International Journal on New Trends in Education and Their Implications
April 2019 Volume: 10 Issue: 2 ISSN 1309-6249

DEVELOPMENT OF ANDROID BASED CHEMICAL LEARNING MEDIA FOR HIGH SCHOOL STUDENTS

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Abstract
The aim of this research is to design and create chemical learning media on smartphones with an android application for high school students. The development model used in the research was research and development which adopted the phase from ADDIE. The research sample consisted of XI grade students of high school Yogyakarta. The instrument used in this study is the media quality assessment sheet. This study resulted in (a) averages for feasibility of the media on all indicators are 76% from media experts, 93% from material experts, 92% from teachers and 87% from students, and (b) android application in the form of chemistry on android can be used as a chemical learning media. With the increasingly rapid development of technology, this Android smartphone can be used as an alternative to the development of chemical learning media in schools.

Keyword: Android application, learning media, smartphone.

INTRODUCTION

The importance of chemical education in teacher professional development can support the use of technology significantly (Tondeur, Braak, & Ertmer, 2016). The lack of understanding of theoretical and pedagogical foundations causes teachers not to utilize learning technology optimally (Voogt & McKenney, 2016). Teachers are not only required to use technology, but can develop various media for learning innovation (Harris, Mishra, &Koehler, 2014). Technology-based learning can support student learning needs, so as to improve the quality of education(Baran, 2004). Therefore, the use of technology-based learning media is very important in education.

Using of digital chemistry learning media is an effort to create meaningful learning. Students prefer digital media rather than print media because the costs needed are low and easier to find information (Weisberg, 2011). Learning digital media is superior in terms of student metacognition than non-digital learning (Norman & Fornes, 2016). One of the digital media that can be used is cellphone or tablet (Adi, Yulianto, Irwan, & Endris, 2016). Digital chemistry learning media can be a new innovation in developing media.

Today, smartphones with Android operating systems are becoming a new trend in choosing software. The development of cellular phones can provide new breakthroughs in the field of education, so students can study anytime and anywhere(Al-Fahad, 2009). Students can be actively involved when using a smartphone (Gikas & Grant, 2013). Smartphones with an Android system can also be used as a media for student learning (Calimag & Mugel, 2014; Remón, Sebastián, Romero & Arauzo, 2017) . The Android platform can facilitate students in authentic, interactive and creative learning (Zhao, Wu, & Chen, 2017). Instead, research shows that many students use smartphones to play games, explore social networking sites, and watch videos (Lepp & Barkley, 2015). Thus, an android smartphone can be used as needed.

To reduce android usage errors in learning, new learning media are needed. Learning media in the form of videos, images, and animations can improve students' learning abilities (Henderson, Selwyn & Aston, 2015). Games with online formative assessment can have a positive impact on student problem solving skills (Gikas & Grant, 2013). The development of android as a learning media can support the understanding of concepts and interest in student learning (Arista & Kuswanto, 2018). One way to develop media is to design and create chemical learning media for high school students through the android application. It is hoped that it can become an alternative learning media that is interesting and can be used by anyone, anytime and anywhere.

METHODS

Research Procedure

The type of research is research and development. This study refers to the ADDIE development model (Dick & Carey, 1996). The research begins with the analysis phase by means of preliminary studies, namely literature studies and field surveys. The second stage is to design the media and identify objectives based on preliminary studies that have been done before. Furthermore, developing instruments in the form of application android. Then test the android application experts, namely media experts and material experts. After that, make revisions according to the results of the validation of the experts. The next step, conducting trials is limited to 5 chemistry teachers. Then the product is implemented in the XI grade students of high school Yogyakarta. The final stage is analyzing and evaluating the media developed. Tabel 1 shows the development research design.

Tabel 1: Research Design

Flowchart of Research Design	
Analysis	Start → Preliminary studies
Design	Identification of purpose → Create flowchart → Create Storyboard
Development	Development of learning → Validation of development instrumen by experts → Revision → Limited Trial
Implementation	Product Trial
Evaluation	Analyze and evaluate the media developed

Data Collection

Data collection techniques using non-test methods. Data collection techniques use media quality assessment data. Media quality assessment data is used to evaluate the quality of instructional media on Android smartphone. The instrument of data collection is in the form of a media quality assessment sheet. The media assessment sheet instrument consists of 1) media expert validation sheet, 2) material expert validation sheet, 3) teacher assessment sheet, and 4) student assessment sheet. Table 2 shows the indicators of quality assessment of adapted media (Mulyanta, 2009; Hays, 2009).

Table 2: Media Quality Assessment Indicator

Indicator			
Expert Media	**Expert Content**	**Teacher**	**Student**
Ilustration	Ilustration	Ilustration	Ilustration
Operational Media	Concept Accuration	Concept Accuration	Understanding of Concept
Technology Utilization	Languange	Languange	Languange
		Operational Media	Operational Media
		Technology Utilization	

Statistical Analysis

Data obtained from this media development research is in the form of quantitative data. Quantitative data in the form of scores 1-5 were obtained from filling out the media quality assessment sheet. Table 3 shows indicator assessment of media quality.

Tabel 3: Media Quality Assessment Category

Category	**Score**
Very Good	5
Good	4
Enough	3
Less	2
Very Less	1

After obtaining an average score, it is included in table 4 which shows the ideal assessment criteria for knowing the quality of android in chemical learning media (Widoyoko, 2011).

Tabel 4: Media Quality Criteria

No	**Score Range**	**Category**
1.	$\bar{X} > \bar{X}_i + 1{,}8\ SB_i$	Excellent
2.	$\bar{X}_i + 0{,}6\ SB_i < \bar{X} < \bar{X}_i + 1{,}8\ SB_i$	Good
3.	$\bar{X}_i - 0{,}6\ SB_i < \bar{X} < \bar{X}_i + 0{,}6\ SB_i$	Fair
4.	$\bar{X}_i - 1{,}8\ SB_i < \bar{X} < \bar{X}_i - 0{,}6\ SB_i$	Poor
5.	$\bar{X} \leq \bar{X}_i - 1{,}8\ SB_i$	Very Poor

Note: $\bar{X}$ = averange score; $\bar{X}_i$ = ½ (ideal max score + ideal min score); Sbi = (½) (½)(ideal max score + ideal min score)

RESULTS

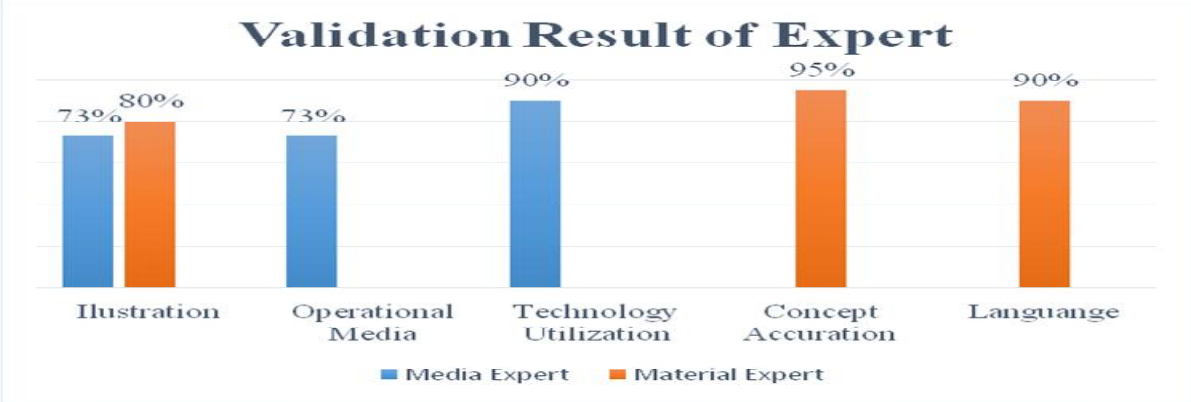
Media validation is carried out by media experts to test whether media is suitable for use in chemistry learning. Indicators include illustration indicators, media operational indicators, and technology utilization indicators. The assessment sheet for media experts consists of 11 questions. Scale scores 1-5 and are assessed with a rating scale of 0% - 100% which means very less to very good.

Graph 1 shows the ideal percentage of the illustration indicator is 73%, in the media operational indicator is 73%, and the indicator of technology utilization is 90%. The percentage of the total average of all indicators shows that the android application is good. In other words, an android application can be used as a learning media.

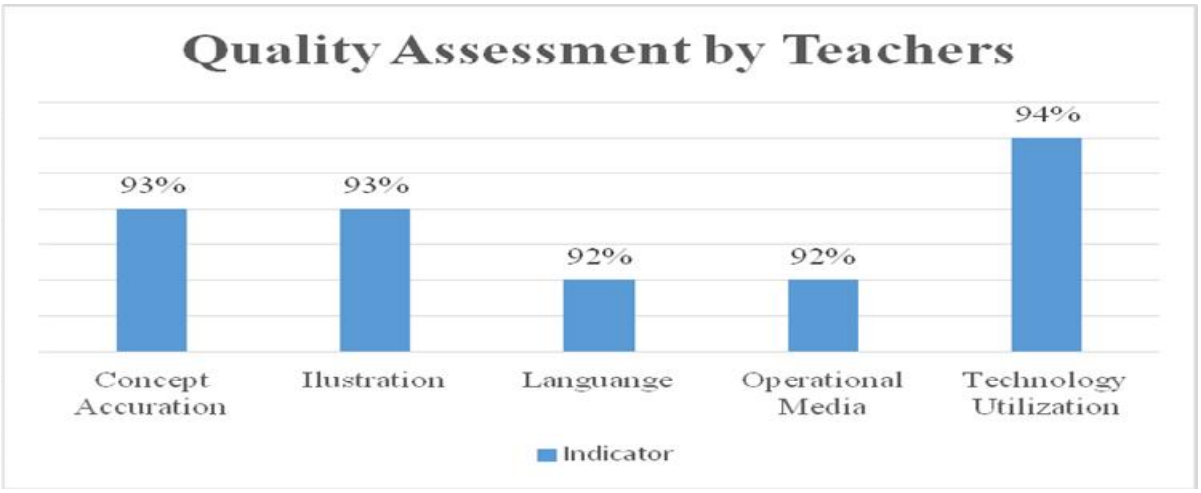
Material validation is done to test whether the concepts in the android application are feasible and easy for students to understand. The concept validation is carried out by chemical concept experts. The concept validation instrument consists of 11 statements which include illustration indicator, concept accuration indicator, and languange indicator. Figure 1 shows the ideal percentage of concept experts on the illustration indicator by 80%, on the indicator concept accuracy is 95%, and the language indicator is 90%. Data obtained from concept experts is shown in figure 1 the percentage of the total of all indicators is 88%. This shows that the android application is very good and serves as a learning media.

After revision, limited trials were conducted for chemistry teachers. Limited trials are used to find out whether the application can be used in the learning process. There are 19 statements given to the teacher to evaluate the media developed. Limited testing is carried out by 5 chemistry teachers. Assessment indicators consist of accuration concept, language, illustrations, media operations, technology utilization. Based on Graph 2, the ideal percentage of the accuration concept indicator is 93%, on the language indicator is 92%, the illustration indicator is 93%, the media operation indicator is 92%, and the technology utilization indicator is 94%. The total percentage of all aspects is equal to 93% which shows that this Android is very well used as a chemical learning media.

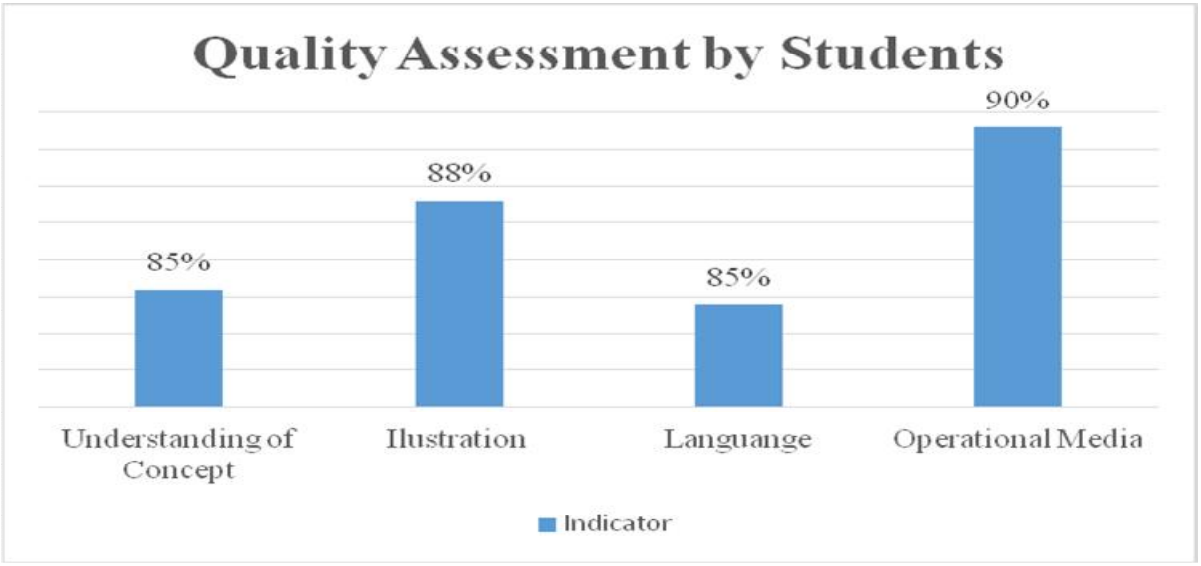
After a limited trial, the implementation was carried out by testing android products in chemistry learning media by 25 eleventh grade students. During the trial students filled out a media quality assessment sheet consisting of 10 statements, including indicators of understanding concepts, illustration indicators, language indicators and media operational indicators. Data obtained from student assessment sheets on media are shown in graph 3. The ideal percentage of concept understanding indicators is 85%, illustration indicators are 88%, language indicators are 85%, and operational media indicators are 90%. The total percentage of all indicators is 87% which shows that this android is very well used as a chemical learning media.



Graph 1: Results of Validation by Experts



Graph 2: Media Quality Assessment by Teachers



Graph 3**:** Media Quality Assessment by Students

DISCUSSION AND CONCLUSION

In this study produced "Chemistry On Android" in the file format Android Application Package (.apk). This media is present in Indonesian, can only be operated on cellphones with an Android system, the material presented is a buffer solution and quizzes are presented to train students' problem solving skills which are equipped with interesting images or animations. Figure 1 shows an explanation of how to make a buffer solution. Attractive background, writing, images and animation can distract students. This is consistent with the statement that learning media in the form of videos, images, and animations can improve students' learning abilities (Henderson, Selwyn, & Aston, 2015). Other research findings show that there are significant differences when students are involved in learning that uses video as a learning medium (Annetta, Minogue, Holmes & Cheng, 2008; Brame, 2016).

Quiz presented in Figure 2 can be used to test students' understanding. In developing this media, quizzes are presented with scores and working time. The score is used to find out how many quiz we can do. Statements about games with online formative assessment can have a positive impact on students' problem solving skills (Gikas & Grant, 2013). Evidenced by giving time to work on the quiz

"chemistry on android" is given a time limit, so that students are trained to think quickly and precisely in working on the problem or solving the problem. Other research findings suggest that constructivist learning based on games can provide new knowledge, so students feel happy (Chan, et al., 2017). Based on several studies, it can be concluded that the learning media presented with the game will provide new experiences for students.

Figure 1: Short Explanation

Figure 2: Quiz

Figure 3 that students pay close attention to the android used as a learning media, this is in accordance with the statement of smartphones with the android system can be used as a medium for

student learning (Calimag, Mugel, Conde, et al, 2014; Remón, Sebastián, Romero, & Arauzo, 2017). With the development of this Android, understanding students' concepts is increasing. Data from media assessment shows that 85% of students understand the concept of buffer solution with good assessment criteria. This means that students easily accept android as an innovative and creative learning media, so they can support students' conceptual understanding. Technology-based learning can support student learning needs, so as to improve the quality of education (Baran, 2014). In practice the researcher made a small group of 4-5 students to try the android media and fill out the assessment sheet that had been provided. Based on the suggestions and comments given by students, it was stated that the video needed to be added with the discussion, added interesting games, pretty good animation, and the audio presented made the students the spirit of learning. The development of android media provided to students has not been fully successful in improving students' understanding. This needs to be a consideration in developing innovative and creative learning media.

Figure 3: Students use android media as a learning media

The product produced in this study is "Chemistry On Android". Android applications in smartphones can be used as learning media for students anywhere and anytime. The research findings state that an android application in the form of a simulation laboratory can be used as a learning medium for high school students (Astra, Nasbey, & Nugraha, 2015). However, not all learning materials and activities use cellular devices. So it is necessary to take steps to determine the learning media that is in accordance with the material presented. In further research, it is expected to be more varied in developing learning media in order to achieve better results. Research can be done using other research instruments. Discussions with relevant parties so that the media produced can get suggestions and comments that are in line with expectations.

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