

Developing Interactive Multimedia for Ulu Script to Facilitate the Learning Motivation of Fourth-Grade Primary School Students

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Abstract: Ulu script, the indigenous writing system of the Rejang people, is taught as part of the Bareang local-content subject in Kepahiang Regency, Bengkulu, yet its instruction at SD Negeri 13 Kepahiang remained lecture-based and reliant on a limited stock of shared textbooks, leaving 60% of fourth-grade students below the minimum attainment criterion and their learning motivation low. This study aimed to develop interactive multimedia for Ulu script that is valid and practical and can facilitate the learning motivation of fourth-grade students. The research used a research and development design following the 4D model of define, design, develop, and disseminate, limited in practice to the develop stage. The product was built with Google Apps Script and Google Sheets and delivered as a web application containing material menus and a group game. Participants were 31 fourth-grade students, comprising five in the limited trial and twenty-six in the field trial, together with two expert validators and the class teacher. Data were collected through interviews, questionnaires, and documentation, and analysed descriptively as percentages. Content-expert validation reached 90% and media-expert validation 88.6%, both highly valid. Student responses reached 85.4% in the limited trial and 84.02% in the field trial, and teacher responses 89.66% and 86.6%, all highly practical. Learning motivation among the twenty-six students reached 87.9%, categorised as very high. The developed multimedia is therefore valid and practical and is able to facilitate students' learning motivation.

Keywords: interactive multimedia; Ulu script; learning motivation; local content; Google Apps Script

Abstrak:

Aksara Ulu, sistem penulisan asli masyarakat Rejang, diajarkan sebagai bagian dari mata pelajaran konten lokal Bareang di Kabupaten Kepahiang, Bengkulu. Namun, pengajarannya di SD Negeri 13 Kepahiang masih berbasis ceramah dan bergantung pada persediaan buku teks bersama yang terbatas, sehingga 60% siswa kelas empat berada di bawah kriteria pencapaian minimum dan motivasi belajar mereka rendah. Studi ini bertujuan untuk mengembangkan multimedia interaktif untuk aksara Ulu yang valid dan praktis serta dapat memfasilitasi motivasi belajar siswa kelas empat. Penelitian ini menggunakan desain penelitian dan pengembangan mengikuti model 4D yaitu mendefinisikan, merancang, mengembangkan, dan menyebarluaskan, yang secara praktis terbatas pada tahap pengembangan. Produk dibangun dengan Google Apps Script dan Google Sheets dan disampaikan sebagai aplikasi web yang berisi menu materi dan permainan kelompok. Partisipan terdiri dari 31 siswa kelas empat, yang terdiri dari lima siswa dalam uji coba terbatas dan dua puluh enam siswa dalam uji coba lapangan, bersama dengan dua validator ahli dan guru kelas. Data dikumpulkan melalui wawancara, kuesioner, dan dokumentasi, dan dianalisis secara deskriptif sebagai persentase. Validasi oleh pakar konten mencapai 90% dan validasi oleh pakar media 88,6%, keduanya sangat valid. Respons siswa mencapai 85,4% dalam uji coba terbatas dan 84,02% dalam uji coba lapangan, dan respons guru 89,66% dan 86,6%, semuanya sangat praktis. Motivasi belajar di antara dua puluh enam siswa mencapai 87,9%, dikategorikan sebagai sangat tinggi. Oleh karena itu, multimedia yang dikembangkan valid dan praktis serta mampu memfasilitasi motivasi belajar siswa.

Kata kunci: multimedia interaktif; aksara Ulu; motivasi belajar; konten lokal; Google Apps Script

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Introduction

Ulu script is the indigenous writing system of the Rejang people and carries considerable historical and philosophical weight as evidence of the literacy of earlier generations in what is now Bengkulu Province. Amid the pressures of globalisation, teaching regional scripts offers a route to preserving local culture and strengthening young people's attachment to their own heritage (Cahyaningsih & Supartinah, 2023). The urgency is not abstract: the national language agency has identified 139 regional languages at risk of extinction, and language shift proceeds as speakers of a given language choose to move to another. In Kepahiang Regency the response has been institutional — Regent Regulation No. 24 of 2022 established the Bareang local-content curriculum, in which Ulu script is taught alongside customs, culture, and everyday Rejang across two lesson hours per week.

Policy at the curricular level, however, does not guarantee results at the level of classroom practice. Observation at SD Negeri 13 Kepahiang found that 60% of fourth-grade students scored below the minimum attainment criterion on the mid-semester assessment for Ulu script. Interviews with the class teacher identified the immediate causes. Instruction relied on lecture supported by static textbook images, an approach Refi and Ritonga (2021) associate with low engagement. The textbook stock was severely limited — one book shared between two students at a desk, and books could not be taken home for fear of loss — so students had no means of revisiting the material outside class. The school owns Chromebooks, an interactive television, a projector, and laptops, but most teachers found these difficult to deploy for local-content teaching. A fifteen-item motivation questionnaire administered to the class produced a preponderance of negative responses, confirming that motivation itself, rather than the material alone, required attention.

Motivation is central because it conditions the effort a student is willing to sustain. Wibawa et al. (2022) distinguish intrinsic motivation, evident in curiosity, interest, and the satisfaction of mastering material, from extrinsic motivation arising from the learning environment, peer and teacher support, and rewards; both influence willingness to persist and to regulate one's own learning. Novia et al. (2021) note the corresponding relationship between motivation and achievement, and the practical implication that teachers must work deliberately to arouse it.

Interactive multimedia offers one response. By combining text, image, audio, video, and animation in a single interactive platform, multimedia can shift the learner from passive reception to active

participation (Kusumawati et al., 2021; Zaharah et al., 2021). Munir (2021) argues that well-designed interactive media are not merely moving visuals but instruments of two-way communication that return feedback to the user directly. Meta-analytic evidence supports the general claim: Noetel et al. (2022) synthesised reviews of multimedia design for learning, and Yu et al. (2021) documented the effects of educational games on outcomes, motivation, engagement, and satisfaction. Work on regional scripts specifically points the same way, with Hidayat et al. (2022) and Supriadi et al. (2020) developing augmented-reality media for Sundanese Kaganga, Cahyaningsih and Supartinah (2023) producing multimedia for Javanese script, and Rahmawati (2025) and Supriyan (2023) reporting on Kaganga media in Rejang Lebong. Rahmawati (2025) found that 94.35% of teachers surveyed considered such media a strong need, and 82.5% of students wanted media that were attractive and visual rather than monotonous.

What has not been developed is an interactive multimedia product for Ulu script that a class teacher can maintain and update without programming expertise. Existing products for regional scripts are typically fixed applications whose content cannot be edited by the teacher. This study addresses that gap by developing a web application built on Google Apps Script with Google Sheets as the content store, so that material, questions, and player groupings can be edited in an ordinary spreadsheet. Two questions guide the research: how valid is the developed multimedia according to content and media experts, and how practical is it according to teacher and student responses? The study also reports students' learning motivation after use, and contributes a low-cost, teacher-editable design that other local-content teachers can adapt.

Method

Research design

This study used a research and development design, a method employed to produce a particular product and examine its quality (Sugiyono, 2021). The development procedure followed the 4D model of *define*, *design*, *develop*, and *disseminate*. In practice the procedure was limited to the *develop* stage; dissemination was not undertaken because of the time available for the research.

Setting and participants

The research was conducted at SD Negeri 13 Kepahiang, a public primary school in Pagar Gunung Village, Kepahiang District, Bengkulu Province, during the even semester of the 2025/2026 academic year. Participants were the 31 fourth-grade students taking the Ulu script material, of whom five took part in the limited trial

and twenty-six in the field trial; the two groups were distinct. Two expert validators were involved: a doctoral candidate at Universitas Bengkulu whose dissertation addresses Rejang culture and script and who leads a cultural literacy community, serving as content validator; and a lecturer in the engineering programme at Universitas Muhammadiyah Bengkulu, a national certification assessor in computing and programming, serving as media validator. The fourth-grade class teacher acted as practitioner respondent.

Instruments

Three instruments were used. Interview guides for the teacher and students explored learning motivation, learning needs, and requirements for the media to be developed. Questionnaires using a five-point Likert scale comprised content-expert and media-expert validation sheets, a student response questionnaire, and a teacher response questionnaire; the assessment aspects followed Abdul Malik et al. (2021). The media instrument covered ease of navigation, artistry and aesthetics, and overall function; the content instrument covered feasibility of content and presentation of information; the practicality instrument for teachers and students combined all five aspects. A separate fifteen-item motivation questionnaire covered the desire to succeed, the drive and need to learn, interest in learning, persistence, independence, and support from the learning environment. Documentation recorded the curriculum, learning outcomes, lesson plans, textbooks, and research activities.

Development procedure

At the *define* stage, learner analysis examined age, prior knowledge, learning experience, understanding of Ulu script, and ability to operate digital devices; task analysis set out the competencies required, from recognising letter forms and distinguishing visually similar characters to reading simple words and writing correctly; and concept analysis established the material to be included, covering letter forms and names, phonetic values, writing conventions, and application in words and sentences. At the *design* stage, Draft I was built using Google Apps Script and Google Sheets with design support from Canva, organised around a gamified concept, the *Balap Karung Bareang* (Bareang Sack Race) game, and made accessible online. At the *develop* stage, Draft I was submitted for expert validation, revised, trialled with five students, revised again, and then trialled with twenty-six students.

Data analysis

Qualitative data from interviews and documentation were analysed through data reduction, display, and conclusion drawing.

Quantitative questionnaire data were converted into percentages by dividing the score obtained by the maximum possible score and multiplying by 100. Validity percentages were interpreted as 80–100% (highly valid), 60–79.99% (valid), 40–59.99% (less valid), 20–39.99% (invalid), and 0–19.99% (very invalid); practicality percentages used the equivalent bands from highly practical downward; and motivation percentages were read as 80–100% (very high), 60–79.99% (high), 40–59.99% (moderate), 20–39.99% (low), and 0–19.99% (very low).

Results and Discussion

The developed product

The product is a web application accessible through a shortened link, containing a home page, a material menu, a game menu, and a settings panel. The home page carries the game name, the teacher's name, and entry buttons for material and game. The material menu presents the twenty parent characters of Ulu script together with diacritics and the vowel-killer sign, and after revision also accommodates uploaded video and PDF material. The game menu allows the teacher to insert students' own photographs as player profiles; students compete in groups to accumulate points by matching Ulu script with Rejang vocabulary such as *inok*, *bak*, *matei*, *bukeu*, and *umeah*. The settings panel controls the number of players, time per question, automatic levelling, a combo bonus for consecutive correct answers, and a penalty that moves a player backwards after a wrong answer.

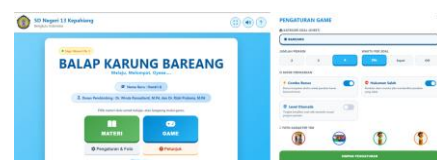


Figure 1. Home page and settings panel of the developed multimedia

The architectural choice matters for sustainability. Because Google Apps Script is a cloud-based, serverless platform integrated with Google Workspace (Google Developers, 2026), and because questions and material are stored in an ordinary Google Sheet, the teacher can add or edit content by typing in a spreadsheet rather than by editing code. Generative artificial intelligence was used during development to assist with script writing and interface design, an application consistent with the guidance for such tools in education and research issued by UNESCO (Miao & Holmes, 2023) and with the emerging empirical literature on their educational use (Zhang et al., 2024).

Validity

Expert validation results are presented in Table 1.

Table 1. Expert validation results

Validator	Assessed aspect	%	Mean
Content expert	Feasibility of content	90.0	90.0
	Presentation of information	90.0	
Media expert	Ease of navigation	92.5	88.6
	Artistry and aesthetics	80.0	
	Overall function	93.3	

The content expert awarded 90% on both feasibility of content and presentation of information, for a mean of 90% in the highly valid category. The media expert awarded 92.5% for ease of navigation, 80% for artistry and aesthetics, and 93.3% for overall function, for a mean of 88.6%, also highly valid. Artistry and aesthetics was the weakest dimension on the media instrument and remained the weakest dimension throughout the trials, which suggests that the visual design rather than the functionality was the limiting factor in this version.

Validator comments produced three substantive revisions. The initial version contained only the quiz game, without material that could be studied beforehand; a material menu supporting uploaded video and e-book content was therefore added, with the game triggered after material had been covered. The application lacked a usage guide and a route back to the main menu; a *Petunjuk* (instructions) menu was added and the exit icon replaced by a home button. The content expert also recommended that Ulu script material be paired with Rejang language, so that after composing a word or sentence in Ulu script students also form the corresponding Rejang sentence, in line with the local-content curriculum. All three revisions concern the relationship between the game and the learning it is meant to support, which is the point at which gamified media most often fail.

Practicality

The practicality of the developed multimedia was evaluated through student and teacher responses during the limited and field trials. The assessment covered five aspects: content of the material, presentation, ease of navigation, artistry and aesthetics, and overall function.

As shown in Table 2, student responses remained positive across both stages of implementation. The overall practicality score reached 85.4% in the limited trial and 84.02% in the field trial, placing the multimedia in the highly practical category. Although the overall score

decreased slightly in the field trial, the difference was relatively small, indicating that the multimedia maintained a comparable level of usability when implemented with a larger group of students.

Table 2. Student responses to the practicality of the multimedia

Assessed aspect	Limited trial	Field trial
Content of the material	87.0%	84.6%
Presentation of material	80.0%	82.7%
Ease of navigation	98.0%	90.1%
Artistry and aesthetics	70.0%	70.7%
Overall function	92.0%	92.0%
Mean	85.4%	84.02%

At the aspect level, overall function showed the greatest consistency, receiving 92.0% in both trials. Ease of navigation also received very high ratings, although the score decreased from 98.0% in the limited trial to 90.1% in the field trial. These findings indicate that students were generally able to access menus, operate the multimedia, and engage with its main features without substantial technical difficulty. For primary-school learners, such operational simplicity is important because excessive navigational complexity may divert attention from the learning content itself.

The content of the material also received favourable responses, with scores of 87.0% and 84.6% in the limited and field trials, respectively. Meanwhile, presentation of material increased from 80.0% to 82.7%, suggesting that students continued to perceive the organisation and delivery of the learning content positively during broader classroom implementation. In contrast, artistry and aesthetics received the lowest scores, at 70.0% in the limited trial and 70.7% in the field trial. Although these scores remain within the practical category, they indicate that the visual dimension constitutes the clearest area for further refinement.

Teacher responses provide an additional perspective on the practicality of the multimedia, as presented in Table 3.

Table 3. Teacher responses to the practicality of the multimedia

Assessed aspect	Limited trial	Field trial
Content of the material	90.0%	92.0%
Presentation of information	85.0%	78.0%
Ease of navigation	100.0%	96.0%
Artistry and aesthetics	80.0%	74.0%
Overall function	93.0%	93.0%
Mean	89.66%	86.6%

Table 3 shows that the teacher also evaluated the multimedia positively in both stages, with overall scores of 89.66% in the limited trial and 86.6% in the field trial. Both scores fall within the highly practical category. Similar to the student responses, the highest ratings were found in ease of navigation and overall function. Ease of navigation reached 100.0% in the limited trial and remained very high at 96.0% in the field trial, while overall function remained stable at 93.0% across both trials.

The convergence between student and teacher responses is particularly important. Both groups consistently rated ease of navigation and overall function among the strongest aspects of the multimedia. This pattern indicates that the application was not only technically operable but also sufficiently accessible for classroom implementation. The finding is consistent with Arsyad (2020), who emphasises that practical learning media should be accessible, manageable, and capable of supporting instructional activities without creating unnecessary operational difficulties. It also aligns with Munir (2021), who views interactive multimedia as a learning environment in which users are able to control learning activities and receive responses or feedback from the system.

The teacher's assessment of the material content increased from 90.0% to 92.0%, suggesting that the instructional content remained relevant when the multimedia was implemented in the larger field trial. This finding supports the alignment of the product with the Bareang local-content subject, particularly its integration of Ulu script forms, diacritics, Rejang vocabulary, and related learning activities.

However, the presentation of information decreased from 85.0% in the limited trial to 78.0% in the field trial. This result provides a useful pedagogical signal. While students rated the presentation of material at 82.7% in the field trial, the teacher's lower rating suggests that the organisation, sequencing, clarity of instructions, or connection between learning material and game activities could still be strengthened. Consequently, subsequent revisions should not merely add more information, but should improve how the material is structured and communicated to learners.

Artistry and aesthetics consistently emerged as the weakest dimension across both respondent groups. In the field trial, students rated this aspect at 70.7%, whereas the teacher rated it at 74.0%. This pattern is consistent with the earlier media-expert validation, in which artistry and aesthetics also received the lowest score among the media-validation dimensions. The recurrence of this finding across expert validation, student responses,

and teacher responses suggests that visual appearance represents a genuine area for further development rather than an isolated judgement from one respondent group.

Future refinement could therefore focus on improving visual hierarchy, typography, icon consistency, spacing, interface organisation, and the attractiveness of game elements while maintaining the simplicity required by primary-school learners. These improvements should nevertheless remain pedagogically purposeful. As noted by Purnamawanti et al. (2023), the practical value of learning media is determined primarily by its ability to support learning effectively, rather than by visual attractiveness alone. In the present study, the relatively lower aesthetic scores occurred alongside very high ratings for navigation and overall function, indicating that the multimedia already possesses a strong functional foundation.

The practicality findings should therefore be interpreted beyond the overall mean scores. The aspect-level results reveal a more informative pattern: ease of navigation and overall function constitute the principal strengths of the multimedia; content is positively perceived by students and the teacher; presentation requires further pedagogical refinement; and artistry and aesthetics remain the most evident area for visual improvement. Such an interpretation provides clearer developmental direction than relying solely on the aggregate practicality category.

Practicality is also reflected in the architecture of the developed product. The use of Google Apps Script connected to Google Sheets enables the teacher to update learning materials, questions, and several game components without directly modifying the program code. This feature extends practicality from ease of use by students to ease of maintenance by teachers. In the context of local-content education, such adaptability is especially relevant because teachers may need to modify vocabulary, contextual examples, learning activities, or instructional materials according to local and curricular needs.

Overall, the results demonstrate that the developed Ulu script multimedia is highly practical for classroom use. Its principal strengths lie in operational accessibility, ease of navigation, functional reliability, and the adaptability of its content-management structure. At the same time, the findings identify clear priorities for subsequent development, particularly in visual design and the presentation of instructional information. Thus, the practicality results indicate not that the product is already complete in every dimension, but that its core design is sufficiently functional, accessible, and adaptable to support Ulu script learning in the primary-school context.

Learning motivation

Motivation was measured after the full sequence of lessons using the multimedia had been completed, with the fifteen-item questionnaire administered to the twenty-six field-trial students. Results are presented in Table 4.

Table 4. Students' learning motivation after using the multimedia

Motivation indicator	Score	Max	%
Desire and will to succeed	228	260	87.7
Drive and need to learn	234	260	90.0
Interest in learning	227	260	87.3
Persistence in learning	346	390	88.7
Independence in learning	289	390	74.1
Support of the environment	390	390	100.0
Total	1,714	1,950	87.9

Overall motivation reached 87.9%, within the very high category. Support from the learning environment reached 100%, and the drive and need to learn 90%, while independence in learning was the sole indicator below the very high threshold at 74.1%. The distribution is coherent with the design. Group play, the insertion of students' photographs into the game, point accumulation, and immediate feedback on answers all operate on the environment and on extrinsic drive, so the highest scores fall exactly where the media exert most direct influence. Independence, by contrast, depends on students choosing to revisit material outside the structured activity, which the study did not arrange and which the previous textbook shortage had given them no habit of doing. That the weakest indicator is the one least addressed by the intervention strengthens rather than undermines the interpretation.

The findings are consistent with Winarti et al. (2024), who report that interactive multimedia formats create enjoyable learning experiences that break classroom boredom and raise motivation, and with Khasanah et al. (2024) on game-based media. Supriyan (2023) found in a comparable local-content setting in Rejang Lebong that animation media attracted attention and reduced boredom relative to lecture and static textbooks. Hasan et al. (2021) describe this as the affective function of learning media: the capacity to arouse interest, enthusiasm, and active involvement through moving visual elements. In the present case, the practical constraint identified at the outset — shared textbooks that could not be taken home — was directly relieved by a web application students could reach on their own devices.

Limitations

Three limitations bear on how these results should be read. First, motivation was measured

only after use, without a pre-test and post-test comparison; the appropriate claim is therefore that the multimedia facilitates motivation at a very high level, not that it produced a statistically demonstrated increase. Second, the study was confined to a single school and a single class, and the disseminate stage of the 4D model was not carried out, so generalisation is limited. Third, the product depends on internet access and on devices being available; where connectivity is unreliable, the advantage over printed material narrows. The consistently lower ratings for artistry and aesthetics also indicate that visual design deserves attention in any subsequent version.

Conclusion

The interactive multimedia for Ulu script developed in this study meets both criteria set for the research. It is highly valid, with content-expert validation at 90% and media-expert validation at 88.6%. It is highly practical, with student responses at 85.4% in the limited trial and 84.02% in the field trial and teacher responses at 89.66% and 86.6% respectively. Students' learning motivation after using the multimedia reached 87.9%, categorised as very high. The product is therefore suitable as an alternative learning medium for the Bareang local-content subject at SD Negeri 13 Kepahiang. Its principal contribution is architectural: by storing content in a spreadsheet linked to a Google Apps Script application, it gives the class teacher direct control over material and questions without programming knowledge, which is what allows a locally developed medium to survive beyond the research that produced it. Future research should test effectiveness with a pre-test-post-test design, extend the material beyond the present scope, carry out the dissemination stage across schools implementing the Bareang curriculum, and strengthen the visual design, the dimension both experts and users rated lowest.

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Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Hendri A: conceptualization, methodology, software, investigation, data curation, writing—original draft. Winda Ramadianti: supervision, validation, writing—review and editing. Rizki Pratama: supervision, methodology, writing—review and editing.

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