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AN EMPIRICAL ANALYSIS OF CORRELATION BETWEEN STUDENT DEMOGRAPHICS, LEARNING OUTCOMES, AND BLENDED LEARNING

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Abstract

Blended learning, which integrates traditional face-to-face instruction with online learning, has gained popularity as an educational model. The study examined the relationship between pupil characteristics and learning outcomes and investigated the effectiveness of blended learning. The article endeavors to identify important factors that influence academic sccess in this learning environment by analyzing data from a diverse cohort of students enrolled in integrated learning courses. Education systems worldwide are progressively transitioning to e-learning paradigms as the digital age continues to advance. Additionally, the development of policies and practices that facilitate the effective implementation of blended learning can be informed by this knowledge, thereby improving educational equity and effectiveness. It is imperative to address these issues in order to optimize the potential of integrated

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learning and guarantee that all students have the chance to flourish in this innovative educational model. Furthermore, the investigation underscores the significance of instructional design and support mechanisms in optimizing the advantages of integrated learning. The implications of these discoveries for educators and policymakers are examined, offering a perspective on how blended learning can be optimised to meet the diverse requirements of students and improve the overall effectiveness of education.

Keywords: *Blended learning, Student characteristics, Learning outcomes, Self-regulation, Prior knowledge, Technological proficiency, Instructional design, Educational effectiveness and Student diversity*

Introduction

Despite its growing popularity and the theoretical benefits associated with blended learning, there remains a significant gap in understanding how individual student characteristics influence the effectiveness of this educational approach. This gap in understanding poses a challenge for educators and policymakers striving to optimize blended learning environments to achieve the best possible educational outcomes. One primary issue is that student characteristics such as self-regulation, motivation, prior knowledge, and technological proficiency vary widely among learners. Students with high self-regulation are often better equipped to handle the autonomy required in online learning environments. Conversely, students who struggle with self-regulation may find it difficult to stay on track without the immediate structure provided by face-to-face instruction. This variability can lead to significant disparities in learning outcomes, even within the same blended learning course. Intrinsically motivated students, who engage in learning for personal satisfaction and a genuine interest in the subject, are more likely to thrive in a blended learning setting. They tend to be more proactive in seeking out resources and engaging with online materials. Prior knowledge and academic preparedness also play significant roles in determining how students adapt to and benefit from blended learning. Students with a strong foundation in the subject matter may find it easier to navigate online content and make connections with face-to-face instruction. Technological proficiency is another essential characteristic that can impact a student's success in blended learning environments. Students who are comfortable and skilled in using digital tools and platforms are likely to experience fewer technical barriers, allowing them to focus more on the learning content. Policies and practices that promote educational equity in blended learning environments are essential to ensure that all students, regardless of their characteristics, can benefit from this instructional approach. One crucial policy is ensuring **equal access to technology and the internet**. Providing devices and reliable internet access to students from disadvantaged backgrounds helps bridge the digital divide. Additionally, **inclusive curriculum design** is vital, incorporating diverse perspectives and culturally relevant materials to resonate with all students. **Professional development for educators** is another key practice, equipping teachers with the skills and knowledge to create and deliver inclusive, effective blended learning experiences. This includes training on culturally responsive teaching, differentiating instruction, and using technology to support diverse learners. **Ongoing support for students** is also crucial, including academic tutoring, counseling services, and technical support, ensuring that all students can navigate the blended learning environment

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successfully. **Flexible learning schedules and pacing** policies allow students to progress at their own pace, accommodating those with varying needs and life circumstances. Additionally, **continuous assessment and feedback mechanisms** help identify and address learning gaps promptly, providing targeted interventions and support. **Family and community engagement** practices also promote educational equity, ensuring that families are informed and involved in their children's education.

Previous related literature

Blended learning environments often foster deeper engagement with course materials, provide opportunities for active learning through online interactions and discussions, and support personalized learning experiences. Furthermore, the review highlights the role of technological integration in enhancing the effectiveness of blended learning. Smyth and Zahradnik (2021) synthesize existing research to provide a comprehensive overview of how blended learning influences various aspects of student achievement and engagement. The article begins their systematic review by outlining their methodology, which involved systematically searching and synthesizing empirical studies. They identify and analyze key findings across a range of studies, focusing on metrics such as academic achievement, student satisfaction, engagement, and retention rates. Many studies reviewed by Smyth and Zahradnik reported improvements in student learning outcomes when compared to traditional face-to-face instruction alone. Digital tools and platforms used in blended courses facilitate access to a wealth of resources, enable collaborative learning experiences, and provide immediate feedback to students. These technological features contribute to a more interactive and dynamic learning environment that encourages student participation and deeper comprehension of course content. In terms of student engagement and satisfaction

Moving towards the E-Learning Paradigm

The digital transformation of education has accelerated the adoption of e-learning paradigms, fundamentally reshaping the landscape of teaching and learning. As educational institutions worldwide embrace digital platforms, the potential benefits of e-learning become increasingly evident, alongside the challenges that must be addressed to maximize its effectiveness. The availability of a vast array of resources on digital platforms enhances the learning experience further. E-learning environments can integrate multimedia content, interactive simulations, and extensive online libraries, supporting diverse learning modalities and making education more engaging and comprehensive. These resources allow for a richer educational experience, where students can explore topics in depth and at their own pace. Moreover, e-learning platforms often incorporate interactive elements such as discussion forums, quizzes, and collaborative projects, which can increase student engagement and facilitate active learning. Support mechanisms are equally crucial. **Instructor presence** in both online and face-to-face components fosters a sense of community and provides essential guidance and feedback. **Peer interaction** is another vital support mechanism, as it enhances learning through discussion, collaboration, and shared experiences. Additionally, **scaffolding**—providing support structures that gradually shift responsibility to the learner—helps students develop independent learning skills. **Access to resources** is a fundamental support mechanism. This includes not only access to digital tools and

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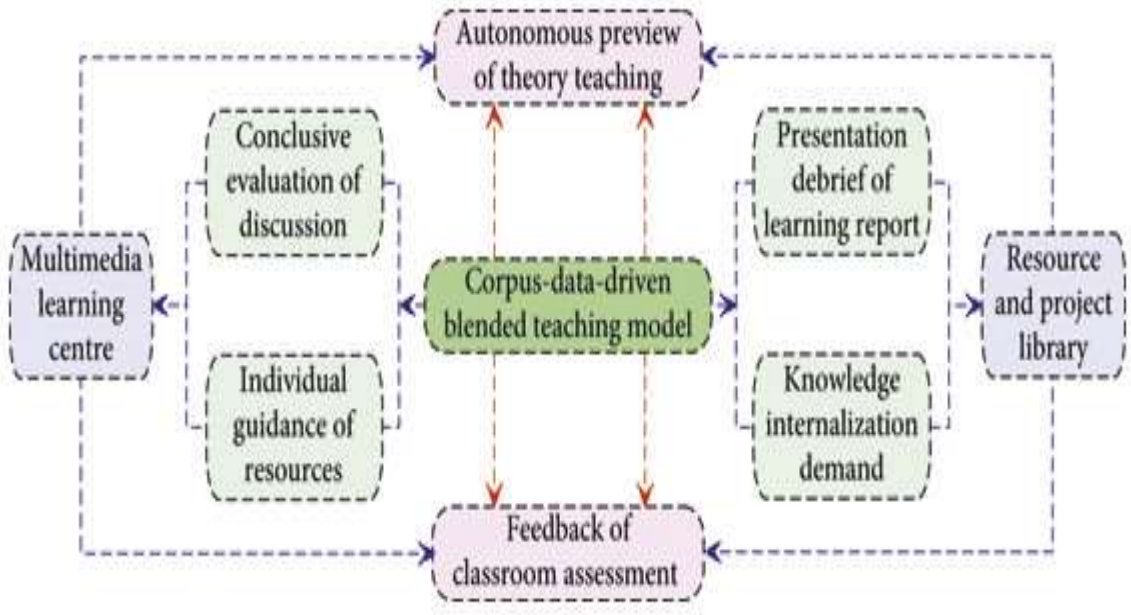
http://magellanes.com/

learning materials but also technical support to navigate online platforms effectively. **Timely and constructive feedback** from instructors further supports student learning by helping them understand their progress and areas for improvement. The integration of these instructional design elements and support mechanisms creates a balanced and effective blended learning environment. This approach not only enhances student engagement and motivation but also leads to improved learning outcomes by addressing diverse learner needs and promoting active, personalized, and supported learning experiences.

Chart: 01

Blended learning teaching Model



Research background

Scalability is another key benefit of e-learning. Digital platforms can easily accommodate large numbers of students without the physical limitations of traditional classrooms. This scalability makes it possible to offer high-quality education to a broader audience, supporting lifelong learning and professional development on a global scale. Despite its many advantages, the transition to e-learning also presents several challenges. One of the most significant is the digital divide. Access to technology and reliable internet connectivity remains a barrier for many students, particularly those from low-income families or in rural areas. Ensuring equitable access to e-learning opportunities is crucial for preventing further educational disparities. Educational institutions and policymakers must work together to provide the necessary infrastructure and support to bridge this gap. Educators must develop strategies to support students in developing these skills and to keep them motivated throughout their learning journey. In

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conclusion, moving towards the e-learning paradigm offers immense potential to transform education, making it more flexible, accessible, and personalized. However, addressing the challenges associated with this transition is essential to ensure that all students can benefit from the opportunities that e-learning provides.

Blended Learning: Transformative Potential in Higher Education

One of the most significant advantages of blended learning is its ability to provide a flexible learning environment that caters to diverse student needs. These tools not only make learning more engaging but also promote critical thinking and problem-solving skills. In-person sessions, on the other hand, provide opportunities for immediate feedback, hands-on activities, and personalized instruction. Furthermore, blended learning supports personalized education by leveraging data analytics and adaptive learning technologies. These tools can track student performance and learning patterns, providing insights that educators can use to tailor instruction to individual needs. Additionally, it encourages students to take an active role in their learning process, promoting self-regulation and autonomy. The scalability of blended learning is another key factor contributing to its transformative potential. Digital platforms can accommodate large numbers of students without the physical constraints of traditional classrooms. This scalability is particularly advantageous for higher education institutions looking to expand their reach and offer courses to a broader audience, including international students. It also supports lifelong learning and professional development, making education more accessible to people at different stages of their careers. Blended learning also fosters a collaborative and inclusive learning environment. Garrison & Kanuka (2004).

Chart: 02

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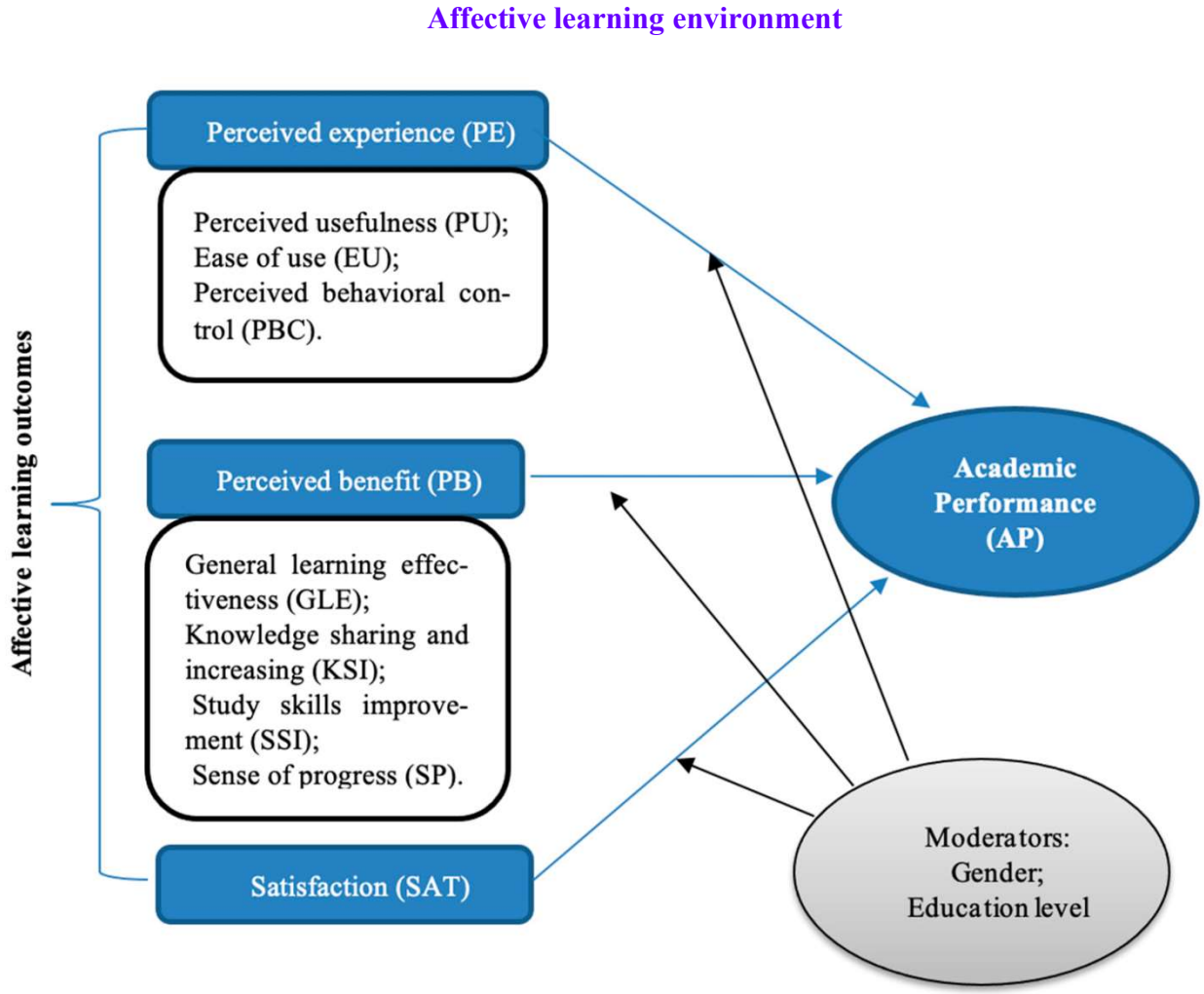

Key challenges of blended learning

The integration of technology presents another significant challenge. Educators must choose and integrate appropriate digital tools and platforms that support learning objectives and facilitate seamless transitions between online and face-to-face components. This includes providing technical support to students and instructors to ensure they can effectively navigate and utilize the technology. Maintaining learner engagement is critical in blended learning environments. Educators need strategies to sustain student motivation and participation across both online and face-to-face activities. Boelens et al.(2020) begin by defining blended learning as an educational approach that combines traditional classroom methods with online learning activities, aiming to leverage the strengths of both modalities. They emphasize the growing prevalence of blended learning in educational contexts worldwide to enhance student engagement, flexibility. One of the fundamental challenges identified is the pedagogical design of blended learning courses. This involves aligning learning objectives with instructional strategies, selecting appropriate technologies, and ensuring that online activities complement and enhance in-person interactions. This may involve incorporating interactive elements, fostering collaborative learning experiences, and providing timely feedback to enhance student motivation and commitment to

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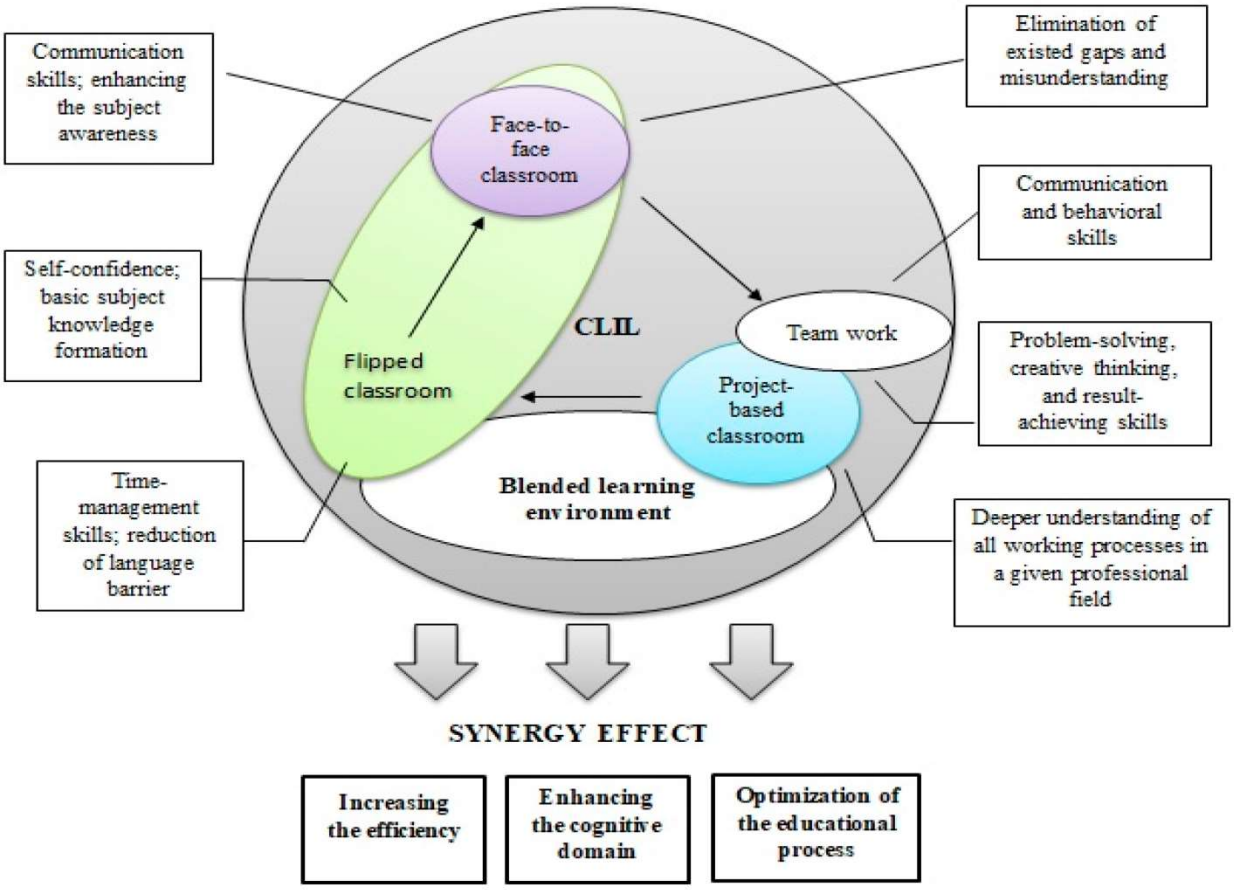
learning. Throughout their analysis, Boelens, De Wever, and Voet underscore the importance of addressing these challenges through systematic planning, collaboration among educators and instructional designers, and ongoing evaluation and adaptation of blended learning strategies. They emphasize the need for professional development opportunities for educators to enhance their pedagogical and technological competencies in blended learning contexts.

Chart: 03

Blended learning environment



Research Objectives

1. To investigate how self-regulation skills impact student success in blended learning environments and identify strategies to support students with varying levels of self-regulation.
2. To explore the role of intrinsic and extrinsic motivation in blended learning and determine how these motivational factors affect student engagement and achievement.
3. To assess how students' prior knowledge and academic preparedness influence their ability to adapt to and succeed in blended learning courses.

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4. To examine the relationship between students' technological proficiency and their performance in blended learning, identifying potential barriers and supports needed.
5. To identify effective instructional design elements and support mechanisms that enhance learning outcomes in blended learning environments.
6. To propose policies and practices that promote educational equity by ensuring all students, regardless of their characteristics, can benefit from blended learning.
7. To provide actionable insights and recommendations for educators and policymakers to optimize blended learning environments for improved student outcomes.

Analysis, findings and Results

A blended learning environment combines traditional face-to-face classroom instruction with online educational resources and activities. This approach leverages the strengths of both in-person and digital learning to create a more flexible and personalized educational experience for students. In a blended learning environment, students typically attend physical classes where they engage in direct interactions with teachers and peers, while also accessing online platforms for assignments, discussions, and supplementary materials. This model allows for a more dynamic and interactive learning experience, catering to different learning styles and paces. By integrating technology into the curriculum, blended learning enhances student engagement, fosters self-directed learning, and provides opportunities for real-time feedback and collaboration.

Table 1

Factors Influencing significant predictors of the efficacy of blended learning

Factors	Mean	Std. Deviation	Mean Rank
Instructional Design	2.21	0.953	2.85
Learning Environment and Support	3.78	1.651	4.18
Motivation	3.52	0.587	3.11
Prior Knowledge and Academic Preparedness	2.84	1.262	3.91
Self-Regulation	3.63	0.624	4.10
Technological Proficiency	2.80	1.731	3.66

The above table shows that **learning environment and support (4.18)** plays important role in the blended learning. **Self-Regulation (4.10)** and p**rior knowledge and academic preparedness (3.91)**

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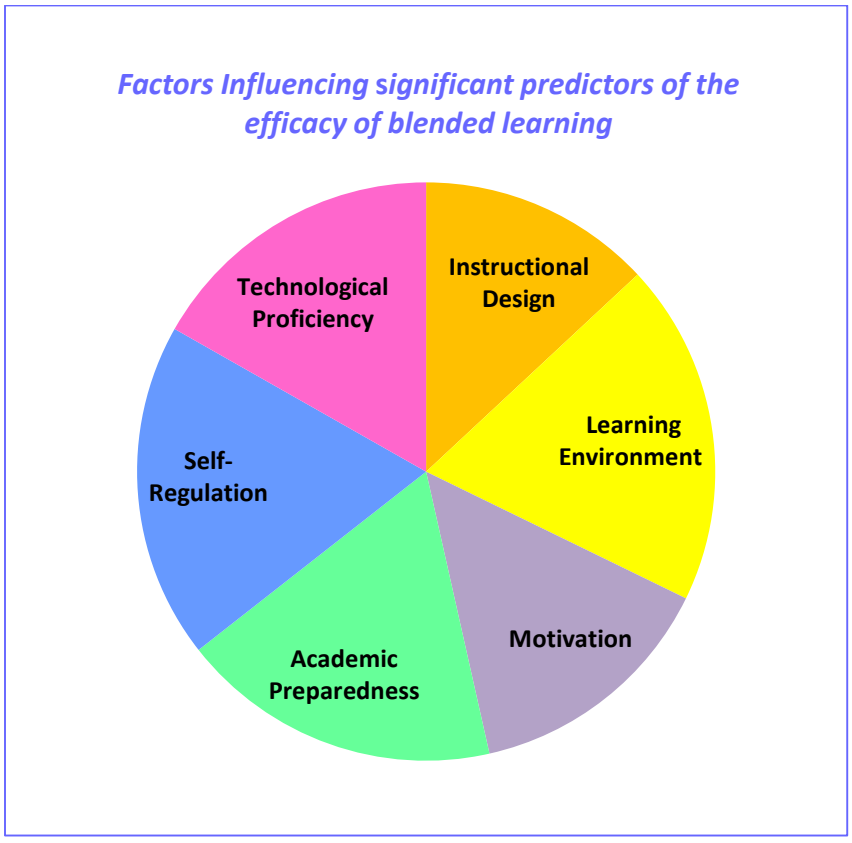
are other factors. **Student Self-Regulation**: Self-regulation is a critical predictor of success in hybrid learning environments. Students with strong self-regulation skills are typically more successful in hybrid learning because they can effectively manage the demands of both online and face-to-face components. **Technological Proficiency**: Technological proficiency encompasses a student's ability to use digital tools and platforms effectively. In a hybrid learning environment, technological skills are essential for navigating online learning management systems, participating in virtual discussions, accessing digital resources, and submitting assignments. Conversely, those with limited technological skills may face significant barriers that hinder their learning experience. Providing adequate technical support and training can help bridge this gap and enhance the effectiveness of hybrid learning for all students. **Motivation**: Motivation can be intrinsic, driven by personal interest and satisfaction, or extrinsic, driven by external rewards such as grades or approval from others. Intrinsically motivated students tend to perform better in hybrid learning settings because they are more likely to engage deeply with the material and persist through challenges.

Figure: 01



Extrinsically motivated students can also succeed, but they may require more structured support and frequent feedback to maintain their engagement and effort. Understanding and addressing the motivational needs of students can help educators design more effective hybrid learning experiences. **Prior Knowledge and Academic Preparedness**: Prior knowledge refers to the information and skills that students already possess before starting a course, while academic preparedness is a broader measure of a student's readiness for the demands of higher education. Students with a strong foundation in the

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subject matter are better equipped to navigate the course content and integrate new information with what they already know. Conversely, students with gaps in their prior knowledge may struggle to keep up, particularly with the self-directed aspects of online learning. **Instructional Design**: The design of the hybrid course itself is another significant predictor of its effectiveness. Well-designed hybrid courses seamlessly integrate online and face-to-face components, ensuring that each mode of instruction complements and reinforces the other. Effective instructional design includes clear learning objectives, engaging and interactive online content, regular feedback, and opportunities for meaningful interaction between students and instructors. **Learning Environment and Support**: The overall learning environment and the support provided to students also play a critical role in the success of hybrid learning. This includes the physical and digital infrastructure, availability of resources, and access to academic and technical support. This support helps students overcome challenges and stay engaged with the course, leading to better academic performance and satisfaction. The significance in the ranks between the factors is measured with the help of Friedman test.

Table 2

Friedman test

No. of. respondents	200
Chi-Square	261.300
difference	5
Asymp. Sig.	0.000

The result shows that calculated Chi-Square value (261.300) is significant at 1% level for the degree of freedom 5. It is concluded that the **learning environment and support, self-regulation** and p**rior knowledge and academic preparedness** are the major factors influence the blended learning. The opinion of the respondents towards the factors may differ based on the demographic nature.

Gender

The gender of the respondents is an important criterion to change the perception towards blended learning. In this context, the satisfaction is measured with the help of hypothesis testing.

Table 3

Gender and impact

Gender	N	Mean	Std. Deviation	Z	Sig.
Male	120	12.5006	3.52460	0.587	0.412
Female	80	12.4127	2.15742		
Total	200	12.5214	3.24570		

The result from the above table reveals that the satisfaction of the female respondents (12.4127) is more than male respondents (12.5006). The result of the One Way Anova revealed that the F value (0.587) is less than the (CV). Hence, the framed hypothesis is accepted. It is concluded that the impact of the respondents does not vary according to their gender. Effective instructional design elements and support mechanisms are critical to enhancing learning outcomes in blended learning environments. First, clear learning objectives are foundational, as they guide both the instruction and students' focus, ensuring that

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all activities align with the desired outcomes. Active learning strategies, such as discussions, problem-solving tasks, and collaborative projects, promote deeper understanding and retention by encouraging students to apply what they have learned in practical contexts.

Discussion and Implications of online learning in higher education

Central to their analysis is the exploration of the key characteristics that define effective online learning environments. They emphasize the rapid growth of online learning programs across universities worldwide, driven by advancements in technology and the increasing demand for flexible, accessible education. Soffer and Nachmias (2020) provided an international perspective on the characteristics and implications of online learning in higher education. Their study explores how online learning has evolved globally, examining its impact on educational practices, student engagement, and institutional strategies. The article highlighted the importance of instructional design, technological infrastructure, and support mechanisms in shaping the quality and effectiveness of online courses. The article also addresses the implications of online learning for higher education institutions and stakeholders. The study examined how online education challenges traditional notions of teaching and learning, requiring educators to adapt pedagogical approaches and leverage digital tools effectively. They discuss the role of institutional policies, faculty development programs, and student support services in fostering a conducive online learning environment. They discuss variations in regulatory frameworks, cultural attitudes towards online education, and technological readiness among institutions, emphasizing the need for adaptable strategies that accommodate diverse educational contexts. The study contributed to understanding the characteristics and implications of online learning in higher education from an international perspective

Conclusion

The study provide insights into the global landscape of online learning, highlighting trends, challenges, and best practices observed across different regions. Ensuring **data privacy and security** is also essential, protecting students' personal information in the digital learning environment. By implementing these recommendations, educators and policymakers can create optimized blended learning environments that support improved student outcomes, ensuring equitable, engaging, and effective education for all learners. Central to their analysis is the exploration of emerging technologies that support and enhance blended learning environments. These technologies enable personalized learning pathways, immersive simulations, and real-time analytics that inform instructional decision-making and improve learning outcomes. Online components can facilitate collaboration across geographical boundaries, allowing students to work together on projects and share perspectives from diverse cultural backgrounds. This global interaction enriches the learning experience and prepares students for the interconnected world they will encounter in their professional lives. However, realizing the full potential of blended learning in higher education requires careful planning and implementation. To optimize blended learning environments for improved student outcomes, educators and policymakers should focus on several key recommendations. First, **invest in robust infrastructure** to ensure all students have access to necessary technology and reliable internet, thus bridging the digital

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divide. **Professional development for educators** is essential, providing ongoing training in digital tools, instructional strategies, and inclusive practices to effectively support diverse learners. Implementing **Universal Design for Learning (UDL)** principles can cater to various learning styles and needs, promoting accessibility and engagement. Policymakers should establish **clear guidelines and standards** for blended learning, ensuring consistency and quality across educational institutions. **Curriculum flexibility** is vital, allowing educators to tailor content and pacing to individual student needs, which fosters personalized learning experiences. Additionally, integrating **formative and summative assessments** helps track student progress, providing data to inform instruction and identify areas needing intervention. **Student support services** should be enhanced, including academic tutoring, mental health counseling, and technical support, ensuring comprehensive support for all aspects of student well-being and learning. Encouraging **family and community engagement** is also crucial, fostering a supportive learning environment beyond the classroom. Moreover, promoting **collaborative learning opportunities** through group projects and discussions can enhance peer interaction and deepen understanding. It supports diverse student needs, enhances engagement, and fosters a collaborative learning environment. By effectively integrating digital and in-person instruction, higher education institutions can unlock the full benefits of blended learning, preparing students for success in a rapidly changing world.

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