

Designing multimedia development for English language learning: Resources of effective instructional process

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Abstract

Innovation in learning media development to facilitate students in supporting optimal learning outcomes is essential. This study aims to design mobile learning multimedia development production related to the mastery of English as a communication tool at the secondary level. It applies the following (4D) procedure: 1) define, which includes theoretical and need analysis; 2) design, which contains an identification of core competencies and basic competencies, selection and collection of materials, making flowcharts and storyboards; 3) develop, which includes the stages of media production, validation of media experts, validation of material experts and student response questionnaires and product trials; and 4) disseminate, which covers the activity of spreading the final validated product to the affiliated users used as learning media and or resources in the instructional process. The product development being tested has gone through several stages: a review from a media expert that includes aspects of software engineering and visual communication and a review from a material expert that contains parts of material and learning design. Students' responses include technical and interesting aspects, limited trials, extensive trials and are feasible for medium learning, resulting in effective and efficient online learning resources.

Keywords: Innovation; design; development; learning multimedia

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1. Introduction

The educational sector faces the pressure of adjusting to quickly changing conditions because of the technological turns of events recently. As of now, all generations have entered the more advanced development of education. They are into digital natives who have experienced childhood in the computerised age instead of getting advanced information from grown-ups (Palfrey & Gasser, 2011). Information, communication and technology (ICT) advancements influence learning styles, from verbal and visual to virtual (Proserpio & Gioia, 2007). Consequently, instructors need to embrace new instructing techniques to interface with understudies (Setiawan et al., 2020; Wankel, 2009).

On the other hand, most instructors are hesitant to change, and they encourage utilising similar educational strategies as they completed 20 years prior (Montiel et al., 2020). Matulich et al. (2008) and Montiel et al. (2020) show that learning is more compelling for millennials and Gen Z when utilising intelligent learning exhibits and person-to-person communication than using conventional talks. The instructive local area has worries about the ramifications of the change in reformist learning styles; so, expanding learning through innovation reception should stay the objective of teachers.

The endeavours of educational institutions to impart learning resources based on multimedia ICT in understudies are packed with difficulties. Wang and Hu (2017) discovered experimental proof that understudies who experienced conventional schooling did not have better judgement when confronted with achieving learning outcomes than understudies who did not encounter any. A few impediments in technical instruction incorporate the hole between the usage of alternative media by speculations and their application in reality (Phillips, 1997; Raman et al., 2019; Roblyer, 2003). Some learning exercises are hard to execute in natural conditions on account of significant expenses, absence of framework or just being excessively dangerous. Innovation stages, for example, portable applications and virtual re-enactment, offer the chance of mirroring certifiable complex cycles and frameworks (Loon et al., 2015; Ralhan, 2016; Salas et al., 2009), which are hard to recreate utilising conventional instructive material, for example, talks or contextual investigations. Multimedia learning resources' innovation gives understudies a profound learning experience because there are three essential highlights of invention: drenching, creative mind and association (Hernawan et al., 2021; Ralhan, 2016; Setiawan & Asrowi, 2018).

This research is especially applicable to react to the ongoing circumstances brought about by the COVID-19 pandemic. First, it is because open-distance learning innovation can acquaint helpful information with the class without leaving it. Furthermore, moving from an actual study hall learning condition to virtual learning can give constant representation and cooperation in a virtual world, which is the same as this present reality (Chuah et al., 2010; Darmawan, 2012; Hackbarth, 1996), and understudies can get practical information without venturing out from home. Hence, virtual innovation can be a learning medium to keep learning at home during a pandemic emergency.

Multimedia learning resources, as in mobile learning, as one sort of virtual advances, can assist understudies with understanding dynamic themes and increasing understudy inspiration (Anitah, 2011; Makransky & Lilleholt, 2018; Poedjiastoeti, 1999; Rubinson, 1995; Smaldino et al., 2008), just as decidedly affecting the mastering results of understudies' conduct abilities-preparing (Cakiroglu & Gokoglu, 2019). A large number of investigations look at the possible utilisation of mobile learning innovation at the college level: it improves apparent learning adequacy (Mayer, 2011; Molenda, 1990; Munir, 2013; Zhang et al., 2017), upgrades understudies' learning results and premium in ecological schooling (Su, 2018), drenches in mobile learning impacts with apparent learning results in science (Makransky et al., 2016), convinces innovation as video tips and deceives computer-generated reality-

based perspectives or potential practices in the space of medical care (Chow et al., 2017) and improves fire well-being conduct abilities (Cakiroglu & Gokoglu, 2019; Lee & Kim, 2021; Tamim, 2021). This exploration fills the gap in designing the utilisation of computer-generated reality-based learning media as another method of showing second language acquisition.

2. Method

2.1 Research design

This research is classified as research and development (R&D). It is a process or steps to develop a new product or improve an existing product. What is meant by products in this context is not only hardware but also software. R&D as a research method, i.e., deliberate and systematic, aims to find, formulate, improve, develop, produce and test the effectiveness of certain products, models, methods, services and procedures that are superior, new, effective, efficient, productive and meaningful (Borg & Gall, 1983; Pargito, 2010; Raiser & Demsey, 2007; Sugiyono, 2007; Thiagarajan et al., 1974).

2.2 Research subjects

The learning media was applied to the instructional process of XII-grade students of vocational high school or secondary level, who took the specialty of electrical and mechanical engineering at vocational high school (SMKN) 2 Surakarta city, Indonesia. It covered two parallel classes participating during the research. A total of 60 students were enrolled and assigned to 2 groups randomly, namely the experiment/treatment group (30 students) and the control group (30 students).

2.3 Research procedure

Development research is the approach that is linked to design and development work—product-oriented development research. Development research is a type of research that aims to develop existing knowledge, educational theories or produce a product in education. The products made in development research include teacher training materials, learning materials for students, learning media to facilitate learning, learning systems etc.

The research development procedure consists of two stages: developing a model product and testing the quality and effectiveness of the resulting product (Sukardjo & Sari, 2009). In development research, one of the development models is known, namely the 4D model. This model consists of four main phases or stages, namely 1) define, 2) design, 3) develop and 4) disseminate.

2.4. 4D model of the language learning media development stage

Define

It includes observations and interviews. First, observations and interviews are conducted to obtain data on the initial conditions of the school and English learning in the classroom, analyse student characteristics and see the supporting factors for implementing multimedia products in schools. Then, it is followed by a literature study, namely the process of reviewing relevant theories and research results.

Design

This learning multimedia design includes activities to determine competency standards and basic competencies developed to be used as learning multimedia. The process of determining competency standards and basic competencies is carried out in collaboration with English teachers, who are

considered experts in these subject areas. The next step is to design the material. It is a guide that is used to write manuscripts (Susilana & Riyana, 2009).

Develop

This development stage includes multimedia production, product validation and product testing. Below is the explanation. *Multimedia production*. The completed multimedia design is then compiled into multimedia form with the Adobe Flash programme installed on the computer, laptop and smartphone. It is also connected to an android programme. *Product validation*. Material experts and media experts will validate the initial product validation. In this study, the English teacher will validate the material, who the researcher considers as an expert in mastering the material to be developed. Aspects that will be validated are the content and learning of the material to be developed. At the same time, the media expert in this study was a lecturer in Educational Technology from Sebelas Maret University, Surakarta. Media experts validate the presentation and visualisation aspects (see Table 1).

Table 1. Guidelines for converting quantitative data into qualitative data

Score interval	Value	Category
$X > 4.21$	5	Very good
$3.40 < X \leq 4.21$	4	Good
$2.60 < X \leq 3.40$	3	Fair
$1.79 < X \leq 2.60$	2	Less
$X \leq 1.79$	1	Poor

The results of the assessments from material experts and media experts will be used to revise the content aspects of the materials and media developed. *Product trial*. The product trial aims to collect data used as a reference for developing media products that will be produced. In addition, the data obtained from product trials are used to revise the product to be developed. The product trial in this study was carried out through several stages, as described below. *Preliminary field test*. This initial product trial stage aims to obtain a description of the application background or feasibility of a product that has been developed. This trial is limited in nature, so it involves a few respondents. Ten respondents in this trial phase from the 10th grade were included. *Operational field test*. Operational testing was the final stage of product testing in this study. The operational field test is an activity also known as an empirical test. This activity is carried out to test the validity of the product hypothesis. Thirty-two respondents at this stage were included. *Implementation*. At this stage, multimedia is implemented in the learning process to know the effectiveness of using multimedia in learning. Multimedia is implemented in a class called the experimental class, which is a class that uses multimedia learning based on multimedia mobile learning. *Evaluation*. After multimedia is implemented, the next stage is evaluation. First, data processing was carried out with a normality test and homogeneity test. The normality test aims to see whether the variance of the experimental class and the control class is normally distributed. Normality test was carried out using the Lilliefors test, while the homogeneity test was carried out to determine whether the variance of the two classes was homogeneous using the Bartlett test. The last step in developing the media for instructional process through 4D model is dissemination. The users along with the developer/researcher distributing the product transfer knowledge on how to implement the media into the programme to achieve the optimum learning objectives by trial and error.

3. Results

The research conducted is R&D. The model used in this study uses a procedural model from the modified development model of the Borg and Gall's (1983) development design and the 4D model (Thiagarajan et al., 1974). The R&D steps are divided into two stages, namely preliminary studies (research) and development (development).

3.1 Analysis

In the analysis phase, the researchers conducted a literature study and a field study. A literature study is carried out by reviewing theories and research results relevant to the research to be carried out. In addition, the researchers also conducted a study of curriculum documents, syllabus and lesson plans for English subjects. Needs analysis was carried out through field observations and interviews with teachers and students. From the analysis stage, the researchers obtained the following data. Based on the initial observations of the activities of the English learning process in class XII students at SMK Negeri 2 Surakarta, it was obtained that the students tended to be passive and less enthusiastic in learning.

The learning process that is more student-centred makes students less active and tends to wait for the concepts considered the most correct by students from the teacher. This happens because there is rarely a means of discussion on a topic problem in a subject taken from various sources by students and then facilitated by the teacher to conclude to create a correct understanding of the concept. Instead, teachers tend to directly provide answers with a preliminary explanation that is still lacking by students. This causes students to experience boredom quickly, be passive and reduce attention in the learning process, thus, in the end, resulting in learning outcomes that are not optimal.

3.2 Product development stage

The initial stage of this model is to determine what it is desired that students can do when they have completed the learning programme. The ultimate goal of learning is the achievement of the learning objectives.

According to the National Education Policy as outlined in Permendiknas RI No. 52 of 2008 (Ministry of Education and Culture of Indonesia) concerning process standards, it is stated that one of the components in preparing a learning implementation plan is the existence of learning objectives in which it describes the learning processes and outcomes that are expected to be achieved by students under basic competencies. The basic competencies in this research are actions/events that were conducted/occurred in the past, referring to the time of occurrence, with those referring to the end.

3.3 Product drafting

In designing the initial multimedia design to be developed, there are several stages carried out by researchers, which include the below.

Identification of core competencies and basic competencies

Developing multimedia that will be used as a medium for learning English for class XII, SMK refers to the 2013 National Curriculum syllabus used at the school. The core competencies and basic competencies included in the media are explained below.

Material selection and collection

Various kinds of material choices presented in multimedia in the form of text, images, animations and videos that are coherent and complementary are collected. Any material that can increase students' attention and activity in learning English grammar is selected.

Setting flow chart

It shows the flow of the developed multimedia starting from the opening page, which then goes to the main page (Figure 1). There are five main menus. The first menu is competence, in which there is information related to core competencies and the subject matter of learning. The second menu is usage, adverbs of time, sentence structure, past tense, regular and irregular verbs and an explanation video.

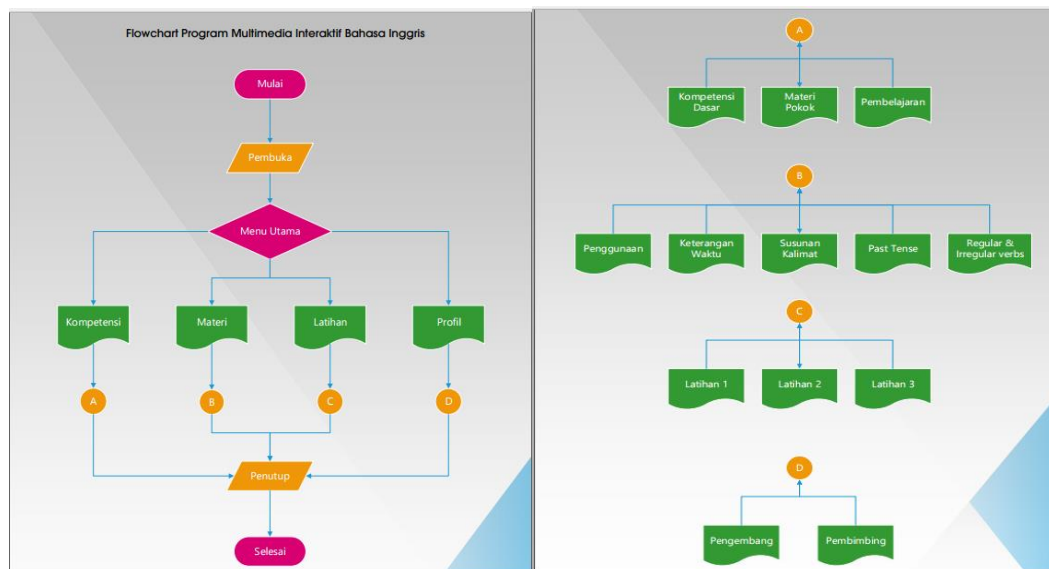


Figure 1. Learning multimedia flow chart and the storyboard construction

Designing a storyboard is necessary to consider and focus on several aspects to become a product that is easy to operate and control and fulfils the artistic element. In addition, it actively involves users and the media itself. The general design in the storyboard that the researchers investigated includes the design of the template, the location of the menu, the navigation buttons and the material in it.

Opening

The opening page displays the title of learning multimedia, the designation for education and class levels, object images and sign pointers to start multimedia teaching (Figure 2).

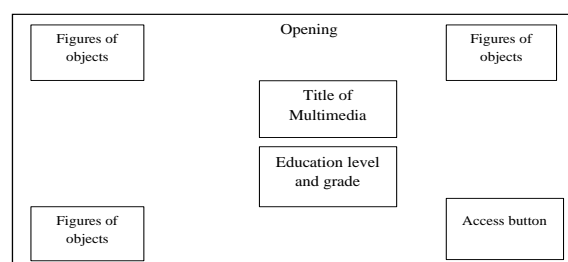


Figure 2. Multimedia opening page storyboard display

There is a main menu on the home page consisting of competencies, materials, exercises, tips and tricks and profiles. Each button links the following page according to the contents (Figure 3).

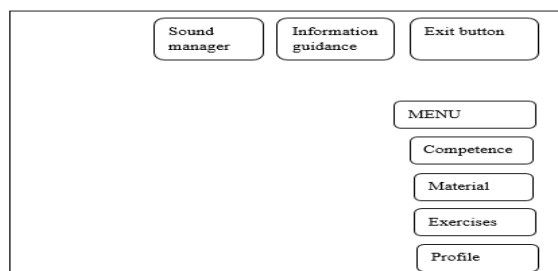


Figure 3. Multimedia main menu storyboard display

Media development stage

Researchers have taken several steps in developing media that will be used as learning multimedia, which includes production, validation of media experts, validation of material experts and product trials (Figure 4).

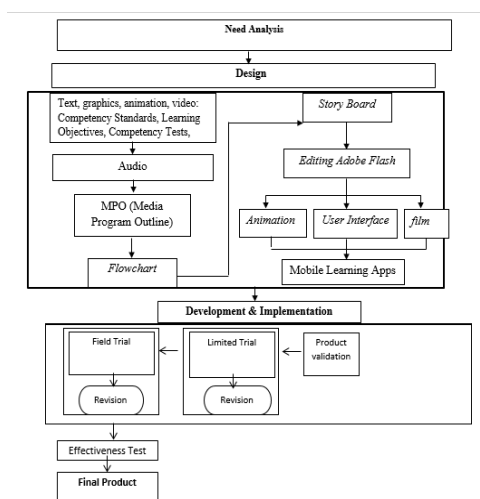


Figure 4. Stages of the 4D-based media development

Media production

Production is the most important and decisive stage in creating a final result by the provisions that have been made previously so as not go beyond the limits that have been contained in the flow chart and storyboard that have been arranged in such a way as in the previous phase.

Opening display

In this opening view, there are several icons, namely title, subject and class. On right and left sides are pinned several pictures of objects representing learning, including the university logo, books, lights and the word 'enter' (Figure 5).



Figure 5. Opening display

Main menu display

Several icons can be found in the main menu view. Each icon has a function that supports multimedia performance. It runs optimally, including a speaker symbol that gives or removes the back sound effect on multimedia, navigation, power button, competencies, materials, exercises, tips and tricks and profiles (Figure 6).



Figure 6. Main menu display

Navigation display

There are several kinds of icons in the navigation display that function to make it easier for users to operate the multimedia that will be used. Aside from being a guide, the buttons on the navigation page also function as shortcuts for users when they want to move, repeat and/or end media usage quickly, precisely and effectively (Figure 7).



Figure 7. Navigation menu display

Content display

The material icon button contains several sub-materials, which are elaborated into several explanatory items: definition, format, component, participants, functions, profile, scoring and score accumulation. Shown in Figure 8 is an example of the content in the sub-material on the regular and irregular verbs icon, including usage, time adverb and sentence structure, and the last is an explanation video.



Figure 8. Content display

Exercise display

The exercise display contains 3 sub-items containing 20 questions. Exercises 1, 2 and 3 are used as evaluations for students in which they are required to fill in their names (Figure 9).

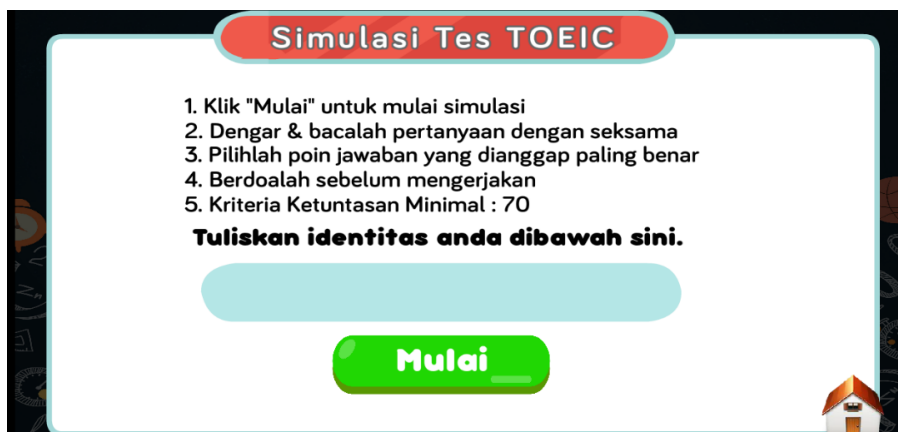


Figure 9. Exercise display

Tips and trick display

The tips and tricks icon contains character animation. In addition, it includes several cues for students or users to comprehend the learning target properly (Figure 10).



Figure 10. Tips and tricks display

Multimedia design expert validation

Validation is a process where certain things are tested for validity and feasibility through an integrated procedure. Validation also functions as a stage for correcting and perfecting a particular product carried out by competent experts in their field.

Media expert validation

Researchers use a questionnaire to test the feasibility of multimedia products tested for feasibility to experts. In the questionnaire, there are 2 aspects, including software engineering and visual communication, in which there are 28 sub-aspects. In the assessment, the expert will be given an option from each sub-aspect in the form of five columns that refer to specific numbers in each of these choices. The rating scale used is as follows: SB (excellent), with a score of 5; B (good), with a score of 4; C (enough), with a score of 3; K (poor), with a score of 2; and SK (very poor), with a score of 1. Table 2 presents the average results of the assessment of the two experts.

Table 2. Media expert assessment results

No.	Media expert	Aspect	Average score	Category	Average aspect score
1.	Media expert 1	Software engineering	4.8	Very good	Software engineering 4.7
		Visual communication	4.6	Very good	(Very good)
2.	Media expert 2	Software engineering	4.6	Very good	
		Visual communication	4.5	Good	Visual Communication 4.6 (Very good)

Based on the media expert validation questionnaire results, an average of 4.7 was obtained for the software engineering aspect. On the other hand, for the visual communication, the element received an average of 4.6. Therefore, it can be seen that the results of media expert validation have an average of 4.7, which means that mobile learning-based multimedia learning in English subjects is categorised as very good.

Content expert validation

Content validation also plays a crucial role in creating the final product of learning multimedia. Material experts can see how far the depth of the material embodied in a multimedia display can contribute positively to a learning activity. Two material experts will judge from two aspects: material content and learning design, using a scale of 1–5. The rating scale used is as follows: SB (excellent), with a score of 5; B (good), with a score of 4; C (enough), with a score of 3; K (poor), with a score of 2; and SK (very poor) with a score of 1.

Table 3. Material expert assessment results

No.	Content expert	Aspect	Average score	Category	Average aspect score
1.	Content expert 1	Material	4.5	Very good	Material 4.7
		Instructional design	4.8	Very good	(Very good)
2.	Content expert 2	Material	4.7	Good	
		Instructional design	4.7	Good	Instructional design 4.7 (Very good)

Based on the material experts' validation questionnaire results presented in Table 3, an average of 4.7 was obtained for the aspect of material content. As for the learning design aspect, an average of 4.7 was obtained. Therefore, it can be seen that the results of the validation of material experts have an average of 4.7, which means that the multimedia learning materials in English subjects are categorised as very good.

Media design revision

Based on the assessments of media experts and material experts on the multimedia design that will be tested, several revisions were made to improve multimedia in terms of both appearance and content. The revisions from the two experts are presented below.

In tips and tricks, it is necessary to provide a good difference in terms of difficulty, the number of questions, and the scheme used to give a challenging effect with graphics that keep on moving and going up.

(Media Expert 1)

Content design revision

Within the material icon, in particular, there are points of use that will bring up the information contained therein when pressed. Here, the expert asks to optimise the space in the column by providing images or symbols related to time or hours to link the content with the picture as a visual representation.

(Content Expert 1)

Product trial

The next stage is carried out after the product in learning multimedia for English subjects has been revised and corrected following the directions, input, assessment and suggestions from material experts/validators and media experts. A trial phase is carried out on students to determine their responses to multimedia.

Limited scale trial

Limited trials were given to 10 students outside the sample class, namely students of class XII. The selection of limited trial objects was carried out on students who had various abilities. The purpose of the limited trial is to collect information through a questionnaire that can be used as material to determine student responses to the media being tested.

Table 4. The results of the trial assessment on the technical aspect and the attractiveness aspect on the limited scale trial

No.	Name	Technical aspect									Interactive aspect							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Alfiana	5	5	4	4	4	5	5	5	4	5	5	5	5	4	4	5	5
2	Amanda	4	4	4	5	5	4	5	4	3	4	4	4	5	4	5	5	5
3	Anggina	5	4	5	4	5	4	4	3	5	5	5	3	3	4	5	5	5
4	Arisal	5	4	3	3	5	5	5	4	5	5	4	5	4	5	5	5	5
5	Drestha	5	4	4	5	4	4	5	5	4	4	3	5	5	4	4	4	3
6	Erika	5	4	4	4	5	4	5	5	5	3	5	4	4	3	5	4	5
7	Ferry	5	5	5	5	4	4	4	5	4	5	5	4	5	5	5	4	5
8	Maria	4	5	4	5	4	4	4	5	5	4	4	5	4	3	5	5	5
9	Risna	5	4	4	5	5	4	5	5	5	5	5	5	5	5	5	5	4
10	Vivian	5	5	5	5	4	4	3	4	5	4	4	4	4	5	5	5	5
Average		4.5									4.5							
Total average		4.5																

Based on Table 4, it can be seen that the results of product testing on students outside the sample class indicate that the technical aspect has an average value of 4.5, which is included in the excellent category, while the attractiveness aspect also has an average value of 4.5, which is also included in the excellent category. These results come from data sources in the form of questionnaires given to students to assess multimedia products being tested as learning media.

Field scale trial

After conducting a limited scale trial in a separate class outside the sample, the researchers also conducted a broad scale trial in the same class, namely class XII. There were 32 students in the class to test the learning media products based on multimedia mobile learning to find out the students' responses through a previously prepared questionnaire. The results of a wide-scale test of multimedia learning English show that in the technical aspect, it has an average value of 4.5, which is included in the excellent category, while the attractiveness aspect also has an average value of 4.6, which is in the excellent category.

The results of students' responses on the wide scale are shown in Table 5

Table 5. Results of product feasibility tests by students on field scale trial

No.	Scoring aspect	Average	Category
1.	Technical aspect	4.5	Very good
2.	Interactive aspect	4.6	Very good
Total average		4.6	Very good

Based on the explanation given in Table 5, it can be concluded that the students' responses to the product being tested on the technical aspect reached an average value of 4.5, which is included in the excellent category. At the same time, the attractiveness aspect got an average value of 4.6. Therefore, the results obtained are also not very different.

The average value obtained is 4.6, which means it is in the excellent category. Therefore, referring to these data, it can be concluded that multimedia learning based on mobile knowledge in English subjects on grammar is effective in helping students learn and is suitable for use in classroom learning and independent study by students (Table 6).

Table 6. Feasibility results

No.	Respondents	Scoring	Category
1.	Content expert	4.7	Very good
2.	Media expert	4.7	Very good
3.	Students	4.6	Very good

4. Discussion

Based on the details of the value, which is then averaged on the feasibility assessment of multimedia learning based on mobile learning in English subjects according to the assessment of material experts, it is included in the excellent category or suitable for use. On the contrary, media experts' assessment results are included in the excellent category or very feasible to use category. Finally, the student trials are included in the excellent category or suitable for use category. Thus, through the assessments of material experts, media experts and students, it can be concluded that multimedia learning based on mobile learning in English subjects on grammar is appropriate to be used as a medium for learning English subjects in vocational high school.

After going through several stages, starting from media production, media expert validation, material validation, design revision and testing on students in classes outside the sample, the next step is media testing to find out its effectiveness in improving students' learning outcomes. Table 7 presents an overview of the final multimedia mobile language learning model in English subjects at XII grade of vocational high school.

Table 7. Media effectiveness test result

Domain	Pre-test		Post-test	
	Control	Experiment	Control	Experiment
Total	30	32	30	32
Average	50.96	47.62	55.73	77.62
Highest score	87	80	93	100
Lowest score	20	13	30	40
Passing grade percentage	16.7%	9.4%	26.7%	68.8%

Table 7 shows that the average post-test value for the control class is 55.73 and the experimental class is 77.62, while the *n*-gain value for the control class is 0.12, with the criteria of increasing the average value being low and the experimental class being 0.65 with the criteria of increasing the average value. Thus, it can be concluded that the experimental class that was given treatment using video media with the direct instruction model learning using the mobile-assisted TOEIC assessment preparation (stable) application had a higher average score increase than the control class using conventional learning methods

4.1 Dissemination

The process to spread the final product of the media for language learning at secondary level is called dissemination. Referring to the guidance or manual book, teachers, educators and users of the product conducted the trial activities in getting to know all the features included in the media.



Figure 11. Users' transfer knowledge activities



Figure 12. Users' product trial

The dissemination activities were run approximately for 2 days in terms of in-house training. In each section, it took about 60 minutes to conduct the school computer library. On the first day, the users got to know about the content within the media covering; navigation, learning objectives, material/content, simulation practice and tips and tricks. The users explored and exposed all of the

functional and technical buttons included to familiarise them whenever and wherever implemented. On the second day, the users focused on the content or list of material integrated in the media. The main target is to give them the information related to the TOEIC coverage and its practical usage. They experience by themselves how to operate the media and also deliver the material to the students appropriately.

5. Conclusion

This development research was conducted through several stages: (a) needs analysis through preliminary research; (b) making learning multimedia designs; (c) product development; (d) implementation; and (e) evaluation. Preliminary research includes learning needs analysis, observation, interviews and reviewing theory. Making media design includes identifying core competencies and basic competencies and learning objectives, selecting and collecting materials and preparing flow charts and storyboards. The development stage includes media production, validating material experts, media experts and student responses to the product being tested, followed by design revisions and improvements.

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