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Strategic development of mobile learning-assisted academic writing materials for society 5.0

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Abstract

Learning in the era of Society 5.0 is increasingly shaped by rapid advancements in information technology, necessitating innovative strategies to support academic instruction. This study responds to the demand for adaptive learning tools by developing mobile learning-assisted teaching materials for academic writing. Framed as developmental research, the study outlines a structured approach to designing and validating these materials. The process began with an input phase involving curriculum analysis and needs assessment from 162 students and 7 lecturers. This informed the drafting of content using a storyboard format, which was organized into individual scenes. The draft underwent validation by two material experts and two media experts. Expert evaluations confirmed the feasibility of the materials, with assessments ranging from good to excellent. The final output is a functional prototype of academic writing materials incorporating mobile learning features, created using the Kodular platform. This research demonstrates the potential of integrating mobile technology into academic writing instruction to meet the evolving educational demands of the Society 5.0 era.

Keywords: Academic writing; Curriculum development; Mobile learning; Society 5.0; Teaching materials.

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1. INTRODUCTION

Learning in the Society 5.0 era offers the potential to generate new value through the advancement of sophisticated technologies. This period presents an opportunity to enhance skills and learning capacities through the integration of physical and virtual environments, supported by big data technologies sourced via the Internet of Things (IoT) and facilitated through mobile learning platforms (Skobelev & Borovik, 2017; Ydyrysbayev & Andayani, 2024). Mobile learning provides a framework for designing and delivering educational content aligned with current technological developments (Kocakoyun & Bicen, 2017; Naveed et al., 2023). The prevalence of mobile-based telecommunications has led to the normalization of mobile learning, or m-learning, in both higher education and professional sectors, enabling autonomous access to digital learning resources through devices such as laptops, notebooks, smartphones, and Personal Digital Assistants (Hayashi et al., 2017; De Villiers, 2024).

Mobile learning offers several pedagogical advantages by fostering student-centered environments. These include access to learning content regardless of time or location, the promotion of lifelong and incidental learning, just-in-time education, context-aware learning experiences, and overall enriched instructional outcomes (Schefer-Wenzl et al., 2019; Moorthy et al., 2019; Garzón et al., 2024; Cavus et al., 2020; Özcan & Kert, 2020). Despite these advantages, integration of mobile learning remains limited in the instruction of academic writing, particularly in the use of teaching materials (Talan, 2020; Cloonan & Fingeret, 2020; Yaraş & Kanatlı-Öztürk, 2022; Yan et al., 2025).

Survey findings indicate that teaching materials in academic writing are predominantly distributed as printed textbooks with International Standard Book Numbers (ISBN), provided before lecture sessions (Pingmuang & Koraneekij, 2022). Constraints have emerged, including students failing to bring textbooks due to forgetfulness, physical damage to materials from frequent use, or the absence of textbooks resulting from reliance on peer lending rather than personal purchase (Hermawan et al., 2020). These issues underscore the lack of mobile-based instructional support in academic writing. Given the documented benefits of mobile learning and the identified instructional limitations, a strategic approach is required to develop mobile-compatible teaching materials for academic writing instruction in the Society 5.0 context (Wahyuni et al., 2020; Mytra et al., 2021).

Society 5.0 is defined as a human-centered societal model wherein information technology plays a transformative role across all aspects of life, including education (Crompton & Burke, 2018). This era empowers learners to determine individualized learning paths in terms of method, timing, and environment, while shifting the emphasis toward assessment and evaluation as key components of the educational process (Laghari et al., 2017). As a result, educational practices within this paradigm are shaped by significant advancements in information technology, encouraging more flexible and student-responsive learning models (Harfoushi, 2017).

Educational preparedness in the Society 5.0 era benefits from improved accessibility to teaching and learning resources, facilitated by robust digital infrastructures. These conditions enable the design of adaptive learning systems that align with curricular objectives and learner capabilities, particularly in technological domains such as data and operational technologies (Abdallah et al., 2021; Asma & Sadok, 2019; Cahyono et al., 2019). Existing research identifies a key challenge for educators: the effective integration of technology in classroom environments to cultivate competencies critical for future success, including communication, critical thinking, global awareness, and intellectual curiosity (Fattah, 2015).

Teaching materials serve as systematically organized instructional content that bridges educators and learners, thereby supporting the cognitive and academic development of learners (Muyasir & Musfikar, 2022). These materials may include traditional formats, case studies, multimedia, and digital learning platforms. Regardless of format, effective teaching materials are those designed to actively support and enhance the instructional process (Herlianus & Gunadi, 2022).

Diverse forms of instructional resources are essential to ensure flexibility and responsiveness within the educational process. Well-structured materials contribute significantly to teaching effectiveness and serve as

foundational components in learner preparedness for advanced study (Prianbogo & Rafida, 2022; Kumala & Winardi, 2020). Instructional content is considered effective when it enhances comprehension and increases the likelihood of achieving desired learning outcomes (Skobelev & Borovik, 2017).

Academic writing is categorized as a professional writing genre characterized by structured argumentation, peer review, and disciplined composition processes (Kholifah & Imansari, 2022). The process demands familiarity with formal structures, the development of multiple, well-substantiated arguments, topic feasibility, clarity in topic presentation, and meaningful contributions that advance scholarly discourse. The genre addresses deficiencies in academic writing instruction by fostering competence and cognitive engagement through brainstorming and critical reflection (Ferdiansyah et al., 2022; Haug & Mork, 2021).

Mobile learning, in this context, refers to instructional practices that utilize mobile technologies to enable unrestricted access to learning resources. It facilitates learning in rural settings and supports educational activities beyond conventional school hours (González De Agüero Vega, 2021). As a comprehensive concept, mobile learning encompasses diverse information sources, including e-books, audio-visual materials, and online lectures, enhancing the flexibility and richness of instructional delivery (Wahid & Aziz, 2022).

Empirical evidence demonstrates the efficacy of mobile learning in developing listening, speaking, reading, and writing skills. Applications such as MLERWS, which integrate mobile learning and video-based instruction, have shown significant success in improving writing proficiency. Furthermore, the use of mobile messaging platforms like WhatsApp has proven effective in facilitating writing skill development (Yuliarni et al., 2019).

1.1. Purpose of study

This study addresses the need for technology-supported instructional design by developing mobile learning-assisted teaching materials for academic writing.

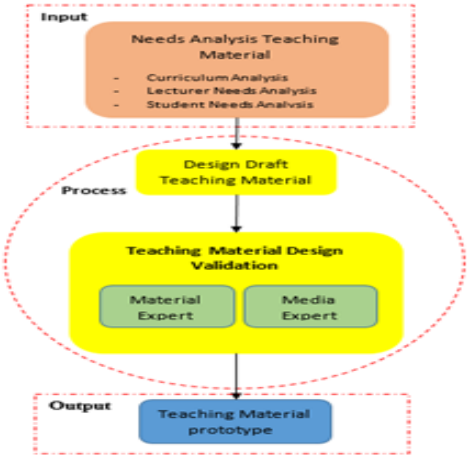
2. METHOD AND MATERIALS

2.1. Research design

This study constitutes a component of development research, aimed at designing mobile learning–based teaching materials to support academic writing instruction aligned with the demands of the Society 5.0 era. The instructional materials will be developed in the form of a user-friendly application that can be installed on digital devices. The development process follows a structured strategy comprising three key stages: (1) identification and preparation of input relevant to academic writing instruction, (2) development of a draft version of the instructional materials followed by a validation process, and (3) presentation of the output in the form of a prototype of academic writing teaching materials. These stages are illustrated in the accompanying Figure 1.

Figure 1

Strategies for preparing the teaching materials



2.2. Procedure

The initial stage involved the preparation of input related to academic writing instructional materials. During this stage, a validated questionnaire was distributed via an online platform to lecturers responsible for writing instruction and to students enrolled in writing skills courses. The collected responses were compiled and analyzed, followed by a triangulation process through interviews with selected lecturers and students. The selection of interview subjects was based on the quality and coherence of their questionnaire responses. Additionally, interviews were conducted with several heads of Indonesian language education study programs to obtain information regarding the curriculum in use.

The subsequent stage encompassed the development of a draft for academic writing instructional materials and the implementation of a validation process. Drafting was guided by the results of the needs analysis, which identified essential content requirements for both lecturers and students. A storyboard was utilized to conceptualize the structure and design of the application interface and instructional menus.

Following the drafting phase, validation was conducted by content and media experts. The validation process undertaken by content experts employed an assessment instrument based on a predetermined grid (Table 1).

Table 1

Instrument grid for the materials experts

No.	Aspect	Indicator	Evaluation				
			1	2	3	4	5
1	Content eligibility	The suitability of the material with the Learning Outcomes of the Course (CPMK)					
		Material completeness					
		Material breadth					
		Material depth					
		Material accuracy					
		Material updates					
		Encourage curiosity					
2	Presentation eligibility	Presentation technique					
		Presentation support					
		Presentation of learning					
		The flow of thought					
3	Linguistic eligibility	Communicative					
		Straightforward					
		Interactive					
		Easy to understand					
		Use of terms, symbols, or icons					
4	Assessment of higher-order thinking-oriented academic writing skills	Elements of higher-order thinking					
		Steps for higher-order thinking-oriented writing					

The validation process conducted by media experts employed an assessment instrument outlined in the instrument grid presented in Table 2.

Table 2

Instrument grid for media experts

No.	Aspect	Indicator	Evaluation				
			1	2	3	4	5
1	Content/material quality (Content Quality)	Accuracy					
		Balanced presentation of ideas					
		Appropriate level of detail					
		Reusable in various contexts					
2	Learning Goal Alignment)	Alignment between learning objectives					

No.	Aspect	Indicator	Evaluation				
			1	2	3	4	5
		Activities Evaluation Characteristics of learners					
3	Feedback and Adaptation	Adaptive content or feedback driven by different learner input or learner modelling					
4	Motivation	Ability to motivate and attract the identified student population's interests					
5	Presentation Design	Visual information design to enhance learning					
		Audio information design to enhance learning Streamline the mental process					
6	Interaction Usability	Ease of navigation, User interface predictability Quality of the interface helps features					
7	Accessibility	Control design to accommodate students with disabilities and mobile learners					
		Presentation format to accommodate students with disabilities and mobile learners					
8	Standards Compliance	Compliance with International standard Operation on commonly used technical platforms					

Scores were assigned by content and media experts based on observations aligned with the scoring guidelines presented in Table 3.

Table 3

Scoring guidelines

Rating/score	Description
5	Excellent
4	Good
3	Fair
2	Poor
1	Bad

2.3. Data analysis technique

After data collection, descriptive statistical analysis was conducted. This analysis involved converting the obtained data into percentage form using the following formula:

$$P = \frac{x}{xi} X\ 100\% \qquad (1)$$

Equation (1) presents the formula used to convert data into percentage form, where *P* denotes the percentage for each criterion, *x* represents the score obtained for each criterion, and *xi* indicates the maximum possible score for that criterion. The resulting *P* values are subsequently compared against the feasibility criteria outlined in Table 4 to determine the appropriateness of the instructional materials.

Table 4

Feasibility criteria for the teaching materials

Scale (%)	Feasibility Criteria
85 – 100	Feasible with an excellent predicate
65 – 84	Feasible with a good predicate
45 – 64	Feasible with a fair predicate
0 – 44	Not feasible

Content and media experts provided evaluations in the form of critical feedback, suggestions, and comments. These responses represented qualitative data, which were analyzed through qualitative

descriptive methods. The analysis process involved the classification and interpretation of qualitative information derived from the expert validation instruments.

The final stage consisted of the development and presentation of a prototype for academic writing instructional materials. Construction of the prototype was carried out using the Kodular platform. Kodular, an open-source web-based platform, facilitates the development of Android-based applications without requiring programming skills. This platform features a mini-dBase function for customizable data storage and offers support for application updates. Additional tools continue to be developed to optimize usability and enhance application design functionality.

The selection of Kodular was supported by empirical evidence indicating its practicality and effectiveness in educational contexts. Previous research reported feasibility scores of 94.25 percent in a small group trial and 88.38 percent in a larger group evaluation, confirming the platform's suitability for educational application development.

3. RESULTS

3.1. Preparing the required input on the teaching materials of academic writing

One of the primary inputs required in developing academic writing teaching materials is an understanding of the curriculum applied across different institutions. Interviews conducted with heads of study programs revealed that while some programs continue to implement the Indonesian National Qualifications Framework (KKNI), others have adopted the *Merdeka* (independent) curriculum. Despite these variations, the general learning outcome of academic writing courses remains consistent: students are expected to develop strong academic writing skills by the end of the course. In some institutions, this objective extends further, requiring students to produce and publish academic work as part of their final output.

A review of course syllabi and lesson plans developed by lecturers shows that the core topics in academic writing courses typically include organizing scientific essays, identifying and developing topics and titles, the various stages of the writing process, effective sentence construction, paragraph development, editing, citation methods, referencing techniques, strategies to avoid plagiarism, and review procedures.

The second key input comes from student feedback regarding their needs and preferences for academic writing teaching materials. This information was gathered using a semi-structured questionnaire distributed via Google Forms, which received responses from 162 students enrolled in various universities across Indonesia. The findings indicated that 78.4% of students preferred academic writing materials delivered in the form of a mobile application. Moreover, 97.5% expressed a strong desire for materials that could motivate them to produce scholarly works. In terms of content, 93.8% of students emphasized the importance of including all writing stages, from problem and idea analysis to outlining, comparing references, integrating ideas and references, making corrections, writing drafts based on feedback, and ultimately publishing the final work.

Additionally, 98.1% of respondents wanted the materials to include essential writing elements such as effective sentence structures, cohesion and coherence, sentence patterns, correct Indonesian spelling, clear writing procedures, and guidance on publishing written work. Interactive features were also valued, with 70.4% of students expressing interest in the inclusion of quiz features, and 96.9% supporting the addition of an evaluation menu in the mobile application.

The third input involves the perspectives and requirements of lecturers who teach academic writing. Their responses, collected through the same Google Form method, reflected insights from seven lecturers at different universities. The majority (85.7%) emphasized the need for teaching materials that promote higher-order thinking skills. Furthermore, 71.4% wanted resources that could enhance students' ability to produce high-quality scientific writing. All participating lecturers (100%) agreed on the importance of designing materials that cater to various learning styles, visual, auditory, and kinesthetic. From a technical perspective, 85.7% preferred the application's layout to be in portrait orientation, and 57.1% supported the use of Kodular as the platform for developing the mobile learning-assisted academic writing materials.

3.2. The process of drafting the teaching materials of academic writing and conducting the validation process

The development of the academic writing teaching materials in this study employed a storyboard approach, with each scene corresponding to a specific menu within the application. Each scene was carefully designed to represent the features and functions of the application interface. The first scene consists of a draft for the main page, which includes the title and identity of the program. This page integrates elements such as an introductory function, animation, textual content, background visuals, text color, and navigational buttons. Additionally, background audio in the form of instrumental music is incorporated to enhance user engagement, as illustrated in the design below (Figure 2).

Figure 2

Main page storyboard

<table>
<tr><th>No.</th><th>Keterangan</th><th>Visual</th></tr>
<tr><td>1</td><td>Scene ini menampilkan halaman utama yang berisi judul dan identitas program
<table>
<tr><th>Fungsi</th><th>Keterangan</th></tr>
<tr><td>Opening</td><td>Opening Program</td></tr>
<tr><td>Animasi</td><td>Logo UNNES berputar dan mengeluarkan cahaya, insert teks</td></tr>
<tr><td>Teks</td><td>Muncul teks judul dan identitas program</td></tr>
<tr><td>Background</td><td>Kombinasi warna R/G/B</td></tr>
<tr><td>Warna teks</td><td>Kombinasi</td></tr>
<tr><td>Tombol Navigasi</td><td>Tombol informasi
Tombol on/off musik
Tombol keluar
Tombol mulai</td></tr>
</table></td><td>

Audio: Musik Instrumental</td></tr>
</table>

The second scene represents the draft of the "invitation to pray" page, functioning as an intermediary frame between the main page and the primary menu. Its primary objective is to encourage students to begin their activities with a moment of prayer, thereby promoting the internalization of character-building values. This scene incorporates a running text animation alongside visual depictions of individuals engaged in prayer, representing the diverse religious traditions practiced in Indonesia. The design layout of this "invitation to pray" page is presented in Figure 3 below.

Figure 3

The frame of invitation to the fray

<table>
<tr><th>No.</th><th>Keterangan</th><th>Visual</th></tr>
<tr><td>2.</td><td>Setelah tombol masuk diklik, maka program akan mengarahkan pada frame ajakan untuk berdoa
<table>
<tr><th>Fungsi</th><th>Keterangan</th></tr>
<tr><td>Scane</td><td>2</td></tr>
<tr><td>Animasi</td><td>Running teks, gambar orang berdoa sesuai agama yang ada di Indonesia</td></tr>
<tr><td>Teks</td><td>Muncul teks ajakan untuk berdoa</td></tr>
<tr><td>Background</td><td>Kombinasi warna R/G/B</td></tr>
<tr><td>Warna teks</td><td>Kombinasi</td></tr>
<tr><td>Navigasi</td><td>Sistem pop up</td></tr>
</table></td><td>

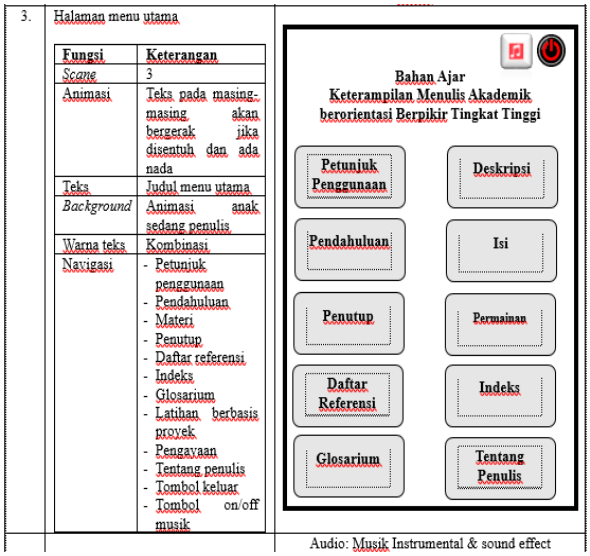
Audio: Musik Instrumental</td></tr>
</table>

The third scene presents the draft of the main menu, which encompasses the complete set of menu options available within the mobile learning-assisted academic writing teaching materials. This main menu serves as

the central navigation interface, allowing users to access various features and content integrated into the application. The layout and design of the main menu draft are illustrated in Figure 4.

Figure 4

Main menu storyboard

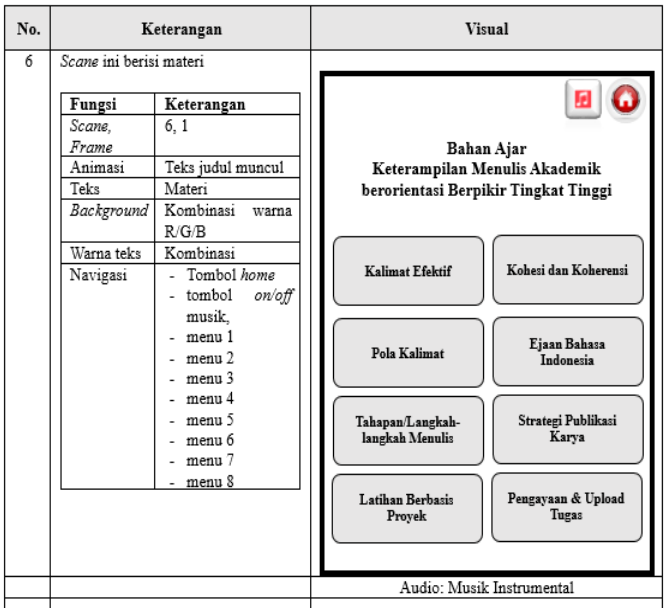


3.	Halaman menu utama Fungsi: Keterangan *Scane*: 3 Animasi: Teks pada masing-masing akan bergerak jika disentuh dan ada nada Teks: Judul menu utama *Background*: Animasi anak sedang penulis Warna teks: Kombinasi Navigasi: - Petunjuk penggunaan - Pendahuluan - Materi - Penutup - Daftar referensi - Indeks - Glosarium - Latihan berbasis proyek - Pengayaan - Tentang penulis - Tombol keluar - Tombol on/off musik	Bahan Ajar Keterampilan Menulis Akademik berorientasi Berpikir Tingkat Tinggi Petunjuk Penggunaan Deskripsi Pendahuluan Isi Penutup Permainan Daftar Referensi Indeks Glosarium Tentang Penulis Audio: Musik Instrumental & sound effect

The fourth scene features the draft of the "Contents" menu, which includes the essential academic writing materials required by both students and lecturers. This menu provides structured access to the core instructional content, ensuring alignment with the identified learning needs. The design of the contents menu is depicted in Figure 5.

Figure 5

Contents menu storyboard

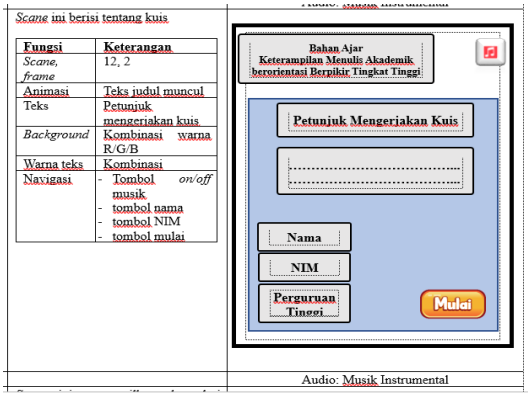


No.	Keterangan	Visual
6	*Scane* ini berisi materi Fungsi: Keterangan *Scane, Frame*: 6, 1 Animasi: Teks judul muncul Teks: Materi *Background*: Kombinasi warna R/G/B Warna teks: Kombinasi Navigasi: - Tombol *home* - tombol *on/off* musik, - menu 1 - menu 2 - menu 3 - menu 4 - menu 5 - menu 6 - menu 7 - menu 8	Bahan Ajar Keterampilan Menulis Akademik berorientasi Berpikir Tingkat Tinggi Kalimat Efektif Kohesi dan Koherensi Pola Kalimat Ejaan Bahasa Indonesia Tahapan/Langkah-langkah Menulis Strategi Publikasi Karya Latihan Berbasis Proyek Pengayaan & Upload Tugas Audio: Musik Instrumental

The fifth scene presents the draft of the "Quiz" menu, which includes a series of questions designed to assess students' understanding and knowledge after engaging with the academic writing teaching materials. This feature functions as a formative evaluation tool to reinforce learning outcomes. The layout and structure of the quiz menu are illustrated in the following Figure 6.

Figure 6

Quiz menu storyboard



Once the draft of the academic writing teaching materials was completed, the researchers proceeded with a validation process involving both material and media experts. The material experts selected for this stage were lecturers who teach writing skills courses but had not previously participated in the needs analysis questionnaire. Meanwhile, the media experts included lecturers specializing in learning media or instructional technology. These individuals were chosen due to their extensive experience and expertise in their respective fields. Feedback and recommendations from both sets of experts served as the basis for refining and enhancing the draft teaching materials. The results of the data analysis provided by the material and media experts are summarized in Table 5.

Table 5

Results of data analysis

	Material Expert 1	Material Expert 2	Media Expert 1	Media Expert 2
x	83	76	84	86
xi	90	90	100	100
p	92.2	84.4	84	86

Based on the results of the descriptive statistical analysis, the p-values obtained from each expert were compared with the feasibility criteria table for teaching materials. The findings indicate that, according to Material Expert 1, the mobile learning-assisted academic writing teaching materials fall under the "excellent" feasibility category. Material Expert 2 rated them as having "good" feasibility. Similarly, Media Expert 1 assessed the materials as "good," while Media Expert 2 rated them as "excellent." These combined evaluations from both material and media experts suggest that the academic writing teaching materials are considered feasible and appropriate for prototyping.

3.3. Displaying the output in the form of a prototype of academic writing teaching materials

The development of the mobile learning-assisted academic writing teaching materials was carried out by incorporating the corrective feedback and suggestions provided by both material and media experts on various aspects and indicators. The resulting prototypes reflect these improvements and are presented through key components such as the main page, main menu, and quiz section. The prototype of the main page of the mobile learning-assisted academic writing teaching materials is illustrated in the following figures 7.

Figure 7

Main page prototype

Meanwhile, the prototype of the main menu of mobile learning-assisted academic writing teaching materials can be seen in the following Figure 8.

Figure 8

Main page prototype

The prototype quiz on the mobile learning-assisted academic writing teaching materials can be seen in Figure 9.

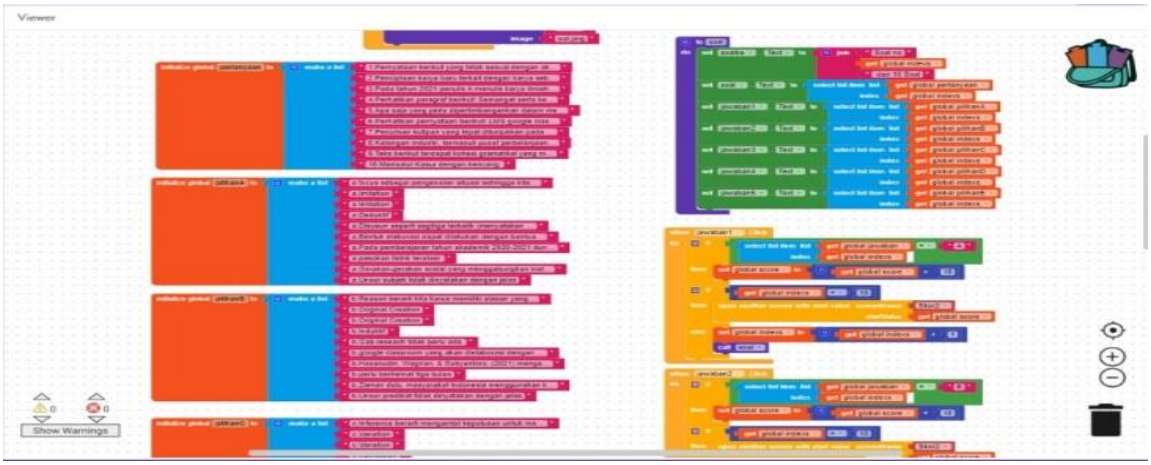
Figure 9

Quiz prototype

The process of creating quizzes using the Kodular platform involves several structured steps. Initially, global data must be prepared to store the total number of questions and corresponding answers. Upon completion of this data preparation, a procedure is developed to manage the questions, with each question assigned a sequential number (for example, from 1 to 10). Each answer is then linked to the global data through a predefined procedure. Logical constructs are implemented using conditional statements to evaluate correctness, where correct responses result in score increments and incorrect responses do not alter the score. Subsequently, the collected data is transferred to the subsequent screen, referred to as the score screen, by employing the logic of opening another screen while passing the relevant values, as illustrated in the following Figure 10.

Figure 10

The concept of quiz creation



4. DISCUSSION

The instructional strategy is initiated through a structured process comprising three primary stages: first, the compilation of essential resources for instructional material development; second, the formulation of preliminary drafts of these materials followed by a systematic validation procedure; and third, the final stage involves the presentation of a prototype as the tangible outcome. The creation of academic writing instructional resources grounded in mobile learning principles is particularly vital in addressing the pedagogical demands of the Society 5.0 era.

The preliminary stage emphasizes the necessity of aligning instructional content with relevant curricular frameworks, specifically the Indonesian National Qualifications Framework and the Independent Curriculum. This alignment must be complemented by a consideration of student-centered needs and insights from both learners and faculty members. These two curricular models constitute the foundational reference points for contemporary higher education practices within Indonesia (Dewi, 2021). In addition to curricular conformity, it is imperative for instructional planning to integrate anticipatory responses to emerging educational paradigms. This includes critical feedback from academic personnel concerning prevailing educational developments as well as ongoing student input aimed at the refinement of pedagogical strategies (Yanuarto et al., 2021).

The second phase involves the construction of a storyboard prototype, which is subsequently subjected to validation by experts in both subject content and instructional media. A storyboard functions as a schematic visualization that facilitates the organization and transmission of pedagogical concepts, thereby fostering meaningful student participation in experiential and active learning scenarios (Zhu and Wang, 2023). This visual representation serves to outline the projected structure and functionality of the instructional media. Expert evaluation of both the storyboard and the descriptive design of the intended application is essential at this juncture to ensure pedagogical soundness and technological viability prior to implementation in educational settings (Elaish et al., 2017). The confluence of storyboard development and expert validation serves a critical role in the instructional design process by providing a structured visualization of the educational application and delivering evaluative insights into its academic appropriateness and feasibility (Khodabandelou et al., 2022).

In the final phase, creation of a prototype incorporates expert suggestions and recommendations. Emphasis on innovation is critical in the development of academic writing teaching materials (Metruk, 2020). Innovative learning media contribute to instructional effectiveness and influence the success of the learning process. One innovative approach involves designing educational applications using the Kodular platform (Ilma et al., 2021). Empirical evidence demonstrates that learning media developed with Kodular can take the form of electronic modules that enhance cognitive skills among learners (Soykan and Kaşot, 2018). Additional research shows that learning media developed through Kodular achieved an evaluation score of 81 percent in the excellent category based on expert assessments, indicating high feasibility (Xiangming et al., 2020). Consequently, the use of the Kodular platform in prototyping academic writing teaching materials is deemed an appropriate choice for enhancing both effectiveness and feasibility of instructional media (Sung et al., 2019).

5. CONCLUSION

To support learning in the Society 5.0 era, the development of a strategic framework for preparing mobile learning assisted academic writing teaching materials is essential. The strategy begins with the preparation of input through curriculum analysis, including the Indonesian National Qualifications Framework and the Independent Curriculum, as well as the collection of responses and needs from 162 students and 7 lecturers. This is followed by the drafting of materials in the form of a storyboard structured into individual scenes, and the implementation of a validation process conducted by two subject matter experts and two media experts.

In the validation stage, feasibility evaluations indicated that the mobile learning assisted academic writing teaching materials were classified as feasible. Material Expert 1 assigned an excellent predicate, Material Expert 2 assigned a good predicate, Media Expert 1 assigned a good predicate, and Media Expert 2 assigned an excellent predicate. The final phase involves the presentation of the output in the form of a prototype of academic writing teaching materials, with emphasis on innovation through the utilization of the Kodular

platform. The researcher recommends that future researchers explore teaching material strategies in other subjects so that they can support learning in the Social 5.0 era.

Conflict of Interest: The authors declare no conflict of interest.

Ethical Approval: The study adheres to the ethical guidelines for conducting research.

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