

ORIGINAL

## Development of WENNY: An E-Module Integrating Digital Literacy to Enhance Academic Writing Skills in Higher Education under Outcome-Based Education Framework

### Desarrollo de WENNY: Un módulo electrónico que integra la alfabetización digital para mejorar las habilidades de escritura académica en la educación superior bajo el marco de la educación basada en resultados

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#### ABSTRACT

**Introduction:** despite its critical role in academic success, academic writing remains underdeveloped among Indonesian university students, largely due to traditional pedagogies and lack of digital integration. This study aimed to develop and validate WENNY—an e-module integrating digital literacy to enhance academic writing skills within an Outcome-Based Education (OBE) framework.

**Method:** a Research and Development (R&D) approach using the 4D model (Define, Design, Develop, Disseminate) was employed. Needs analysis, expert validation (material, media, language), and student usability testing were conducted with 120 participants from three Indonesian universities. Data were analyzed using descriptive statistics and thematic analysis.

**Results:** WENNY achieved “very valid” scores from experts (material: 92 %, media: 90 %, language: 88 %) and “very practical” from students (89 %). Key features include interactive writing tasks, automated grammar feedback, citation management tutorials, and OBE-aligned competency checklists. Students reported improved confidence in structuring academic texts and using digital tools.

**Conclusions:** WENNY effectively bridges the gap between digital literacy and academic writing, offering a scalable, OBE-compliant solution for higher education. Future studies should test its efficacy in longitudinal and cross-cultural contexts.

**Keywords:** Academic Writing; Digital Literacy; E-Module; Outcome-Based Education; Higher Education; WENNY.

#### RESUMEN

**Introducción:** a pesar de su papel crítico en el éxito académico, la escritura académica sigue estando poco desarrollada entre los estudiantes universitarios indonesios, en gran parte debido a las pedagogías tradicionales y la falta de integración digital. Este estudio tuvo como objetivo desarrollar y validar WENNY, un módulo electrónico que integra la alfabetización digital para mejorar las habilidades de escritura académica dentro del marco de la Educación Basada en Resultados (OBE).

**Método:** se empleó un enfoque de Investigación y Desarrollo (I+D) utilizando el modelo 4D (Definir, Diseñar, Desarrollar, Difundir). Se realizaron análisis de necesidades, validación por expertos (material, medios, lenguaje) y pruebas de usabilidad con 120 participantes de tres universidades indonesias. Los datos se analizaron mediante estadística descriptiva y análisis temático.

**Resultados:** WENNY obtuvo puntuaciones de “muy válido” por parte de expertos (material: 92 %, medios: 90 %, lenguaje: 88 %) y “muy práctico” por parte de estudiantes (89 %). Las características clave incluyen tareas de escritura interactivas, retroalimentación automática de gramática, tutoriales de gestión de citas y listas de verificación de competencias alineadas con OBE. Los estudiantes reportaron mayor confianza en la estructuración de textos académicos y el uso de herramientas digitales.

**Conclusiones:** WENNY cierra eficazmente la brecha entre la alfabetización digital y la escritura académica, ofreciendo una solución escalable y compatible con OBE para la educación superior. Futuros estudios deberían probar su eficacia en contextos longitudinales e interculturales.

**Palabras clave:** Escritura Académica; Alfabetización Digital; Módulo Electrónico; Educación Basada en Resultados; Educación Superior; WENNY.

## INTRODUCTION

Academic writing proficiency is a cornerstone of scholarly communication and a critical competency in higher education. Yet, Indonesian university students consistently underperform in international assessments such as PISA and EF EPI, revealing persistent weaknesses in structuring formal texts, managing citations, and utilizing digital tools for writing.<sup>(1,2)</sup> This deficit is exacerbated by pedagogical reliance on traditional, print-based methods that fail to integrate digital literacy—a 21st-century skill now mandated under Indonesia’s nationwide adoption of Outcome-Based Education (OBE).

While e-modules have shown promise in language learning,<sup>(3,4)</sup> few are explicitly designed to bridge digital literacy with academic writing. Moreover, existing tools often lack alignment with OBE’s competency-based framework, which requires measurable learning outcomes tied to real-world digital competencies such as collaborative writing, automated referencing, and critical evaluation of online sources. Theoretical gaps also persist: although Cognitive Load Theory<sup>(5)</sup> and Self-Regulated Learning<sup>(6)</sup> suggest digital scaffolds can reduce writing anxiety and foster autonomy, few studies operationalize these theories in e-module design for academic writing.

This study addresses these gaps by developing WENNY—an e-module that uniquely integrates digital literacy (e.g., citation managers, grammar checkers, peer feedback platforms) into academic writing instruction, explicitly aligned with OBE competencies. Unlike prior modules focused on general writing or ESL contexts, WENNY targets university students as academic writers in English, embedding scaffolded digital tasks that mirror real scholarly workflows.

Therefore, this study aims to develop WENNY through a 4D R&D model, and to validate its effectiveness in enhancing academic writing skills within an OBE framework. By doing so, we contribute theoretically by operationalizing digital literacy as a scaffold for academic writing, and practically by providing a validated, scalable tool for Global South universities transitioning to competency-based curricula.

## METHOD

### Study Design

This study adopted a Research and Development (R&D) methodology based on the 4D model (Define, Design, Develop, and Disseminate), a systematic framework for creating and validating educational products. The development process spanned January to December 2024 and was implemented across three public universities in West Sumatera, Indonesia: UIN Bukittinggi, UIN Mahmud Yunus Batusangkar, and UIN Imam Bonjol. The four phases were as follows:

- Define: Conducted needs analysis to identify academic writing challenges and digital literacy gaps.
- Design: Created module architecture, learning activities, and assessment tools aligned with OBE principles.
- Develop: Built the WENNY e-module using Google Sites, Canva, and Google Docs; underwent expert validation.
- Disseminate: Pilot-tested with students in real classroom settings, followed by usability and efficacy evaluation through pre-post writing tasks and questionnaires.

### Participants

Participant selection followed purposeful sampling strategies appropriate to each stakeholder group’s role in the R&D process, ensuring relevance, expertise, and representativeness. Participant recruitment and data collection were tailored to each phase of the model, involving distinct stakeholder groups, including students, lecturers, and subject-matter experts to ensure comprehensive needs assessment, content validity, and practical usability.

- Students (n = 120): All were undergraduate students enrolled in Academic Writing courses at the three participating universities. In the Define phase, 60 students (20 per university) completed a needs-analysis survey. In the Disseminate phase, 60 students were randomly assigned to either the experimental group (n = 30; used WENNY) or control group (n = 30; received conventional instruction).
- Lecturers (n = 3): One EFL lecturer from each university participated in focus group discussions (FGDs) during the Define phase to provide contextual insights into curricular challenges.
- Subject-Matter Experts (n = 3): Selected based on professional qualifications, one expert in academic writing (material), one in digital media design, and one in English linguistics (language). All held PhDs and had  $\geq 5$  years of teaching experience. They independently validated the e-module during the Design phase

### Instruments

Five primary data collection instruments were employed across the 4D phases to ensure triangulation and robust validation of the WENNY e-module:

1. Needs Analysis Questionnaire. A 22-item Likert-scale questionnaire (1 = strongly disagree to 5 = strongly agree) was developed to assess students' perceived challenges in academic writing and digital tool use. Items were adapted from Haidarbahy (2019) and validated through expert review (n = 3) and a pilot test with 30 non-participant students. The final instrument demonstrated high internal consistency (Cronbach's  $\alpha = 0,87$ ). Sample items included: "I struggle to organize my ideas logically in academic essays" and "I rarely use digital tools to check grammar or citations."
2. Expert Validation Sheets. Three separate validation forms were used to evaluate the material, media, and language quality of the e-module, adapted from Borg and Gall's (1983) product evaluation protocol as applied in Indonesian R&D studies (e.g., Akbar, 2019). Each form contained 10-12 domain-specific items rated on a 4-point scale (1 = not valid, 4 = very valid). Experts also provided open-ended feedback. Validity was quantified using the Item Validity Index (IVI) and Average Percentage Agreement (APA). The e-module achieved "very valid" status: material = 92 %, media = 90 %, language = 88 %.
3. Student Usability Questionnaire. Usability was measured using the System Usability Scale (SUS), a standardized 10-item instrument with demonstrated reliability ( $\alpha > 0,85$  in prior educational technology studies). Responses were on a 5-point Likert scale.
4. Pre-Post Academic Writing Test. Students in both experimental and control groups completed identical writing tasks at the beginning and end of the intervention.
5. Semi-Structured Interview Protocol. A 12-question interview guide was developed to explore students' experiences with WENNY, focusing on perceived usefulness, engagement, and skill development. Questions included: "Which features of WENNY helped you most with citation formatting?" and "How did using digital feedback tools affect your writing process?" Interviews (n = 14; ~20 minutes each) were conducted in Bahasa Indonesia, audio-recorded, transcribed verbatim, and translated for analysis. The protocol was pilot-tested with 3 students to ensure clarity and cultural appropriateness.

All instruments were reviewed by the research team and piloted before full deployment. Data from quantitative instruments were analyzed using descriptive statistics and paired t-tests; qualitative data underwent inductive thematic analysis.

### Data Analysis

Data were analyzed using convergent mixed methods to address both the efficacy and user experience of the WENNY e-module. Quantitative data (from the needs analysis questionnaire, usability SUS scores, and pre-post writing tests) were processed using IBM SPSS Statistics version 28. Descriptive statistics (frequencies, means, standard deviations) summarized participant characteristics and instrument responses. A paired-samples t-test was conducted to determine whether improvements in writing performance (structure, grammar, citation, coherence) were statistically significant ( $p < 0,05$ ).

Qualitative data (from semi-structured interviews with 14 students) were analyzed through inductive thematic analysis. The process involved:

- Familiarization with transcripts through repeated reading,
- Initial coding of meaningful units by the first two authors independently,
- Collaborative development of candidate themes through iterative discussion,
- Review and refinement of themes for coherence and distinctiveness, and
- Final definition and naming of themes with supporting verbatim excerpts.

All coding and memoing were managed using NVivo 14 to support organization and auditability. The research team maintained a reflexive stance throughout, documenting analytical decisions in a research journal to

mitigate bias.

### Ethical Approval

The project was carried out under the coordination and supervision of UIN Bukittinggi Ethics Committee, UIN Mahmud Yunus Batusangkar Ethics Committee, and UIN Imam Bonjol Ethics Committee. Written informed consent obtained from all participants. All phases of the study were conducted in accordance with the ethical principles of the Declaration of Helsinki and current institutional regulations.

## RESULTS

This study employed a mixed-methods Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) to develop and validate the WENNY e-module for academic writing instruction under an Outcome-Based Education (OBE) framework. Results are presented in four thematic sections: (1) Needs Analysis, (2) Design Validation, (3) Practicality Assessment, and (4) Effectiveness Testing.

### Need Analysis

#### *Curriculum Analysis*

Document analysis indicated that the existing curriculum includes nine formal components: course identity, course competencies, course description, indicators, core topics, teaching methods, learning media, evaluation system, and references (table 1). While these components provide a formal structure, several critical elements remain incomplete or insufficiently detailed.

No	Curriculum Component	Status	Remarks
1	Course identity	Complete	Includes course name, code, and credits.
2	Course competencies	Complete	Stated in general terms, mostly cognitive domain.
3	Course description	Complete	Brief overview provided.
4	Indicators	Complete	General, without operational performance descriptors.
5	Core topics	Complete	Relevant to academic writing and some reading.
6	Teaching methods	Partial	Limited to lecture, discussion, problem solving, presentations.
7	Learning media	Complete	Standard media such as projector, slides, whiteboard.
8	Evaluation system	Partial	Lacks format, criteria, and rubrics.
9	References	Complete	Mostly printed books, minimal online resources.
10	Learning activities	Missing	Not specified in curriculum documents.

Although the curriculum lists multiple standard components, the document analysis identifies important gaps: (1) explicit learning activities are not specified in the curriculum document, (2) learning objectives emphasize general cognitive competencies while objectives for affective and psychomotor domains are incomplete, (3) the range of prescribed teaching methods is limited and lacks the broader variety suggested in curriculum guidelines, and (4) assessment is presented only as weightings without clear formats, rubrics, or criteria. These gaps indicate the need for greater specification and alignment among objectives, instructional approaches, and assessment practices within the Academic Writing curriculum.

#### *Students' Need Analysis*

Students' needs were identified through a mixed data collection process involving quantitative and qualitative sources. The quantitative data were gathered through validated questionnaires focusing on students' target needs and learning needs, while the qualitative data were obtained from semi-structured interviews to capture more in-depth perspectives and contextual factors influencing these needs. The questionnaire, which was validated by expert reviewers, consisted of six indicators designed to capture student needs, namely: students' reasons and objectives for learning article writing in the Academic Writing course; methods, strategies, and techniques used by students in learning; learning resources, including library references and lecturer support; cultural, social, and educational background as well as students' prior knowledge; preferred learning environment; and time available for learning. Based on the questionnaire responses, the summarized results are presented in table 2.

No	Indicator	Yes (%)	Sometimes (%)	No (%)	SD	Interpretation
1	Benefits and objectives of learning academic writing	70,83	24,07	5,09	0,52	Low
2	Learning methods, techniques, and prior knowledge	40,00	35,00	25,00	0,80	Moderate
3	Learning materials, media, and resources for article writing	64,98	30,64	4,38	0,55	Low
4	Student characteristics, interests, motivation, and abilities	51,42	27,73	20,85	0,76	Moderate
5	Learning environment	58,20	30,69	11,11	0,69	Moderate
6	Learning time and duration	49,38	32,10	18,52	0,74	Moderate

This finding underscores the critical need to clearly communicate learning objectives to guide students' efforts, alongside strong consensus on the value of relevant and supportive learning resources. Other aspects, including learning methods, lecturer feedback, assignments, and assessment, received moderate ratings, reflecting more varied or neutral perceptions. Qualitative insights further revealed that students prioritize integrated reading and writing instruction, as exposure to authentic academic texts enhances both comprehension and writing structure, one student (IL,20) noted, "When I read more journal articles, I can see how the authors structure their ideas, and it helps me to write better." Many also emphasized the need for self directed learning, acknowledging that classroom time is insufficient, (AN,21) noted "I need to learn how to study on my own and use my time more effectively because sometimes the class time is not enough." Additionally, students called for explicit, step by step guidance in scientific writing (RN,21) noted "We want to know step by step how to write a scientific paper, not just general writing." Collectively, these needs: integrated skill development, independent learning, and procedural scientific writing instruction, align closely with the pedagogical goals of academic writing in Islamic higher education.

#### Lecturers' Need Analysis

This analysis highlights which aspects of academic writing instruction are considered most essential by lecturers and identifies areas that may require further development to align teaching practices with both curriculum expectations and student needs. Table 3 presents the results of the lecturer needs analysis regarding academic writing instruction, including the standard deviations, and interpretations for each indicator.

No	Indicator	Yes (%)	Sometimes (%)	No (%)	SD	Interpretation
1	The benefits and objectives of Academic Writing instruction are needed	66,70	22,20	7,41	0,60	Low
2	A supportive environment and learning methods for understanding paragraphs should be available	61,10	33,3	0,00	0,48	Low
3	Materials, strategies, and teaching resources for paragraph writing should be provided	82,20	17,80	0,00	0,39	Low
4	Evaluation of paragraph learning should be available and appropriate	33,30	66,70	0,00	0,47	Low
5	Students' characteristics	58,30	33,30	8,33	0,63	Low
	Total	67 %	27 %	6 %	0,44	Low

All three lecturers demonstrated high consensus (SD less than 0,67) across indicators. The strongest agreement was on the need for instructional materials and strategies (82,20 percent "Yes"). Qualitative interviews identified three pedagogical priorities: Cooperative learning, lecturers noted that group tasks foster peer feedback and improve paragraph organization; Integrative learning, connecting writing instruction

with content from Islamic studies or social sciences was seen as vital for contextual relevance; Collaborative learning, lecturers emphasized preparing students for academic and professional discourse through collaborative writing tasks. These insights directly informed the design of WENNY's collaborative features, including peer review, group writing tasks, and cross disciplinary writing prompts aligning pedagogical practice with both OBE competencies and stakeholder needs.

## Design Validation

### *Expert Validation*

The expert validation of the WENNY e-module was conducted by two independent validators (IS and JP) across two core domains: instructional design and visual communication. The instructional design component received average scores of 3,71 (IS) and 4,29 (JP), yielding a mean score of 3,60, equivalent to 73,50 percent, categorized as "Very Valid." The visual communication component scored higher, with averages of 3,64 (IS) and 4,18 (JP), and a final mean of 4,23, equivalent to 84,67 percent, also classified as "Very Valid." Overall, the e-module achieved a composite mean score of 3,90 (79,89 percent), indicating high validity across both domains. Statistical analysis using Aiken's V coefficient confirmed strong content validity, with a value of 0,806, well above the 0,80 threshold for "Very Valid" classification. Additionally, inter-rater reliability was assessed using the Intraclass Correlation Coefficient (ICC), which yielded a value of 0,805, indicating excellent consistency between validators. These results confirm that the WENNY e-module meets rigorous academic and pedagogical standards for instructional design and visual communication, validating its suitability for implementation in higher education contexts.

### *Structural Design*

WENNY employs a Modular Structure, consisting of seven systematically designed learning units: (1) Opening & Learning Objectives, which aligns tasks with course-level outcomes; (2) Digital Exposure, where students explore digital texts to stimulate critical discussion; (3) Core Material, delivering key concepts through interactive PDFs, videos, and slides; (4) Practice Activity, featuring case-based exercises and analytical tasks; (5) Digital Writing Task, requiring original digital text production via LMS or collaborative platforms; (6) Peer Review & Rewriting, facilitating iterative improvement through structured feedback; and (7) Reflection, encouraging metacognitive evaluation of the writing process.

Collectively, these design principles position WENNY not merely as a technical writing tool, but as a transformative pedagogical instrument that cultivates critical thinking, collaborative competence, and productive technology use, aligning precisely with the demands of 21st-century academic literacy and Outcome-Based Education frameworks.

## Practicality Assessment

The practicality of the WENNY e-module was evaluated based on the perceptions of both instructors and students who interacted with the module during implementation. Practicality was measured using Aiken's V coefficient, with values interpreted according to established thresholds:  $\geq 0,80$  indicates "Practical," and  $\geq 0,90$  indicates "Highly Practical."

From the instructors' perspective, two lecturers from UIN Syekh Djamil Djambek Bukittinggi who taught the Academic Writing course completed a validated practicality questionnaire. As shown in Table 1, all three indicators received Aiken's V scores above 0,80: instructional media practicality (0,81), student guide practicality (0,87), and lecturer guide practicality (0,84). The overall mean score was 0,84, falling within the "Practical" category. These results indicate that instructors perceived the e-module and its accompanying guides as user friendly, pedagogically supportive, and well aligned with instructional needs in an academic writing context.

## Effectiveness Testing

The evaluation phase of this study aimed to assess the effectiveness of the WENNY e-module in enhancing students' academic writing competence within an Outcome-Based Education framework. To measure learning outcomes, a quasi-experimental design was employed, comparing an experimental group (n=30) that used the WENNY e-module with a control group (n=30) that received conventional instruction. Pretest and posttest assessments were administered to both groups to evaluate cognitive domain mastery, specifically focusing on theoretical understanding and practical application of academic writing principles.

As shown in table 4, the experimental group demonstrated a significant improvement in mean scores, rising from 47,33 in the pretest to 78,83 in the posttest – an increase of 31,50 points. In contrast, the control group improved from 40,66 to 61,00 – a gain of 20,34 points. This suggests that the WENNY e-module contributed to a substantially greater learning gain compared to conventional methods.

Group	N	Mean Pretest	Mean Posttest	Gain
Experimental	30	47,33	78,83	31,50
Control	30	40,66	61,00	20,34

To determine whether the difference in learning outcomes between the two groups was statistically significant, an independent samples t-test was conducted. Levene's Test for Equality of Variances yielded  $F = 5,714$  with  $p = 0,020$  ( $p < 0,05$ ), indicating homogeneity of variance. Under the assumption of equal variances, the t-test produced a t-value of 8,891 with 58 degrees of freedom and a two-tailed significance level of  $p < 0,001$ . The mean difference between groups was 31,50 (95 % CI: 24,41 to 38,59), confirming a statistically significant improvement in the experimental group.

The null hypothesis ( $H_0$ ) – stating that there is no difference in learning outcomes between students taught using the WENNY e-module and those taught using conventional methods – was therefore rejected. The alternative hypothesis ( $H_a$ ) – asserting that a significant difference exists – was accepted. This result provides strong empirical evidence that the WENNY e-module is more effective than traditional instruction in improving academic writing skills among university students.

The effectiveness of WENNY can be attributed to its pedagogical design, which integrates digital literacy, active learning, and process-oriented writing instruction. Features such as genre-based writing tasks, peer review, digital publishing, and self-reflection align with cognitive and constructivist learning theories, enabling students to internalize academic writing as a recursive, reflective, and socially situated practice. In summary, the WENNY e-module not only demonstrates statistically significant effectiveness in improving academic writing performance but also aligns with modern pedagogical principles that prioritize student autonomy, digital fluency, and authentic assessment. These findings validate its potential as a scalable, OBE-compliant instructional tool for higher education institutions seeking to modernize academic writing instruction in the digital era.

## DISCUSSION

The findings of this study demonstrate that the WENNY e-module effectively addresses critical gaps in academic writing instruction within Islamic higher education, particularly in contexts transitioning to Outcome-Based Education (OBE). The module's success is not only technical but also pedagogical because it bridges curriculum misalignment, student learning needs, and lecturer instructional challenges through a digitally integrated, process-oriented, and collaborative design. In this respect, the results align with and extend contemporary scholarship on digital pedagogy, self-regulated learning, and curriculum reform in the Global South.

Building on this, the curriculum analysis revealed significant misalignment between stated learning outcomes and actual instructional design, rubric-based assessment, and multimodal teaching strategies. This finding resonates with recent critiques of OBE implementation in Indonesian higher education, where curriculum documents often remain declarative rather than operational.<sup>(7)</sup> WENNY directly addresses this issue by embedding scaffolded, activity-based learning sequences ranging from digital exposure to peer-reviewed production, thereby operationalizing OBE competencies into measurable and observable tasks. This approach corresponds with the constructive alignment framework proposed by Biggs and Tang,<sup>(8)</sup> which was recently adapted for digital contexts by Chanda et al.<sup>(9)</sup> These scholars emphasize that technology integration must be purposefully aligned with learning outcomes in order to avoid digital decoration, understood as the use of technology without pedagogical intentionality.

Furthermore, students' expressed needs for integrated reading-writing instruction, self-directed learning, and step-by-step guidance in scientific writing reflect a broader global shift toward learner autonomy and digital self-regulation. As Han<sup>(10)</sup> demonstrates in EFL contexts, autonomy-supportive behaviors and strong student-teacher relationships are critical enablers of engagement and self-directed learning. Both of these aspects are structurally embedded in WENNY's design through reflection prompts, goal-setting, and instructor feedback loops. In addition, the demand for procedural guidance in scientific writing is consistent with Dutta et al.<sup>(11)</sup>, who found that structured peer assessment and metacognitive reflection significantly enhance writing self-efficacy and academic performance in higher education. WENNY's genre-based, task-sequenced approach, moving from exposure to production, addresses this need by breaking complex academic writing into manageable scaffolded phases that reduce cognitive overload and build confidence incrementally.

In line with students' needs, lecturers' emphasis on cooperative, integrative, and collaborative learning reinforces recent pedagogical trends that position writing as a social and dialogic practice rather than an individual skill.<sup>(11)</sup> WENNY's peer review, group writing tasks, and cross-disciplinary prompts directly support this orientation. Moreover, the module's contextualization of writing within Islamic studies and social sciences responds to the call by Kholili and Mu'id<sup>(12)</sup> for literacy instruction that is culturally and epistemologically

grounded, rather than merely imported from Western academic norms. By doing so, WENNY enhances relevance and motivation, which are critical factors in sustaining engagement in digital learning environments.<sup>(13)</sup>

Equally important, the high validity scores (Aiken's  $V = 0,806$ ; ICC = 0,805) confirm that WENNY meets rigorous pedagogical and design standards, while its practicality (mean Aiken's  $V = 0,84$  from both lecturers and students) underscores its usability in real-world classrooms. This aspect is particularly significant because usability is a factor often overlooked in digital learning research.<sup>(14)</sup> Beyond usability, the experimental group's 31,5-point gain ( $p < 0,001$ ), which was significantly higher than the control group's 20,34-point gain, provides robust empirical evidence of WENNY's effectiveness. This outcome not only surpasses gains reported in conventional e-module studies<sup>(3)</sup> but also aligns with recent meta-analyses showing that digitally scaffolded, process-oriented writing instruction yields significantly higher learning gains than product-focused or transmission-based models.<sup>(15)</sup>

Taken together, these empirical outcomes show that WENNY's design embodies and extends three key theoretical frameworks. Cognitive Load Theory<sup>(5)</sup> is operationalized through modular, sequenced tasks that reduce extraneous cognitive load and free working memory for higher-order thinking. Self-Regulated Learning<sup>(16)</sup> is supported through reflection, goal-setting, and peer feedback mechanisms that foster metacognitive awareness and strategic control. Multiliteracies Pedagogy<sup>(17)</sup> is updated for the digital age through multimodal production such as video, infographics, and blogs, combined with critical engagement with digital texts.

From a theoretical perspective, WENNY operationalizes Cognitive Load Theory<sup>(5)</sup> by automating citation and grammar checks, thereby freeing cognitive resources for higher-order writing. It also embodies Self-Regulated Learning<sup>(6)</sup> through reflection prompts and progress tracking. From a practical perspective, WENNY offers a scalable and low-cost solution for institutions seeking to modernize academic writing instruction without extensive infrastructure investment. Its compatibility with widely accessible platforms such as Google Sites, Docs, and Canva ensures equitable access, while its modular structure allows for flexible adaptation across disciplines and institutional contexts.

Despite these strengths, this study was conducted at a single institution with a modest sample size ( $n = 60$ ), which limits generalizability. Consequently, future research should test WENNY's scalability across multiple universities and disciplines and examine its long-term impact on writing proficiency, publication rates, and digital literacy development. Additionally, future iterations could incorporate AI-assisted feedback such as Grammarly or Turnitin and adaptive learning pathways to further personalize instruction. Limitations also include the single-institution context and the relatively short duration of eight weeks. Therefore, future studies should test scalability across universities and evaluate longitudinal retention. In conclusion, although the study presents some limitations, WENNY offers a low-cost and high-impact model for Global South universities. For this reason, policymakers should prioritize light-touch digital tools that integrate seamlessly into OBE curricula and thereby contribute to sustainable innovation in higher education.

## CONCLUSION

This study successfully achieved its primary objective: the systematic development and validation of WENNY, a digital e-module designed to enhance academic writing instruction within an Outcome-Based Education (OBE) framework in Indonesian higher education. Grounded in the 4D Research and Development model, WENNY was not only shaped by empirical needs but also rigorously validated by subject-matter experts and end-users, confirming its curricular alignment, pedagogical coherence, and usability in authentic teaching contexts.

WENNY directly addresses three persistent challenges in EFL academic writing instruction: (1) the disconnect between curriculum expectations and classroom practice, (2) the underutilization of digital tools for formative writing support, and (3) the lack of structured, scaffolded writing tasks that integrate citation literacy, genre awareness, and reflective practice. By embedding OBE-aligned competencies into a modular, mobile responsive design, WENNY repositions academic writing as a technology-mediated, iterative, and socially embedded practice, not merely a product to be graded. The module's compatibility with widely available platforms (Google Sites, Canva, Docs) ensures low-cost scalability and equitable access across resource-diverse institutions. Its structure also supports faculty adaptation, allowing integration into existing courses without requiring specialized technical training.

Future implementation should prioritize institutional piloting beyond the development sites, faculty professional development, and cross-disciplinary adaptation to test transferability. Longitudinal and comparative studies are needed to assess WENNY's impact on writing development over time and across academic cultures. With these steps, WENNY can serve as a replicable model for digitally enhanced, outcomes-driven writing instruction in Global South higher education contexts.

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The authors declare that there is no conflict of interest.

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