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Validity of "Hi_Science" As Instructional Media Based-Android Refer to Experiential Learning Model

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Abstract. Hi_Science is instructional media based-android in learning science on material environmental pollution and global warming. This study is aimed: (a) to show the display of Hi_Science that will be applied in Junior High School, and (b) to describe the validity of Hi_Science. Hi_Science as instructional media created with colaboration of innovative learning model and development of technology at the current time. Learning media selected is based-android and collaborated with experiential learning model as an innovative learning model. Hi_Science had adapted student worksheet by Taufiq (2015). Student worksheet had very good category by two expert lecturers and two science teachers (Taufik, 2015). This student worksheet is refined and redeveloped in android as an instructional media which can be used by students for learning science not only in the classroom, but also at home. Therefore, student worksheet which has become instructional media based-android must be validated again. Hi_Science has been validated by two experts. The validation is based on assessment of meterials aspects and media aspects. The data collection was done by media assessment instrument. The result showed the assessment of material aspects has obtained the average value 4,72 with percentage of agreement 96,47%, that means Hi_Science on the material aspects is in excellent category or very valid category. The assessment of media aspects has obtained the average value 4,53 with percentage of agreement 98,70%, that means Hi_Science on the media aspects is in excellent category or very valid category. It was concluded that Hi_Science as instructional media can be applied in the junior high school.

INTRODUCTION

Learning process can not be seperated from selection of appropriate learning strategies, including methods of teaching, learning model, learning enviroment, instructional media, and others. Choosing one of learning strategies which appropriate is not easy. Teachers must know problems of students in the learning process. Then, they will look for a solution for the students' problems, starting from analysis of students' characteristics, learning needs of students, and others to find the appropriate learning strategies. One example of learning strategies selection is presenting new innovations in the learning process. New innovations in learning systems are current demands. In fact, science and technology is growing rapidly everyday. It has brought big impact for people's life, especially for education. These changes are experienced by people, who were born in different periods of time, and have different personalities, viewpoints, and values. As a result of these interactions, the borders of each geration has been classified and their characteristics has been determined [1].

Demographics by generation in the 20th century are G.I. Generation, The Silent Generation, The Baby Boomers, Generation-X, and Millennia or Generation-Y. Demographics by generation in the 21st century started New Silent Generation or Generation- Z (Gen-Z). They are included of Gen-Z that born in 2000 to 2020 [2]. Most of students in

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Indonesia today, especially in the primary schools and junior high schools, are Gen-Z. They are known as 'Digital Natives' and they have some characteristics such as: (a) born into world marked by increasing interregional and intercommunity conflict, (b) witnessed widespread use electronic gadgets and digital technologies like internet and social networking sites, and (c) characterized as tech savvy, globally connected, flexibel and smarter, and tolerant of diverse cultures [3]. In the 21st century students need to understand the best how to apply the media resources available for learning, and to use media creation tools to create compelling and effective communication products such as videos, audio podcasts, Web sites, and others [4]. Therefore, characteristic of these generation is important to know, especially in learning science that many involve the use of variety instructional media.

Science should be viewed as a way of thinking in the pursuit of understanding the nature, as a way of investigating claims about phenomena, and as a body of knowledge that is resulted from inquiries [5]. Learning science teaches students to understand the concept through direct experience, searching for information, and examining the opinion [6]. In learning science, students are treated like a scientist. Students prove a phenomenon or solve a problem passing several procedures that are also known as scientific methods. Steps of the scientific methods also be memorized as: (a) identify the problem, (b) examine the data, (c) form a hypothesis, (d) do an experiment, and (e) make a conclusion [7]. To implement all of this, teachers must choose one of learning models which is appropriate. Each learning model of science has its own orientation and emphasis. According the new curriculum, learning science with any model always has an orientation to be an active learning, innovative, elaborative, and make the students happy that always consider the subtance contexts related to the enviroment and daily events [6].

One of learning models that involves direct experience from students is experiential learning model. According to Kolb, learning is a process, in which knowledge has created through transformation of experience [8]. Some research result in Table 2 describe the effectiveness implementation of experiential learning model.

TABLE 1. Some research about implementation of experiential learning model

Researcher	Year	The result of research
Sholihah	2014	This study observed the effectiveness of experiential learning model. The results showed that implementation of experiential learning model was more effective than conventional learning to improve learning achievement and appreciation of students in learning mathematics [9].
Taufik	2015	This study was research and development (R & D). The result showed that application of device on natural science learning in SMP N 1 Muntilan was effective in mproving scientific literacy and problem solving ability of the students [10].
Nisrochah	2016	This research was dissemination of learning device based on experiential learning model. Her study was conducted in Brebes and the subject were grade VII students of junior high schools representing the high, medium, and low categories of schools. The research showed that science teaching based on the experiential learning model affects the scientific literacy and problem solving skills of the students of all categories [11].

According to the result of some research in Table 2, experiential learning model can be applied in learning process to maximize the ability of students, especially for learning science. The experiential learning theory involves studying in four phases connected with doing, sensing, observing, reflecting, thinking and planning. Kolb connects those four phases; Concrate Experience (CE) for doing, Reflexive Observation (RO) for observing, Abstract Conceptualising (AC) for thinking, and Active Experimenting (AE) for planning [12]. These four phases in experiential learning model can facilitate students in learning science like scientist through scientific methods.

Some explanations above emphasize a few things that must be considered by teachers in choosing learning strategy. An example is the selection learning strategy including learning model, instructional media, and others that be adapted according to students needs without excluding the times. This paper gives an example of learning strategy for learning science with instructional media referring to a learning model. Instructional media based-android is the learning media selected. Instructional media based-android is named Hi_Science. Hi_Science is a learning application that adopts students wroksheet developed by Taufik. Beside based-android, Hi_Science is made referring to experiential learning model. Therefore, the fourth phase of experiential learning model can be facilitated in this application. Why must based-android application be used as instructional media? Average ages of students in junior high schools is 12 to 14 years old, and average ages of students in senior high schools is 15 to 17 years old. That is mean they are borned around 2000 to 2005. According to demographic by generation in the 21st century, most of students today are Gen-Z. One of learning tools for Gen-Z is using mobile learning. Mobile learning is

learning tool with small size and portable computing devices, that is can support students and teachers in learning process. Mobile learning are included smartphone, personal digital assistants (PDAs) and others handheld devices [13]. One of mobile larning is smartphone based-android. In 2015 the number of smartphone user in the world is up to 1.8 billion. This number will continue to increace and it is expected to pass 2.87 billion in 2020. Google's Android and Apple's iOS are two most popular smartphone operating system in the industry. According to the data from Statistical Portal in 2015, Android system has sold 81.61%, iOS system has sold 15.89%, microsoft has sold 1.88%, RIM system has sold 0.31%, and others system has sold 0.32% [14]. In Indonesia, many researchers used mobile learning based-android as instructional media in the classroom, that can improves some skills of their students. Some research used android as instructional media can be seen in Table 2.

TABLE 2. Some research used android as instructional media

Researcher	Year	Subject	The result of research
R. A. Anggreani and R. Kustijono	2013	SMPN 2 Kota Mojokerto (8^{th} grades)	Instructional media based-android in learning physics is give positive impact of learned physics motivation, understood the concept, and made students happiness. Students response is amount 91.72%, that is mean very good category [15].
A. Dwiyani	2017	SMA N 2 Ngaglik (10^{th} grades)	Implementation of PjBL module based-android can improve science process skills with gain score amount 0.56 (medium category). Besides that, these module is significant to improve scientific attitude with gain score 0.82 (high category) [16].
M. Yadiannur	2017	SMA N Samarinda (12^{th} grades)	Implementation WE (worked Example) Dinamic Electricity based-android can improve ability of mathematical representation and interpretation of electrical circuits amount 88.3% [17].
E. Surahman and H. D. Surjono	2017	SMA N 1 Depok Sleman Yogyakarta (11^{th} grades)	Implementation adaptive mobile learning can improve learning outcome of students. Learning outcome increased amount 33.80 after their used this product. Adaptive mobile learning was developed to support blended learning process. According the data obtained score amount 3.42 in very good category, that is mean this product proven to support blended learning process [18].

Some areas in Indonesia are familiar with smartphone based-android. However, some people assume childrens that use of smartphone has bad impact for learning process. This research tries to introduce the positive impact of smartphone in learning process. Hi_Science is made with regard new era developtment, demographic by generation (Gen-Z), and students learn like a scientist with scientific method.

METHOD

This study is an quasi experimental research. Learning science using Hi_Science as instructional media that refers to experiential learning model have been disseminated in junior high schools in Kotawaringin Timur. Hi_Science as instructional media based-android was adopted from students' worksheet developed by Taufik. The validation of students' worksheet by Taufik had an avarage value 4.2 including excellent category with 93.46% percentage of agreement [10]. Students worksheet had been re-developed in a form of Hi_Science, so an additional validation had been required. Although Hi_Science adopted students' worksheet by Taufik, Hi_Science has a different display design and there are some parts which are enhanced. Based on these, this paper only describes about display and validation result of Hi_Science.

Validation of Hi_Science used validation sheet by two expert validators in media aspect and two validators in materials aspect. Assessment of material aspect included learning process, phase of experiential learning model, and content quality, that all consist of 9 criteria. Assessment of media aspect included visual and audio, and software engineering, that all consist of 17 criteria. Validation sheet used likert scale from 1 to 5. Validation result were analyzed using average score by validators. Then, the average score was analyzed qualitatively.

RESULTS AND DISCUSSION

Display of Hi_Science

Hi_Science is learning media that can run on mobile phone based android, so this application is included in mobile learning. Hi_Science can make students learn to be active anywhere and anytime through scientific methods. It corresponds with the opinion about characterisctics of mobile learning that are accessible, immediate, interactive, contextually aware, flexible in learning, can be used everywhere and every time, and ensure bigger number of students engage because the mobile learning is based on modern technologies which students use everyday [19].

The size of Hi_Science application is 102.461 MB. This application has an offline design, except in the part of students' homework and the part that uploads the result of students' discussion. Hi_Science was created using Construct2 then the building used Intel XDK. Moreover, Inskape was used to redesign and create of display in this application and such as background, character, buttons, and soon. The display of Hi_Science in smartphone or mobile phone can be seen in Figure 1.

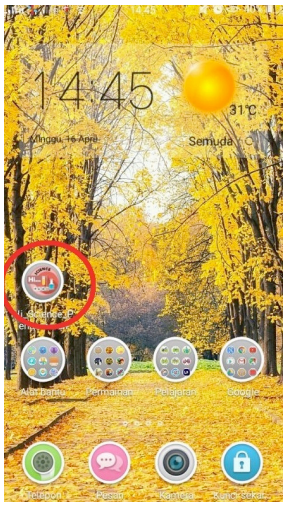


FIGURE 1. Hi_Science application in smartphone

Learning materials selected for this application are Environmental Pollution and Global Warming. These materials have been selected because they correspond to the experiential learning model. According to Rosidin, the stimulus of learning process is learning experience. Experiences are defined as interactions between individuals and their environment [20]. Environmental Pollution and Global Warming are subject matters related to the experience of students in everyday life. Therefore, this application in smartphone is named Hi_Science_Pencemaran. Figure 2 below shows the loading page of Hi_Science.

Hi_Science is made attractive through selection of background, colour, character, button, music, and others. This is appropriate with one of determination of multimedia learning quality. Multimedia learning can raise motivation to the learning through the use of composition, colours, graphics, sound, music, animation, and precise video [21].

(a) (b)

FIGURE 2. Loading page of Hi_Science: (a) loading bar and (b) start page.

After loading pages, the instruction menu about user navigation and setting will appear. This instruction menu can be passed. Figure 3 shows instruction menu of Hi_Science.

(a) (b)

FIGURE 3. Instruction menu: (a) about use of navigation and (b) about setting.

Figure 4 below shows main page of Hi_Science including: material button, quiz button, about developer, navigation, setting, bibliograpy, and exit button.

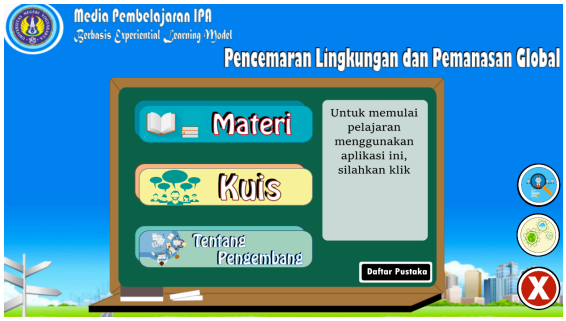


FIGURE 4. Main page of Hi_Science

The button material contains 5 submenus, including menu of core competence and basic competence, and menus of subjects' matter (pollution of water, pollution of gases, global warming, and impact of global warming). It is shown in Figure 5 below.

FIGURE 5. Selection of learning material

Every part of subject matter has 5 button including learning objectives, science issues, your experiences, explanation of matter, and experiment. It is shown in Figure 6 below.

(a) (b)

FIGURE 6. Five buttons in every part of subject matter: (a) pollution of water and (b) pollution of gases

The part of your experience facilitates the first phase and the second phase of experiential learning model. Your experience page 1 facilitates Concrete Experience (CE). According to Kolb, CE phase emphasizes students on active engagement, relating to others, and learning from their experience. Students learn to be open-minded, adaptable, and sensitive to themselves and others [22]. Your experience page 2 facilitates Reflection Observation (RO). This phase requires students to observe, listen, see problems, and find the purpose in learning materials [22]. CE and RO phase are shown in Figure 7 below.

(a) (b)

FIGURE 7. Your experience: (a) page 1 and (b) page 2.

The button explanation of matter facilitates third phase on experiential learning model, this phase is Abstract Conceptualization (AC). AC phase is an application of thought and logic. Planning, theory development, and analysis are part of this phase [22]. The button experiment facilitates last phase on experiential learning model, these phase is Active Experimentation (AE). This phase involves testing theory and implementation of the plan through

activities [22]. AC and AE phase are shown in Figure 8 below. The students' activities in 4 phases are explained in Table 3.

(a) (b)

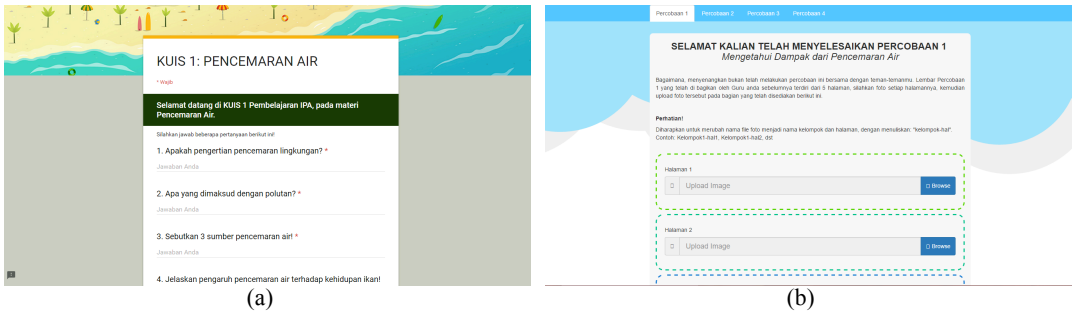
FIGURE 8. The buttons: (a) explanation of materials and (b) experiment.

TABLE 3. Phase of experiential learning model on Hi_Science

Phase of experiential learning model	Facilitated on smartphone at scene:	Descibe activity of students
Concrate Experience (CE)	Your experience (page 1)	Students observe an event that is often encountered in daily activity.
Reflection Observation (RO)	Your experience (page 2)	Students identify problems by answering some questions releated to the events presented earlier.
Abstract Conceptualization (AC)	Explanation of matter	Students learn the material that had been prepared and presented in smartphone.
Active Experimentation (AE)	Experiment	Students doing experiments

In the last phase of these learning model (AE), students are directed to conduct experiments using scientific methods, starting from identifying the problem, making hypothesis, defining variabels, experimenting, colecting data, analyzing data, and making a conclusion. Therefore, even though Hi_Science is an instructional media based-android, it does not rule out the characteristic of learning science.

Other advantage of Hi_Science is that the teachers have an account to coordinate students assigments. Figure 9 shows students' assigments including students' homework in quiz and upload the result of their discussion. This section is designed online using google form application, so the students' mobile phones must be connected to the internet.



(a) (b)

FIGURE 9. Students assigments: (a) students' homework and (b) upload result of students' discussion.

Every quiz contains some questions that have been adapted for the learning objectives. Beside that, this section makes students easier to learn everywhere and everytime through their smartphones. Mobile devices are technologies that can be carried and used everywhere enabling learners to access knowledge anytime and anywhere. The learning system's main target of the next generation is to adapt with the current development and modern technologies in order to provide new techniques of learning [23].

The Results Hi_Science Validation

Validation of Hi_Science consists of materials aspect and media aspect. The results validation of materials aspect is shown in Table 4.

TABLE 4. The results of Hi_Science materials aspect validation.

Aspect	Avarage score by expert validators	Category
Learning process	4.50	Excellent
Phase of experiential learning model	4.88	Excellent
Content quality	4.63	Excellent
Avarage	4.72	Excellent
Percentage of agreement	96.47%	High

Table 6 shows materials aspect validation of Hi_Science. Aspect of learning process is excellent. It means that the application shows material according to learning objectives. Phase of experiential learning model is excellent. they are all of the subject matter in Hi_Science including five phases of experiential learning model (CE, RO, AC, and AE). Aspect of content quality is excellent. It shows that the concept of matter, the suitability of the material descriptions, the use of language, and clarity sentences have compliance. Over all, the result validation of material aspect is excellent and it means very valid with percentage aggrement 96.47% in high category. Table 5 below shows Hi_Science validation of media aspect.

TABLE 5. The results Hi_Science media aspect validation

Aspect	Average score by expert validators	Category
Visual and audio	4.45	Excellent
Software engineering	4.83	Excellent
Avarage	4.72	Excellent
Percentage of agreement	98.70%	High

Table 7 shows visual and audio is in excellent category with an avarage value 4.45. That means: (a) proportion of layout including text, picture, and animation is appropriate, (b) proportion of colours is appropriate, (c) selection of backgorund is appropriate, (d) the font type selection is correct, (e) the font size selection is correct (f) the shape of navigation button is interesting, (g) the navigation button is interesting, (h) movement of animation is interesting and fluent, (i) animations have been matched with the subject of learning, (j) pictures match with subject of learning, and (k) the music selection is appropriate. Software engineering aspect is in excellent category with an avarage value 4.83. That means: (a) the operation of Hi_Science is easy, (b) instruction for using are clear, (c) Hi_Science is interesting learning media, (d) Hi_Science provides new innovations learning in classroom, and (e) this media follows development of science and technology. Overall validation has average value 4.72 in excellent category with percentage of agreement 98.70%.

Based on the results of this validation, Hi_Science can be applied as instructional media in junior high schools, especially in Kotawaringin Timur. Based on preliminary research result by spreading questionnaires in several schools, 94.68% of students have smartphones with 94.38% type of the smartphone is android. This data is obtained from high school category. In medium school category, data obtained is 81.10% students have smartphones with 89.81% of smartphone is android. In low category school, obtained data shows that 39.69% students have smartphones with 82.35% is android. It means Hi_Science can be applied in junior high school in Kotawaringin Timur. The use of this application is expected to make students learning actively in solving problems, so that all students' abilities can be trained maximally. This corresponds to the oppinion about mobile learning in classrooms often has students working interdependently, in groups, or individually to solve problems, to work on projects, to meet individual needs, and to allow student's voice and choice [24]. Implementation of experiential learning model is useful to improve students' problem solving skills. Each experience is made to be a reflection and then bring up

reason to produce a concept. The next phase, this concept will be implemented in experiments that serve as problem solving [20].

CONCLUSION

Hi_Science is instructional media based-android in learning science. In this study, Hi_Science refers to experiential learning model. Therefore, pollution of enviroment and global warming is chosen as the subject materials in this application. To apply in smartphone, this application is named Hi_Science_Pencemaran. The results of the validation of material and media aspects are in excellent category. It is concluded that Hi_Science_Pencemaran as instructional media can be applied in the junior high schools.

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