The Development of an *Android* Application of Terms Register in Malay – English for KSSM Physics and Its Usability among Student Teachers

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Abstract

This research aims to develop an *Android* application of terms register in Malay – English for KSSM Physics for Physics student teachers' use. A need analysis was performed to obtain feedback from ten student teachers about the existence of this application. This application is developed based on the ADDIE instructional model and undergoes a pilot test using a qualitative approach to obtain the initial feedback. After improvement, this application undergoes an application validity process through three experts using face and content validity forms. A quantitative approach was made using the Heuristic Evaluation Questionnaire (HEQ) survey on 30 student teachers to obtain the application usability. This research has produced an application on an *Android* platform containing 418 extracted terms from Standard Document for Curriculum and Assessment (DSKP) for Form 4 and Form 5 Physics with the application name is FiPhyNeo. FiPhyNeo receives a Content Validity Index (CVI) of 0.93. FiPhyNeo also has obtained high usability (mean = 4.37 ± 0.34). This research developed an Android application called FiPhyNeo containing terms register in Malay – English for KSSM Physics for student teachers that is valid with high usability. This research will benefit the student teachers, current teachers, and students for a fast and easy search of terms register and operates in offline mode to support the teaching and learning of Physics.

Keywords: Translation, Android, KSSM

INTRODUCTION

Teaching and Learning of Science and Mathematics in English (PPSMI) policy was introduced in 2003 and abolished in 2010 by stages in the Malaysian public education system. The policy aimed to improve students' English command and accelerate their science and mathematics mastery [1]. The English language proficiency among Malaysians triggered this solution as there has been no improvement since 1970 [1]. During its implementation, school students and teachers must use the English version of the Science and Mathematics syllabus. However, the English proficiency among students, especially in rural areas, is still low, and it becomes difficult for them to understand the subjects in English [2]. In addition, the differences in the achievement of Science and Mathematics among the rural and urban students were significantly different during the PPSMI implementation [3]. From the educator's perspective, many teachers agreed that they were not fluent enough to use English in teaching and preferred the Malay language, which is the

country's national language [4]. Because of these problems, the Malaysian government came up with a new policy after the Malaysian Cabinet in July 2009 abolished the PPSMI.

Upholding the Malay Language and Strengthening Command of English (MBMMBI) policy is a reformed approach by the government to keep the Malay language as the national language, a tool of unity and a medium of communication towards achieving 1Malaysia idea while strengthening the English language as the international communication medium [3]. During the implementation of this policy, Science and Mathematics syllabus reverts to the Malay language in national schools. Although it seems like an excellent solution to overcome PPSMI problems, students who used to learn Science and Mathematics in English had to be mentally and cognitively prepared for the change in the medium of instruction as they might get confused [1]. As a result, their academic performance might be affected. Thus, a dynamic solution must be emphasized for the student's and teacher's readiness to face the new policy requirement.

Dual Language Programme (DLP) is a part of the MBMMBI policy. DLP emphasizes English as an instruction means in Science and Mathematics teaching and learning [5]. Unlike the PPSMI, DLP is optional and implemented only in certain schools which have fulfilled the criterion outlined by the Malaysian Ministry of Education (MOE) [6]. However, according to Md Yunus & Islam Ahmad Sukri (2017), pre-service teachers in their study admitted to experiencing difficulties in teaching Science and Mathematics in English throughout their 2-months teaching practicum. The major problem faced by the teacher is their poor command of English (73.53% of respondents) and a minor issue of constant preparations of translating notes for students (8.82% of respondents). Since there are DLP and regular classes in the national schools, the curriculum now has Malay and English syllabi. Thus, teachers must strengthen their Malay and English proficiency and switch their delivery mode quickly in both languages. To probe Physics understanding the dual language, several researchers translated well-known standard concept surveys to Malay, for example, FCIspm and CSEMy [7, 8]. These translated instruments are useful for teachers to probe students' understanding without the language barrier.

Since the independence of Malaysia, the education system has undergone many changes, starting from the Razak Report in 1956 to the Integrated Curriculum for Primary School (KBSR) and the Integrated Curriculum for Secondary School (KBSM). Standard Based Curriculum for Secondary Schools (*Kurikulum Standard Sekolah Menengah* - KSSM) was enacted to meet the new policy requirements under the Malaysia Education Blueprint (PPPM) 2013-2025 [9]. It is to ensure that the quality of the curriculum implemented in secondary schools is comparable to international standards. In Physics subject, this curriculum aims to increase understanding of Physics concepts through meaningful learning experiences and develop skills including 21st Century Skills (KA-21) and High Order Thinking Skills (HOTS) [10, 11]. KSSM Physics has only been implemented in 2020 [12]. There are two new topics in the new curriculum: (1) Gravitation in the Form 4 syllabus and (2) Quantum Physics in the Form 5 syllabus. New topics mean there are new terms and concepts. Thus, the teacher must master all the terms in both languages before starting the teaching and learning session.

The COVID-19 pandemic that hit the country had a significant impact on various sectors. Due to the increase in COVID-19 cases, all schools were closed, following the Movement Control Order (MCO) government declaration on the 16th of March 2020. Accordingly, MOE has issued a handout of The Implementation of Teaching and Learning Guidelines [13]. It changed the teaching and learning pattern from two-way and face-to-face to Teaching and Learning at Home (PdPR) [14]. According to Bernama (2020), telecommunication devices such as smartphones and online application platform gadgets were prohibited from being brought to school before. However, it is the other way around when the world of education is virtual and done at home. Thus, the use of telecommunication devices at home is maximum during this pandemic situation. However, there are some people that unlucky to face this new norm. Some do not have access to the internet and appropriate device tools [16]. Furthermore, online classes consume so much internet data making this new way of learning a real deal to face [17]. Thus, an offline learning application is required to maximize the use of telecommunication devices in learning and reduce internet data consumption.

Based on the aforementioned situations, a Physics terms register application containing the latest syllabus terms and operating in offline mode is needed. Plus, the application must be light and provided with a simple interface for a fast and easy search. The perception of the use of the application was determined among student teachers. They were selected because they were the product of PPSMI and had an initial experience during their initial practicum session delivering the MBMMBI syllabus.

Therefore, two objectives were aimed for this study : (1) to develop an *Android* application of terms register in Malay – English for KSSM Physics and (2) to determine the usability of the developed *Android* application among student teachers. This study sought to answer the following research questions:

(i) Is the developed *Android* application of terms register has satisfactory content validity?
(ii) Is the developed *Android* application of terms register has satisfactory usability?

MATERIALS AND METHODS

The research design for this study is developmental research using the ADDIE instructional model. The ADDIE model is a guideline for building effective training and performance support tools suitable for media development [18]. There are five phases in the model: Analysis, Design, Development, Implementation, and Evaluation.

Analysis

The first phase of the ADDIE model is analysis. This phase involved two analyses: (1) need analysis and (2) document analysis. The need analysis aims to obtain the need to run the study. A need analysis form (see Appendix 1) contains parts A and B. Part A consists of five Physics terms (term number 1 to 5) that need to be translated from Malay to English. In comparison, part B consists of five Physics terms (term number 6 to 10) that need to be translated from English to Malay. Ten student teachers were purposively selected and given five minutes to complete the form. They were free to use any translation medium in the meantime. The results are shown in Figure 1.
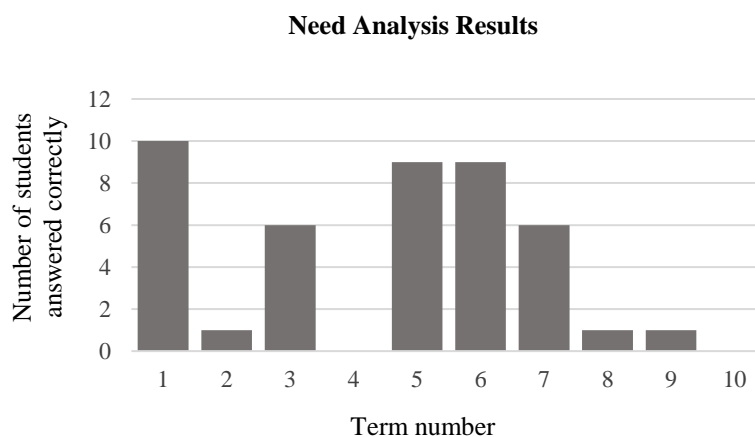
Need Analysis Results

Figure 1 Result from the need analysis, the number of students answered correctly for each corresponding term versus the term number.

Based on the results, for part A, all respondents could not provide the correct match for term 4 (*Hukum Kegravitian Semesta Newton*), and only one student could give a correct match for term 2 (*Haba Pendam Tentu Pelakuran*). For part B, all respondents could not provide the correct match for term 10 (Rarefaction), and only one student could give a correct match for terms 8 (Plane Wavefront) and 9 (Step Down Transformer). The finding showed that the student teachers were facing difficulties translating the terms, and the need for this application development study was justified.

The next was the document analysis. The Physics terms are extracted from the Standard Document for Curriculum and Assessment (Dokumen Standard Kurikulum dan Pentaksiran-DSKP) for Physics [19]. In total, 418 terms were extracted for the Form 4 and Form 5 syllabus and translated into Malay and English using a reliable medium.

Design

In the design phase, the extracted terms from the previous stage were keyed in the FieldWorks Language Explorer 9. The software is used to prepare the lexicon for the application. First, every term was inserted one by one according to the listed categories. Then, it is then exported in the format of 'LIFT' for the next process.

Development

The Android application of terms register in Malay – English for KSSM Physics is developed using the Dictionary App Builder software in the development phase. This free software helps to build customized dictionary apps for Android and iOS smartphones and tablets. Several components like the lexicon, fonts, colors, styles, and others are coded using simple coding. The app's icon is also produced in several dimensions to comply with *Android* devices of various sizes and resolutions. The final product is produced in 'APK' format and named FiPhyNeo.

Implementation

In the implementation phase, the developed app is distributed among four student teachers as a prototype. First, a pilot was performed to obtain respondents' initial views and comments on the developed app. For any problems that occur, this phase will be repeated. Each repetition of this phase will go through repair and refinement until no more problems occur. Then, the app underwent a validity process done by three experts from Physics education familiar with all the Physics terms. Plus, one of the experts holds a professional diploma in language translation. The instruments used were face and content validity forms (see Appendix 2). The face validity used Agree/ Disagree checkboxes to indicate the agreement of experts, while the content validity used Likert scales of 1- Strongly Disagree to 5- Strongly Agree. The total score for content validity is 25.

Evaluation

This phase is the final phase of the ADDIE model. In the evaluation phase, the usability of FiPhyNeo was obtained by getting feedback from the targeted respondents. Thirty student teachers were selected using the purposive sampling method and required to answer the app's usability questionnaire. The questionnaire used is Heuristic Evaluation Questionnaire (HEQ) (see Appendix 3), adapted from Ariffin et al. (2018). This questionnaire uses Likert scales of 1- Strongly Disagree to 5- Strongly Agree. Finally, the data were analyzed to interpret the FiPhyNeo usability.

RESULTS AND DISCUSSIONS

As a result, an *Android* application of terms register in Malay – English for KSSM Physics named FiPhyNeo is developed. 'Fi' stands for the first syllable of *Fizik* (Physics in Malay), and 'Phy' stands for the first syllable of Physics. 'Neo' is originated from the Greek word meaning new or modified. FiPhyNeo has an APK storage of 2.6 MB and can be operated in offline mode. It also has several features like quick search (Figure 2), adjustable font size (Figure 3), and three theme choices (Figure 4).
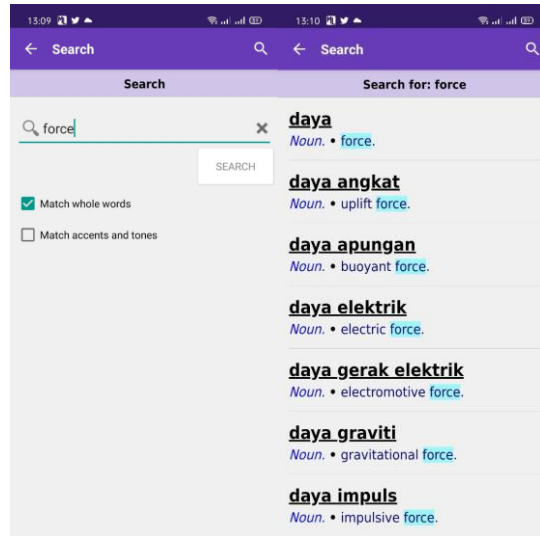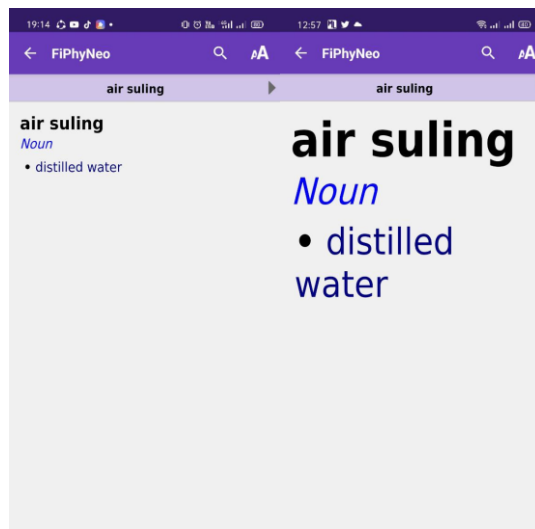
Figure 2 Quick search feature

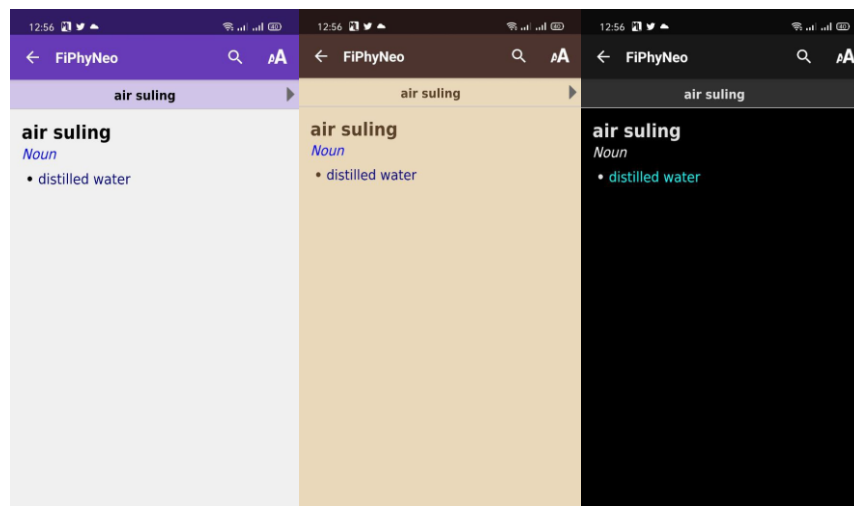**Figure 3** Adjustable font size feature

Figure 4 Application's themes

Is the developed Android application of terms register has satisfactory content validity?

For the face validity analysis, all three experts have chosen to agree on the entire item. The content validity analysis of this study used the Content Validity Index (CVI) method adapted from Md Yusoff et al. (2018). According to Sidek and Jamaludin (2005), cited in Madihie & Noah (2013), if and only if the percentage of content validity achievement is more than 70% (0.70), then it has good content validity. Table 1 shows the findings of the content validity in this study.

Table 1 CVI findings

Expert	Expert's Score	Expert's CVI
Expert 1	24	1.00
Expert 2	23	0.80
Expert 3	25	1.00
CVI Average	0.93	

Based on Table 1, the score for every expert is more than 0.70, which shows excellent content validity. The CVI average of the three experts is 0.93 shows that the developed app has satisfactory content validity.

Is the developed Android application of terms register has satisfactory usability?

The usability of this study is obtained from the feedback of the HEQ. The HEQ contains ten dimensions of mobile app's usability: (1) accessibility, (2) consistency, (3) good ergonomic and minimalist user interface design, (4) readability and ease of recall, (5) efficiency and flexibility, (6) realistic error management, (7) suitable content for local culture, (8) aesthetic value according to local culture, (9) the language use is for local culture and (10) the local philosophy has local culture value. The usability analysis is descriptive. The mean score and the standard deviation are calculated for every statement focus in every dimension and tabulated in Table 2. The data is then presented in the median boxplot form in Figure 2.

Table 2: The mean score and standard deviation for every statement focus

Heuristic Principle	Statement Focus	Mean Rankings on 5-point Likert Scales, where 5 = Strongly Agree Mean (Standard Deviation)	Mean Rankings According to Heuristic Principle (Standard Deviation)
		FiPhyNeo (n = 30)	
Accessibility	Mobile content can be accessed and interacted with via a mobile phone	4.70 (0.47)	4.45 (0.78)
	Application can be easily found using a mobile phone	4.20 (1.00)	
Consistency	The font layout, text type, size and content are very consistent	4.47 (0.51)	4.36 (0.82)
	The images and icons are very consistent	4.00 (1.17)	
	The colour for the background is consistent	4.60 (0.62)	
Good ergonomic and minimalist	Simple and brief design interface	4.60 (0.50)	4.53 (0.64)
	The touch screen interaction is good	4.60 (0.72)	

user interface design	The interaction via the virtual keyboard is good	4.40 (0.67)	
Readability and ease of recall	The text content and application are readable	4.57 (0.50)	
	The pictorial content is readable	3.63 (1.30)	4.26 (0.86)
	All the navigation steps are easy to remember	4.57 (0.50)	
Efficiency and flexibility	Can search text content fast	4.57 (0.82)	
	Can navigate easily using the hyperlinks	4.03 (1.10)	4.31 (0.93)
	Can navigate easily using the available buttons	4.33 (0.80)	
Realistic error management	Application will not be closed immediately without warning	3.43 (1.52)	4.02 (1.15)
	Application launches without error	4.60 (0.56)	
Suitable content for local culture	Mobile content is suitable for local culture	4.70 (0.47)	
	Mobile content is easy to learn	4.60 (0.81)	4.65 (0.66)
Aesthetic value according to local culture	The text presentation is in accordance with local culture	4.53 (0.78)	4.10 (1.31)
	The graphics presentation respects local culture	3.67 (1.58)	
The language use is for local culture	Local language enables me to use the software functions	4.60 (0.50)	
	Local language is helpful for me in learning local culture	4.43 (0.73)	
	Combination of English and local language is useful for using the software functions	4.57 (0.63)	4.54 (0.60)
	Combination of English and local language is helpful for me for educational purposes for local culture	4.57 (0.50)	
The local philosophy has local culture value	Local philosophy embedded reflects the local culture software	4.30 (0.70)	
	The local philosophical value is suitable for educational purposes for local culture	4.37 (0.72)	4.33 (0.71)
Mean and standard deviation across all heuristics		4.37 (0.34)	

According to Ahmad and Meerah (2002), cited in Ali et al. (2017), the interpretation means score used is 1.00 to 2.33 (low), 2.34 to 3.67 (medium), and 3.68 to 4.00 (high). Based on Table 2, the mean score for every focus statement of heuristic principles is above 3.67 (high) except for three: (i) the pictorial content is readable, (2) application will not be closed immediately without warning, and (3) the graphics presentation respects local culture. However, they are still in the medium level of the mean score and will be considered for improvement in the next research. The mean score across all heuristics is also high, 4.37 ± 0.34.
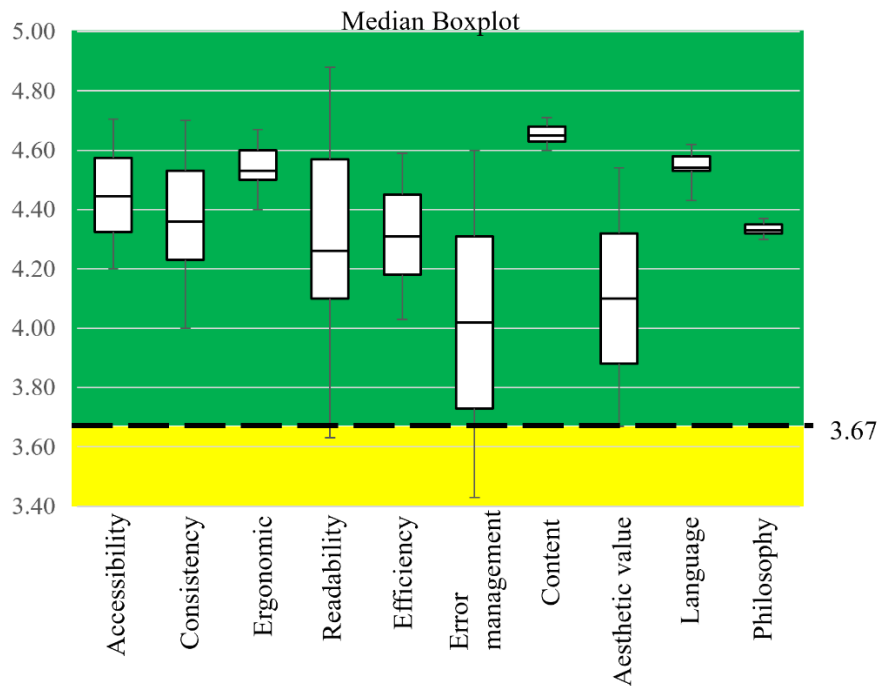
Figure 5 The graph of heuristic principle versus the score mean

As for the usability according to heuristic principles, Figure 5 shows the summarized usability for a more graphical presentation where median boxplots for every heuristic principle are in the green zone, which indicates high mean scores. Thus, the developed Android application of terms register has satisfactory usability.

IMPLICATIONS

At least three groups will get direct benefit from this research: student teachers, current teachers, and school students. The developed app contains extracted terms from the latest syllabus (KSSM) and has high validity. Thus, it is a trusted source to refer for Physics terms register available in Malay and English. In addition, it has a simple user interface that complies with a fast and easy search of terms register. Furthermore, the developed app operates in offline mode that helps in reducing internet data consumption. For those who run the study on terms register app's development or other same fields of study, this research can be a helpful guide for them.

CONCLUSION

This research developed an application called FiPhyNeo containing terms register in Malay – English for KSSM Physics for student teachers, expert validated with high usability. The content validity for the FiPhyNeo was high (CVI = 0.93) and obtained high usability (mean = 4.37 ± 0.34). FiPhyNeo has a small APK storage of 2.6 MB and can be operated in offline mode. It also has several features like quick search, adjustable font size, and three theme choices.

ACKNOWLEDGEMENT

SUPPLEMENTARY MATERIALS

The following materials are accessible in the following link: https://bit.ly/fiphyneo

(i) APK Installation Package
(ii) Appendix 1: Need Analysis Form
(iii) Appendix 2: Content Validity Form
(iv) Appendix 3: Heuristic Evaluation Questionnaire (HEQ)

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