



Augmented Reality for Contextual English Learning: Designing a Sasirangan-Based Learning Application for Secondary Students in South Kalimantan

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Abstract: Indonesia's English proficiency remains comparatively low, while English learning media in secondary education rarely integrate locally meaningful cultural content, immersive mobile technology, and the educational dimensions of Sustainable Development Goal (SDG) 4.7. This gap is particularly visible in South Kalimantan, where Sasirangan—a traditional hand-dyed textile carrying philosophical meaning—has rarely been incorporated into English language learning. This study employed Design-Based Research (DBR) across four phases: analysis and exploration, design, development, and reflection/evaluation. A needs-analysis questionnaire was administered to 748 Grade 12 students from six senior high schools in South Kalimantan. The design phase involved a focus group discussion with six English teachers to formulate learning objectives, task structures, and AR-supported interactions for argumentative and discussion texts. The development phase produced an Android-based augmented reality application called SasiVision integrating Sasirangan cultural content into contextual English learning. The prototype was evaluated through expert validation involving media, material, and language experts, followed by a practicality survey involving 80 student users. The expert validation score reached 85.66%, indicating that the prototype was highly valid with minor revisions. The practicality score reached 71.4%, indicating that the application was practical for classroom use with revision. The highest student responses concerned multimodal learning support and clarity of AR-based Sasirangan visualization, while the lowest scores related to installation difficulty and technical performance, indicating the importance of device compatibility and infrastructure readiness in AR-assisted learning implementation. This study contributes a validated and practical prototype for contextual English learning that integrates augmented reality, local cultural heritage, and SDG 4.7-oriented education. The findings provide pedagogical design principles and implementation considerations for culturally contextualized AR-assisted language learning in secondary education, while establishing a foundation for future effectiveness studies examining learning outcomes and critical-thinking development.

Keywords: Augmented Reality in Education, Culturally Contextual Learning, Design-Based Research, Sasirangan-Based Learning, Sustainability-Oriented Education.

1. Introduction

Sasirangan is a heritage and luxury product of South Kalimantan with profound philosophical meaning that reflects the noble values of the Banjar people. It is promising as a contextual learning medium that brings instructional content closer to students' real-life experiences (Brown & Lee, 2015; Tatal, 2023). To date, Sasirangan has been integrated into learning in biology, science, social studies, and mathematics. Yet, it has rarely been integrated into English language learning. At the secondary level, English learning materials frequently discuss environmental issues such as domestic and industrial waste, environmental management, and environmental



preservation (Hardini *et al.*, 2022); however, the instructional materials do not sufficiently engage with students' local cultural contexts.

When the learning process involves Sasirangan, students are able to relate what they are learning to the social and cultural environment around them. Students can discuss the philosophical meanings of Sasirangan motifs, environmentally friendly production techniques, the application of natural dyes, and efforts to preserve local culture through English projects or the use of English texts. Such activities not only enhance students' vocabulary and literacy skills but also their awareness of culture and environmental preservation. In addition, the use of local cultural contexts creates an authentic learning atmosphere, which positively affects students' understanding and improves their achievement in learning English (Barkhoda *et al.*, 2025; Pathomchaiwat & Thongrin, 2025; Ratri *et al.*, 2025). In this way, learning becomes more meaningful because students directly connect language learning with cultural and environmental issues through an integrated approach.

Moreover, following rapid changes in education after the COVID-19 pandemic (Hutchinson & Waters, 1987; Lim *et al.*, 2025; Richards, 2013), the use of technology has become an indispensable part of the teaching and learning process, including in English language education. Digital applications and platforms have been used to develop students' English proficiency, including mobile applications for reading and writing skills, critical-thinking skills, and ECO-ELT (Hossain, 2024; Zhou & Colomer, 2024; Klimova & Zamborova, 2020; Koowuttayakorn & Taylor, 2022; Jepri Ali Saiful, 2020). These studies have reported positive results in students' reading, writing, listening, and speaking skills. However, most existing tools are culturally generic and do not sufficiently incorporate the Indonesian sociocultural setting, especially local cultural values, making learning less meaningful and contextual for students (Asmayawati *et al.*, 2024; Ramdiah *et al.*, 2020). This situation highlights the need to create technology-based media for learning English that integrate local culture, such as Sasirangan, so that students can learn English meaningfully while maintaining their own culture. Consistent with this perspective, incorporating local culture into technology-enhanced learning also supports Sustainable Development Goal (SDG) 4 on Quality Education, particularly Target 4.7, which underscores the relevance of education to sustainable development, cultural preservation, and respect for cultural diversity (Malik *et al.*, 2025; Rimba *et al.*, 2025; Yildirim & Aytan, 2025). Local culture-based English learning not only enhances the digital literacy of students who use the technology, but also makes the innovation relevant and contextual through local wisdom. Studies have demonstrated that cultural integration in the learning process positively affects cultural identity, cross-cultural awareness, and a positive stance toward diversity (Asmayawati *et al.*, 2024; Ramdiah *et al.*, 2020). The integration of technology, culture, and language learning therefore enables students to develop 21st-century competencies in a holistic way, including language skills, technological literacy, and cultural awareness (Mutammimah *et al.*, 2024).

Although previous studies have examined augmented reality (AR) in language learning, integrated local content into English instruction, and incorporated environmental issues into the classroom, few studies have systematically combined these three aspects within a single instructional design framework. There is still a need to develop an AR-based English learning application for secondary students that focuses on English literacy skills, local culture, and environmental awareness. Therefore, this study contributes to the field by developing SasiVision as an AR-assisted English learning application that integrates Sasirangan cloth into contextual English learning, aligning instructional design with SDG 4.7 principles. Through this development, the present study links educational technology, cultural values, and sustainable education. In addition, preliminary studies, national examination reports, and classroom observations in secondary schools in South Kalimantan indicate relatively low English literacy skills among students, particularly in writing, speaking, and critical thinking. These results are consistent with the 2024 English First Proficiency Index, which ranked Indonesia as a low-proficiency country (Education First, 2024). Students usually have difficulty formulating clear arguments, analyzing information critically, and relating their learning content to local cultures. This highlights the need for learning interventions that can not only improve linguistic competence but also strengthen higher-order thinking skills in line with 21st-century competencies.

A deep learning approach is viewed as an appropriate pedagogical approach that can promote critical thinking, abstract reasoning, and meaningful learning experiences focused on developing students' skills and character. Furthermore, the introduction of local wisdom into the learning process has been identified as capable of positively enhancing students' sense of relevance, cultural awareness, and positive attitudes toward language learning, and the application of technologies such as Augmented Reality (AR) has been shown to be effective in



promoting motivation, engagement, and language learning outcomes. Subsequently, the development of English learning media based on Sasirangan local wisdom and the integration of AR technology are perceived as strategic and necessary innovations. This study was conducted in response to the needs of secondary school students in South Kalimantan.

This study, therefore, positions SasiVision as a technology-based application and instructional design that operationalizes SDG 4.7 through AR-assisted contextual English learning rooted in local cultural heritage. It aims to develop and validate an augmented reality-based English learning application named SasiVision that integrates Sasirangan local wisdom to support English literacy and critical thinking while aligning with SDG 4.7. Specifically, the objectives of this study are as follows: 1) to identify the needs of secondary students in South Kalimantan for contextual English learning media integrating Sasirangan and AR technology; 2) to develop the SasiVision application through a systematic design-based research (DBR) process; 3) to assess the validity of SasiVision based on expert assessment; and 4) to assess the practicality of SasiVision based on user evaluation.

2. Literature Review

2.1. Augmented Reality in Language Learning

Augmented Reality (AR) technology has been acknowledged as a valuable tool to transform traditional learning experiences into interactive and engaging activities. The earliest form of AR was developed by Ivan Sutherland in the 1960s when he created a head-mounted display that projected computer-generated pictures onto real-world objects (Parlar & Sütcü, 2025). Unlike virtual reality, which generates totally immersive digital settings, AR complements the real world with computer-generated perceptual information, making it particularly ideal for educational applications where context and physical presence are vital.

In the area of English language teaching, the integration of AR into teaching practice has grown substantially over the past decades due to the widespread use of mobile technology devices. In addition, the development of accessible Software Development Kits (SDKs) has made it feasible for AR designers to adapt them for language education. Recent research has indicated that AR has been implemented at every level of education, from preschool to tertiary education (Popescu *et al.*, 2017). AR applications have also been used to measure students' progress in English language skills (Parlar & Sütcü, 2025), English teachers' competence (Alsuwaihel, 2024), and other areas of language teaching and learning. AR is also believed to generate enjoyable learning experiences, enhance students' motivation, and develop their sense of interaction and collaboration (Yuda *et al.*, 2022).

However, most AR-based language learning applications remain focused on general vocabulary instruction, gamification, or student engagement without sufficiently integrating local cultural heritage or sustainability-oriented educational goals. This limitation indicates the need for AR learning environments that are not only technologically interactive but also culturally contextualized and pedagogically meaningful.

2.2 Sustainable Development Goal 4.7

Sustainable Development Goal 4 (SDG 4) is a global agenda to provide universal access to quality education and to give people the opportunity to engage in lifelong learning by 2030 (Saini *et al.*, 2022). As one of the 17 Sustainable Development Goals adopted by all United Nations member states in 2015, SDG 4 is considered one of the leading goals for achieving the broader 2030 Agenda for Sustainable Development. Education has been a catalyst for development in many areas of sustainable development, including poverty reduction, gender equality, improved health, and environmental sustainability.

SDG 4 takes the form of a comprehensive framework consisting of 10 targets and 11 indicators used to measure progress in quality education within the global community. These include free primary and secondary education (Target 4.1), equal access to quality pre-primary education (Target 4.2), affordable technical, vocational, and higher education (Target 4.3), increased employment-related skills (Target 4.4), non-discrimination in education (Target 4.5), universal literacy and numeracy (Target 4.6), and education for sustainable development and global citizenship (Target 4.7). The SDG 4 framework has four levels—global, thematic, regional, and national with countries serving as the primary point for monitoring processes (UNESCO Institute for Statistics, 2017). This multi-layered



approach is applicable to comparative global research as well as to assessments of educational progress that are oriented to regional circumstances.

The development of augmented reality (AR) as a language learning tool aligns with United Nations SDG 4.7, which aims to provide equitable and inclusive quality education and lifelong learning opportunities for all. AR-based technology, which overlays digital content onto real-world environments, has already been shown to facilitate language learning through immersive, interactive, and contextual experiences. This literature review covers the intersection of AR in language learning and how the technology can be used to address SDG 4.7 by summarizing recent research, pedagogical implications, and future opportunities.

2.3 Integrating Sasirangan in Language Learning

The integration of local culture into language learning has been widely recognized as a means of facilitating meaningful, contextualized, and sustainable education (Alhosani, 2022; Barkhoda *et al.*, 2025; Hossain, 2024; Isnaniah *et al.*, 2025). Local culture can be regarded not only as language material but also as a means of developing learners' intercultural competence and identity formation (Ratri *et al.*, 2025). The implementation of cultural heritage in education in Indonesia is in line with the Merdeka Belajar policy, which promotes a contextual approach to learning that is sensitive to students' social realities and regional backgrounds. The traditional hand-dyed fabric of South Kalimantan, Sasirangan, reflects philosophical ideals of perseverance, spirituality, and harmony with nature. These motifs carry symbolic meanings related to health, protection, and balance (Ekawati *et al.*, 2019; Permatasari *et al.*, 2025; Ramdiah *et al.*, 2024). By including Sasirangan in English learning, students are able to acquire linguistic knowledge while also gaining insight into local culture, thereby contributing to the development of cultural literacy and language competence.

Pedagogically, integrating local culture into English instruction aligns with deep-learning concepts that emphasize critical thinking, reflection, and knowledge transfer (Peng, 2024; Ridho *et al.*, 2021). With the mediation of augmented reality (AR), aspects of Sasirangan can be visualized interactively, giving learners opportunities to explore motifs, stories, and history through 3D visualization. This supports not only engagement but also both the cognitive and affective aspects of learning (Fuad *et al.*, 2024; Permatasari *et al.*, 2025). Moreover, the inclusion of Sasirangan is aligned with SDG 4, particularly Target 4.7, which focuses on education for sustainable development and respect for cultural diversity. Through SasiVision, English teaching can become a means of empowering students and their communities, enabling them not only to master language and become competitive in the global market, but also to contribute to a self-reliant and sustainable local society. Therefore, Sasirangan learning through AR can be recognized as a novel way of learning that integrates technology, culture, and sustainability in the pursuit of quality education.

Overall, AR and cultural learning have been discussed independently in earlier studies, but relatively few studies have combined both concepts in the context of sustainable education. This research bridges that gap by incorporating AR technology and local culture to facilitate language learning in ways that align with SDG 4.7.

2.4 Conceptual Framework of SasiVision

The conceptual framework of SasiVision integrates three primary dimensions: augmented reality features in the SasiVision app, Sasirangan cultural content in argumentative and discussion texts, and education for sustainable development and cultural preservation. The Sasirangan content includes topics such as motifs, the philosophical meanings of those motifs, local wisdom, ways to preserve Sasirangan as part of Banjar cultural identity, and strategies for promoting it globally. The framework is based on the assumption that meaningful language learning becomes more effective when students interact with contextualized cultural materials through interactive digital environments. Within the application, augmented reality (AR) functions as a technological affordance that supports visualization, interaction, and student engagement. Through AR features, students can observe and explore Sasirangan motifs and related cultural objects in more concrete and contextual forms in their English class, as shown in Figure 1.



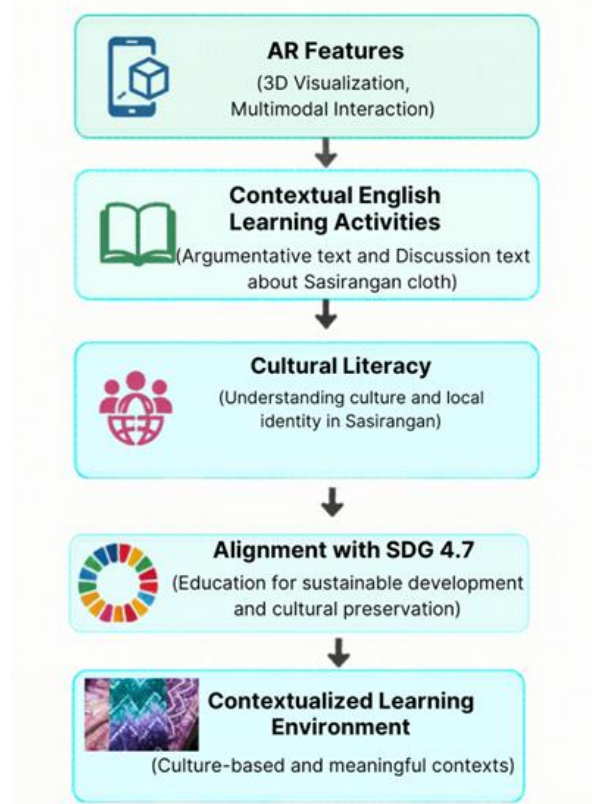


Figure 1. Conceptual Framework of SasiVision Application

As shown in Figure 1, at the content level, Sasirangan cultural materials serve as culturally responsive learning resources that strengthen cultural literacy and local identity awareness. The integration of local cultural heritage into English learning also supports contextual learning experiences that connect instructional content with students' sociocultural environments (Wedyan *et al.*, 2022). In addition, the learning activities embedded within the application are designed to encourage observation, interpretation, discussion, and reflection, which may support deeper engagement and critical-thinking processes during learning. These pedagogical and technological integrations align with SDG 4.7, particularly in promoting culturally inclusive, sustainable, and meaningful educational practices through the preservation and integration of local cultural knowledge within digital learning environments (Mardiansah *et al.*, 2025; Rimba *et al.*, 2025; Yıldırım & Aytan, 2025).

3. Research Methods

3.1. Research Design

This study employed design-based research (DBR) to design and develop a new product, namely the SasiVision application (McKenney & Reeves, 2013; Plomp & Nieveen, 2013). DBR is a systematic and iterative research methodology aimed at developing an instructional learning application through four phases: 1) analysis and exploration, 2) design, 3) development, and 4) reflection and evaluation, as shown in Figure 2, with further detail provided in Figure 3.

As shown in Figure 2, the results of each phase were analyzed and refined before the next phase began. During the analysis and exploration phase, the researchers explored students' needs, lacks, and wants in relation to incorporating Sasirangan local culture into language learning. During the design phase, the researchers developed learning scenarios, learning content, and AR features according to the pedagogical objectives and local cultural values. Subsequently, during the development phase, the SasiVision prototype was designed, tested, and revised based on expert validation and users' responses. Lastly, the reflection and evaluation stage aimed to measure the performance of the design, identify areas requiring revision, and extract lessons that could guide future educational technology development. Figure 3 presents the procedure clearly, showing that validity and practicality tests were conducted during the development of the SasiVision application.



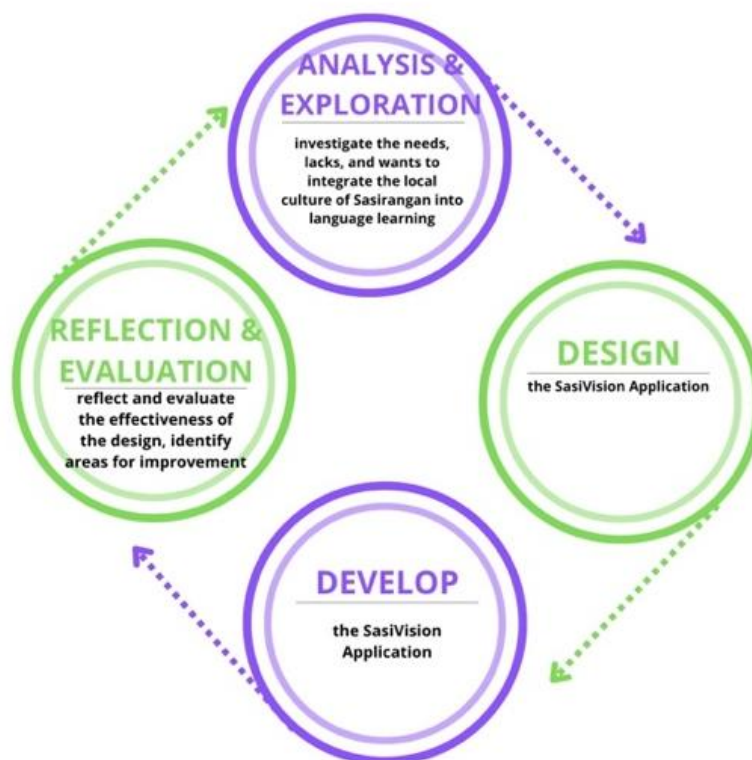


Figure 2. The design-based research phase in this study Adapted from McKenney & Reeves (2013); Plomp & Nieveen (2013); Scott *et al.*, (2020)

Table 1. The Participant Flow Across the Four DBR Phases of SasiVision Development

Phase	Date	Participants (N)	Role / Purpose	Output / Feeds Into
1. Analysis & Exploration	7–29 August 2025	748 Grade 12 secondary school students (437 female, 311 male)	Needs-analysis survey via Google Form measuring six constructs related to English learning needs, AR familiarity, and cultural-content preferences	Quantitative descriptive results reported in Table 5 (needs-analysis findings)
2. Design	11–12 September 2025	6 secondary school English teachers in South Kalimantan (5 female, 1 male)	Focus group discussion (FGD) on curricular fit, lesson architecture, and cultural-content selection for argumentative and discussion texts (Grade 12)	Lesson architecture and storyboard for SasiVision (reported in Table 7)
3. Development	3 October 2025	3 experts (1 media, 1 material, 1 language; 1 female, 2 male)	Expert validation of the SasiVision prototype against media, material, and language criteria	Aggregate validity score of 85.66% (reported in Table 8 and Section 4.3)
4. Reflection & Evaluation	30 November 2025	80 student users (55 female, 25 male)	Practicality test via Google Form on installation, navigation, content clarity, AR interaction, and perceived usefulness	Practicality results reported in Table 9 (overall mean 71.4%)

3.2. Participants

A total of 748 secondary school students were involved in the analysis and exploration phase. These students came from six schools across urban and rural settings in South Kalimantan. They answered a needs-analysis questionnaire comprising thirty-one valid and reliable items, and the questionnaire was validated by three experts



(media, material, and language experts from three different universities). Then, six secondary school teachers were involved in the design phase through a focus group discussion to discuss classroom activities as well as activities in SasiVision. In the development phase, three experts were involved, and finally, in the reflection and evaluation phase, 80 users participated to improve the product. The participant flow of this study can be seen in Table 1.

3.3. Instruments

A structured needs-analysis questionnaire was developed to capture six constructs hypothesized to inform the design of the SasiVision application from the students' perspectives. All items used a five-point Likert scale (1 = strongly disagree to 5 = strongly agree).

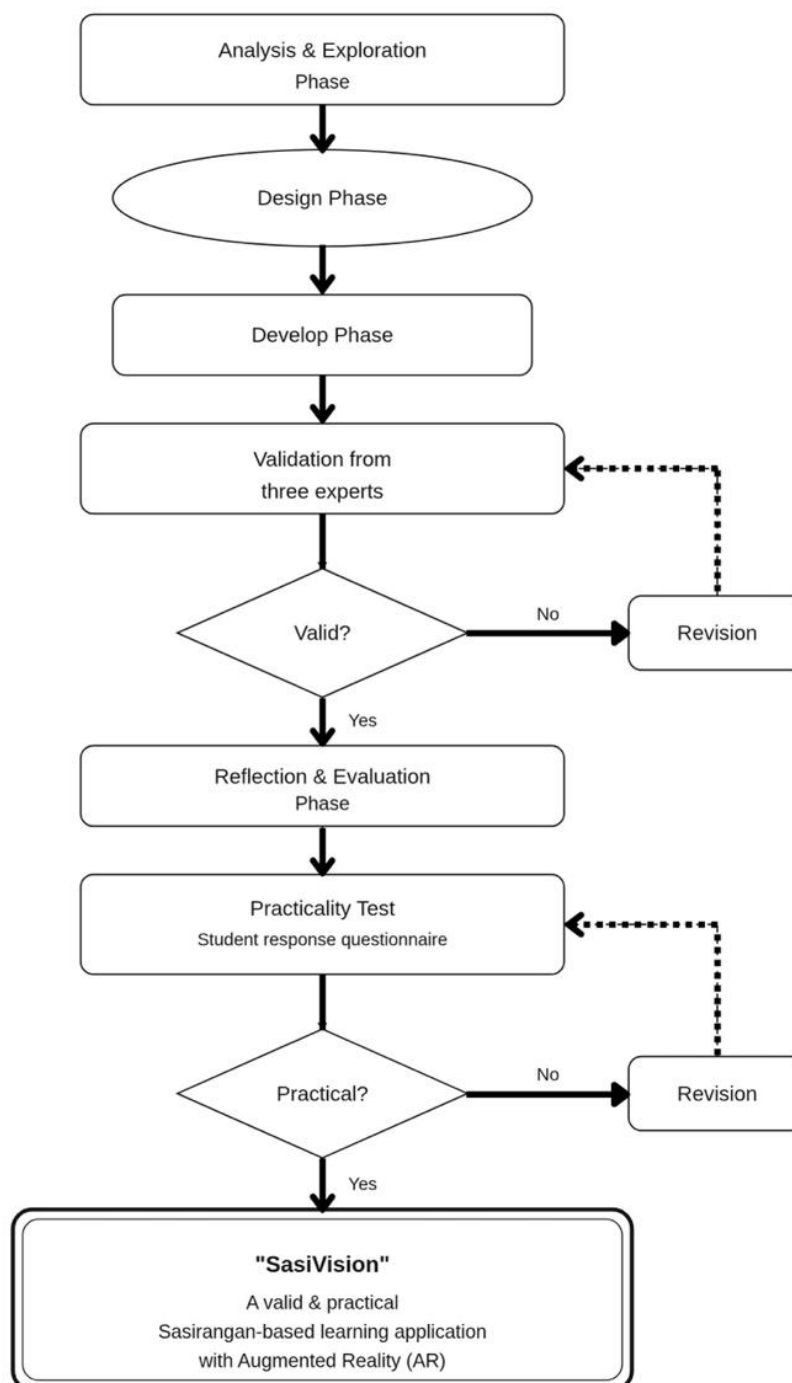


Figure 3. The research procedure in this study

Table 2. The Needs Analysis Questionnaire Reliability

Variable	Item	Statement	Reliability Score
Environmental Science Integration	ESI1	I can describe how Earth's physical systems (air, water, soil) interact with living things.	0.694
	ESI2	I understand how human activities such as environmental pollution affect natural systems.	0.805
	ESI3	I can explain the positive and negative impacts of human actions on the environment over time.	0.783
	ESI4	I know how culture influences environmental change.	0.763
Critical Thinking and Problem-Solving	CTPS1	I evaluate information from various sources (e.g., science, local knowledge, social media) before forming an opinion about environmental issues.	0.729
	CTPS2	I think creatively when looking for solutions to environmental problems, for example, waste from Sasirangan cloth production.	0.732
	CTPS3	I collaborate with others (friends, school, or family) to protect the environment.	0.745
	CTPS4	I consider the long-term impacts of today's environmental actions.	0.720
	CTPS5	I have participated in projects or activities (e.g., clean-ups, tree planting, campaigns) to protect the environment.	0.699
Value and Pro-environmental Behavior	VPB1	I believe that all living things, including humans, are part of the environment.	0.681
	VPB2	I care about how environmental issues affect people in different communities.	0.778
	VPB3	I feel optimistic that we can solve environmental problems together.	0.789
	VPB4	I respect other people's opinions even if they have different views on environmental issues.	0.744
	VPB5	I believe that young people can make a big difference in protecting the environment.	0.828
Language Competence	LC1	I can understand texts in English (articles, websites, social media posts) about environmental issues.	0.762
	LC2	I can watch or listen to videos or podcasts in English about the environment and understand the main ideas.	0.779
	LC3	I have enough confidence to discuss environmental issues in English.	0.770
	LC4	I am able to generate ideas regarding environmental problems and their solutions in English.	0.816
	LC5	I understand environmental issues, facilitated by my English skills.	0.704
	LC6	Every time I need to search for environmental information from worldwide sources, I use English.	0.771
Sasirangan Value Integration	SVI1	I have learned about the environmental impacts of the production process of traditional cloth such as Sasirangan.	0.653
	SVI2	I am able to explain the process and values of Sasirangan patterns in English.	0.739
	SVI3	Learning about Sasirangan helps me understand how local traditions can support environmental sustainability.	0.658



	SVI5	I am interested in writing or presenting about Sasirangan in English as part of cultural and environmental education.	0.767
	SVI7	I want to learn more about Sasirangan while learning English.	0.718
Technology Integration	TI1	Learning media that help me understand the material through visualization are important.	0.692
	TI3	I need technology such as Augmented Reality to help me understand English materials.	0,733
	TI4	I need a learning approach that makes me think more deeply, understand meaning, and reflect, such as deep learning.	0.733
	TI5	I want English lessons to be connected with my local culture.	0.736
	TI6	Learning media that incorporate local wisdom such as Sasirangan are necessary.	0.750
	TI8	I want to learn English using technology-based media such as Augmented Reality.	0.742

Adapted from: The PISA 2025 science framework of the environmental science competencies

Three constructs—Environmental Science Integration (ESI), Critical Thinking and Problem Solving (CTPS), and Value & Pro-Environmental Behavior (VPB)—were adapted from the PISA 2025 Science Framework, while three others—Language Competence (LC), Sasirangan Value Integration (SVI), and Technology Integration (TI)—were developed to suit the study's context. Content validity was confirmed through expert review from three universities in Indonesia. The initial 40 items were reviewed, representing the domains of (a) instructional media and educational technology, (b) English language teaching and applied linguistics, and (c) Banjar/Sasirangan cultural studies and environmental care content. Each expert independently rated every item on three criteria—relevance to the target construct, clarity of wording, and language appropriateness for secondary school students—using a four-point validity scale (1 = invalid to 4 = highly valid), interpreted with the criteria adapted from (Fajriana *et al.*, 2025). Items that received a mean expert rating below 3.00, or that received substantive qualitative comments from two or more experts, were either revised or flagged as candidates for deletion. Inter-rater agreement was inspected, and disagreements were resolved through a follow-up consensus discussion with the three experts.

The questionnaire was then pilot-tested and subsequently administered to 748 twelfth-grade students across six secondary schools in urban and rural South Kalimantan. Nine items were removed, leaving thirty-one items for data collection. The remaining indicators demonstrated outer loading values of at least 0.6, with most falling close to or surpassing the recommended threshold of 0.7 (Hair *et al.*, 2021). This means that the retained indicators are sufficiently capable of representing their respective latent constructs, as described in Table 2.

Other instruments included expert validation forms used to validate the questionnaire and separate validation forms used to assess the developed product, namely the SasiVision app. The expert validation forms used to evaluate the SasiVision application itself, as well as the user-practicality questionnaire administered to 80 students during the reflection and evaluation phase, were developed separately and assessed using the validity and practicality criteria reported in Tables 3 and 4.

3.4. Data Collection and Data Analysis

The data for problem identification and analysis were gathered through a questionnaire distributed via Google Forms from August 7 to August 29, 2025, to 748 secondary school students during the analysis and exploration phase. Among all twelfth-grade secondary schools in South Kalimantan, six schools were selected through sampling from urban locations (two schools) and rural locations (four schools). Ethical approval was obtained from the Department of Education and Culture of South Kalimantan, and informed consent was provided before the participants filled in the questionnaire. Another data set was obtained from three experts who validated SasiVision during the development phase. Finally, an online questionnaire through Google Forms was distributed to 80 student users during the reflection and evaluation phase. The questionnaire data were analyzed descriptively using SPSS,



and the expert validation results were analyzed using the criteria given in Table 3. Meanwhile, users' responses were assessed using the practicality-level criteria provided in Table 4.

Table 3. Validity Level Criteria of SasiVision Application

No	Percentage Scale	Validity Level
1	85.01%-100%	Highly valid, can be used without revision
2	70.01%-85%	Valid, can be used with revision
3	50.01%-70%	Less valid, needs major revision
4	01.00%-50%	Invalid, cannot be used

Adapted from Fajriana *et al.*, (2025)

Table 4. Practicality Level Criteria of SasiVision Application

No	Percentage Scale	Practicality Level
1	85.01%-100%	Highly practical, can be used without revision
2	70.01%-85%	Practical, can be used with revision
3	50.01%-70%	Less practical, needs major revision
4	01.00%-50%	Impractical, cannot be used

Adapted from Fajriana *et al.*, (2025)

4. Results

This study was conducted to develop SasiVision, an augmented reality (AR)-based English learning medium integrating Sasirangan content through a deep-learning approach for secondary school students in South Kalimantan. The aim of this research was to support students' English proficiency and critical-thinking skills through contextual English learning that incorporates South Kalimantan local culture and utilizes augmented reality technology.

4.1. Analysis and Exploration

The research team reviewed English learning content and the incorporation of Sasirangan, and secured research permits to collect data in six high schools throughout South Kalimantan in order to examine the need for English content integrated with Sasirangan. After that, the needs-analysis questionnaire was distributed to 748 students in six schools through Google Forms, as documented in Figure 4.



Figure 4. Secondary school students responding to the SasiVision needs-analysis questionnaire

The findings indicate students' interest and their willingness to participate in a new learning method. This validates that technology-enhanced, culture-based learning in English is perceived by students as useful and appropriate. The findings of the needs analysis show that, in general, students reported moderate to high levels of need in most aspects of English learning related to cultural, environmental, and technological literacy, with mean scores ranging from 2.87 to 4.22, as shown in Table 5.

These findings in Table 5 show that the average scores (2.87 to 4.22) are quite high and indicate a strong need for contextual and meaningful learning experiences, which is in accordance with the tenets of the deep-learning approach. Students' responses also indicate that contextual learning supported by AR can make English learning more interesting and relevant to their lives. The analysis showed gaps between the students' current situation and the desired expectations. Thus, development focused on items whose mean score was less than 3.2, since they represent areas needing improvement. These questions are Q20 (I feel confident discussing environmental issues in English with classmates or teachers), Q21 (I can write about environmental problems and solutions in English), Q23 (I use English to find environmental information from international sources), Q25 (I have learned about the environmental impact of producing traditional fabrics such as Sasirangan), Q26 (I can explain the process and cultural meaning of Sasirangan in English), Q29 (The current learning media used in English has not yet exploited the application of technology), and Q39 (The current learning media used). More detailed results of the needs analysis for each aspect are given in Table 6.

Figure 4 depicts that a majority of students consider English learning that focuses on both cultural and technological issues to be highly relevant and motivating. Overall, the students' perceptions of all questionnaire items were favorable, demonstrating their motivation and willingness to learn in more realistic and technology-based settings.

Table 5. The Results of the Needs Analysis Questionnaire Each Item (N=768)

N		Q1	Q2	Q3	Q4	Q6	Q7	Q8	Q9	Q10	Q12	Q13	Q14	Q15	Q16	Q18	Q19
	Valid	748	748	748	748	748	748	748	748	748	748	748	748	748	748	748	748
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean		3.44	4.13	3.84	3.81	3.54	3.41	3.96	3.83	3.94	4.22	3.89	4.00	4.10	4.20	3.28	3.23
Median		3.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	3.00	3.00
Std. Deviation		.961	.860	.866	.894	.917	.917	.969	.890	1.034	.967	.921	.967	.905	.893	.898	.906
Range		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Minimum		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

N		Q20	Q21	Q22	Q23	Q25	Q26	Q27	Q29	Q31	Q33	Q35	Q36	Q37	Q39	Q40
	Valid	748	748	748	748	748	748	748	748	748	748	748	748	748	748	748
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean		3.00	3.00	3.35	3.02	3.02	2.87	3.76	2.97	3.55	3.91	3.61	3.91	3.59	2.96	3.71
Median		3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00
Std. Deviation		.939	.948	.944	1.039	.980	.914	.909	1.011	.976	.911	.907	.881	.902	.993	.903
Range		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Minimum		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Table 6. The Results of the Needs Analysis on Each Aspect

No.	Aspect	Strongly Disagree	Disagree	Partly Agree	Agree	Strongly Agree
1.	Environmental Science Integration	2.58%	3.54%	28.64%	41.24%	24.0%



2.	Critical Thinking and Problem-Solving	3.1%	4.47%	31.93%	36.81%	23.69%
3.	Value and Pro-environmental Behavior	2.45%	2.19%	19.02%	37.44%	38.9%
4.	Language Competence	5.64%	13.97%	49.11%	22.62%	8.66%
5.	Sasirangan Value Integration	5.72%	12.22%	42.46%	27.46%	12.14%
6.	Technology Integration	1.92%	3.21%	36.39%	36.80%	21.68%
Average		3.57%	6.6%	34.59%	33.73%	21.51%

The results of this phase indicate that the respondents wanted a more interactive, contextual, and technology-based learning experience. However, they were not yet confident or accustomed to combining English learning with local cultural and environmental issues. Thus, a new learning experience capable of enhancing language skills, developing environmental awareness, and instilling pride in local culture, specifically Sasirangan fabric, is required.

4.2. Designing Phase of SasiVision Application

The design phase focused on developing the system and interface of the application to ensure alignment between the users' needs, wants, and lacks identified in the analysis and exploration phase and the learning objectives in the classroom. During this second phase, the research team conducted a focus group discussion (FGD) with six high school teachers from South Kalimantan on September 11–12, 2025. The activity aimed to establish a shared understanding and collaboratively design the learning units/modules (English skills), learning objectives, and classroom activities to be conducted, as shown in Figure 5.

The FGD activities involved teachers and the research team during the needs-analysis and application-development process. Figure 5 shows the presentation and discussion session conducted with participating teachers and researchers, including collaborative discussion and feedback regarding the development of the SasiVision AR-assisted English learning application, held on September 11–12, 2025. The activities also resulted in the lesson concept described in Table 7.

Table 7 presents the lesson concept co-designed with the six English teachers in South Kalimantan, showing how each session sequences vocabulary building, comprehension, and text production while linking specific Sasirangan motifs to specific AR interaction modes and assessment instruments. This level of specification supports reproducibility and clarifies the pedagogical mechanism through which AR affordances, local cultural content, and English-language tasks jointly serve SDG 4.7 (education for cultural diversity and sustainable development).

4.3. Developing Phase of SasiVision Application

Based on the findings of the design phase, the researchers developed an application termed "SasiVision," which was intended to support English and critical-thinking skills among twelfth-grade high school students. The SasiVision application was developed as an Android-based AR-assisted learning medium. It was designed to support interactive English learning activities integrated with Sasirangan content.

The development process focused on usability, accessibility, and alignment between AR features and instructional objectives. The application was then validated by three experts: one media expert, one language expert, and one material expert. The results obtained from the validation by these three experts are given in Table 8.

Table 8 shows that the mean score from these experts is 85.66%, which indicates that the application is viable, although it should be used with modifications based on their suggestions. The team revised SasiVision based on the experts' recommendations, including providing relevant quizzes in the lessons, modifying some wording to make the process easier, and listing compatible phones for accessing the app. The final design process resulted in a fully integrated version that combines 3D Sasirangan models with learning content. The admin dashboard was optimized for user, quiz, and content management. The SasiVision application interface developed during this phase is shown in Figure 6.



Table 7. SasiVision Lesson Concept for Grade 12 Argumentative and Discussion Texts Learning

Module	Session	Learning Objective	English Skill	Sasirangan Content	AR Interaction	Learning Activities	Assessment
Module 1: Argumentative Text and Cultural Understanding	Session 1	Students are able to identify the topic, main idea, supporting arguments, conclusion, and reflect on an argumentative text about Sasirangan.	Reading, Viewing, Vocabulary Development	Sasirangan motifs, philosophical meanings, Banjar cultural identity, myths and heritage values	Students explore Sasirangan motifs through the SasiVision AR feature and interact with 3D visualizations and audio-supported texts.	Pre-reading vocabulary activity; watching Sasirangan video; exploring motifs with AR; reading and listening to the text <i>Keep Sasirangan's Soul Alive</i> ; identifying topic, main idea, and arguments; pair discussion and reflection.	Formative assessment through observation, worksheet completion (Worksheet 1 and Worksheet 2), discussion participation, and reflective responses.
Module 1: Argumentative Text and Cultural Understanding	Session 2	Students are able to express opinions and recommendations regarding cultural preservation and sustainability related to Sasirangan.	Speaking, Critical Thinking, Discussion	Sasirangan preservation, cultural sustainability, local wisdom, cultural promotion	AR-supported contextual prompts and visualization of Sasirangan motifs to stimulate discussion and opinion sharing.	Group discussion about preserving Sasirangan culture; reflective speaking activities; sharing ideas on cultural sustainability and promotion through digital media; oral presentation and classroom discussion.	Oral performance assessment, participation rubric, reflective speaking evaluation, and teacher observation.
Module 2: Discussion Text and Cultural Analysis	Session 1	Students are able to analyze discussion texts and evaluate perspectives related to Sasirangan culture and sustainability issues.	Reading Comprehension, Discussion	Traditional and modern interpretations of Sasirangan, cultural identity, sustainable cultural practices	Students use AR features to observe Sasirangan motifs and access multimodal learning content related to cultural interpretation.	Reading and analyzing discussion texts; comparing traditional and modern perspectives; and engaging in collaborative discussion.	Worksheet analysis, discussion participation, and comprehension tasks.
Module 2: Discussion Text and Creative Communication	Session 2	Students are able to create and communicate argumentative or discussion-based responses related to Sasirangan and sustainability awareness.	Writing, Creative Communication	Sasirangan as cultural heritage and cultural ambassador; sustainability-oriented promotion	Students interact with AR-supported cultural objects and contextual prompts for project-based communication activities.	Creating posters and posting them on Instagram; presenting ideas for cultural preservation; and engaging in collaborative project discussion.	Project assessment and presentation assessment.



Figure 5. Teachers and the research team at the focus group discussion (FGD) on September 11–12, 2025

Table 8. SasiVision Validation Test Results

No.	Criteria	Percentage	Category
The Media Expert			
1.	Interface design	88%	Highly valid
2.	Navigation and usability	90%	Highly Valid
3.	AR functionality	82%	Valid
4.	Technical performance	76%	Valid
5.	Multimedia integration	89%	Highly valid
Average		85%	Highly valid
The Material Expert			
1.	Content relevance	90%	Highly valid
2.	Accuracy of content	87%	Highly valid
3.	Learning quality	88%	Highly valid
4.	Instructional design	85%	Highly valid
5.	Cultural integration	92%	Highly valid
Average		88.40%	Highly valid
The Language Expert			
1.	Language accuracy	84%	Valid
2.	Readability	82%	Valid
3.	Communicative quality	83.88%	Valid
4.	English Learning Suitability	84.25%	Valid
Average		83.58%	Valid
Final overall mean		85.66%	Highly valid

Figure 6 shows the SasiVision application, which is accessible to twelfth-grade secondary school students in South Kalimantan. SasiVision is an AR-based learning tool that aims to support students' English skills and critical-thinking skills. SasiVision combines AR technology with a deep-learning approach to provide a meaningful, interactive, and contextual learning experience. Students can learn vocabulary, texts, and communicative activities in English by exploring the history, philosophy, and motifs of Sasirangan through its augmented reality visual features.

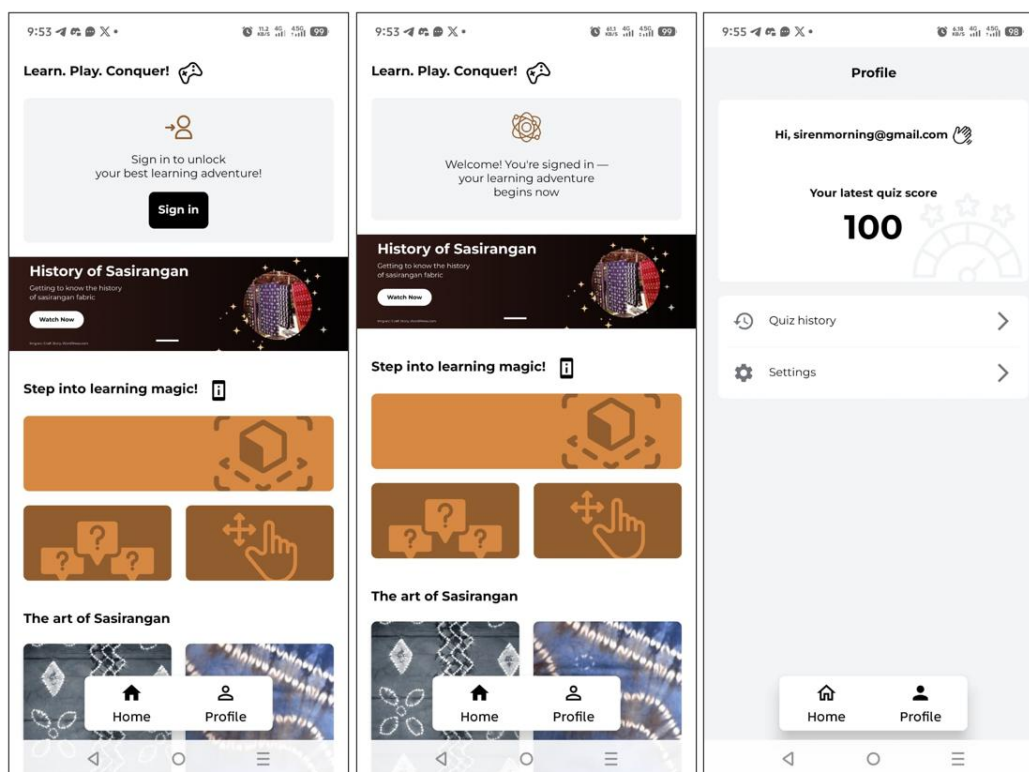


Figure 6. Design of the home and profile pages of the SasiVision application

4.4. Reflection and Evaluation Phase of SasiVision Application

Table 9 shows that the SasiVision application achieved an overall practicality score of 71.40%, indicating that it is practical for learning. The highest-rated aspects were the integration of text, images, and audio/video (80.00%) and the clarity of AR-based 3D Sasirangan objects (79.60%), suggesting that the application effectively supports engaging and culturally meaningful learning experiences. In contrast, ease of installation received the lowest score (57.80%), followed by technical difficulties (63.60%) and navigation (66.40%), indicating the need for further technical improvements. Nevertheless, the predominance of practical ratings across the indicators demonstrates that SasiVision is a practical tool for supporting English-language and culture-based learning.

Table 9. Descriptive statistics of user evaluation for practicality of SasiVision application

No	Statement (abbreviated)	Percentage	Interpretation
1	The application is easy to install.	57.80%	Less practical
2	Features are easy to understand.	70.80%	Practical
3	Navigation is user-friendly.	66.40%	Less practical
4	It has minimal technical difficulties.	63.60%	Less practical
5	Instructions are clear.	74.20%	Practical
6	The interface design is appealing.	72.80%	Practical
7	Colors and layout are comfortable.	76.20%	Practical
8	The combination of text, images, and audio/video enhances learning.	79.60%	Practical
9	It has the combination of text, image, and audio/video enhances learning.	80.00%	Practical
10	Learning becomes more engaging.	78.20%	Practical
11	Content helps understand Sasirangan culture.	77.80%	Practical

12	My understanding of Sasirangan's philosophy improves.	78.60%	Practical
13	The application promotes critical and reflective thinking.	76.80%	Practical
14	It helps improve my English skills (4 skills).	77.20%	Practical
15	Learning feels more meaningful and contextual.	77.60%	Practical
16	Learning time is efficient.	75.40%	Practical
17	Accessible anytime without difficulty.	74.60%	Practical
18	Suitable for classroom and independent learning.	76.20%	Practical
19	Suitable for classroom and independent learning	78.00%	Practical
20	Overall, the app is practical and feasible.	77.40%	Practical
Overall Score		71.40%	Practical

The highest-rated aspects were multimodal learning features (mean = 4.00) and the clarity of AR-based Sasirangan objects (mean = 3.98), which indicate that students found the learning experience interesting and culturally enriching. On the other hand, ease of installation had the lowest score (mean = 2.89), indicating that technical optimization is necessary to improve the application across different devices and reduce memory demands. Although the application demonstrated generally positive practicality results, several usability aspects remained challenging. The installation aspect received the lowest score ($M = 2.89$, $SD = 1.03$), indicating that some users experienced difficulties during application setup.

5. Discussion

The findings of this study indicate that the SasiVision application demonstrates strong design validity and acceptable classroom practicality. As an augmented reality-assisted English learning medium, SasiVision integrates Sasirangan traditional cloth, its cultural heritage, and SDG 4.7-oriented education. Overall, this study provides evidence of the validity, practicality, and contextual relevance of SasiVision within secondary English learning. These findings support the idea that incorporating native cultural background into language education can enhance relevance (Darvin, 2025; Lim *et al.*, 2025).

The expert validation score of 85.66% positions SasiVision within the "highly valid" category, according to the criteria adapted from (Fajriana *et al.*, 2025). This level of validity indicates that the three expert dimensions evaluated media, material, and language judgment converged on a positive overall assessment, while still surfacing actionable refinements concerning interface wording, quiz-item phrasing, and device-compatibility documentation. These findings support previous studies suggesting that augmented reality can facilitate immersive and interactive learning experiences in language education, as stated by Popescu *et al.* (2017) regarding the pedagogical readiness of AR-based learning environments and by Belda-Medina (2025) regarding the integration of language and content in AR-mediated CLIL settings, while also extending Wedyan *et al.* (2022) by demonstrating that culturally embedded AR content can satisfy expert validity criteria when grounded in a systematic DBR process. The present study expands previous studies by showing that AR-assisted English learning can serve as a means of contextualized cultural learning based on local wisdom and sustainability-oriented education. The integration of Sasirangan in English learning activities not only acted as decorative cultural content but also served as a semantic and contextual anchor that supported vocabulary growth, argumentative discussion, cultural interpretation, and reflective learning (Isnaniah *et al.*, 2025; Wedyan *et al.*, 2022). Students could relate the texts in English to concrete cultural objects, philosophical concepts, and environmental themes related to the creation and preservation of Sasirangan through AR-assisted visualization (Lutfianto *et al.*, 2020; Kholodniak, 2025; Marrahi-Gomez & Belda-Medina, 2024). This reinforces earlier findings that culturally contextualized language learning can increase learner engagement and cultural literacy, thereby making learning more meaningful and socially relevant.

The findings on practicality also provide valuable insights into the use of SasiVision in the classroom. The overall practicality score was 71.4%; however, several lower-scoring items reveal technological limitations that should not be ignored. The lowest-scoring components were application installation, technical difficulties, and navigation



usability. Some students reported that they could not install SasiVision because it only operates on Android smartphones, requires 80.86 MB of space, and needs certain smartphone specifications to run the app. The specifications are as follows: Android 10 or later, Google ARCore support, 4 GB RAM, 2 GB of free space on 64 GB storage, and a camera of more than 12 MP. The results indicate that the use of AR-assisted learning depends on smartphone specifications, storage space, and ARCore support across students' diverse devices. Hence, the current findings suggest that technological accessibility is an important practical consideration in the use of AR-assisted educational applications in secondary schools, especially when students use their personal mobile devices with different hardware capabilities. These findings echo [Muryanti et al. \(2023\)](#), who identified device readiness and technical preparedness as decisive factors in teachers' acceptance of AR for teaching English vocabulary, and [Indrawan et al. \(2024\)](#), whose bibliometric review on AR for character development within local wisdom highlights recurring technical-access barriers in school contexts. By contrast, the highest-scoring items multimodal content combining text, images, and audio/video and the clarity of AR-rendered Sasirangan objects suggest that the pedagogical and visual design of the prototype is already operating as intended. Students stated that the application was interactive, culturally meaningful, and interesting for English learning exercises. The results are consistent with earlier research showing that interactive design coupled with culturally relevant learning content in a technology-enhanced language-learning setting has a positive impact on students' language learning ([Hasumi & Chiu, 2024](#); [Perales & Ulla, 2025](#)). [Ma and Yan \(2021\)](#) stated in their study that teachers' roles are important in incorporating technologies such as applications into language learning. Teachers who are able to introduce and guide students in using such applications in formal and informal settings support the successful use of the technology and provide positive experiences for students as users.

Regarding the relationship between SDG 4.7 and the inclusion of local culture, Sasirangan-based learning activities not only introduced students to English language tasks but also to the ideals of cultural preservation, sustainability, and respect for local identity. In this way, SasiVision implements SDG 4.7 at the classroom level by combining language acquisition with education for cultural diversity and sustainable development ([Saini et al., 2022](#); [Hanapi et al., 2025](#)). In addition, it makes learning more contextualized and helps students understand what they are learning because it is relatable to their lives ([Tutal, 2023](#); [Sari et al., 2024](#); [Mulyanah et al., 2025](#)). As such, the inclusion of local history in English learning also serves as linguistic practice, the development of cultural literacy, and sustainability-oriented education ([Dvorghets & Shaturnaya, 2015](#); [Nugraheni et al., 2026](#)). There are also contextual and transferability factors to note. Some aspects of SasiVision are closely related to the sociocultural environment of South Kalimantan, such as Sasirangan motifs, Banjar philosophical narratives, and regional cultural connotations. These elements may need to be adapted for deployment in other regions. However, the broader pedagogical framework of incorporating local cultural heritage into AR-assisted contextual English learning could be transferable to other Indonesian educational contexts by utilizing other regional cultural materials and local-wisdom resources as supplementary teaching materials. When using these materials, teachers' responsibility is critical in evaluating and ensuring adequate environmental education in EFL contexts ([Veszelinov, 2026](#)).

Overall, the DBR method in this study also yielded some reusable design ideas for the future development of culturally contextualized AR-assisted language learning. First, local cultural information should function as teaching material rather than merely as attractive visuals. Second, AR features should directly support the teaching objectives, such as vocabulary learning, discussion, and interpretation activities. Third, multimodal learning resources that include visual, verbal, and interactive components can boost engagement and understanding. Fourth, reflective and debate-based tasks are necessary to encourage deeper cultural and critical engagement. Finally, technology accessibility and classroom practicality should be consistently considered during development and implementation. However, some limitations should also be noted, since the present study only assessed validity and practicality. There was no experimental design or pre-test/post-test measurement to assess improvements in English proficiency or critical-thinking performance. Moreover, the practical evaluation was conducted with a limited sample of 80 users in a specific regional setting, which restricts the generalizability of the findings. In terms of device consistency, there were technical limitations related to ARCore compatibility and the diversity of smartphones. Therefore, future research should explore the effectiveness of SasiVision using quasi-experimental or longitudinal methodologies, as well as lighter and more accessible deployment strategies for wider implementation.

6. Conclusion

This study found that SasiVision, an augmented reality-assisted English learning application that integrates Sasirangan cultural heritage, has strong expert validity and moderate user practicality in the context of secondary English teaching in South Kalimantan. The results suggest that contextual AR-supported learning media based on local cultural content can be systematically developed using a design-based research approach and can enable meaningful and culturally appropriate English learning aligned with SDG 4.7. From a practical point of view, the prototype provides a complementary learning medium that integrates contextual English teaching, multimodal interaction, and local cultural literacy into a mobile learning environment. The program was particularly strong in AR visualization, multimodal learning support, and contextual cultural interaction. At the same time, the data also pointed to key implementation limitations in terms of installation difficulty, device compatibility, and technical performance, revealing that infrastructure preparedness remains a key concern for wider classroom uptake. This study provides evidence of design validity, pedagogical practicality, and implementation readiness to guide future effectiveness research. Hence, the next empirical step should be to conduct quasi-experimental studies to explore the effect of SasiVision on quantifiable English learning outcomes, critical-thinking development, and cultural literacy in broader educational contexts. Future research can also consider adapting the framework to various regional cultural contexts and more affordable technological deployment options for Indonesian secondary education.

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Author Contribution Statement

Rizky Amelia: Conceptualization, Methodology, Validation, Writing - Original Draft. Heldiansyah: Data Curation, Writing - Review & Editing. Siti Kustini: Writing - Review & Editing. Novita Triana: Writing - Review & Editing. Damar Galih Aji Pradana: Formal analysis, Visualization. All the authors read and approved the final version of the manuscript.

Does this article screen for similarity?

Yes

Data Availability

Data are available upon request from the corresponding author.

Conflict of Interest

The authors have no conflicts of interest to declare. There is also no financial interest to report. The author certifies that the submission is original work and is not under review at any other publication.

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