

## Learning media for the transliteration of Latin letters into Bima script based on android applications

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### ABSTRACT

Preservation of Indonesian culture is an important thing that must be considered. One of the efforts that have been made in preserving culture is technological development implementation. In cultural preservation, based on data obtained from 45 respondents from the Bima community in Indonesia, 34.9% of the community does not understand the Bima script. It means that only 65.1% of the community can understand Bima script. This condition will continue to grow if there is no effort made to preserve the Bima script. Because people should have a comprehensive knowledge of the Bima script to understand its usage in writing and reading activities, people tend to have less desire to learn the Bima script. Mataram University is trying to develop creative and innovative learning products to learn the Bima script learning model in an interactive application using a smartphone to translate Latin letters into the script. This development aims to facilitate the process of learning Bima characters for the community. The method that has been used is to apply a string replacement algorithm based on the Bima script rules in the reference book containing the ancient Bima script. According to the experiment result, the alpha test value from 31 respondents is 99.36%, and the Beta test value from 45 respondents Bima society is 91.50%. It can be concluded that this application is feasible as a learning medium.

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## 1. INTRODUCTION

Cultural digitization is a crucial thing to pay attention. Currently, the application of information technology and the internet of things supports various kinds of community activities. The use of smartphones is increasing in Indonesia, allowing all activities to be carried out through these smart devices to create an effective and efficient process in various activities, including cultural preservation in research such as games, dictionaries, and text transliteration [1], [2]. Bima script is a culture that is intended as a medium of information exchange for the Bima community before the Malay Arabic script was replaced by the Latin script required as it is today because it is a compulsory material for learning in education in Indonesia. Bima script consists of two old models and a new model, the old model is no longer used because there is no similar manuscript, apart from that of Raffles which is proof that the ancient bima script was ever used [3]. The obligation to use Latin letters as a medium for exchanging information on a national and international scale, as well as rules that are different from Latin letters, has made the use of the Bima script steadily

decreasing. This fact is a problem because it indicates that the Bima script's process of preservation and learning has decreased. There are thousands of ancient manuscripts of the Samparaja Museum in Bima City consisting of Malay Arabic script and Bima script. The ancient manuscript contains various important information related to the history of the Bima community [4]. Researchers in Indonesia has undertaken several efforts to conserve the Bima script on a large scale, including [5], several other studies related to the Indonesian script [6] have been carried out for preservation-related to the Balinese script, and research was carried out [7].

The massive research is supported by the legacy of ancient manuscripts containing important history for a region that has a script like Bima with the history of the Sultanate. The problems faced in writing Bima scripts require several things that need to be mastered by a writer and the ability to write Bima script symbols. The author also understands the meaning of rules and punctuation in the Bima script. Several regions have gradually introduced literary transliteration through digital media as a medium of learning [8]. Literacy learning media are not only limited to games and dictionaries, but robots have also been developed to write characters [9]. The development of research to get the aksara transliteration application accusation analyzes the accuracy necessary to find the best method [10]. Apart from learning Balinese script text, it is also developed in the image processing process. Apart from learning Balinese script text, it is also developed in the image processing process [11]. The problem faced in the process of transliteration of the Bima script is in the rule base setting, while the research that examines the implementation of a rule base with a decision tree [12], [13]. With the Nusantara script font's release in various versions, the development of the Nusantara script application can be done intensively, such as Balinese serif noto font, Bima Mbojo Font [14]. In addition to the problems that are so complex, this research requires special attention because in implementing the transliteration rule, there are errors when generating results [15]. To understand all the versions, people require help and practice guidance. In previous research, the transliteration algorithm method for Latin letters to Bima script has been developed [16] and obtained an accuracy of 92.72%. Besides being viewed from the public acceptance of the transliteration application learning process, it is also viewed from the point of view of the teacher [17].

This study applies a string replacement algorithm in transliterating Latin letters into Bima script based on previous research. This study will be tested using Alpha Testing, Beta Testing, where the value obtained for alpha testing is 99.36%, and the testing value for beta testing is 91.50%. It is intended to see the public response in using applications that have been published on the Google Appstore.

## 2. RESEARCH METHOD

Several previous studies have been carried out to preserve characters in Indonesia, including the following. Research related to the comparison of transliteration of Latin script into Balinese script has been carried out, this is important. After all, the Balinese script process is carried out because of the more complex process in the Bima script makes this research very useful in the process of cultural preservation. The application gets transliteration results, and a statement that the Balinese script transliteration application (TAB) gets an accuracy of 68% of the 151 test data used [6].

Research related to the acceptance of the Balinese script application to the community has been carried out. It discusses the results of community acceptance of innovative learning media applications, discussing the crowd feedback analysis process on the application, which aims to monitor the public's point of view regarding applications released by the University of Education Ganesha, Indonesia. The application analysis results get public acceptance from the total application downloads of 32,000 installations and 152 ratings (63 ratings and reviews) and get an average score of 4.2 from the best score of 5 [18].

Research that discusses the collaboration carried out in Information Technology and the scientific field of Balinese Language, the Ganesha University of Education in developing innovation. In making optical character recognition (OCR) media, it is used to carry out the process of reading Balinese characters in the form of images into text [7].

Public acceptance of the script transliteration application is discussed. This is necessary to see the level of public interest in the application designed. Crowd Feedback Analysis of Learning The Latin Script to Bali Transliteration Mobile Application is a study that focuses on discussing public acceptance of transliteration applications. As well as in other research that discusses the Recognition of Sasak Script Handwriting Patterns Using the Linear Discriminant Analysis Method and Backpropagation Neural Networks, this study developed a method used to develop the handwritten character of the Sasak script which aims at cultural preservation. This research resulted in 92.20 % accuracy value 92% precision and 92% callback with a total data of 10,800 datasets [19].

The next research is applying the Rule Base Algorithm with the Hexadecimal approach to the Bima script transliteration into Latin letters. In this study, authors develop a transliteration method with the input

type of Bima characters and Latin letters using the string replacement method and the hexadecimal approach to facilitate the reading process of characters with Bima script. This approach is conducted to help people read Bima script easily in Latin script. The research accuracy is more than 90.00. % accuracy [16].

The application of the string replacement algorithm by utilizing hexadecimal numbers that have been used by previous studies and get a good accuracy above 90%, in this study choosing an algorithm with hexadecimal processing to implement the rule base that has been denuded previously to obtain optimal transliteration. The output of this application is in the form of Android-based Bima learning media. The android platform was chosen with the hope of getting high acceptance in the community as in previous research.

The Bima Mbojo script has now been released in a digital version so that people can write the Bima script in digital writing, such as on laptops and smartphones that have installed the font but in use, it still requires a special understanding in writing Bima characters. The last version that was released with bima characters in digital form consists of 36 characters consisting of letters and punctuation [20]. The Bima script using the Bima Mbojo font is displayed in Table 1, while in Table 2 is an old version of the Bima script that has been abandoned. Tebel 3 explains how a script with writing rules and without writing rules Where in this writing has used matching correct writing rules from the literature used [21].

Table 1. Bima script font

A	BA	CA	DA	FA	GA	HA	JA	KA	LA	MA	NA	PA	RA	SA
TA	WA	YA	p1	p2	p3	p4	p5							

Table 2. Older Bimanese letter from raffles 1,817 [3]

a	chha	ph	na	sa	ra	ta	tha	ba	la	gha	ja	pa	da	wa	ma
cha	dha	bha	ka	nga	rha	dha	ha	kha	ba	ya	da	fa	ga	nia	

Table 3. Bima script font with rule base

Input text	Bima script font	With rule based mbojo script
Saya cinta Bima		

In the process of preserving the Bima script, the Samparaja Museum [22] and Asi Mbojo [23] play a very important and massive role. Some of the roles are holding training and learning Bima script writing, as well as receiving visits from outside the region and across countries. In the museum, there are also thousands of ancient manuscripts in the form of the Bima script and other characters such as the Malay Arabic script, which is a historical legacy and the civilization of the Sultanate in the city of Bima.

Bima script, which is the script used before the Malay Arabic script, was used as a medium of information exchange and to write messages and information on the sultanate or work in the fields of religion and diplomacy [24]. At the Samparaja Museum, the number of characters found in ancient manuscripts is dominated by Malay Arabic script as shown in Figure 1. There is a history related to Islamic civilization in the manuscript, which is very important to study [25]. Android is the operating system used for smartphones where the use of smartphones in Indonesia in 2018 has reached 62.41%, with cellular signal network coverage in 2018 of 77.172% [26]. Based on this very significant increase in smartphone use, online-based learning models will potentially be accepted by the community. Currently, the development of transliteration applications in the form of mobile with the Android platform has emerged so that the community will easily accept the design of an Android-based literacy learning media application.



Figure 1. Bima script file at the *Samparaja* Museum

This research applies a string replacement algorithm that is attached to the application rule base. The rule base or standard rule in writing the Bima script is obtained from the learning process based on the rules found in the manuscripts found in books [4]. For example, the character ma is derived from 1 single character m. All reading rules found in book sources are described and implemented in the string replacement method [20].

The application of the string replacement algorithm by utilizing hexadecimal numbers that have been used by previous studies and get a good accuracy above 90%, in this study choosing an algorithm with hexadecimal processing to implement the rule base that has been denuded previously to obtain optimal transliteration. The output of this application is in the form of Android-based Bima learning media. The android platform was chosen with the hope of getting high acceptance in the community as in previous research.

### 3. RESULTS AND DISCUSSION

This study's results are the learning media for transliterating Latin letters into Bima script. Figure 2 shows each stage of the transliteration process. This stage discusses the analysis process to collect materials and methods, aiming to design a string replacement algorithm. This approach will be combined with addressing with hexadecimal numbers, consisting of character data collection, punctuation, 16-bit Unicode Transformation Format (UTF) generation process, character rule data collection, community understanding survey related to characters. Bima, collecting reference literature [4], defining the method or determining the method used.

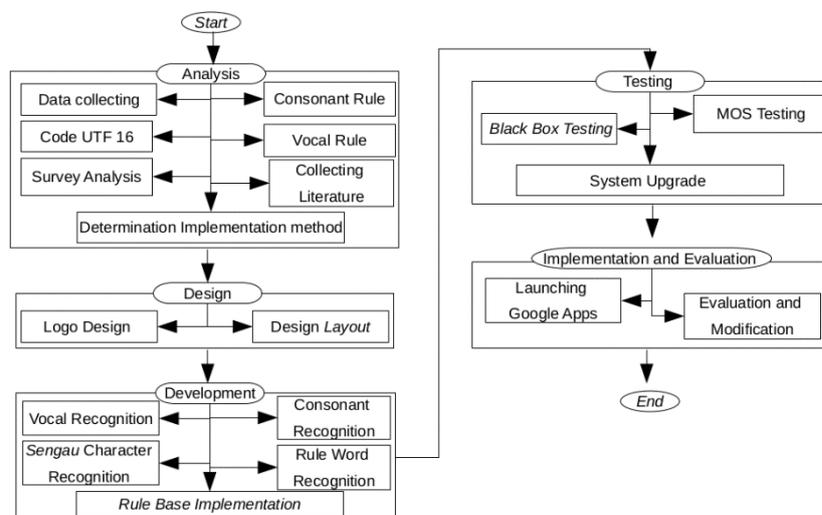


Figure 2. Transliteration Bima script to latin script design model

This design stage discusses the process of designing the layout of the display of the Bima script learning application and designing the application logo to be released. At this stage, the arrangement of the location of the text input and output text is determined. Thus, users get an easy-to-use application experience and a comfortable display presentation. This development stage discusses the process of developing the code that serves as the core of the application, namely the program flow that is tasked with executing user input. Here, the program consists of vowel recognition, consonant recognition, vocal character recognition, and punctuation recognition, and after the character has been determined, rules in the writing process are used, as in Figure 3, refers to research by Aranta, Bimantoro, and Putrawan [5].

<pre>input="bima" #(a) a=(input   .replace("a", "0061")   .replace("b", "0062")   .replace("i", "0069")   .replace("m", "006d") ) print(a)</pre> <p>00620069006d0061</p> <p>(a)</p>	<pre>input = a #(b) b=(input   .replace("006d0061", "006d")   #input all rule base   .replace("...", "...") ) print(b)</pre> <p>00620069006d</p> <p>(b)</p>	<pre>input = b #(c) c=(input   .replace("0062", "b")   .replace("0069", "i")   .replace("006d", "m") ) print(c)</pre> <p>bim</p> <p>(c)</p>
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Figure 3. (a) First filter, (b) Second filter, (c) Third filter, of string replacement transliteration

The next step is to implement the rule base in the system code in the Bima Script transliteration application, the result of the C output can be changed to the Bima script font to get the transliteration result. The testing process is carried out by two methods at testing this stage, namely black box testing related to system functionality and testing the mean opinion score (MOS) related to testing to users. The end of the research process.

**3.1. Main menu**

The following is the menu view of the Bima script transliteration application page. This application consists of a main menu page, which contains text and voice input pages, delete text, reference pages, about the application, and output text, like the application flow in Figure 4.

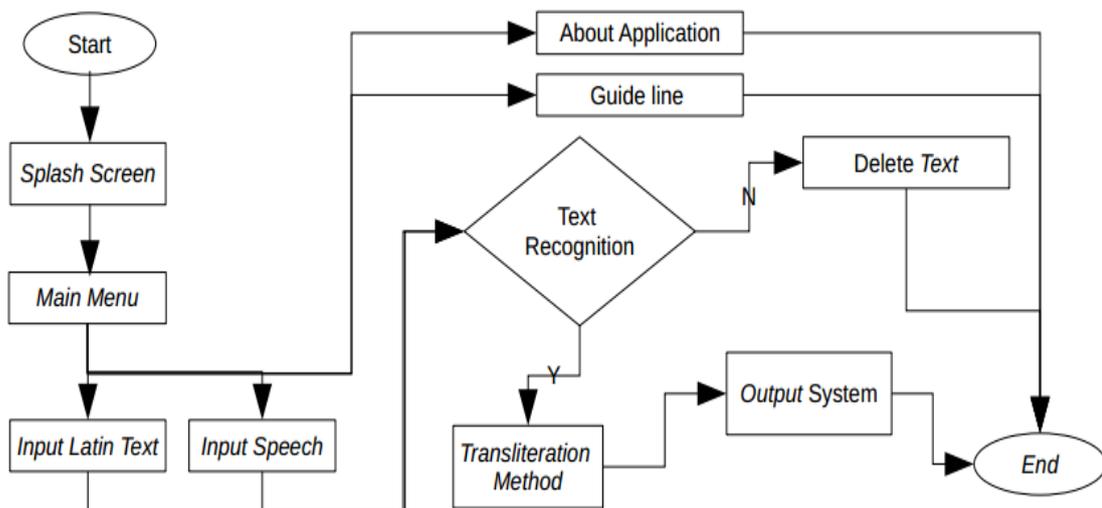


Figure 4. Screen flow Bima script transliteration

The following is the main menu view of the Bima script transliteration application page. On this main page, there are sections for input text, output text, and input speech. In this input, the text that is input will automatically be auto transliterated. The appearance is as in Figure 5 (a), (b).

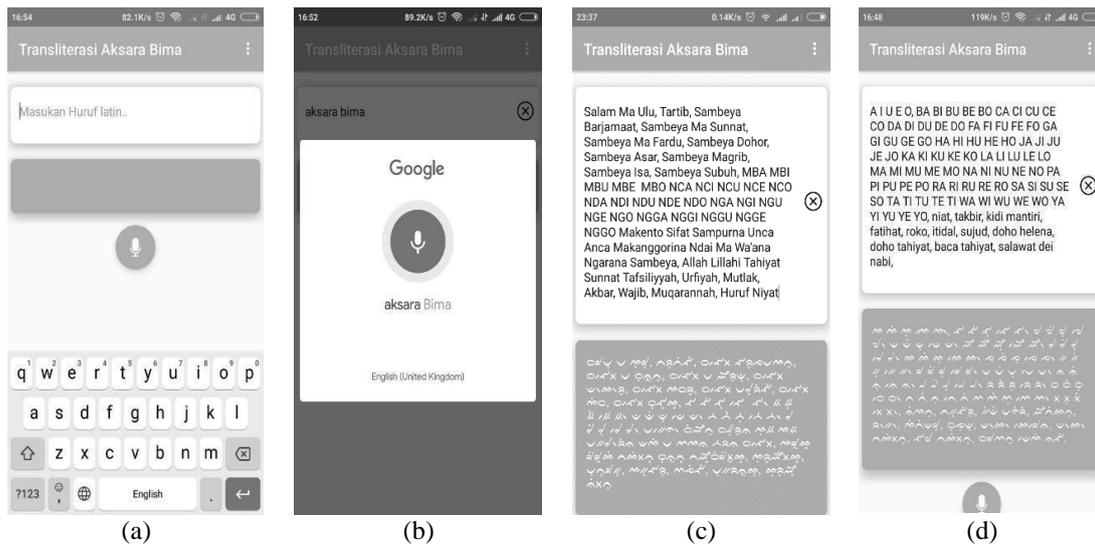


Figure 5. (a) Main menu input text, (b) Input using speech recognition, (c) First text transliteration result, (d) Second text transliteration result

### 3.2. Transliteration output

The following is a display of the main menu page where the Bima script input process has been carried out, while the results appear in Figure 5 (c), (d)

Figure 5 (c), (d), shows the transliteration results of the Bima script based on the book used as the test standard [13]. Based on this image, the application can display conformity results in testing by 100% based on test data available from the book used; it can be concluded that the application. This can perform the Bima script transliteration process and can be used as a learning medium for the Bima script transliteration process.

### 3.3. Transliteration output

This study uses an Alpha Testing scenario as done in previous studies [1], which aims to experience user responses to the level of ease of installation and operation of the device, on various versions of the android user. This test managed to collect 31 respondents who already had an Android smartphone, and the test results were 99.36% successful in the installation and use of application features. The results of this test are shown in Table 4.

Table 4. Alpha testing

Questions	31 Total sample testing		Percentage
	Success	Failed	
When using the Bima script transliteration application, are you enabled to enter Latin letters by typing text on screen ?	31	0	100%
When using the Bima script transliteration application, could you enter Latin text using the microphone feature?	30	1	96.77%
When using the Bima script transliteration application, could you delete total letters with the cross mark feature?	31	0	100%
When using the bima script transliteration application, could you open the about transliteration page in the application?	31	0	100%
When using the Bima script transliteration application, could you open a user manual page?	31	0	100%
Total successful using application			99.36%

In the next test, the beta testing process is carried out. This test is a reference to previous research [1]. This examination aims to carry out the analysis process at the level of customer interest in using the Bima script transliteration application. Some of the questions asked in this testing process include how significant this application can help the learning process to understand the Bima script, how much is the contribution of this application in the process of preserving the culture, whether this application is easy to use

by the user, and does this application help in the transliteration process of the Bima script text. The results of this test are shown in Table 5. The final test analysis this application gets a review where the application has been downloaded over 100 times on the Google App Store with a user satisfaction level of 4.8 on a scale of 5 [27].

Table 5. Beta testing

Question	45 Total sample testing							Total $\Sigma(\text{value} \times \Sigma \text{respondent})$	Percentage
	7	6	5	4	3	2	1		
Can this application help the process of learning transliteration Latin text to the Bima script?	20	18	5	2	0	0	0	281	89%
Do you think this application will help the preservation of the Bima script insignificantly?	27	13	3	2	0	0	0	290	92%
The appearance of this application is attractive and easy to use (User Friendly)?	20	19	4	2	0	0	0	282	90%
Does this application help the transliteration process?	30	14	1	0	0	0	0	299	95%
Total success									91.50%

#### 4. CONCLUSION

Based on the results of the application design that has been socialized to the Bima community, this application can meet the result 99.36 of Beta Testing and 91.50 of alpha Testing. The testing application for examining the data contained in the Book of Local Civilizations that Had Lost made by Maryam. As in Figure 2, the application can perform a total transliteration process accuracy on the test data is 100% from 149 data testing. This application can be used as a medium for learning the Bima script prospect of the development of research results and application prospects of further studies into the next (based on result and discussion), and application has been downloaded over 100 times on the Google App Store with a user satisfaction level of 4.8 on a scale of 5. For the future, this application will be developed for a two-way model, namely the Bima script towards Latin to facilitate the transliteration process of ancient manuscripts found in the Samparaja Museum.

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