

Printed, digital, or blended modules: which best enhances learners' academic performance in Filipino subject?

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Article Info

Article history:

Received Oct 21, 2025

Revised Apr 1, 2026

Accepted Jun 8, 2026

Keywords:

Blended modules

Digital

Effectiveness

Experimental research

Filipino 1

Printed

ABSTRACT

The Philippine education sector increasingly relies on printed, digital, and blended modules to sustain and personalize learning. This quantitative experimental study compared these delivery formats in the subject language and communication in Filipino academic context among 108 randomly selected grade 11 learners assigned to printed-only, digital-only, or blended (print+digital) conditions. A validated researcher-made 50-item achievement test was administered before and after a six-week intervention in which groups studied the same competencies and completed parallel tasks, differing only in delivery format. Using analysis of covariance (ANCOVA) to control baseline performance, posttest scores differed significantly by modality, $F(2, 104)=18.91$, $p<0.001$, partial $\eta^2=0.27$. The blended group obtained the highest mean score ($M=42.78$) and significantly outperformed both single-format groups, while printed-only and digital-only outcomes were comparable. Open-ended feedback suggested that print resources supported organization and annotation, whereas digital activities enabled practice and timely feedback; combining both helped clarify steps and correct errors. Consistent with constructivism and the cognitive theory of multimedia learning, intentionally integrated print and digital components appear to enhance interactivity and manage cognitive load. Schools are encouraged to adopt accessible blended module designs and provide implementation support in low-connectivity contexts; future studies should replicate the comparison in other settings and examine longer-term retention.

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1. INTRODUCTION

In recent years, education has increasingly been delivered through multiple instructional modalities—printed, digital, and blended modules—driven by the need for flexible, student-centered learning and intensified by the COVID-19 pandemic. International meta-analyses and reviews indicate that when modalities are intentionally designed (e.g., clear goals, active processing, and feedback), blended and flipped approaches often outperform single-format instruction in student achievement and attitudes [1]–[4]. In the Philippines, K-12 curriculum reform and efforts to strengthen senior high school (SHS) standards for Filipino subjects have increased the demand for teacher-ready materials that can be implemented across low-tech, digital, and blended settings [5]. In Filipino 1: *Wika at Komunikasyon sa Akademikong Filipino*

(language and communication in Filipino academic context), digital modules can support interactive, flexible, and personalized learning, while blended sequences can leverage complementary strengths—for example, pairing captioned or signposted video with print-based analysis to strengthen vocabulary and comprehension [6]. Data-driven module development grounded in learners' least-mastered competencies further demonstrates how competency mapping can focus content, guide practice, and prioritize remediation in language instruction [7].

However, the urgency for instructional improvement is reinforced by persistent learning challenges documented in international assessments and related research on Philippine education. Studies using Programme for International Student Assessment (PISA)-related evidence and comparative analyses highlight continuing gaps in reading literacy and the limits of predominantly teacher-centered approaches, strengthening the case for evidence-based, student-centered instructional strategies [8]–[11]. These conditions heighten the need for module designs that explicitly scaffold planning, monitoring, practice, and feedback—features linked to higher achievement in online and blended environments [12], [13]. Comparative evidence further indicates that integrating complementary instructional components, such as video-based content and collaborative learning activities, can produce better academic performance than conventional single-mode instruction, reinforcing the value of carefully designed blended approaches for improving learning outcomes [14].

Across disciplines, digital modules have been associated with achievement gains and improved learner confidence, supported by multimedia features that promote autonomy and self-directed learning, particularly in under-resourced settings [15]–[17]. Meta-analytic evidence shows that interactive video elements (embedded questions and prompts) yield additional gains over passive viewing [18], and instructor on-screen presence can offer motivational benefits when integrated with strong pedagogy [19], [20]. Beyond general academic outcomes, digital modules can support higher-order skills such as conceptual understanding and critical thinking [21], [22], yet effectiveness also depends on learners' metacognitive awareness and digital competencies [23] and on implementation conditions such as time-on-task, feedback cycles, and access [24], [25]. Development studies that optimize online/offline delivery and self-instructional e-module features further highlight design choices that sustain learning when connectivity is limited [26]–[28].

At the same time, modality choices can interact with task demands; evidence comparing paper and screen reading suggests that comprehension differences can be small overall but vary with text complexity and task length [29]. In the Philippines, recurring disruptions (e.g., typhoons and extreme heat) can trigger class suspensions and rapid shifts to alternative delivery, underscoring the need for flexible, modality-ready learning modules [30]. Guided by these realities, the study is anchored in constructivism and the cognitive theory of multimedia learning. Constructivism views learners as active meaning-makers who build knowledge through authentic engagement and reflection [31], while multimedia learning theory explains how coordinating verbal and visual information across channels can strengthen comprehension and retention [32].

Within this framework, printed modules remain vital in low-resource contexts because they enable self-paced learning without internet access or devices [33], whereas digital modules can be more engaging but depend on connectivity and technological resources that remain unevenly available [34]. Blended modules seek to balance accessibility and interactivity by combining print and digital strengths for diverse learner needs [35]. However, direct comparisons of printed, digital, and blended modules within the same instructional setting—particularly in Philippine SHS Filipino 1—remain limited; establishing comparative effects can inform the strengthened SHS rollout and guide investments in module sequencing, feedback design, and teacher support [5], [13], [36].

Therefore, the primary goal of this study is to evaluate the effect of printed, digital, and blended modules on students' academic performance in Filipino 1: *Wika at Komunikasyon sa Akademikong Filipino*. Specifically, it seeks to determine how these instructional modalities affect students' performance. Through comparative analysis, this research aims to generate evidence-based insights for improving teaching practices and curriculum delivery in SHS Filipino language instruction. This study aims to answer the following research questions: i) how do students' academic performance levels in Filipino 1 compare before and after exposure to i) printed module; ii) digital module, and iii) blended module? and is there a significant difference in students' posttest academic performance in Filipino 1 after exposure to i) printed module; ii) digital module, and iii) blended module when controlling for pretest scores?

2. METHOD

2.1. Research design

This study employed a quantitative experimental approach using a factorial design operationalized as a single-factor, three-level pretest–posttest comparison (printed, digital, and blended modules), complemented by an embedded qualitative component (open-ended learner feedback) to help contextualize

the results. A factorial design enables the systematic comparison of multiple conditions (and, where applicable, the examination of main and interaction effects) within one experimental framework [37]. Unlike a design that necessitates a control group, a factorial design can consist entirely of experimental groups, which aligns with the present study's use of three active instructional conditions [37]. Additionally, the researcher ensured that: i) participants were matched based on a characteristic that could influence their performance in the dependent variable; ii) each participant engaged in the intervention; and iii) the size of the natural sets being examined was taken into consideration. Table 1 presents the design implemented by the researcher to meet the specified criteria. Pretest results were utilized to confirm the equivalence of the three groups. The allocation of intervention to each group was randomly determined using a lottery drawing system.

Table 1. The research design by intervention group

Section	Interventions		
A	Pretest	Printed module	Posttest
B	Pretest	Digital module	Posttest
C	Pretest	Blended module	Posttest

2.2. Participants

Initially, all the 112 students from the three intact sections were pretested as to the level of their performance in Filipino 1: *Wika at Komunikasyon sa Akademikong Filipino*. The three sections that participated were randomly selected from the business entrepreneur (BE) cluster, sections A and D having 37 each group, and B has 38 learners. The final participants were 108 students coming from sections A, B, and D, which is composed of 36 students per section. Sampling size was determined using the Cochran formula set at 99% confidence level. Olsen *et al.* [38] note that researchers may reasonably include about 15 participants per group to provide a reasonable basis for planning sample size. Furthermore, consistent with guidance on randomized comparative designs, balanced allocation across groups is commonly used because it generally improves statistical power and the precision of group comparisons [39]. In line with this, the study maintained comparable group sizes and targeted at least 15 participants per condition, a sample size that has been used in prior randomized trial protocols based on a priori power calculations [40]. This balanced grouping supports more dependable comparisons of outcomes across the intervention conditions. In addition, the 36 participants in each group were picked via a thorough match-pairing process based on their pretest performance to satisfy the conditions of analysis of covariance (ANCOVA) and to satisfy the minimum number of participants for experimental research. Using one-way analysis of variance (ANOVA), the pretest results showed that the three groups were equivalent, with no significant differences in pretest performance [$F(2, 104)=1.435$; $p=0.245>0.05$] which satisfied the conditions for experimental research.

To avoid internal and external validity issues, the researchers instructed the students not to write their names; instead, the researcher requested a research assistant to randomly assign them their individual examinee number throughout the pretest and posttest. As a result, their identities were not divulged in relation to their findings during the research process. The researcher excluded from the analysis any participant classified as delinquent—those with frequent absences during the intervention—as well as their matched counterpart

2.3. Data gathering instrument

The research instrument used was a researcher-made test aligned with the first quarter curriculum guide for Filipino 1. It consisted of 50 multiple-choice items carefully mapped to first-quarter competencies: i) explaining the meaning, importance, and characteristics of language in communication and its role in society; ii) analyzing the uses and functions of language within the self, family, society, nation, and the world; iii) providing example situations that demonstrate these language functions; iv) comparing language varieties across selected heard, read, and viewed situations; v) analyzing language variety in texts based on purpose, context, and audience; vi) linking language concepts to communication situations using personal knowledge, perspectives, and experiences; vii) identifying causes and effects of key events in the development of the Filipino language; viii) explaining the writing system and basic Filipino spelling rules; and ix) analyzing Philippine language situations based on what is heard, read, and viewed. Each item was meticulously written to align with the corresponding competency. Content validity was established through expert review by five validators from the West Visayas State University-Integrated Laboratory School and the College of Education, and the instrument was revised based on their feedback to improve clarity, alignment, and coverage.

To complement the quantitative evidence and capture learners' experiences, the posttest also included a brief open-ended section. These prompts invited students to describe which parts of the lessons or modules most supported their learning, challenges they encountered, how they applied concepts in real contexts, and suggestions for improvement. Responses were not counted toward the multiple-choice score; instead, they were

summarized qualitatively to contextualize the test results and illuminate how learners engaged with the competencies. For reliability, the multiple-choice portion underwent internal-consistency testing using Kuder-Richardson 20 (KR-20), yielding a coefficient of 0.76, which indicates acceptable reliability for research purposes. Scoring was done by giving 1 point per correct answer, and total scores were interpreted as follows: 40.01-50.00=very high, 31.01-40.00=high, 20.01-30.00=average, 10.01-20.00=low, and 0.00-10.00=very low.

2.4. Procedure and intervention

2.4.1. Before the intervention

The researcher's objective was to assess the impact of printed, digital, and blended modules on the performance of grade 11 learners in Filipino 1. To move beyond traditional instruction, the researcher introduced three forms of modules as interventions. The primary instrument utilized was a researcher-made, 50-item multiple-choice test aligned with the First Quarter Curriculum Guide for Filipino 1. This test underwent content validity review by five validators and was revised based on their feedback. A pilot test was also conducted to students possessing similar characteristics but are not part of the study. After which, an item analysis was performed, and the reliability coefficient was computed using KR-20 to determine if the instrument was reliable. Prior to implementation, written permission to conduct the study was obtained, and informed consent was secured from the participants. The participants consisted of 108 randomly selected students, 36 from each of the three sections (A, B, and D) of the business entrepreneur cluster. Initially, all students were pretested to determine their baseline performance in Filipino 1. The allocation of the interventions—printed module, digital module, and blended module—to the three groups was determined using random assignment through a lottery drawing system. To minimize the influence of extraneous factors and ensure consistency, all classes were scheduled in the morning. Furthermore, to uphold the reliability and validity of comparisons, a rigorous match-pairing process was implemented based on students' pretest performance, which ensured that the 36 participants in each group were equivalent prior to the intervention, thereby satisfying the conditions for ANCOVA [41]. Finally, classes in each of the three sections chosen were all scheduled in the morning to decrease the influence of extraneous factors.

2.4.2. During the intervention

The intervention spanned six weeks, commencing on June 23, 2025. Filipino 1 session were held twice a week for one and a half hour, at the university where the researcher taught. During this phase, participants were exposed to their respective intervention conditions: the first group received the printed module, the second group utilized the digital module, and the third group engaged with blended module. During the six-week intervention, one researcher served as the facilitator—guiding and monitoring students' progress—while the remaining researchers served as observers. Crucially, all three groups covered identical topics and completed the same assignments, quizzes, and chapter tests; the only deliberate variation across the sections was the mode of content delivery, which ensured that any differences in outcomes could be attributed solely to the type of instructional module used.

2.4.3. After the intervention

As shown in Figure 1, following the conclusion of the six-week intervention period on August 4, 2025, a posttest was administered to all participants to ascertain whether their performance in Filipino 1 had improved. In addition to the quantitative assessment, the posttest included a brief open-ended section where students were asked to describe which parts of the modules supported their learning, challenges encountered, and suggestions for improvement.

The quantitative data collected from the pretest and posttest results underwent statistical analysis. Descriptive statistics, including the mean and standard deviation, were computed to summarize the performance levels of the three groups. For inferential testing, a one-way ANCOVA was employed to determine if there was a statistically significant difference in posttest performance among the groups, utilizing the pretest scores as a control covariate. The responses from the open-ended section were summarized qualitatively, using functional narrative analysis, to contextualize the test results and illuminate how the learners engaged with the content competencies. Finally, to address ethical considerations and ensure equitable access, after the experiment, all students—including those who used only print or only digital—also received the blended modules to ensure fairness. This post-study access (waitlist/crossover) ensured that no group was disadvantaged by the allocation [42].

2.5. Ethical considerations

In keeping with American Psychological Association (APA) ethical standards for research with human participants, this study upheld voluntary participation via written informed consent; assured anonymity by replacing names with randomly assigned examinee numbers during pretest and posttest;

minimized risk by limiting activities to regular instructional tasks (use of printed, digital, or blended modules) and class schedules already in place; protected confidentiality by storing de-identified scores on password-secured files accessible only to the research team; and permitted withdrawal at any point without penalty. Data were reported only in aggregate form, and no identifying details appear in this manuscript [43]. In compliance with the Philippine Data Privacy Act of 2012 (RA 10173), educational records in this study were processed solely for legitimate research purposes and protected through restricted access controls and secure storage, consistent with data-privacy practices reported in Philippine education research [44].

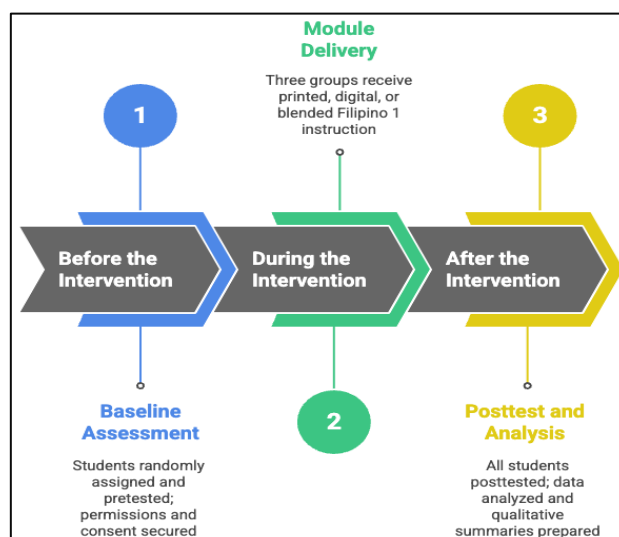


Figure 1. Flowchart of the study procedures from beginning to end

3. RESULTS AND DISCUSSION

3.1. Levels of students' learning outcomes in Filipino 1

As shown in Table 2, students in all three groups began with comparable “average” pretest performance (digital module: $M=28.61$; printed module: $M=27.08$; blended module: $M=26.61$), and all groups registered notable gains after the intervention, with the digital module ($M=37.97$) and printed module ($M=38.14$) each reaching a “high” level and the blended module achieving the highest mean ($M=42.78$), corresponding to a “very high” level.

This rank-ordering (blended > single-mode) accords with meta-analytic evidence that blended designs generally surpass single-format instruction on academic performance across countries [45], [46]. The superiority of the combined condition is theoretically consistent with multimedia design principles—particularly signaling, segmenting, and cognitive load management—which enhance comprehension when information is coordinated across channels and structured into manageable units. At the same time, medium-specific advantages are not absolute: syntheses on paper versus digital reading indicate that overall comprehension differences are small or context-dependent and can vary with task demands, text complexity, and learner characteristics [29], [47]. Accordingly, while these findings support a blended approach for Filipino 1, practical significance should be confirmed with effect sizes and covariate-adjusted models (e.g., ANCOVA), and future analyses should test moderators such as competency difficulty and item format to determine which learners benefit most from each modality [29], [45]–[47]. Overall, the pattern reinforces the growing body of evidence that integrating instructional varieties of materials yields greater gains than relying on a single mode, because presenting information through multiple, complementary channels (e.g., visual and verbal) can reduce cognitive overload and strengthen retention.

Table 2. Pretest and Posttest scores in Filipino 1

Categories	Pretest				Posttest			
	N	SD	M	Interpretation	N	SD	M	Interpretation
Digital	36	5.60	28.61	Average	36	3.27	37.97	High
Printed	36	4.42	27.08	Average	36	4.29	38.14	High
Blended	36	3.54	26.61	Average	36	3.37	42.78	Very High

Note: 50.00-40.01 “very high”; 40.00-30.01 “high”; 30.00-20.01 “average”; 20.00-10.01 “low”; and 10.00-0.00 “very low”.

3.2. Differences in students' posttest performance in Filipino 1

To determine if the observed differences in student performance were statistically significant, an ANCOVA was used to compare the posttest scores while controlling for the pretest results. The analysis in Table 3 shows there was a significant difference in the posttest performance among students who used the different types of instructional modules [$F(2, 104)=18.91, p<0.001$]. The partial eta squared value ($\eta^2=0.27$) indicates a large effect size, meaning that 27% of the variance in students' posttest performance is explained by the type of module used when controlling for the pretest. This substantial effect underscores the pedagogical importance of selecting appropriate instructional materials. Prior studies also highlight that combining traditional and digital instructional materials not only enhances performance but fosters higher-order thinking [48] and adaptability essential for 21st-century learners [49]. Building on this overall effect, the researchers next examined pairwise differences to clarify where the advantages lay.

Subsequently, a Bonferroni-corrected post hoc analysis clarified the pattern of differences. The test revealed that there was no significant difference ($p=1.00$) in posttest performance between the digital module group and the printed module group. By contrast, a significant difference existed between the group that used both the digital module and printed module and the group that used the digital module alone ($p<0.001$), as well as between the combined-module group and those who used the printed module solely ($p<0.001$). Taken together, these results indicate that blending formats yields a reliable advantage over either format used alone. To clarify how this advantage arose, the researchers analyzed qualitative evidence from students' open-ended responses. Students' open-ended responses converged with the quantitative results. Learners in the blended module group consistently described complementary roles for each format: the printed overview clarified the main steps and the e-module enabled immediate practice (B-07); moving from a handout to short online quizzes made the process clearer and faster (B-12); using a paper checklist and then verifying answers online helped correct errors (B-21). Print-only students noted both strengths and limits: they could underline and annotate but lacked instant feedback (P-11); the notes were dependable, yet they wanted more interactive practice (P-05). Digital-only students valued quick feedback but asked for stronger structure: without a summary page they lost the "big picture" (D-09), and they preferred a printable outline to organize ideas (D-14). These patterns explain the performance pattern: single-mode groups performed similarly, whereas the blended group outperformed both because paper supported planning and organization while online activities provided timely feedback and error correction (B-03).

Consistent with this interpretation, the non-significant difference between the digital module and printed module groups suggests that the mode of delivery—whether digital or print—has minimal impact when used in isolation. This supports the view that design quality, rather than medium per se, is the critical determinant of learning outcomes [50]. By contrast, the marked advantage of combining both modules highlight the value of multimodal learning environments. By allowing students to encounter and re-encounter content through complementary channels, blended approaches cater to varied learning preferences and foster deeper interactivity and engagement [51].

Accordingly, the results contribute to the discourse on technology integration by showing that while single-mode instruction can be effective, well-designed blended strategies provide a statistically significant advantage. Therefore, educators and curriculum designers are encouraged to adopt hybrid module designs to maximize student achievement and foster a more inclusive and engaging learning environment. Extending this implication, converging literature situates the present findings within contemporary theory and practice. Recent syntheses show that blended and flipped models commonly surpass single-format instruction when design is intentional and time-on-task is optimized [1], [52]. Mechanistically, benefits emerge when materials coordinate complementary channels and structure learning with segmentation, signaling, and frequent practice, moves known to reduce extraneous load and strengthen comprehension and retention [53], [54]. At the same time, realizing these gains depends on implementation quality and learner supports: the online component can introduce challenges (e.g., self-regulated learning demands, feedback, and access) that must be addressed, and achievement in online/blended contexts is often predicted more by self-regulated learning supports than by medium alone [55]. Taken together, the findings—no significant difference between digital and print alone, but a clear benefit for their integration—are consistent with prior empirical evidence [1], [50], [55] and supports hybrid designs that integrate clear goals, structured activities, and ongoing assessment.

Learners' experiences from posttest open-ended responses triangulate these quantitative results: students in the blended group commonly reported that alternating between printed summaries and short e-module activities helped them "see the steps" and "practice right away"; print-only students emphasized reliable access and ease of annotation but noted limits in interactive practice; digital-only students valued immediate feedback and short quizzes yet asked for printable outlines. Together, these accounts mirror the ANCOVA and post hoc findings—equivalence between single modes but a clear advantage when print and digital were integrated.

Table 3. ANCOVA results on the differences in Pretest and Posttest scores in Filipino 1

Categories	Sum of squares	df	Mean square	F	Sig.	Partial eta squared
Contrast	513.66	2.00	256.83	18.91*	0.00	0.27
Error	1412.64	104.00	13.58			

Note: *p<0.001 significant.

4. CONCLUSION

A blended design that uses both printed and digital modules in a planned sequence aligns well with constructivism and the cognitive theory of multimedia learning. Print organizers help students build understanding by giving structure for note-taking and reflection, while short digital activities support active practice, immediate feedback, and step-by-step processing through signaling and segmentation. In practical terms, units should follow a simple print-digital-print cycle: begin with a concise printed organizer and example, move to brief online checks for understanding with timely feedback, then return to print for consolidation and application. To ensure access, provide offline-ready versions of digital content and printed fallbacks for low-connectivity settings. Embed light self-regulation supports—planning checklists, progress trackers, and short reflection prompts—so students can plan, monitor, and adjust their learning. Pair frequent low-stakes digital quizzes with rubric-guided print tasks, and review both performance and process indicators to refine pacing and support.

Accordingly, schools are encouraged to adopt the blended form of these modules as the standard approach, with clear implementation steps: develop policy guidance that specifies the print-digital-print cycle, invest in teacher training focused on task-media matching and feedback workflows, provide adaptable templates and offline packages to ensure equity, pilot in selected units, gather feedback from students and teachers, and use results to improve and scale across sections. This course of action turns constructivist and multimedia learning principles into everyday practice that is clear, fair, and sustainable. Nonetheless, the findings should be interpreted considering limitations, including the use of intact sections from a single learning cluster and institution, the six-week implementation window, and reliance on a researcher-made achievement test. Future research should replicate the comparison using larger and more diverse samples, longer follow-up periods to examine retention and transfer, and additional qualitative evidence on learner experiences and implementation conditions to strengthen generalizability and guide modality selection.

FUNDING INFORMATION

This research is supported by the West Visayas State University Research and Development Center under Board of Regents (BOR) Resolution No. 55-2021.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

INFORMED CONSENT

Throughout this research, privacy was safeguarded as a legal right; personal information was only identified when it was scientifically necessary and prior to that, written consent was obtained.

ETHICAL APPROVAL

The research related to human use has been complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration and has been approved by the authors' institutional review board or equivalent committee.

DATA AVAILABILITY

The data that support the findings of this study are available from West Visayas State University. Restrictions apply to the availability of these data, which were used under license for this study. Data are available https://drive.google.com/drive/folders/1eBbCzhF0p47dLwYcy9VkeDnPLSVoyk_g?usp=drive_link with the permission of West Visayas State University.

REFERENCES

- [1] R. F. Schmid, E. Borokhovski, R. M. Bernard, D. I. Pickup, and P. C. Abrami, "A meta-analysis of online learning, blended learning, the flipped classroom and classroom instruction for pre-/in-service teachers," *Computers and Education Open*, vol. 5, p. 100142, 2023, doi: 10.1016/j.caeo.2023.100142.
- [2] W. Cao, "A meta-analysis of effects of blended learning on performance, attitude, achievement, and engagement across different countries," *Frontiers in Psychology*, vol. 14, p. 1212056, 2023, doi: 10.3389/fpsyg.2023.1212056.
- [3] Z. Yu, W. Xu, and P. Sukjairungwattana, "Meta-analyses of differences in blended and traditional learning outcomes and students' attitudes," *Frontiers in Psychology*, vol. 13, p. 926947, 2022, doi: 10.3389/fpsyg.2022.926947.
- [4] M. I. Baig and E. Yadegaridehkordi, "Flipped classroom in higher education: a systematic literature review and research challenges," *International Journal of Educational Technology in Higher Education*, vol. 20, Art. no. 61, 2023, doi: 10.1186/s41239-023-00430-5.
- [5] J. S. Barrot, "K to 12 curriculum reform in the Philippines: towards making students future ready," *Asia Pacific Journal of Education*, vol. 43, no. 4, pp. 1193–1207, 2023, doi: 10.1080/02188791.2021.1973959.
- [6] M. F. Teng, "Incidental vocabulary learning from captioned video genres: vocabulary knowledge, comprehension, repetition, and working memory," *Computer Assisted Language Learning*, vol. 38, nos. 5–6, 2025, doi: 10.1080/09588221.2023.2275158.
- [7] S. P. Bacio, Jr., "Identifying learners' least-mastered competencies in Filipino 11: a foundation for digital module development," *International Journal of Information and Education Technology*, vol. 15, no. 6, pp. 1277–1288, 2025. 10.18178/ijiet.2025.15.6.2330.
- [8] A. Sandoval-Hernandez, D. Zhao, Z. Chen, and N. Eryilmaz, "The association between educational systems and reading literacy performance in PISA across the Asia-Pacific region and countries," in *International Handbook on Education Development in the Asia-Pacific*, W. O. Lee, P. Brown, A. L. Goodwin, and A. Green, Eds. Singapore: Springer, 2023, doi: 10.1007/978-981-19-6887-7_26.
- [9] M. P. Calica, "The effect of parental characteristics and home resources on reading performance of 15-year-old students in the Philippines," *The New Educational Review*, vol. 62, pp. 67–79, 2020, doi: 10.15804/tner.2020.62.4.06.
- [10] S. K. Ho and Z. Gan, "Instructional practices and students' reading performance: a comparative study of 10 top performing regions in PISA 2018," *Language Testing in Asia*, vol. 13, Art. no. 48, 2023, doi: 10.1186/s40468-023-00261-1.
- [11] J. Y. Haw, R. B. King, and J. E. R. Trinidad, "Need supportive teaching is associated with greater reading achievement: what the Philippines can learn from PISA 2018," *International Journal of Educational Research*, vol. 110, Art. no. 101864, 2021, doi: 10.1016/j.ijer.2021.101864.
- [12] Z. Xu, Y. Zhao, B. Zhang, J. Liew, and A. Kogut, "A meta-analysis of the efficacy of self-regulated learning interventions on academic achievement in online and blended environments in K-12 and higher education," *Behaviour & Information Technology*, vol. 42, no. 16, pp. 2911–2931, 2023, doi: 10.1080/0144929X.2022.2151935.
- [13] B. Wisniewski, K. Zierer, and J. Hattie, "The power of feedback revisited: a meta-analysis of educational feedback research," *Frontiers in Psychology*, vol. 10, Art. no. 3087, Jan. 2020, doi: 10.3389/fpsyg.2019.03087.
- [14] A. K. C. Wong, T. T. M. Hung, J. Bayuo, and F. K. Y. Wong, "The development and implementation of a blended video watching and peer learning model for master's nursing students: a quasi-experimental study," *BMC Nursing*, vol. 22, Art. no. 62, 2023, doi: 10.1186/s12912-023-01204-0.
- [15] J. Kapoor and G. K. Cheema, "Impact of digital modules on math achievement by gender and locality," *Journal of Interdisciplinary Studies in Education*, vol. 13, Special Issue 1, pp. 34–52, 2024, doi: 10.32674/7eh5nh63.
- [16] R. Kasperski and G. Ben-Yehudah, "Developing digital academic skills in preservice teachers: performance and metacognitive perspectives," *Journal of Education for Teaching*, vol. 50, no. 4, pp. 613–626, 2024, doi: 10.1080/02607476.2024.2323583.
- [17] M. V. Arun, T. P. Rani, and J. A. Jasmine, "Project educate: a skill-based e-learning for rural areas," in *4th International Conference on Computing and Communications Technologies (ICCTT)*, 2021, pp. 219–222, doi: 10.1109/ICCTT53315.2021.9711825.
- [18] R. Ploetzner, "The effectiveness of enhanced interaction features in educational videos: a meta-analysis," *Interactive Learning Environments*, vol. 32, no. 5, pp. 1597–1612, 2024, doi: 10.1080/10494820.2022.2123002.
- [19] M. Beege, N. L. Schroeder, S. Heidig, G. D. Rey, and S. Schneider, "The instructor presence effect and its moderators in instructional video: a series of meta-analyses," *Educational Research Review*, vol. 41, p. 100564, 2023, doi: 10.1016/j.edurev.2023.100564.
- [20] A. Callimaci and A. Fortin, "The impact of teacher video presence on student performance and satisfaction in undergraduate accounting courses," *Accounting Education*, vol. 33, no. 6, 2024, doi: 10.1080/09639284.2023.2257676.

- [21] A. Hasanati, E. Supriana, and N. Mufti, "Effectiveness of digital modules with recitation programs to improve students' conceptual understanding and critical thinking skills in learning work and energy," in *AIP Conference Proceedings*, vol. 2569, no. 1, 2023, doi: 10.1063/5.0114390.
- [22] J. S. Prbasari, Muzzazinah, and D. Wahyuningsih, "The need for implementation of problem-based learning electronic modules (e-modules) to improve students' critical thinking ability," in *AIP Conference Proceedings*, vol. 2727, 2023, doi: 10.1063/5.0141919.
- [23] I. M. Romi, "Digital skills impact on university students' academic performance: an empirical investigation," *Edelweiss Applied Science and Technology*, vol. 8, no. 5, pp. 2126–2141, 2024, doi: 10.55214/25768484.v8i5.1965.
- [24] R. A. Rasheed, A. Kamsin, and N. A. Abdullah, "Challenges in the online component of blended learning: a systematic review," *Computers & Education*, vol. 144, p. 103701, 2020, doi: 10.1016/j.compedu.2019.103701.
- [25] W. Meng, L. Yu, C. Liu, N. Pan, X. Pang, and Y. Zhu, "A systematic review of the effectiveness of online learning in higher education during the COVID-19 pandemic period," *Frontiers in Education*, vol. 8, 2024, doi: 10.3389/educ.2023.1334153.
- [26] P. M. Torion and S. P. Bacio, Jr., "Video lessons for the course introduction to computing through online/offline mode (ICOM): its development and evaluation," *International Journal of Information and Education Technology*, vol. 14, no. 6, pp. 845–855, 2024, doi: 10.18178/ijiet.2024.14.6.2110.
- [27] H. Widiawati, Sujarwo, and B. Saptono, "The effectiveness of electronic use of Moodle-assisted modules in student numeracy literacy learning," *International Journal of Information and Education Technology*, vol. 15, no. 8, pp. 1729–1742, 2025, doi: 10.18178/ijiet.2025.15.8.2374.
- [28] A. Alenezi and A. Alenezi, "Evaluating the effectiveness of Nearpod's interactive science modules on student achievement in Saudi middle schools," *Cogent Education*, vol. 12, no. 1, 2025, doi: 10.1080/2331186X.2025.2580078.
- [29] Y. Li and L. Yan, "Which reading comprehension is better? A meta-analysis of the effect of paper versus digital reading in recent 20 years," *Telematics and Informatics Reports*, vol. 14, Art. no. 100142, 2024, doi: 10.1016/j.teler.2024.100142.
- [30] E. M. Preña and C. P. Labayo, "Policy responses to extreme heat and its impact on education: the Philippine experience," *Policy Futures in Education*, vol. 23, no. 3, pp. 652–675, 2025, doi: 10.1177/14782103241288276.
- [31] Y. Chen, L. Ma, P. Pirzada, and K. K. Chai, "Evaluating a guided personalised learning model in undergraduate engineering education: a data-driven approach to student-centred pedagogy," *Education Sciences*, vol. 15, no. 7, Art. no. 925, 2025, doi: 10.3390/educsci15070925.
- [32] R. E. Mayer, "The past, present, and future of the cognitive theory of multimedia learning," *Educational Psychology Review*, vol. 36, Art. no. 8, Jan. 2024, doi: 10.1007/s10648-023-09842-1.
- [33] Ç. Kaygısız, "Comparison of digital and printed text reading process," *Education and Information Technologies*, vol. 30, pp. 22709–22733, 2025, doi: 10.1007/s10639-025-13668-5.
- [34] T. E. Gocotano, M. A. L. Jerodiaz, J. C. P. Banggay, H. B. Rey Nasibog, and M. B. Go, "Higher education students' challenges on flexible online learning implementation in the rural areas: a Philippine case," *International Journal of Learning, Teaching and Educational Research*, vol. 20, no. 7, pp. 262–290, 2021, doi: 10.26803/IJLTER.20.7.15.
- [35] L. T. Ferraz, D. M. Frohlich, C. E. Hodgkins, H. Yuan, and P. C. Castro, "Optimising the provision of health information for older adults across paper and screen formats – a requirement study with content producers and consumers," *PLOS Digital Health*, vol. 4, Art. no. e0001090, Nov. 2025, doi: 10.1371/journal.pdig.0001090.
- [36] A. Bozkurt, "A retro perspective on blended/hybrid learning: systematic review, mapping and visualization of the scholarly landscape," *Journal of Interactive Media in Education*, vol. 2022, no. 1, p. 2, Jul. 2022, doi: 10.5334/jime.751.
- [37] B. C. Kahan *et al.*, "Reporting of factorial randomized trials: extension of the CONSORT 2010 statement," *JAMA*, vol. 330, no. 21, pp. 2106–2114, Dec. 2023, doi: 10.1001/jama.2023.19793.
- [38] M. H. Olsen *et al.*, "An internet-based emotion regulation intervention versus no intervention for non-suicidal self-injury in adolescents: a statistical analysis plan for a feasibility randomised clinical trial," *Trials*, vol. 22, no. 1, 2021, doi: 10.1186/s13063-021-05406-2.
- [39] V. W. Berger *et al.*, "A roadmap to using randomization in clinical trials," *BMC Medical Research Methodology*, vol. 21, Art. no. 168, 2021, doi: 10.1186/s12874-021-01303-z.
- [40] L. A. R. Costa, *et al.*, "The influence of a supervised group exercise intervention combined with active lifestyle recommendations on breast cancer survivors' health, physical functioning, and quality of life indices: study protocol for a randomized and controlled trial," *Trials*, vol. 22, Art. no. 934, 2021, doi: 10.1186/s13063-021-05843-z.
- [41] W. Schwarz, "The ANCOVA model for comparing two groups: a tutorial emphasizing statistical distribution theory," *Frontiers in Psychology*, vol. 16, p. 1600764, 2025, doi: 10.3389/fpsyg.2025.1600764.
- [42] A. K. Gandhi, A. Poojari, B. Vashistha, M. Rastogi, and R. Vashistha, "Crossover study," in *Translational Radiation Oncology*, 2023, pp. 323–325, doi: 10.1016/B978-0-323-88423-5.00014-5.
- [43] A. Fahrudin and R. Fitriyana, "Research ethics in psychology," in *Ethics in Social Science Research: Current Insights and Practical Strategies*, pp. 55–65, 2024, doi: 10.1007/978-981-97-9881-0_4.
- [44] R. J. S. Sancon, "Data privacy best practices of a local higher educational institution: a model for governance," *IOER International Multidisciplinary Research Journal*, vol. 5, no. 2, 2023, doi: 10.54476/ioer-imrj/688585.
- [45] M. A. Ashraf *et al.*, "A systematic review of systematic reviews on blended learning: trends, gaps and future directions," *Psychology Research and Behavior Management*, vol. 14, pp. 1525–1541, 2021, doi: 10.2147/PRBM.S331741.
- [46] R. Wang and A. Raman, "Systematic literature review on the effects of blended learning in nursing education," *Nurse Education in Practice*, vol. 82, Art. no. 104238, 2025, doi: 10.1016/j.nepr.2024.104238.
- [47] G. Fontaine *et al.*, "A meta-analysis of the effect of paper versus digital reading on reading comprehension in health professional education," *American Journal of Pharmaceutical Education*, vol. 85, no. 10, Art. no. 8525, Nov. 2021, doi: 10.5688/ajpe8525.
- [48] X. H. Vu, "Leveraging technology for higher-order thinking development: instructional design strategies in higher education," *International Journal of Technologies in Learning*, vol. 32, no. 2, pp. 25–46, 2025, doi: 10.18848/2327-0144/CGP/v32i02/25-46.
- [49] P. Alipour, "A comparative study of online vs. blended learning on vocabulary development among intermediate EFL learners," *Cogent Education*, vol. 7, no. 1, Art. no. 1857489, 2020, doi: 10.1080/2331186X.2020.1857489.
- [50] W. K. Monib, A. Qazi, and R. A. Apong, "Microlearning beyond boundaries: a systematic review and a novel framework for improving learning outcomes," *Heliyon*, vol. 11, no. 2, Art. no. e41413, 2025, doi: 10.1016/j.heliyon.2024.e41413.
- [51] D. Chu, "Exploring perspectives on student engagement and learning outcomes in online-offline English teaching: a structured assessment using SuperHyperSoft and PSI methods," *Neutrosophic Sets and Systems*, vol. 83, Apr. 2025.
- [52] A. Iranmanesh and Z. Onur, "Generation gap, learning from the experience of compulsory remote architectural design studio," *International Journal of Educational Technology in Higher Education*, vol. 19, Art. no. 40, 2022, doi: 10.1186/s41239-022-00345-7.
- [53] Y. Zhao, Y. Li, S. Ma, Z. Xu, and B. Zhang, "A meta-analysis of the correlation between self-regulated learning strategies and academic performance in online and blended learning environments," *Computers & Education*, vol. 230, Art. no. 105279, 2025, doi: 10.1016/j.compedu.2025.105279.

- [54] B. Çeken and N. Taşkın, "Multimedia learning principles in different learning environments: a systematic review," *Smart Learning Environments*, vol. 9, Art. no. 19, 2022, doi: 10.1186/s40561-022-00200-2.
- [55] G. D. Çemçem, Ö. Korkmaz, and V. Kukul, "Readiness of teachers for blended learning: a scale development study," *Education and Information Technologies*, vol. 29, pp. 23631–23655, 2024, doi: 10.1007/s10639-024-12777-x.

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