ScEd-ALS as ubiquitous learning in science

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Abstract. The use of technology in education can be carried out through various telematics networks. The use of hypermedia or web (e-learning) and computing on mobile allows the subject matter to be distributed to students quickly, not limited by space and time. Independent learning is possible to occur. This paper aims to inform the framework of curriculum development at the Science Education Adaptive Learning System (ScEd-ALS) version of the smartphone that supports Ubiquitous learning. The research method used is development research. The research instruments included: observation sheets, checklist sheets, and VARK questionnaire. The results of the study: The ScEd-ALS curriculum development framework that accommodates the VARK Flemming learning style preferences of students. This curriculum framework is the foundation for the development of the smartphone version of the ScEd-ALS media prototype. This research was validated by material experts and media experts and was declared worthy of being tested. The curriculum development framework in this media has provided the right teaching materials, and it is easier to create a new environment that adapts to the learning style preferences of students.

1. Introduction

Learning through mobile technology has given a new touch to the world of education. Cellular technology (digital technology era) with all its applications presents new challenges for its users with easy access to information, communication, and data exchange. In education, one of which is to provide insight on planning and preparation for blended learning, where mobile learning is integrated into the presentation of the traditional curriculum [1,2,3].

Progressing computing and communications have changed the concept of teaching and learning significantly in decades past. Of course, this is the main attraction and the challenge for researchers in the field of science computer, and technology education to undertake a variety of experimental studies to test the learning outcomes of students [4,5].

The conventional learning that has been used by teachers has many weaknesses. One of the weaknesses that still occurs is the presentation of abstract material that is always carried out without the help of visualization, face-to-face interactions of students and teachers are limited by space, time, and the teacher's ability to serve guidance (personalization). Teachers have difficulty identifying the personalization of students' learning so that teacher services are not optimal. The learning motivation of students can even decrease when dealing with a teacher's teaching style that is monotonous, not creative, and does not understand the characteristics of their students, especially during a pandemic like this (Corona). The existence of technology cannot be ignored to solve these educational problems. The use of Information Technology can be used as a solution to solve the problem of personalization...
of learning [6] and health protocols (social distance) during a pandemic through a form of distance learning [7].

One of the most widely used IT applications in the world today, especially in cellular technology, is the Android operating system [8,9]. Android applications in education allow constraints in the teaching and learning process to be reduced. One advantage of the android system in education is that it can accommodate individual diversity[10,11,12]. Each individual has a personalization/preference in learning or what is known as a learning style [13]. Each student has a unique way to process the information received into knowledge for themselves. Media that can facilitate the learning of students personally become indispensable. The power of technology must be able to simplify the process of delivering material and learning, and all of that needs to be designed in the curriculum [14,15].

The results of the research show that learning that accommodates students' learning preferences will make it easier for students to learn. Various research shows basic learning styles as a significant indicator influence the success of students learning and the impact of education [16]. Many recommended learning styles include David Kolb's Model, Peter Honey, and Alan Mumford's Model, Learning Modality, Neil Fleming's VAK/VARK model, Anthony Gregorc's Model, Cognitive Approach, and the NASSP Model [17]. The VARK learning style model (Fleming, 2006), shows that it is beneficial for improving learning [18,19].

Learning science at the secondary school level does not escape from the low monotonous presentation of material science. Researchers have researched the development of ScEd-ALS on a hypermedia version packaged in an interactive CD, used by students both classically and individually. Some research findings once its limitations, the use of hypermedia interactive CD version requires procurement computer, or a compatible laptop and LCD screen to display it. In line with the help of android in learning technology, the Science Education Adaptive System Learning (ScEd-ALS) has been modified to the android version, which is conceptually adaptive to the learning style preferences of VARK Flemming students [20].

Media ScEd-ALS requires the availability of content knowledge in developing a curriculum framework. The curriculum framework provides the foundation for designing, delivering and evaluating knowledge content [21]. The process is to adapt the curriculum in the local context to suit the needs of the audience [22]. The development of a science content curriculum in this matter needs to pay attention to the depth and breadth of concepts associated with the demands of essential competencies. The preparation of learning activities refers to the development of competency achievement indicators. Segments of the learning activities of students adapted to the learning style preferences of learners or termed as a pedagogic intervention. Pedagogic intervention vertically refers to the demands of the essential competencies of the subject, and horizontally is an implementation action to achieve competence [23].

The storyboard for the Android version of the ScEd-ALS material was developed pedagogic interventions/teaching actions tailored to four VARK Flemming learning styles, namely Visual, Aural, Read Write, and Kinesthetics. The complexity of the learning component can be accommodated via a smartphone which is the basis of Ubiquitous learning. This paper aims to provide information on how to develop a science curriculum framework in the ScEd-ALS media.

2. Research Methods

This study uses development research [24,25] with a cycle process: analysis, design, evaluation and revision, systematic reflection and documentation. This report is limited to the analysis, design and evaluation and revision stages. The study begins by conducting a literature study and document collection. The literature study was carried out in the form of analysis of research results from computer-based ScEd-ALS media developed by Zulfiani, Suwarna, and Miranto [20], analysis of journals/reference books that are relevant to science learning, and the condition of students' learning styles in school. Also, a survey was conducted of 153 eighth grade students of Junior High School in South Tangerang, which aimed to find general patterns of student learning styles according to VARK Flemming. The research instruments were observation sheets, checklist sheets, and the VARK questionnaire. At the design stage, a media curriculum framework is obtained which is described
through the storyboard table of learning materials. Then a media prototype was made, which was validated by two experts.

3. Results and Discussion

The result of the two literature study was the finding of essential variables in the development of the ScEd-ALS product as an android version of the science learning media. The following are the results of the field study in the analysis of student needs, curriculum development, and media.

3.1. Student Needs Analysis

At this stage, identification of learning styles at Junior High School in South Tangerang with a total sample of 153 students. This stage aims to determine how the trend of emerging learning style patterns is spread. This information is used as the basis for the instructional development of priority teaching materials that must be prepared. The learning style pattern of students aged 13-4 years, in Junior High School South Tangerang with a total of 153 people in 2018, dominated by unimodal compared to multimodal. The highest unimodal learning styles are Aural (33%), Read/Write (23%), Kinesthetic (20%) and Visual (12%).

3.2. ScEd-ALS Media Curriculum Development Framework

The teaching material in this research is motion material and simple machines which are studied in class VIII Curriculum of 2013. The selection of material is based on the problem of obtaining the results of the 2017 national examination of junior high school students who have low absorption. Motion and simple machine concept has the lowest absorption (40%-42%) compared to other materials and obtaining material integration [26]. The development of the Android version of the ScEd-ALS media is a development of the interactive CD version that was previously developed. Some of the content that is considered weak in previous studies (CD Interactive) was revised to provide additional and animation.

The instructional arrangement of teaching materials is adjusted to the classification of the four learning styles of field study results. Instructional teaching materials are written in the program storyboard. (Table 1) Storyboards are packaged and assessed several times by taking into account the suitability of pedagogical interventions. Zulfiani et al. in 2019 as an example of presentation of teaching materials for learners' visual form of intervention pedagogy it is giving the image display-image, change the majority of the text into a visual form and adding background attractive. Teaching materials for aural learning styles presented in a way provides the audio narration of the text material, adding music or background, change text material into a form of narrative conversation with a yes or no. Media with a Read/Write learning style presented articles (text) with lots of reading or information and hypertext for further information. In the teaching material, kinesthetic intervention is made in the form of presenting material through procedural activities such as simple, practical exercises that can be done in class or at home, presenting virtual experiments that maximize button clicks [27,28].

Storyboards of teaching materials that have been developed are validated by material experts and at the same time learning. Some notes that become input regarding the flow or validity of the material become the basis for making revisions.

Table 1. Storyboard.

| Indicators of Competency Achievement | Visual | Aural | Read and Write | Kinesthetic |
|-------------------------------------|--------|-------|----------------|-------------|
| Describes the function of muscles for humans | Given pictures and words were describing muscle function. | A recorded description of muscle function is presented. | A paper on muscle function is presented. | Given words of explanation, regarding muscle function, muscle contraction and relaxation. |
Mention the types of motion that involve the muscles working under the consciousness

A picture of the contractions of the biceps and triceps are presented with clear picture instructions. Did you know that there are muscles that work unconsciously and out of consciousness? Given pictures and words of explanation about the three types of muscles.

Did you know that there are muscles that work subconsciously and out of consciousness? Audio is played about the three types of muscles and how they work.

Describes the application of simple machines working principles to the motion system

Do you still remember the simple machine's material? Did you know, it turns out that the motion system in our bodies also follows the principles of simple machines. Can you provide an example? An example is given when someone raises a barbell.

Do you still remember the simple machine's material? Did you know, it turns out that the motion system in our bodies also follows the principles of simple machines. Can you provide an example? An example is given when someone raises a barbell.

Can you provide an example? The footage is given of an example when someone raises a barbell. In your opinion, what kind of simple machines is it when lifting a barbell?

Can you provide an example? An example is given when someone raises a barbell. In your opinion, what kind of simple machines is it when lifting a barbell?

Hold up an object that is a little heavy around you (e.g. a drinking bottle) with one hand. Move up and down the object with your hands like someone lifting a barbell.

The storyboard framework allows follow-up at the media development stage. The following is an example of display design results. (Figure 1)
3.3. Media development Framework

They are learning Media development android based to need the mission and objectives of development it self software that provides convenience to users in understanding the teaching material to obtain optimal learning results. Choosing compatible main and supporting software, adjusting the placement of material and the sequence of learning activities, choosing visualization/image resolution, and using sound, narrative text, music, and audio effects (effects or illustrations that are expected to make the display clearer). According to Luther (1994), multimedia development is carried out in six stages, namely: concept, design, material collection, assembly, testing, and distribution [29]. The second component is content or material. The content or material designed by researchers is expected to be useful in learning with various learning styles.

3.3.1. The results of the technical design of the Android version of the ScEd-ALS. ScEd-ALS made a cover when it started operating as a start-up. The ScEd-ALS cover contains the title of learning media, buttons for various learning styles that link to the main page of each learning style, profile buttons, and learning objectives buttons. Users can select the appropriate learning style menu by pressing the "Aural, read and write, visual, and kinesthetic" buttons to continue to the next page. After pressing the "Aural, read and write, visual, and kinesthetic" button, students will enter the main page, which consists of the meeting button on personalized learning.

Figure 1. Example of display design results in the android version of ScEd-ALS.
3.3.2. **The results of optimizing the Android version of the ScEd-ALS.** The application uses a variety of software by the function and time of use. The software includes Microsoft PowerPoint, Corel Draw X7 Photoshop, Adobe Flash CS6 Ispring quiz maker.

3.4. **Results of Material and Media Validation**

The results of validation by science experts on media development are excellent regarding the six indicators. Media expert validation both for indicators of depth and completeness of the material as well as the accuracy of pedagogical interventions for each learning style.

This research is a media development that is limited to the analysis, design and evaluation stages. At the analysis stage, an adaptive media curriculum development framework is obtained, which is the basis for programming, namely the material storyboard. The resulting storyboard is part of academic accountability in developing measured and rational media. This research is in line with Pratiwi [30] who developed a learning media design in the form of a mobile-based multimedia application for accounting students at vocational high school. The media developed can be accessed through students' cell phones with an eye-catching display design, combining materials, simulations and fun games. So that according to learning needs. The media prototype obtained was evaluated by experts, both media experts and material experts. This process is necessary to ensure that this medium is academically viable for use at its level. The media also receives input from media experts who consider important factors such as the practicality and usability of the media. It is in line with what Oktiningrum did [31] that in development research, the prototype stage requires an expert review of content, construction and language.

4. **Conclusion**

The Curriculum development framework on the ScEd-ALS smartphone version considers basic competence demands, integrated science concepts motion eight junior high school, learning style characteristics of learners that can improve learning outcomes. The learning design is packaged in a storyboard that has four features of the VARK learning style. Media development includes selecting the selected software according to its purpose. Media experts and material validated media ScEd-ALS with good results. Media has been providing teaching materials more efficiently and providing a new environment that adapts to learners' learning style preferences. For further research, to be used as a medium of learning in schools, field trials are required on a limited and large scale.

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