

Development of Lontara Technobraille as an Arduino-based Lontara Script Learning Medium for Visually Impaired Students at SLB A Yapti Makassar

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ABSTRAK

Penelitian ini bertujuan untuk menganalisis efektivitas media pembelajaran Lontara Technobraille berbasis Arduino dalam meningkatkan kemampuan membaca dan menulis aksara Lontara di kalangan siswa tunanetra di SLB-A Yapti Makassar. Penelitian ini menggunakan desain eksperimental pretest-posttest dengan kelas eksperimen dan kelas kontrol yang melibatkan 13 siswa tunanetra tingkat SMA. Data dikumpulkan melalui tes literasi, kuesioner motivasi, dan observasi, menggunakan instrumen dan media yang telah divalidasi oleh para ahli. Analisis data dilakukan menggunakan metode deskriptif kuantitatif. Hasil menunjukkan peningkatan skor rata-rata dari 40,8 menjadi 81,0, dengan kelas eksperimen memperoleh hasil yang lebih tinggi dibandingkan kelas kontrol. Temuan ini menunjukkan bahwa Lontara Technobraille efektif dalam mendukung pembelajaran inklusif dan pelestarian aksara Lontara.

Kata Kunci: Aksara Lontara, Arduino, Media Pembelajaran, Tunanetra.

ABSTRACT

This study aims to analyze the effectiveness of Arduino-based Lontara Technobraille learning media in improving Lontara reading and writing skills among visually impaired students at SLB-A Yapti Makassar. This study used a pretest-posttest experimental design with an experimental class and a control class involving 13 high school-level visually impaired students. Data were collected through literacy tests, motivation questionnaires, and observations, using instruments and media that had been validated by experts. Data analysis was performed using quantitative descriptive methods. The results showed an increase in the average score from 40.8 to 81.0, with the experimental class obtaining higher results than the control class. These findings indicate that Lontara Technobraille is effective in supporting inclusive learning and the preservation of the Lontara script.

Keywords: Lontara script, Arduino, Learning Media, Visually Impaired.

1. INTRODUCTION

Inclusive education is a fundamental right for all citizens of the country, including those who have disabilities. *Undang-Undang Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional* stipulates that every citizen of the country is entitled to equal education without discrimination (Republic of Indonesia, 2003, p. 6). This principle is based on Pasal 31 UUD 1945, which guarantees education to all citizens of the country, including renters. However, in practice, educational access for Tunanetra students still presents a number of challenges, particularly in the teaching of local literacy based on visual and symbolic literacy.

One of the local subjects that has experienced learning obstacles is the Lontara script, a traditional script of the Bugis-Makassar people that has high historical and cultural value. The South Sulawesi Provincial Government, through Governor Regulation No. 79 of 2018, emphasizes the importance of regional language and script development at all levels of formal and non-formal education (Government of South Sulawesi, 2018, p. 4). However, the implementation of this policy has not fully reached blind students due to the limited availability of accessible learning media that suits their specific needs.

This condition was discovered at SLB-A Yapti Makassar, Sulawesi Selatan's only outside school specializing in tuna. Based on initial observations and discussions with the teacher, Lontara learning is currently conducted verbally without the use of tactile or audio media. As a result, siswa experience

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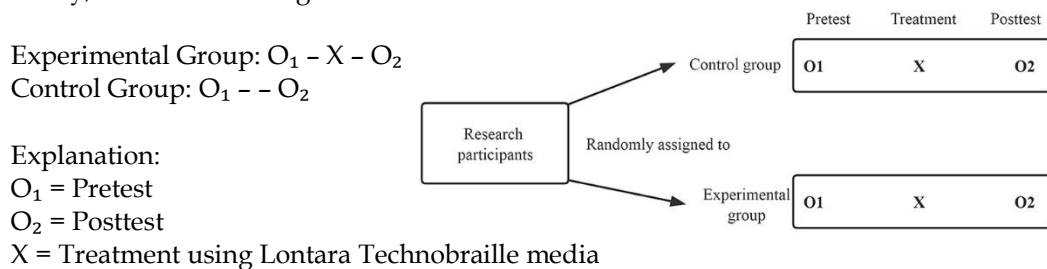
difficulty determining the form of huruf, studying, and writing aksara Lontara, which is influenced by the level of local literarism. One-on-one learning also reduces motivation and anxiety among students during the learning process. This is consistent with the findings of Praptaningrum (2020, p. 45), who stated that multisensory media is required for students to understand abstract concepts optimally. Various alternative solutions have been developed to aid with the learning of tunanetra students, including as the use of audio media and braille materials. However, the solution is parsimonious and does not simultaneously integrate operational, auditorial, and local contexts. As a result, innovative learning media are required to address the need for accessibility, learning efficacy, and community engagement.

Based on the findings, this study proposes a solution based on the development and implementation of Lontara Technobraille, a learning media based on Arduino that integrates Lontara huruf in the form of braille timbul with audio. The purpose of this media is to provide multisensory learning experiences so that tunanetra students may understand, study, and write about aksara Lontara independently. The purpose of this research is to assess the effectiveness of using Lontara Technobraille in improving the literacy skills of Lontara tunanetra students at SLB-A Yapti Makassar. The study's findings are expected to be practical for students and teachers in terms of experiential learning, as well as theoretical for the development of accessible media for learning based on local beliefs.

2. METHOD

This study use quantitative methods in conjunction with other types of experimental research. The research strategy used is a pretest-posttest control group design, with the goal of evaluating the effectiveness of media learning Lontara Technobraille based on Arduino in terms of improving students' ability to learn and write Lontara.

Systematically, the research design can be described as follows:



(Gambar 1. Desain Pretest-Posttest Control Group)
 (Sumber. Internet)

Research Time and Location

The research subjects were 13 visually impaired high school students at SLB-A Yapti Makassar, located on Jalan Kapten Pierre Tendean, Tallo District, Makassar City, South Sulawesi. The sampling technique used was purposive sampling, considering that all visually impaired high school students actively participated in learning the local Lontara script.

The subjects were divided into two groups:

Experimental class	5 students (grade XI)
Control class	8 students (grades X and XII)

Research Objectives and Subjects

This study's focus is on local aksara Lontara learning in the context of tunanetra education. The study's subjects included 13 SMA students from SLB-A Yapti Makassar. The subject selection technique employs purposive sampling, with the goal of increasing the number of active SMA students participating in local learning. The subject was divided into two groups: five students for experimentation (grade XI) and eight students for control.

Research Procedures

The research process involves several stages. The first step is to take a pretest to assess the ability of new students to understand, study, and write Lontara. The second step is decision-making, in which the experiment class uses Lontara Technobraille media based on Arduino with multisensory capabilities to learn, whereas the control class uses traditional verbal learning. The third step is to provide a posttest to all research subjects in order to improve the literacies of Aksara Lontara after the experiment is over.

Media Use Training

The training stage is conducted to train students and teachers in using Lontara Technobraille. The training covers an introduction to lontara letters in braille form, how to operate Arduino-based buttons, and understanding the audio output that accompanies each letter.

Tool Development

The development of the Lontara Technobraille tool began with the design of an Arduino-based system capable of producing sound output whenever a Lontara letter is selected. The Lontara letters are then converted into raised Braille so that they can be felt by blind students, while also being integrated with an audio system so that the pronunciation of the letters can be heard clearly. The resulting prototype is then tested to ensure safety, comfort, and functionality suitability for the students' needs before being used in the training and mentoring process.

Assistance and Evaluation

Assistance is provided directly in the classroom to ensure that students can operate the media properly and teachers are able to utilize it in the teaching and learning process. Evaluation is carried out through observation, questionnaires, and simple tests in the form of pre-tests and post-tests on students to measure improvements in Lontara literacy. This process also serves as a means to improve weaknesses in the media and adjust teaching methods to suit the needs of visually impaired students.

Data Analysis Techniques

Data analysis was conducted descriptively and inferentially.

1. Descriptive Analysis

This analysis was used to determine the mean value, minimum score, maximum score, and improvement in student abilities before and after the treatment.

<p>Mean value formula:</p> $\bar{X} = \frac{\sum X}{N}$	<p>Explanation:</p> <p>\bar{X}: Mean Value</p> <p>$\sum X$: Total score</p> <p>N: Number of subjects</p>
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2. N-Gain formula

To determine the level of improvement in learning outcomes, the N-Gain formula is used:

<p>N-Gain formula:</p> $N-Gain = \frac{Skor_{post} - Skor_{pre}}{Skor_{maks} - Skor_{pre}}$	<p>N-Gain criteria:</p> <p>$g \geq 0.7$: High</p> <p>$0.3 \leq g < 0.7$: Medium</p> <p>$g < 0.3$: Low</p>
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3. Paired Sample t-Test

The paired sample t-test is used to determine the significance of the difference between the pretest and posttest scores.

<p>t-test formula:</p> $t = \frac{\bar{d}}{\frac{S_d}{\sqrt{n}}}$	<p>Explanation:</p> <p>\bar{d}: Average score difference</p> <p>S_d: Standard deviation of differences</p> <p>n: Number of samples</p>
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Test criteria:

- If the Sig. value is < 0.05 , there is a significant difference.
- If the Sig. value is ≥ 0.05 , there is no significant difference.

Research Instrument Table

Research instruments are tools used to collect data in accordance with the research objectives. The instruments used in this study are summarized in Table 1.

(Table 1. Research Instrument Table)

No.	Type of Instrument	Purpose of Use	Data Collection Techniques
1.	Arduino-based Lontara Technobrilie learning media	Multisensory learning tools to improve blind students' ability to read and write Lontara script	Learning implementation
2.	Lontara literacy test (pre-test and post-test)	Measuring students' abilities before and after treatment	Braille and oral tests
3.	Observation sheet for learning activities and motivation	Observe students' activity, independence, and motivation during learning	Direct observation
4.	Media validation questionnaire	Assessing media suitability in terms of content, media, and ease of use	Likert scale questionnaire
5.	Documentation	Supporting research data in the form of photos and activity notes	Field documentation

All instruments were tailored to the characteristics of visually impaired students and underwent a validation process before being used in the study.

Data Presentation

The research results are presented in tables and graphs to clarify the comparison of pretest and posttest scores between the experimental and control groups.

(Table 2. Pre-test & Post-test Score)

Class	Pre-test	Post-test
Eksperimen (XI)	42.6	83.6
Control (X & XII)	39.4	79.3

3. RESULT AND DISCUSSION

Result

The results of this study are based on the analysis of literacy test results from Lontara students at SLB-A Yapti Makassar, which include pretest and posttest scores. The test results are presented in a deskriptif manner to show the changes in students' abilities following the introduction of Lontara Technobrilie learning materials based on Arduino. According to pretest results, students' ability to read and write Lontara is still quite low. The rata-rata pretest score for students in the experiment group was 42.6, while the control group received a rata-rata score of 39.4. This result indicates that prior to learning, Lontara students' literacy skills were rather low and fell within the category of rendah.

After using the Lontara Technobrilie media, there was an increase in the posttest scores for both groups. The experimental group received a rata-rata posttest score of around 83.6, while the control group had a rata-rata score of approximately 79.3. Table 2 shows the comparison of the rata-rata pretest and posttest scores of the students in the experimental and control groups.

Class	Pre-test	Post-test
Eksperimen (XI)	42.6	83.6
Control (X & XII)	39.4	79.3

The results indicate that the nilai increase in the experimental group is higher than in the control group. In a deskriptif manner, students who use Lontara Technobraille learning materials report better learning outcomes than students who use traditional learning methods.



(Gambar 2. Lontara Technobraille learning)

Discussion

The use of Lontara Technobraille educational materials based on Arduino has a positive impact on students' ability to read and write Lontara. A higher score on the posttest in the experimental group compared to the control group indicates that learning materials that align with student characteristics can facilitate learning more effectively. The integration of audio as an auditory stimulus and braille text as a tactile stimulus enables students to learn Lontara through multisensory learning. In order to facilitate the process of pengenalan and penulisan aksara, this pendekatan helps students understand aksara forms and bunyi in a collaborative manner. This is in line with the findings of Praptaningrum (2020), which states that learning for students with special needs will be more effective if they can learn more from a single source.

The availability of Lontara Technobraille media makes it easier for teachers to provide local materials in a more systematic manner. This media serves as a teaching tool that enhances students' visual skills, making the learning process more inclusive and structured. The role of media as a learning facilitator is crucial in creating a learning environment that is suitable for students with specific needs.

The use of educational media that can be used in Lontara education contributes to the local way of life. Pemerintah Provinsi Sulawesi Selatan has made it possible for Tunanetra students to learn aksara daerah through Peraturan Gubernur Nomor 79 Tahun 2018. As a result, Lontara Technobraille media affects not just academic but also social and cultural aspects.

Program Sustainability

The sustainability of the Lontara Technobraille program is achieved through Penta Helix collaboration involving the government, academics, communities, the business world, and the public. This program is supported by the South Sulawesi Provincial Education Office for potential implementation in other special needs schools. The South Sulawesi Education Ambassador plays a role in strengthening cultural literacy and educational campaigns. The most important aspect of community service programs is their usefulness to partners.

Educational Aspects	This program improves the ability of 13 visually impaired high school students to recognize, read, and write Lontara script using a multisensory method through Braille and audio. Teachers also receive teaching modules as guidelines so that the local content learning process can be carried out in a more structured and sustainable manner.
Social Aspects	This activity builds the confidence of visually impaired students as they are able to learn independently. In addition, positive interactions between teachers, students, and the implementing team strengthen social awareness of inclusive education in the surrounding community.
Cultural Aspects	Through the use of Lontara Technobraille, the preservation of the Lontara script as a cultural heritage of South Sulawesi can be more effective. Blind students now

	contribute to preserving local culture through literacy, in accordance with South Sulawesi Governor Regulation No. 79 of 2018.
Cultural Aspects	Collaboration Aspect This program opens up opportunities for collaboration between schools, universities, the Education Office, and the South Sulawesi-West Language Ambassador, so that its benefits can be extended to other special needs schools. Lontara Technobridge media also has potential for development, both in terms of design and the addition of material and technology, so that in the future it can become an inclusive learning medium that is ready to be replicated and developed more widely.

Summary of Discussion

Through multisensory learning, Lontara Technobridge learning materials based on Arduino are developed to enhance Lontara literacy among students. Dampak penggunaan media is seen in the increase in learning outcomes, student activities, and kemandirian as well as in the implementation of inclusive education and aksara Lontara as a local warisan.

4. CONCLUSION

The use of Arduino-based Lontara Technobridge learning materials can improve students' ability to read and write Lontara texts at SLB-A Yapti Makassar. This media facilitates multisensory learning through the integration of braille text and audio, making it easier for students to understand, comprehend, and express Lontara in a more personal way. The higher learning outcomes in the experiment group compared to the control group indicate that using educational media in accordance with the characteristics of the students is crucial for promoting an effective learning process. As a result, Lontara Technobridge can be considered an alternative educational medium that promotes inclusive education as a local warisan.

5. ACKNOWLEDGMENT

This research was funded by the Student Creativity Program–Community Service of the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, and supported by SLB-A Yapti Makassar City and Muhammadiyah University Makassar.

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