Nanotechnology Perceptions
ISSN 1660-6795
www.nano-ntp.com

The Impact Of Video-Based Blended Learning On Learning Achievement Of Students With Special Needs

Nor Zanira Abd Manan and Associate Professor Dr. Hafizul Fahri Hanafi

Faculty of Computing and Meta Technology
Sultan Idris Education University
Tanjung Malim, Perak.

The integration of technology in special education has gained increasing attention, yet its full impact remains under-researched. This study examines the impacts of teaching method, gender, age, and type of special needs on the academic achievement of students with special needs, as well as the interaction effects among these factors. Employing a quasi-experimental design with pre-tests and post-tests, the study involved 107 students (aged 10-12) with various special needs, including mild intellectual disabilities, ADHD, and autism, who were selected from four schools in Selangor, Malaysia. Participants were divided into a control group using conventional methods and a treatment group using blended learning with video. The research instrument comprised test questions on life skills topics (personal hygiene, residential management, and classroom management) for special needs students. The treatment involved three two-hour sessions over consecutive weeks. ANCOVA analysis revealed that blended learning with video significantly enhanced student achievement compared to conventional methods. Notably, gender, age, and type of special needs did not significantly affect achievement post-treatment, nor were there significant interaction effects between these factors and the learning method. These findings suggest that blended learning with video is consistently effective across diverse student demographics and special needs categories. This study provides empirical evidence supporting the use of video-based blended learning to enhance learning achievement in special education. The results have important implications for educational policy and practice, suggesting that integrating blended learning with video can be an effective strategy to improve special education quality in Malaysia and support inclusive education policies. Future research should explore long-term effects and optimal implementation strategies in varied educational settings.

Keywords: Blended learning, learning video, students with special needs, student achievement, technology integration.

Introduction

The rapid development of information and communication technology (ICT) has revolutionized various aspects of human life, including education. In the context of 21st-century education, the integration of ICT into teaching and learning has become increasingly crucial (Ebrahimi, 2016; Rumeli & Md Rami, 2023). Malaysia has actively pursued efforts to

integrate technology into its education system, exemplified by initiatives such as the introduction of smart electronic schools aimed at increasing ICT usage at the school level (Cheok, Wong, Ayub, & Mahmud, 2017; Zulkifli & Noor, 2023).

Despite these advancements, significant challenges persist in implementing technology in education, particularly within special education. Students with special needs often encounter barriers due to their diverse and complex requirements. Therefore, leveraging technology and innovative learning methods, such as blended learning, is increasingly important in supporting these students (Xu et al., 2023; Yang & Ogata, 2023). Blended learning, which merges traditional teaching methods with digital technology, has shown considerable potential in enhancing the academic achievement and skills of students with special needs (Badre, 2020; Stetter et al., 2020). Additionally, the use of teaching aids like learning videos has proven effective in creating a more engaging, inclusive, and interactive learning experience (Zhao et al., 2021; Yoo & Huang, 2020).

While there is a growing body of research on the effectiveness of blended learning and the use of technology in special education, most of these studies are centered in Western countries. There is a notable lack of research focusing on the Malaysian context, which presents unique challenges and opportunities given its diverse educational landscape. This gap in the literature underscores the need for localized studies to understand the impact of blended learning on students with special needs in Malaysia.

In this study, we aim to address this research gap by examining the effects of blended learning with the use of a video teaching kit, known as the Life Management Kit, on the achievement of students with special needs in several primary schools in Selangor, Malaysia. This study not only explores the overall effectiveness of the blended learning approach but also delves into specific factors that may influence its impact, such as gender, age, and type of students with special needs.

The developed conceptual framework for this study considers several key factors influencing the learning achievement of students with special needs. These factors include the learning method (blended vs. conventional), gender, age, and type of students with special needs. This framework is informed by previous studies highlighting the importance of these factors in special education (Bryant, Bryant, & Smith, 2019; Schwartz, Hopkins, & Stiefel, 2021; Kim, Bal, & Lord, 2018; Allaham, Siaw, & Nor, 2022).

Blended learning has been identified as a promising approach to provide personalized and flexible learning experiences for students with special needs (Bryant et al., 2019; Perlado Lamo de Espinosa, 2021; Wang et al., 2018). Gender differences can significantly influence academic performance and learning styles (Hadjar et al., 2014; Schwartz, Hopkins, & Stiefel, 2021). Age is also a critical factor, given the developmental differences and varying learning needs across age groups (Barnhill et al., 2019; Johnson et al., 2019; Kim, Bal, & Lord, 2018). Lastly, the type of special needs (such as mild intellectual disabilities, ADHD, or autism) plays a crucial role in the academic achievement and social interaction of students with special needs (Allaham, Siaw, & Nor, 2022; García-Carrión et al., 2018; Kocaj et al., 2018; Susilo, 2017).

By addressing these factors within the Malaysian context, this study seeks to contribute to the existing body of knowledge and provide insights that can inform educational practices and policies aimed at improving the learning outcomes of students with special needs in Malaysia.

Methodology

The study involved 107 students from four schools in Selangor, Malaysia, stratified into two groups: a control group utilizing conventional teaching method and a treatment group experiencing a blended learning approach incorporating video content. This design allows for a direct comparison between traditional and innovative pedagogical strategies in special education.

The research protocol comprised three distinct phases: pre-test assessment, learning intervention, and post-test evaluation. Prior to the intervention, all participants underwent a comprehensive pre-test to establish baseline knowledge across the target topics. This crucial step enables the quantification of learning gains attributable to the intervention. The study involved a three-week intervention period, with each of the three topics (Personal Hygiene and Health, Residential Management, and Classroom Management) allocated a dedicated 2-hour session per week. This structured approach ensured consistent exposure and allowed for in-depth exploration of each subject area.

The treatment group experienced a blended learning approach utilizing a specially designed learning kit. This kit integrated engaging video content with interactive quizzes, adhering to the principles of Universal Design for Learning (UDL). The control group received instruction through conventional methods using existing teaching materials, providing a baseline for comparison. Following the intervention, a post-test mirroring the pre-test was administered to assess knowledge acquisition and retention. The use of identical pre-test and post-test instruments allowed for direct comparison of learning outcomes, providing a clear measure of the intervention's impact. This approach aligns with best practices in educational research, as highlighted by Sanders (2019), enabling the quantification of knowledge gains attributable to the intervention.

The blended learning intervention was meticulously crafted to align with UDL principles, ensuring an inclusive and adaptive learning experience. It incorporated multiple means of representation, action, and engagement, presenting content through visual, auditory, and text-based elements, offering diverse ways for students to demonstrate understanding, and using real-world examples and gamified elements to spark interest and sustain motivation. This UDL-based approach aimed to address the heterogeneous needs of special education students, potentially offering a more effective learning strategy compared to conventional methods.

The study utilized a carefully constructed set of test questions designed to assess comprehension of Life Management topics among special needs students. Specifically, the set of test questions was carefully designed and developed by subject matter experts in the field of Life Management. These experts collaborated to create a specialized assessment tool that is

tailored for use by special education teachers. This test aims to evaluate the comprehension levels of students with special needs and is an integral part of their educational journey. By utilizing this well-crafted research instrument, educators can gain valuable insights into the students' understanding and tailor their teaching strategies accordingly to support their learning and growth effectively.

To rigorously assess the effectiveness of the intervention, an Analysis of Covariance (ANCOVA) was employed. This statistical method was chosen for its ability to control for pre-existing differences between groups, thus isolating the effect of the intervention. The pre-test scores served as the covariate, while the post-test scores were the dependent variable. The independent variable was the learning method, gender, age, and type of students). ANCOVA allows for a more precise estimate of the treatment effect by adjusting for initial differences in baseline knowledge. This approach enhances the study's statistical power and reduces the potential for Type II errors (Smith & Johnson, 2021). All statistical analyses were conducted using SPSS version 27, with a significance level set at p less than .05. ($p < .05$)

Findings

The Statistical Package for the Social Sciences (SPSS) Version 23.0 was used to analyze the study data through descriptive and inferential statistical procedures. Table 1 shows the distribution of study participants according to demographic factors.

Table 1 Distribution of Study Participants According to Demographic Factors

Name of school	Group		Gender		Age			Category of students	
	Control	Treatment	Male	Female	'10'	'11'	'12'	Mild intellectual disabilities	ADHD, Autism, and others
	N	N	N	N	N	N	N	N	N
School A	15	16	17	14	4	11	16	18	13
School B	13	13	13	13	6	13	7	18	8
School C	11	13	11	13	6	14	4	18	6
School D	12	14	14	12	5	13	8	18	8
Overall	51	56	55	52	21	51	35	72	35

The table above shows that the study sample consisted of 107 students, with 51 males and 56 females. In terms of age, 21 students were 10 years old, 52 students were 11 years old, and 35 students were 12 years old. The student categories were divided into 72 students with

mild intellectual disabilities and 35 students in the categories of ADHD, Autism, and others. This study involved two groups: the control group with 51 participants and the treatment group with 56 participants.

ANCOVA analysis was conducted to assess the main effects of the learning method on student achievement, as well as the effects of gender, age, and type of special needs on student achievement. Table 2 provides a summary of the analysis results.

Table 2 ANCOVA of main effects of study constructs

Measure	df	F	Sig	Partial η^2
Learning method	1	371.81	.000**	.781
Gender	1	1.673	.199	.016
Age	2	2.19	.117	.041
Student category	1	.137	.712	.001

** $p < .001$

The analysis results show a significant main effect of the learning method on student achievement, $F(1,106) = 371.81$, $p < .001$, $\eta^2 = .78$. Students using the blended learning method with video (M = 73.36) had higher learning achievement compared to those using the conventional learning method (M = 52.04), after controlling for pre-test achievement scores.

However, the same analysis indicated no significant main effect of gender on student achievement, $F(1, 106) = 1.67$, $p > .05$, $\eta^2 = .016$. In this study, male students (M = 63.00) and female students (M = 63.42) had similar learning achievements after undergoing the learning treatment, after controlling for pre-test achievement scores.

The analysis also showed no significant main effect of age on student achievement, $F(2, 106) = 2.19$, $p > .05$, $\eta^2 = .041$. There were no significant differences in learning achievement among students aged 10 years (M = 64.46), 11 years (M = 60.86), and 12 years (M = 65.85) after undergoing the learning treatment, after controlling for pre-test achievement scores.

Similarly, there was no significant main effect of the type of students with special needs on student achievement, $F(1, 106) = .137$, $p > .05$, $\eta^2 = .001$. In this study, students with mild intellectual disabilities (M = 62.92) and students with ADHD, Autism, and other categories (M = 63.79) had similar learning achievements after undergoing the learning treatment, after controlling for pre-test achievement scores.

An ANCOVA analysis involving the interaction between study constructs was also conducted. It assessed the interaction effects between the learning method, gender, age, and type of special needs on student achievement. Table 3 provides a summary of the analysis results.

Table 3
ANCOVA of interaction effects of study constructs

Ukuran	df	F	Sig	Partial η^2
Learning method * Gender	1	.544	.463	.005
Learning method * Age	2	1.80	.170	.035
Learning method * Student category	1	1.02	.315	.010

The results indicate that there was no significant interaction effect between the learning method and gender on student achievement, $F(1, 106) = .54$, $p > .05$, $\eta^2 = .005$. This suggests that the learning achievements of male and female students were similar regardless of the learning method used. Both genders performed equally across various learning methods.

Similar analysis showed no significant interaction effect between the learning method and age on student achievement, $F(2, 106) = 1.80$, $p > .05$, $\eta^2 = .035$. This means that students aged 10, 11, and 12 displayed similar learning achievements, irrespective of the learning method employed. The combination of age and learning approach did not significantly influence their achievement.

Likewise, there was no significant interaction effect between the learning method and type of students with special needs on student achievement, $F(1, 106) = 1.02$, $p > .05$, $\eta^2 = .010$. This indicates that the difference in effectiveness between blended learning and conventional learning did not depend on the type of students with special needs. Students with mild intellectual disabilities and those with ADHD, Autism, and other categories achieved statistically similar learning outcomes, regardless of the learning method used.

Discussion

This study's primary objective was to investigate the impact of blended learning incorporating video content on the academic achievement of students with special needs. The ANCOVA analysis yielded several significant findings that merit in-depth discussion from both theoretical and practical standpoints.

From the theoretical perspective, the study's main finding provides robust support for the Blended Learning Theory proposed by Garrison and Kanuka (2004). Students exposed to the blended learning approach with video demonstrated significantly higher achievement levels compared to those following conventional learning methods. This empirical evidence strengthens the theoretical foundation asserting that the synergistic combination of online and face-to-face learning can substantially enhance educational outcomes. This study extends this theory's applicability to special education contexts, filling a crucial gap in the literature.

Likewise, these findings align closely with Mayer's (2009) Cognitive Multimedia Theory, offering further validation in the context of special education. The superior performance of students utilizing video-based teaching aids corroborates the theory's central tenet that learning is optimized when students engage with content that integrates visual and auditory elements. This study provides compelling evidence that multimedia approaches can significantly enhance information processing and retention for students with special needs, potentially due to the multi-sensory nature of the content presentation.

Also, these findings also resonate with the principles of Universal Design for Learning (CAST, 2018). The consistent effectiveness of the blended learning approach across diverse student groups (regardless of gender, age, or specific special needs category) aligns with UDL's emphasis on providing multiple means of engagement, representation, and action/expression. This study contributes to the growing body of evidence supporting UDL as a framework for inclusive education.

From the practical perspective, these findings underscore the critical need for schools and educational institutions to prioritize the integration of technology, particularly blended learning with video, into their pedagogical approaches. This necessitates substantial investment in technological infrastructure to support multimedia content delivery, comprehensive teacher training programs focused on effective implementation of blended learning strategies, and development of high-quality, accessible video content tailored to the needs of special education students.

Arguably, such revelations have significant implications for curriculum development in special education. Curricula should undergo a comprehensive redesign to seamlessly incorporate blended learning elements. This redesign should ensure that learning resources, including video materials and interactive online content, are readily accessible to students beyond traditional classroom hours. Furthermore, the curriculum should emphasize the creation of adaptive, personalized learning pathways that effectively leverage the strengths of both digital and traditional instructional methods. By implementing these changes, educational institutions can create a more flexible and responsive learning environment that caters to the diverse needs of students with special needs.

Such findings provide a strong empirical basis for educational policymakers to take decisive action. It is crucial that resources be allocated for the development and implementation of technology-enhanced learning environments specifically tailored for special education settings. Policymakers should also establish comprehensive guidelines for the creation and use of multimedia content in special education curricula. These guidelines should ensure that the content is both accessible and effective for students with various special needs. Additionally, the implementation of professional development programs is essential to equip educators with the necessary skills to effectively utilize blended learning approaches. By addressing these areas, policymakers can create a supportive framework that facilitates the widespread adoption of blended learning in special education.

While this undertaking did not find significant interaction effects between learning method and student characteristics (gender, age, and type of special needs), it underscores the critical importance of inclusive educational practices. Teacher training programs should place a strong emphasis on strategies for adapting blended learning approaches to meet the diverse needs of all students. Schools must strive to create universally accessible learning environments that can accommodate a wide range of learning styles and abilities. To ensure the ongoing effectiveness of blended learning methods across all student demographics, regular assessments should be conducted. These assessments will help identify any potential

gaps or areas for improvement in the implementation of blended learning strategies, allowing for continuous refinement of inclusive education practices.

In conclusion, this study makes significant contributions to both the theoretical understanding and practical application of blended learning in special education contexts. By demonstrating the positive impact of video-enhanced blended learning across diverse student groups, these findings pave the way for more inclusive, technologically-integrated educational approaches. The study underscores the importance of leveraging multimedia technologies to create engaging, accessible, and effective learning environments for all students, particularly those with special educational needs. As such, it is imperative that educators, policymakers, and researchers collaborate to refine and expand upon these findings, ultimately working towards a more inclusive and effective educational landscape for all learners.

References

1. Allaham, M. R., Siaw, Y. L., & Nor, A. M. (2022). Roles of resource room teachers in primary schools: A case study on special education in Palestine. Journal of Special Needs Education, 12, 31-51.
2. Badre, D. P. (2020). Mainstreaming Intellectually Disabled with Blended Learning. Our Heritage, 68.
3. Barnhill, G. P., Chawarska, K., & Grindle, C. F. (2019). Video modeling interventions for promoting adaptive behavior in individuals with autism spectrum disorder. Journal of Autism and Developmental Disorders, 49(6), 2330-2340.
4. Bryant, D. P., Bryant, B. R., & Smith, D. D. (2019). Teaching students with special needs in inclusive classrooms. Sage Publications.
5. Carey, L.A. (2022). Evaluating training outcomes: A comparison of pre- and post-training survey results. Journal of Workplace Learning, 34(5), 345-356. https://doi.org/10.1108/JWL-09-2021-0135
6. Cheok, M. L & Wong, S. L. (2014). Predictors of E-Learning Satisfaction among the Malaysian Secondary School Teachers. 22nd International Conference on Computers in Education: Asia-Pacific Society for Computers in Education, pp. 33–36.
7. Ebrahimi SS (2016). Effect of digital reading on comprehension of English prose texts in EFL/ESL contexts. Int. J. English Language and Literature Studies, 5(2), 111-117.
8. García-Carrión, R., Molina Roldán, S., & Roca Campos, E. (2018). Interactive learning environments for the educational improvement of students with disabilities in special schools. Frontiers in psychology, 9, 1744.
9. Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. The internet and higher education, 7(2), 95-105.
10. Hadjar, A., Krolak-Schwerdt, S., Priem, K., & Glock, S. (2014). Gender and educational achievement. Educational Research, 56(2), 117-125.
11. Johnson, M., & Kim, S. (2019). Blended learning for students with autism spectrum disorder: A case study. Journal of Autism Studies, 36(2), 213-228.
12. Kim, S. H., Bal, V. H., & Lord, C. (2018). Longitudinal follow-up of academic achievement in children with autism from age 2 to 18. Journal of Child Psychology and Psychiatry, 59(3), 258-267.
13. Kocaj, A., Kuhl, P., Jansen, M., Pant, H. A., & Stanat, P. (2018). Educational placement and achievement motivation of students with special educational needs. Contemporary Educational Psychology, 55, 63-83.

14. Mayer, R. E. (2002). Multimedia learning. In Psychology of learning and motivation (Vol. 41, pp. 85-139). Academic Press.
15. Perlado Lamo de Espinosa, I., Muñoz Martínez, Y., & Torrego Seijo, J. C. (2021). Students with special educational needs and cooperative learning in the ordinary classroom: some learnings from teaching practice. Journal of Research in Special Educational Needs, 21(3), 211-221.
16. Rumeli, M. S., & Md Rami, A. A. (2023). Meneroka Kesediaan dan Persepsi Pemimpin Pendidikan Terhadap Revolusi Industri 4.0. International Journal of Education and Training (InjET), (Mac), 1-9.
17. Schwartz, A. E., Hopkins, B. G., & Stiefel, L. (2021). The effects of special education on the academic performance of students with learning disabilities. Journal of Policy Analysis and Management, 40(2), 480-520.
18. Smith, J., & Johnson, A. (2021). Assessing the effectiveness of educational interventions for special education students: An analysis of covariance approach. Journal of Special Education Research, 14(3), 127-142.
19. Stetter, M. E., Hughes, C. E., Vasquez, E., Saffold, A., & Mani, K. (2020). Blended learning for students with special needs: A systematic review of experimental studies. Journal of Special Education Technology, 35(3), 209-223.
20. Susilo, A. P. (2017). Memahami komunikasi penyesuaian diri anak tunarungu di sekolah inklusi. Interaksi: Jurnal Ilmu Komunikasi, 6(2), 1-10.
21. Wang, Q., Woo, H. L., Quek, C. L., Yang, Y., & Liu, M. (2018). Using the TPACK framework to understand challenges and opportunities of blended learning: Perceptions of teachers and students. Computers & Education, 123, 17-29
22. Xu, Z., Zhao, Y., Liew, J., Zhou, X., & Kogut, A. (2023). Synthesizing research evidence on self-regulated learning and academic achievement in online and blended learning environments: A scoping review. Educational Research Review, 39, 100510.
23. Yang, C. C., & Ogata, H. (2023). Personalized learning analytics intervention approach for enhancing student learning achievement and behavioral engagement in blended learning. Education and Information Technologies, 28(3), 2509-2528.
24. Yoo, H. J., & Huang, W. (2020). Facilitating comprehension through video-based learning: A comparison of interactive and non-interactive video formats. International Journal of Educational Technology in Higher Education, 17(1), 1-15.
25. Zhao, Y., Chen, Y., Gong, L., Yang, T., Shi, J., Liu, H., & Hu, Z. (2021). Interactive video modeling: A comprehensive review and meta-analyses on effect sizes and moderating variables. Review of Educational Research, 91(1), 155-195.
26. Zulkifli, F. A. M., & Noor, N. A. Z. M. (2023). Analysis of Telegram Use for Online Learning among Teachers and Students. Journal of Engineering, Technology, and Applied Science (JETAS), 5(2), 89-98.