# Using Mayer's Principles in Designing Mobile-Based Learning Module: Implementation in the subject of Simulation and Digital Communication For Vocational High School

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**Abstract:** The use of technology in education recieved little attention. Teachers are required to develop multimedia elements in teaching materials. The use of multimedia elements in teaching materials is able to attract students' attention, achieve better retention rates and then improve student performance. Multimedia elements need to be organized in a better way. One good approach is to follow the Mayer Principles of Design, which are the Principles of Multimedia, the Principles of Spatial Contiguity, Temporal Timing Principles, Coherence Principles, Principles of Modality, Repetition Principles, and Individual Differences Principles. On top of that, the interactions created during the learning process also contribute to effective learning. This research was research and development reffering to the steps of development design of the Alessi & Trollip model consisting of: (1) planning, (2) design, and (3) development.

**Keywords:** Mayer; Mobile; Module; Simulation

## Introduction

The use of media in the learning process aims for the learning process can take place appropriately and efficiently so that the quality of education can be improved. From several media alternatives, the tools that are capable of providing a learning experience and capable of covering all are the digital learning modules. Using the learning module also gives students the opportunity to learn in their own way.

Multimedia messages designed with the ordinances of the human brain work more likely to be more meaningful learning compared to multimedia messages that are not designed to follow the workings of the human brain. To obtain multimedia that can improve students' understanding and have good display quality then multimedia messaging design needs to be integrated with the principle of multimedia design [1]. The development of multimedia by using the mayer principle can minimize errors that cause learning media is not effective when compared with some other principles. The use of multimedia in the learning module will be more optimal if supported by a device that is easy to use, one of them is a smartphone. Thus students can study wherever and whenever.

Simulation and digital communication are subjects that fall under the category of expertise subjects in multimedia skills program of vocational high school. Subjects of simulation and digital communication are classified as new subjects since the turn of the curriculum. So that no resources and learning media are needed to facilitate students and teachers in the learning process. These subjects emphasize mastery of the theory and practice of computer applications. On applications effectively by utilizing presentation making programs. The final goal in of the

presentation materials, the students are expected to be able to understand and apply effective presentation techniques.

Based on the explanation above, this research aims to designing mobile-based learning modules using the principle of multimedia design mayer with implementation on the subject of simulation and digital communication for vocational high school.

## Literature Review

### A. Basic Concept of Mayer's Multimedia Design Principles

Richard E. Mayer instructional methods are outlined in twelve principles of designing multimedia for learning[1]. The twelve principles are grouped into three according to the main purpose of multimedia design, namely (1) reducing excessive cognitive processes and not related to the material (extraneous); (2) managing the essential cognitive processes; and (3) developing a generative process. The twelve main design principles are:

1) Coherence principle - people learn better when extraneous words, pictures and sounds are excluded rather than included.

2) Signaling Principle - People learn better when cues that highlight the organization of the essential material are added.

3) Redudancy Principle - People learn better from graphics and narration than from graphics, narration and on-screen text.

4) Spatial Contiguity Principle - people learn bettern when corresponding words and poctures are presented near rather than far from each other on the page or screen.

5) Temporal Contiguity Principle - People learn better when corresponding words and pictures are presented simultaneously rather than succesively.

6) Segmenting Principle - People learn better from a multimedia lesson is presented in user-paced segments rather than as a continuous unit.

7) Pre-training Principle - People learn better from a multimedia lesson when they know the names and characteristics of the main concepts.

8) Modality Principle - People learn better from graphics and narrations than from animation and on-screen text.

9) Multimedia Principle – People learn better from words and pictures than from words alone.

10) Personalization Prinsiple – People learn better from multimedia lessons when words are in conversational style rather than formal style.

11) Voice Principle – People learn better when the narration in multimedia lessons is spoken in a friendly human voice rather than a machine voice.

12) Image Principle – People do not necessarily learn better from a multimedia lesson when speaker's image is added to the screen.

### B. Basic Concept of Learning Module

Learning modules are teaching materials that are arranged in a systematic, planned and interesting, is the unit of the smallest learning program that students learn independently in order to achieve certain goals[1][2][3]. Learning module has characteristics that can be used self instructional, user friendly, self contained, stand alone, information power is strong enough, serve individual differences, have clear objectives, systematic, utilize learning communication media, and evaluation of mastery of matter in stratum[3][4][5].

### C. Basic Concept of Mobile Learning

M-Learning or mobile learning relates to learning using mobile devices such as mobile phones and other information technology tools for learning[6]. Application on mobile learning refers to the use of mobile devices on android smartphone application. Development which is

designed to be used in education. learn by using a mobile device/ smartphone where the subject matter is loaded into the smartphone in the form of an application.

Applications on mobile learning refers to the use of mobile devices in the mobile phone as one can access materials and applications related to learning anytime and anywhere[7].

**Table 1.** Advantages of using M-Learning

| No | Advantages |
|----|-----------|
| 1 | Convenience, users can acces from anywhere in the learning content, including quizzes, evaluation, and more. |
| 2 | Collaboration. Learning can be done at any time in real time. |
| 3 | Portability, use of books is replaced with RAM to learning that can be set up and connected. |
| 4 | Interesting, Learning combined with the multimedia will be fun. |

## Methodology

This research and development procedure adapts several steps of development in the Alessi and Trollip models[7]. The model of multimedia development model oriented to learning software through 3 stages of planning, design and development.

*A. Planning*

Stage is the initial stage in Alessi & Trollip development model. There are several steps taken at this stage:
1. Define the scope and the content
   Scope and the content for the project are defined, and the type of application is determined. This is the first step.
2. Identify characteristics of learners
   Collect the information in the document about learner characteristics (age, educational level, motivation), information relevant to the subject material.
3. Determine and collect resources
   Resources that will be used like software to process data, books that are used as references.

4. Conduct initial brainstroming
   This step is the process of generating ideas about a subject

*B. Design*

At this stage, the results of a needs analysis survey, a collection of materials and reference sources form the basis for developing this mobile-based learning module. There are several steps taken at this stage:
1. Develop initial content ideas
   The development of this initial content is based on the results of the initial brainstorming carried out at the planning stage.
2. Create flowcharts and storyboards
   The program flowchart describes the program workflow which later became the basis for storyboard development

*C. Development*

The development stage is the last stage in the development model of Alessi & Trollip[7]. Steps taken at this stage include:
1. Create the graphics
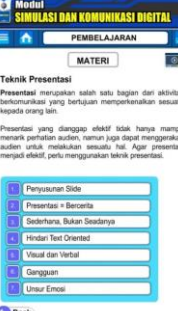   Stage for producing graphics needed for development
2. Produce audio and video

The stage for producing audio and video that is suitable and necessary for development

3. Assemble the piece

At this stage, the whole project is built, as well as the programming done to create the mobile-based learning module applications. At this stage authoring tools are used which are equipped with programming and development capabilities for use on mobile devices.

Assembling the sections in this mobile-based learning module also pay attention to the design principles according to.

**Table 2.** Design Application with Mayer's Principles

| Name | Mayer's Design Principles | |
| --- | --- | --- |
| | *Design* | *Description* |
| Coherence principle |  | In this developmen, unnecessary or unrelated content such as words, images, music, irrelevant videos are excluded. |
| Signaling principle |  | This principle states that students learn better when important parts of the material are highlighted or given highlights. |
| Redudancy Principle |  | This principle states that students learn better than pictures and narratives or printed images and text rather than printed images, narratives and texts |

| | | |
|---|---|---|
| Spatial Contiguity Principle |  | This principle states that students learn better when text with related images is presented close together |
| Temporal Contiguity Principle |  | This principle states that students learn better when related texts and images are presented simultaneously on one page |
| Segmenting Principle |  | Segmenting principle. This principle states that students learn better when learning messages are presented in gradual segments. |
| Pre-training Principle |  | The application of this principle to product development is found in the program / module usage instructions section. |

| | | |
|---|---|---|
| Modality Principle |  | In the development of this product, material video points are accompanied by narration but not accompanied by text. |
| Multimedia Principle |  | In the development of this product, the material is arranged with pictures not just words |
| Personalization Principle | - | This principle is applied to programs using informal language styles. |
| Voice principle | - | In this development, the narrator's voice on the video is the voice of the developer and not the sound of the machine (computer) |
| Image Principle | - | The application to this principle is in the video section that does not include the speaker image (narrator) on the screen. |

## D. Prepare support materials

At this stage, the whole project is built, as well as the programming done to create the mobile-based learning module applications. At this stage authoring tools are used which are equipped with programming and development capabilities for use on mobile devices. During this phase all data, text, images, video, and animations to the project collected in appropriate digital format.

## E. Testing

During this phase, the application module is run and checked to ensure that mobile based module development is done in accordance with what has been designed.

# 1. Conclusion

In the design of mobile-based learning module of simulation and digital communication for vocational high school there are several characteristics that must be considered include the Mayer's multimedia principles.

The development of this mobile-based learning module can be used as a reference for researchers in developing mobile learning (m-learning) and adapted to the needs of the materials to be loaded into the mobile-based learning module.

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