students get engaging, pertinent content that enhances the core curriculum. Supplemental resources are essential for improving the learning experience by providing extra chances for practice, differentiation, real-world application, and self-directed inquiry. These resources guarantee that students of varying abilities and learning styles receive the necessary support to thrive, while also promoting independence and enhanced engagement with the content. As technology advances, the accessibility and diversity of additional resources will expand, rendering them essential to contemporary education.

Figure: 03



Objectives:

1. To assess the impact of student characteristics (e.g., self-regulation, motivation, digital literacy) on their outcomes in blended learning environments.
2. To identify which student traits most significantly predict success, engagement, and satisfaction in blended learning courses.

3. To provide recommendations for educators on how to tailor blended learning strategies based on student characteristics.

Research Methodology- Sources of data

The primary data were collected through structured questionnaire (google form). Secondary data was collected by referring several books, official records of the organization, visiting websites, magazines, and journals.

Sampling Size/Design - For the purpose of achieving the objectives of the study, the present study selects 200 respondents through random sample technique.

Analysis and Results

Factor Analysis

The digital era has transformed the availability and accessibility of supplementary resources. The advent of internet platforms has granted students access to a wide range of educational tools and content from any location, at any time. Digital sites like Khan Academy, Coursera, and YouTube Education provide complimentary tutorials, courses, and exercises across various disciplines. These digital resources are particularly beneficial in blended or online learning contexts, where students may require further assistance to thrive in a less organized or self-directed environment. Moreover, educational applications and software offer interactive methods for students to connect with material, frequently enhancing the learning experience to render it more interesting and accessible. Integrating real-world applications is a crucial element of auxiliary materials. The respondents using a 5-point Likert scale to measure their difficulties. Here is the outcome.

Table 1: KMO and Bartlett's Test

Measure of Sampling Adequacy.		0.877
Bartlett's Test	Approx. Chi-Square	806.452
	difference	68
	Sig.	0.000

The table above indicates that the outcome of the (KMO test) is statistically significant, with a value of 0.877. The Bartlett's Test of Sphericity yields a significant result, as the estimated Chi-Square value (806.452 for the difference – 68) exceeds the predicted value. The statistical significance is seen at a 1% level with a p-value of 0.000. Therefore, the data's dependability is highly regarded and used for factor analysis.

Table 2: Communalities

	Factors	Initial	Extraction
1.	Familiarity	1.000	.778
2.	Instructional Design	1.000	.753
3.	Student Engagement	1.000	.969
4.	Technological Accessibility	1.000	.724
5.	Pedagogical Approaches	1.000	.806
6.	Motivation	1.000	.966
7.	Self-Regulation	1.000	.847
8.	Time Management Skills	1.000	.769

9.	Academic Background	1.000	.792
10.	Cognitive	1.000	.745
11.	Prior Knowledge	1.000	.961
12.	Non-Cognitive Skills	1.000	.954
Extraction Method: PCA			

The Principal Component Analysis indicates that the extraction values for all the statements pertaining to the difficulties exceed 0.700. The range fluctuates between 0.724 and 0.969. Therefore, ultimately, all 12 statements are being analyzed. The proportion of the variation that is accounted the variables in the model.

Table 3: Total Variance Explained

Constructs	**Eigen values**			**Loadings (E)**			**Rotation Sums of Loadings**		
	Total	% (Variance)	Cum %	Total	% (Variance)	Cum %	Total	% (Variance)	Cum %
1	6.381	53.178	53.178	6.381	53.178	53.178	3.597	29.976	29.976
2	1.327	11.059	64.236	1.327	11.059	64.236	2.710	22.580	52.556
3	.899	7.495	71.731	.899	7.495	71.731	1.919	15.991	68.547
4	.734	6.117	77.848	.734	6.117	77.848	1.116	9.301	77.848
5	.607	5.062	82.911						
6	.457	3.804	86.715						
7	.397	3.304	90.019						
8	.332	2.764	92.783						
9	.283	2.360	95.142						
10	.272	2.267	97.409						
11	.177	1.474	98.883						
12	.134	1.117	100.000						

The 12 assertions are divided into 4 components, which account for 77.85% of the total variance, exceeding the threshold of 70%. All four components have Eigen values more than 1, whereas the values of the other components are less than 1. The first component of the model accounts for 53.17% of the explanation, the second component for 11.05%, the third component for 7.49%, and the final component for 6.11%. The model has a cumulative total variance extraction of 77.84%. The table below displays the component matrix after rotation. In blended learning, students' academic backgrounds may affect how comfortable they are with the self-directed and technology-driven nature of the learning environment. Students who are accustomed to traditional, lecture-based instruction may find it challenging to adapt to the autonomy and flexibility of blended learning. In contrast, students with prior experience in online or hybrid learning may feel more comfortable navigating digital platforms and engaging with online content. Instructors can support students by offering guidance on how to succeed in blended learning environments, such as strategies for independent learning and time management. Providing clear expectations for both online and face-to-face components can help students from diverse academic backgrounds adjust more effectively.

Table 4: Rotated Component Matrix

Sl.No	Factors	Component			
		1	2	3	4
1.	Technological Accessibility	0.832			
2.	Instructional Design	0.825			
3.	Student Engagement	0.770			
4.	Familiarity	0.678			
5.	Pedagogical Approaches	0.526			
6.	Motivation		0.814		
7.	Self-Regulation		0.811		
8.	Time Management Skills		0.807		
9.	Prior Knowledge			0.857	
10.	Academic Background			0.828	
11.	Cognitive				0.872
12.	Non-Cognitive Skills				0.555

The table above displays the rotated component matrix, which indicates that 12 issue statements have been categorized into four components based on their distinctiveness. Technological Accessibility, Instructional Design, Student Engagement, Familiarity and Pedagogical Approaches are grouped together followed by Motivation, Self-Regulation and Time Management Skills as second group, Prior Knowledge and Academic Background as third and last Cognitive and Non-Cognitive Skills. Pre-existing knowledge and educational background are critical determinants of student achievement in blended learning settings. Prior knowledge denotes the comprehension and information a student already holds regarding a subject prior to commencing a new course. A student's academic background encompasses their prior educational experiences, accomplishments, and fields of study. Both factors are essential in influencing how students assimilate, process, and utilize new information in a mixed learning environment. Students commence blended learning courses with differing degrees of prior knowledge, which can substantially influence their engagement with the course content. Students possessing a robust foundation in a subject may find it easier to comprehend new concepts and go through the course more effectively. In contrast, students with little prior knowledge may find it challenging to maintain the required pace, necessitating supplementary support or resources to comprehend the content thoroughly. Educators can mitigate these disparities by administering diagnostic exams at the commencement of a course to evaluate students' prior knowledge. This assists in identifying students who may require more resources, such as tutorials, foundational reading, or supplementary tasks, to address knowledge deficiencies. Customizing learning trajectories via differentiated instruction or adaptive learning technology can guarantee that all students, irrespective of their past knowledge, can interact meaningfully with the course material. Furthermore, eliciting existing knowledge prior to the introduction of new concepts can enhance understanding. Methods such as previewing subjects, linking new information to established knowledge, or employing analogies pertinent to students' real-life experiences enhance the relatability and comprehensibility of new content. A student's academic history, encompassing the subjects studied, performance in prior courses, and adaptability to various learning environments, can significantly impact their success in blended learning. Students from diverse academic fields may examine the same topic from distinct viewpoints and using different problem-solving methodologies. A student with a scientific background may approach a statistics course differently from a student with a humanities background. Ultimately, comprehending and addressing the diverse degrees of prior knowledge and academic backgrounds helps facilitate a more inclusive and effective blended learning experience. By differentiating instruction and offering necessary support, educators may guarantee that all students, irrespective of their initial level, can realize their academic potential.

Discussions

In a blended learning environment, instructional design must consider the equilibrium between digital and face-to-face training, ensuring that online elements enhance and support classroom learning. This entails meticulous organisation of

the order and tempo of educational activities, the use of multimedia resources (e.g., movies, simulations, interactive exercises), and the integration of active learning methodologies such as conversations, collaborative projects, and problem-solving tasks. Effective instructional design emphasises flexibility and adaptability, enabling students to engage with content at their own speed while promoting meaningful interactions with classmates and instructors. The use of formative assessments, feedback systems, and individualised learning trajectories can augment the educational experience by offering students continuous assistance and avenues for reflection. Furthermore, instructional design in blended learning must emphasise accessibility and inclusivity, guaranteeing that course contents are accessible to all students, irrespective of their technological proficiency, devices, or learning preferences. This may entail providing various content forms, employing universal design principles, and addressing unique student needs during course planning. Ultimately, meticulous instructional design is crucial for optimising blended learning, fostering a unified and engaging educational experience that enhances student achievement. Student participation is a critical determinant of the efficacy of blended learning. It denotes the extent of students' active engagement and commitment to their learning process. Engagement in blended learning manifests in various dimensions—cognitive, emotional, and behavioral. Cognitive engagement pertains to the manner in which pupils assimilate information, employ critical thinking, and resolve difficulties. Emotional involvement signifies students' interest, motivation, and favourable attitudes towards learning. Behavioral engagement encompasses active involvement in educational activities, whether online or in-person, including attending lectures, fulfilling assignments, and communicating with classmates. In mixed learning contexts, sustaining elevated engagement necessitates meticulously designed techniques that integrate both in-person interactions and digital resources. Interactive instruments, like quizzes, forums, and collaborative activities, together with tailored learning experiences, are essential for maintaining student engagement. Instructors must deliver prompt feedback and cultivate a collaborative environment that promotes communication and peer learning to maintain student engagement throughout the course. Instructional design is a pivotal element that influences the efficacy of mixed learning environments. It pertains to the methodical creation of educational experiences that seamlessly combine online and in-person components to improve learning outcomes. An well organised instructional design offers a lucid, integrated framework that connects course objectives, resources, assessments, and activities to enhance student engagement and content understanding.

Conclusion

The 12 assertions are divided into 4 components, which account for 77.85% of the total variance, exceeding the threshold of 70%. The model has a cumulative total variance extraction of 77.84%. A student's technological proficiency significantly influences their effectiveness in a blended learning setting. Students adept with digital tools and platforms typically traverse the course more effectively, engage more actively, and finish assignments with greater ease. Students deficient in technology abilities may struggle to interact with online elements, like accessing resources, submitting assignments, or engaging in discussions. The technology divide may result in irritation and disengagement, ultimately impacting academic achievement. To address these problems, teachers may offer orientation sessions or tutorials to acclimatize students to the tools and platforms utilized during the course. Moreover, creating user-friendly and intuitive online interfaces helps bolster student confidence and promote more continuous engagement. Pedagogical strategies in blended learning must adjust to the multiple characteristics of the setting, integrating the advantages of both conventional face-to-face instruction and digital learning. Effective pedagogical strategies encompass the use of active learning approaches, customized instruction, and collaborative learning, aimed at enhancing comprehension and retention of knowledge. Active learning, encompassing student engagement in debates, case studies, problem-solving, and project-based learning, is especially vital in blended learning environments. This method can be effectively utilised in both online and offline environments, enabling students to interact with content and apply their knowledge in significant ways. Moreover, differentiated instruction, which customizes teaching strategies to meet individual student requirements, can be effectively integrated into blended learning settings via adaptive learning technologies. These technologies modify content or pace according on student performance, delivering personalized learning experiences that accommodate various learning styles. Collaborative learning, typically enabled through group work and peer interaction, is a crucial pedagogical strategy in blended learning. Online forums, collaborative papers, and virtual breakout rooms facilitate student collaboration, idea sharing, and social connection despite physical absence from the classroom. These interactions facilitate information acquisition and promote social-emotional development. Effective blended learning

necessitates a synthesis of robust student involvement, sufficient technological proficiency, and deliberate pedagogical strategies that leverage the adaptability of online education alongside the human interactions inherent in in-person teaching.

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