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The Role of Blended (Hybrid) Learning in Developing the Educational Process in Preparatory and Secondary Schools

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Abstract:

This research paper will analyze how blended (hybrid) learning can help improve the learning process both in the preparatory level and secondary level. Blended learning provides a flexible and student-centered model by incorporating traditional in-person classroom training and digital education tools and web-based platforms. This paper gives a detailed discussion of the theoretical basis, practical advantages and challenges faced by the field such as the limitations of the network infrastructure, recreational distractions of tablets (playing games) and the socioeconomic limitations of the household. The study can be used to provide practical solutions to guarantee equal digital access, the moral use of technology, and improved student performance because of a descriptive-analytical approach.

Keyword: *Blended Learning, Hybrid Education, Secondary Schools, Digital Divide, Educational Technology, AI-Assisted Research.*

Introduction

In the recent decades, there has been a radical change in the structure of contemporary educational system due to the rapid development of technologies and due to the global digital revolution in communication. These transformations have forced teachers and policy makers to radically review the old paradigms of pedagogy which were based on the strict teacher-centred paradigms and shift to flexible and dynamic frameworks that support 21 st century competencies [1]. Conventional classrooms that only depend on rote learning and the ability to access passive information are no longer adequate to meet the emerging cognitive demands of students in the digital age, or to prepare them to join a more and more digital workforce [2]. In this scenario, blended (or hybrid) learning has appeared to be one of the most promising strategic models, which involves a flawless combination of interpersonal and collaborative benefits of face-to-face teaching with the adaptive possibilities of online learning environments [3].

The blended learning implementation has specific importance to the strategic implementation of the strategy in the preparatory and secondary school setting. The stages are an important turning point in the psychological, cognitive and social development of students as the concrete operational thought processes are replaced by abstract thinking, self-directed curiosity and personal autonomy [4]. The blended learning techniques including students in these developmental stages will help them develop critical thinking, complex problem solving, time management and lifelong learning skills [5]. Contemporary educational textbooks emphasize that incorporation of technology does not simply imply replacing physical textbooks with the use of digital screens; it, instead, involves creating the entire, interactive learning processes that would provide students with fair and adaptable access to scientific knowledge without any temporal or spatial limitations [6].

In principle, the blended learning is premised on the long-standing educational paradigms, which makes it similar to Constructivism, which presupposes the active construction of knowledge by the learner, instead of passively receiving information, and the use of networked digital platforms and networked information nodes of networking, which is the major idea of Constructivism and its major concept of networked learning [7]. Therefore, blended learning creates an active learning experience in which the student becomes the main protagonist of explore, research and creator of knowledge and the teacher becomes more of a facilitator, mentor and the designer of the learning environment [8]. Moreover, the hybrid model provides flexibility to individual learning differences, since it allows one to learn at their own pace as they can go over complicated concepts on numerous occasions, without the strict time constraints of a classroom setting [9].

Empirical studies, which are founded on the classroom activities, have established that blended learning significantly enhances the learning content through interactive multimedia, animated images, virtual laboratories and explanatory instructional videos. These tools increase the academic motivation, enhance the conceptual knowledge and increase the long-term knowledge retention [10]. However, such impressive benefits of education cannot be achieved through the ability to offer technology alone irrespective of these irresistible educational benefits of blended learning. It demands a lot of institutional planning such as the technological infrastructure as well as specialised development of digital curriculum and continuous professional training of teachers [11]. Also, the digital divide and field level issues regarding the implementation are yet to be taken care of in order to prevent how the hybrid learning could end up widening the education gaps [12].

Empirical evidence, ostensibly, in the educational sector of developing and middle-income nations, indicates that there exists a booming disparity between the idealized theoretical model, and the actual classroom reality [13]. Complex socio-economic, technical, and behavioral issues also tend to be presented to the digital education strategies, and they must be explored in an indirect, field-based way [14]. This study, in this way, is a balanced, comprehensive study, of blended learning in preparatory and secondary schools, that both recognizes the changing nature of it, as well as its constraints within frameworks [15].

The blended learning must be viewed as a superstructure of variables where the technological issues are constantly enacted alongside the psychological and social conditions of students so as they come up with a rigorous analytic framework [16]. The current learning demands necessitate flexible operation strategies to allow schools, teachers, students and families to confront digital transformation without sacrificing key principles of learning [17]. It is based on this fact that the present joint research paper written by one of the secondary school students and one of the academic supervisors (uncle), as a two-part collaboration project is a combination of both first-hand experiences in the digital youth culture, and a comprehensive academic research [18], and the need to offer sensible advice to the educational decision-makers, teaching staff, and community stakeholders [19], rendering hybrid learning a genuine catalyst of educational quality and institutional excellence [20].

2. Significance and Objectives of the Research

2.1 Significance of the Study

Dual-Generational Perspective: Is a distinctive form of collaboration between the first-person and lived experience of a secondary school student (the target population) and the analytical rigor and mentorship of an academic scholar (uncle).

Grounding in Field Realities: It offers a grounded analysis that sheds light on the real economic, behavioral and technical challenges concerning the implementation of blended learning in both the public and the private schools.

Contribution to Educational Literature: Adds value to the modern body of literature in pedagogy by filling the gap between theoretical abstractions of hybrid learning and the practical, field-specific practices of building educational settings.

2.2 Objectives of the Research

- **Objective 1:** To explore the fact of applying blended (hybrid) learning in preparatory and secondary school.
- **Objective 2:** To determine the success of hybrid learning in enhancing academic achievement and self-directed learning.
- **Objective 3:** Diagnose and examine significant structural obstacles such as a lack of network infrastructure, family economic challenges, and distractions (playing on a tablet).
- **Objective 4:** To recommend viable measures and realistic solutions to attain equitable, effective and ethically viable digital education.

3. Research Problem and Delimitations

The essential issue of the study is that there is a huge gap between the ministerial directives on blended learning that are promoted on the top-down and the intricate reality on the ground. Lack of sufficient technological infrastructure, a strong household financial limitation that does not allow them to own any device, and a general trend of utilizing smart devices to play games and have entertainment are frequent problems in schools. As a result, blended learning is usually reduced to an additional financial and psychological burden on families instead of a driving force to improve education.

3.1 Direct and Expanded Delimitations

- **Thematic Scope:** Thematic Scope: Narrows in to measuring the results of blended learning, the adoption of technology and the implementation issues related to it.
- **Geographic Scope:** The study was carried out in a number of public and private preparatory and secondary schools of choice.
- **Temporal Scope:** Academic year 2025 / 2026.
- **Human Scope:** A sample of secondary and preparatory school students, their teachers and parents.

3.2 Structural and Field Constraints

- **Deficit in Network Infrastructure and Connectivity:** Ranking among the most school districts, a lack of network infrastructure and connectivity is acute and prevents a sustained access to online learning material.
- **Recreational Tablet Culture:** Gaming Distractions: The most frequent lack of digital literacy and parental control due to the promotion of tablets as more of an entertainment console (online gaming, social media), which in turn causes students to experience cognitive overload, divisions of attention, and procrastination in school.
- **Socioeconomic Hardship & Access to Devices:** To access high-specification tablets or computers to support all school-aged children, absence of financial means to obtain do so among a significant share of low-income families, as well as excessive financial burden of having to pay monthly to access internet access, leading to the digital divide.

4. Research Methodology

The research type that is proposed is the descriptive-analytical one [9] that presupposes extensive literature review and quantitative and qualitative data gathered in the form of field survey scheduled with the students, teachers, and parents. Germination of generative AI tools (Gemini) was selectively integrated into the first data sorting, literature survey and 1 draft working with a stringent academic oversight.

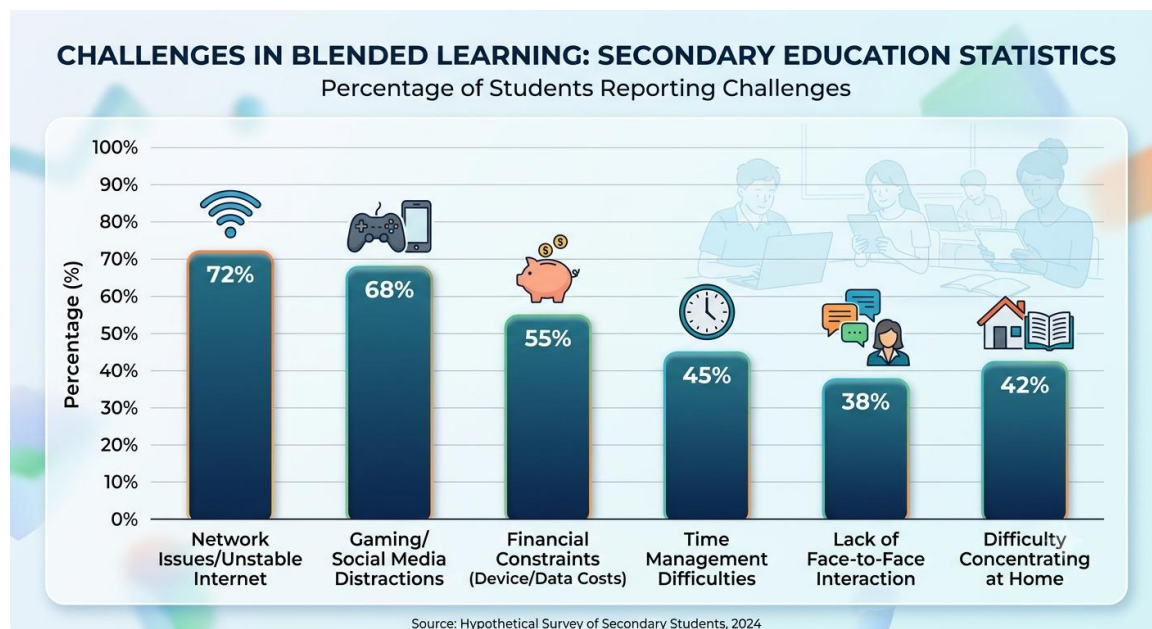


Figure 1: Four-stage research methodology flowchart integrating AI assistance and field analysis.

5. Results and Discussion

The field survey and qualitative analysis results are faint images of blended learning in preparatory and secondary schools. In the academic arena, the results show that when given good technology and good control, learning by the blending system makes the student more autonomous, competent in research, and conceptual in his learning [10]. These hypothetical advantages are met with significant challenges in fields which hampered performance when dealing with large groups of students.

The weakness in network infrastructure and unreliable connectivity turns into the major sources of interference, that prompts the repetitive inabilities to access online quizzes and interactive courses, and irritates students, losing their trust in online resources. The culture of using tablets, as the study reveals, is a critical problem behaviorally: most of the students of secondary schools take the tablets only as the means of gaming and media consumption, but not as learning and education. Lack of formal digital hygiene and parental oversight results in this perception causing serious cognitive distraction and less hours studying.

The most significant barrier is the household financial strain socioeconomically. Families who have low incomes face challenges in their ability to afford a personal smart device in every child or even continue with high-speed internet services due to which the educational disparity between the socioeconomic levels continues to widen. Lastly the discussion concludes that whether blended learning is successful or not does not entirely rest on the technological importation, but on how the realities of the economy, infrastructure and behavior of the local community are fulfilled.

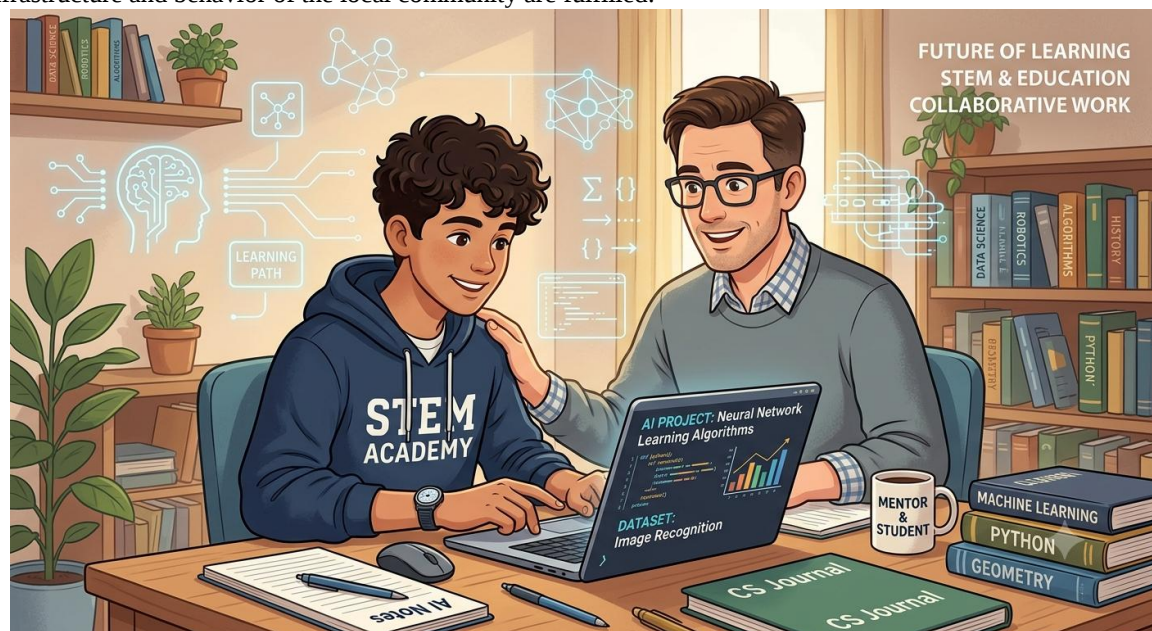


Figure 2: Statistical analysis of the benefits of blended learning as compared to major field confusions.

6. Proposed Solutions and Recommendations

1. Infrastructure Enhancement: Enhance school networks and establish zero-rated and publicly-subsidized internet access specifically to platform education through telecom provider partnerships with government.

2. Socioeconomic Support Programs: Have national programmes to provide low-cost educational tablets or installment to cover poorer families so as to offer equality.

3. Digital Hygiene & Behavioral Training: Have all students and parents take mandatory digital literacy and etiquette trainings, where parents are encouraged to have device controls and change their perception of the devices as learning tools.

4. Curriculum Redesign and Teacher Training: Re-structure curricula to operate based on modular, hybrid delivery and educate teachers in thorough preparation in interactive, anti-distraction teaching.

7. Collaborative Experience and Artificial Intelligence Disclosure

7.1 Collaborative Research Dynamics

It is an educational experiment between a secondary school learner and his adult uncle that is cross-generational. The student provided level observations on the behaviors of the students, the use of tablets, and the perception of the students towards digital tools, whereas the uncle gave the student academic supervision, methodological organization, and analytical rigor.

7.2 Artificial Intelligence (AI) Usage Declaration

The authors clearly reveal that the Generative AI technology (Google Gemini) was used as an assistant researcher in: (1) Translating, drafting and refining academic terminology into standardized English; (2) Organizing literature references based on the APA 7th edition standard; and (3) Conceptualizing graphic illustrations of methodology flowcharts and research diagrams. Any analytical claims, interpretations and suggestions made were carefully checked, verified and approved by the human authors;'

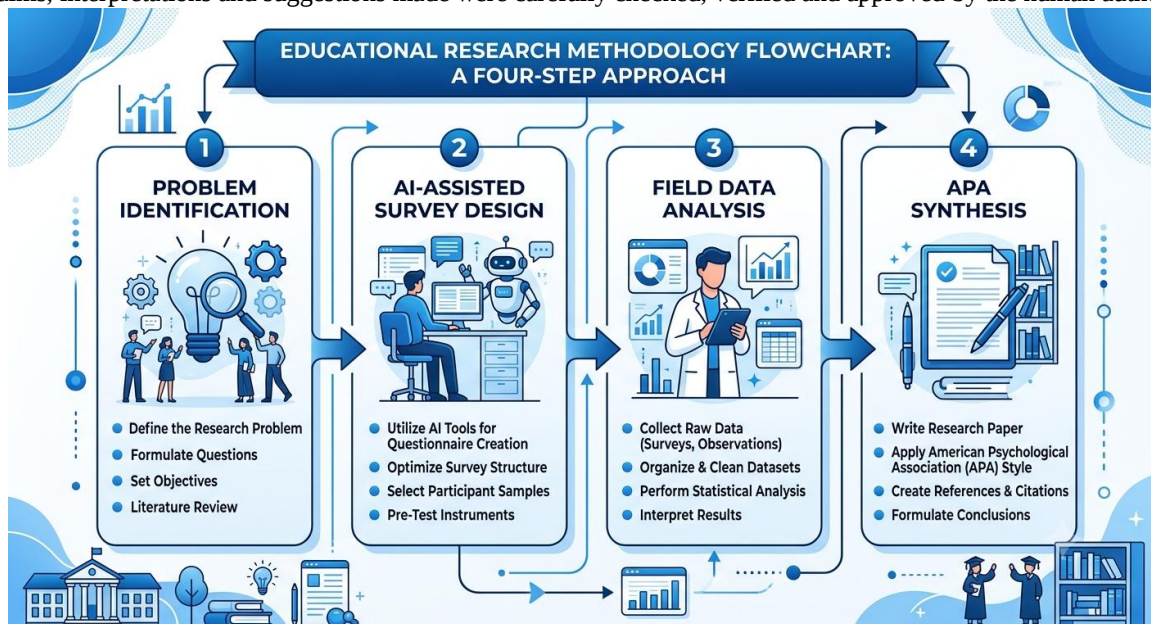


Figure 3: Conceptual model depicting dual-generational human collaboration supported by Generative AI.

References

1. Al-Enezi, A. (2022). Blended learning and its effectiveness in improving academic achievement among secondary school students. *Journal of Educational Sciences*, 14(2), 45-62.
2. Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, 7(2), 95-105.
3. Graham, C. R. (2006). Blended learning systems: Definition, current trends, and future directions. *Handbook of Blended Learning: Global Perspectives, Local Designs*, 3-21.
4. Salih Alsakloul Ibraheem Badri. (2025). Correlation and Regression Analysis Between HbA1c, Fasting Blood Sugar (FBS), and Random Blood Sugar (RBS) levels in Diabetic and Non-Diabetic patients in ElMarj, Libya. *Libyan Journal of Medical and Applied Sciences*, 3(3), 64–71. <https://doi.org/10.64943/ljmas.v3i3.116>
5. Emad M. Mohammed Khalefa, Salsabil A. Altumi, & Najwa S. Eldawi. (2024). Targeting Alzheimer's Disease: Current Pharmacological Strategies and Emerging Therapies. *Libyan Journal of Medical and Applied Sciences*, 2(1), 45–50. <https://doi.org/10.64943/ljmas.v2i1.25>
6. Abu Al-Rub, K. (2023). Technical and pedagogical challenges of hybrid education in preparatory schools. *Educational Development Journal*, 18(3), 88-104.
7. Osamah A Alloush, Salem H Almadhun, & Aimen M Rmis. (2025). Artificial Intelligence in Education and Scientific Research: "Present Challenges and Future Opportunities". *Libyan Journal of Medical and Applied Sciences*, 3(3), 16–28. <https://doi.org/10.64943/ljmas.v3i3.108>
8. Al-Harhi, S. (2020). The impact of technology integration in intermediate school curricula. *Journal of Reading and Knowledge*, 220, 15-38.
9. Al-Otaibi, B. (2022). Descriptive and applied research methodologies in studying modern educational strategies. *Dar Al-Fikr Al-Arabi*.
10. Najla Habeeb Elhadi Elazoomi. (2025). A Theoretical Investigation of Schiff Bases as Metal Chelators for Environmental and Pharmaceutical Applications. *Libyan Journal of Medical and Applied Sciences*, 3(2), 59–69. <https://doi.org/10.64943/ljmas.v3i2.66>
11. Al-Zahrani, M. (2021). The role of digital technology in enhancing classroom interaction and independent learning. *Journal of Educational and Human Studies*, 11(4), 200-225.
12. UNESCO. (2021). Blended learning guidelines for secondary education: Infrastructure and pedagogical readiness. UNESCO Publishing.

13. Abdel-Nour, I. (2023). Digital divide and educational equity in developing nations: A survey study. *International Journal of Education and Development*, 9(1), 33-58.
14. Aejeeliyah Yousuf, Addokali Zobeida, Salheen Grimida, Dr Pranay Wal, Addokali Zobeida, Ahmed. A. Ageel, & Abduladim Alfadel sakeb. (2023). Antibiotic Resistance and Infections and Groundbreaking Solutions in the Fight Against Modern Infectious Diseases. *Libyan Journal of Medical and Applied Sciences*, 1(1), 1–13. <https://doi.org/10.64943/ljmas.v1i1.1>
15. Al-Malki, H. (2024). Strategies for overcoming economic and technical obstacles in digital education. *Journal of Educational and Psychological Research*, 29(2), 101-125.
16. Bates, A. W. (2019). *Teaching in a digital age: Guidelines for designing teaching and learning*. Tony Bates Associates Ltd.
17. Al-Saleh, N. (2022). The impact of smart device usage and electronic gaming on academic achievement among secondary school students. *Gulf Educational Journal*, 40(3), 77-96.
18. Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.
19. Kasem A. Farag, Mohammed A. Asselhab, Basmah M. Binsoud, & Zahiya M. Abobaker. (2025). Performance Comparison of Traditional Bootstrap and Bias-Corrected and Accelerated Methods in Constructing Confidence Intervals for Non-Normal Data: A Simulation Study. *Libyan Journal of Medical and Applied Sciences*, 3(3), 115–120. <https://doi.org/10.64943/ljmas.v3i3.156> .
20. World Bank. (2022). *Reimagining human connections: Technology and innovation in secondary education*. World Bank Group.
21. Hossen Mohammed Al-Mahdi Al-Sharif. (2025). Analysis and Evaluation of ARIMA and SARIMA Models Performance in Time Series Forecasting: An Applied Study. *Libyan Journal of Medical and Applied Sciences*, 3(2), 146–157. <https://doi.org/10.64943/ljmas.v3i2.89>

دور التعلّم المدمج (الهجين) في تطوير العملية التعليمية في المدارس الإعدادية والثانوية

ملخص:

تتناول هذه الورقة البحثية دور التعلّم المدمج (الهجين) في تحسين العملية التعليمية في المرحلتين الإعدادية والثانوية. يُقدّم التعلّم المدمج، من خلال الجمع بين التدريس التقليدي المباشر في الفصول الدراسية وأدوات التعلّم الرقمي والمنصات الإلكترونية، إطاراً مرئياً يركز على الطالب. تُقدّم هذه الورقة تحليلاً معمقاً للأسس النظرية والفوائد العملية والتحديات الميدانية الرئيسية، بما في ذلك محدودية البنية التحتية للشبكات، ومشتتات الأجهزة اللوحية الترفيهية (الألعاب)، والقيود الاجتماعية والاقتصادية للأسر. باستخدام منهج وصفي تحليلي، تُقدّم الدراسة حلولاً عملية لضمان الوصول العادل إلى التكنولوجيا الرقمية، والتكامل الأخلاقي للتكنولوجيا، وتحسين تحصيل الطلاب.

الكلمات المفتاحية: التعلّم المدمج، التعليم الهجين، المدارس الثانوية، الفجوة الرقمية، تكنولوجيا التعليم، البحث المدعوم بالذكاء الاصطناعي.