Developing an android-based learning media on human auditory system for junior high school students

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Abstract. The purpose of this research was to produce an Android-based learning media on Human Auditory System for VIII graders of Junior High School. The product is packed in the Application Package File (.apk) format and was triumphantly developed using the Research and Development model consisting of several stages: Analysis, Design, Development, Implementation, and Evaluation. The application contains Objectives, Materials, Simulation, and Interactive Evaluation. The product entitled “Human Auditory System” could be accessed on the Google Play Store. The application was assessed by materials experts, media experts, and teachers. Moreover, the product has gone through three stages of evaluation in VIII Grade of Junior High School students involving six students in One-to-One Trial, 12 students in Small-Scale Trial, and 30 students in Field Trial. The results showed that this product was conveniently used as the learning media for Human Auditory Systems in VIII Grade of Junior High School with a validity value of 4.22 (excellent), and a practicality score of 4.31 (excellent).

1. Introduction
One of the integrated sciences basic competencies for Indonesian Junior High School Grade VIII is the students’ ability in analyzing the human auditory system. This subject matter covers laws, concepts, theories, and mathematical analysis. Based on the 2013 Curriculum, the science subject has to be delivered integrally comprising the physics, biology, and chemistry.

In ensuring students’ basic competence achievement, the subject requires appropriate learning media, particularly on the human auditory topic. The learning media have to be able to facilitate the students to understand thoroughly the issue discussed. Learning media has been believed to be one of the important factors to support teaching and learning activities and to achieve learning objectives [1,2].

Prior to this research, the authors have done a mini-study at SMP Negeri 10 Salatiga. Interviews, questionnaire filling, and document observation were performed to reveal the field data. It turned out that the learning of human auditory system was in need of proper media as the existed learning media was not sufficient in explaining the topic clearly. Most importantly, the provided media have not indicated the integration of natural sciences. Other than that, the learning media is expected to stimulate the students’ self-regulation and unlimited to time and place.
In this computer and internet-based era or so-called as the Industry 4.0, learning media have to follow the trends of the 21st century skills including literacy of technology, information, and communication. The impact of Industry 4.0 is observable from our surrounding in all aspect of life[3,4]. Industry 4.0 presents a digital era which influences the educational revolution [4]. Up to now, technology utilization in the educational world has been rapidly developed[5][6] including the use of Android technology on a smartphone. This technology usage is now called as mobile learning, which is the core concept of Education 4.0. It supports the idea of teaching and learning innovation by taking information technology’s advantages[7].

In the beginning, the function of Android devices was dominated as a means of entertainment, but now it has developed into a learning medium[8]. Many studies have reported the benefits of Android-based learning media. Android-based learning media have been reported to be able to support learning, which is able to provide learners with comfort in learning[9]; build their understanding through continuous and independent simulation and evaluation activities[10]. Besides, the use of Android-based mobile learning is one of the 21st Century learning styles[11]. Through the provision of simulations, students can be helped to understand science deeper[12,13].

With this in mind, the research intended to generate a valid and practical Android-based learning media on the human auditory system for VIII grade of junior high school students.

2. Methods

This research focused on the development of valid and practical learning media. The research design referred to the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. In the analysis stage, the observational and literature data were collected to know the details needed. The design phase included the determination of basic competency, standard competency, and mastery learning, selection and development of learning materials, and examination of validation instrument. The development stage consisted of flowchart and storyboard making, supporting data collection, development of learning media, as well as early product validation and revision. The revised product was then uploaded on Google Play Store to free download. Further, the product was tested using one-to-one, small-scale, and field trial. The data obtained from the implementation were then analyzed and evaluated.

Three experts of media, materials, and educational practitioner (teacher) joined the validation stage. The material expert was asked to score the early product’s validity while the media expert validated the product’s practicality. Finally, the educational practitioner expert had to score both the validity and practicality. The assessment was performed employing questionnaires so that qualitative data were obtained. The results were then analyzed by converting the data as shown in Table 1. The product would have been declared valid and practical if it got the minimum category of ‘good’. The three experts’ assessment was referred to as the feasibility data for the trial.

| Interval | Category |
|----------|----------|
| X> 4,2  | excellent |
| 3,4 <X ≤ 4,2 | very good |
| 2,6 <X ≤ 3,4 | Good |
| 1,8 <X ≤ 2,6 | Fair |
| X ≤ 1,8 | Poor |

The one-to-one trial phase included six students, and there were 12 students involved in the small-scale trial while 30 students participated in the field trial. The students attending the trials were VII graders of SMP Negeri 10 Salatiga. The tests intended to find out the students’ responses to the developed learning media.
3. Results and Discussion

3.1. The product development

This research established and Android-based learning media on human auditory topic for VIII graders of junior high school. The application is available for free on Google Play Store (see Figure 1). This application is 15 MB in size having the icon shown in Figure 2. After finishing downloading the app, the learning media could be run either online or offline.

![Figure 1. The application display on playstore](image1)

![Figure 2. The app’s icon](image2)

The application’s homepage is presented in Figure 3. The dashboard consisting of Objectives, Materials, Simulation, and Evaluation as displayed in Figure 4.

![Figure 3. Homepage](image3)

![Figure 4. Dashboard](image4)

The Objective page is presented in Figure 5. It covers the competency indicator arranged based on high-order thinking skills. Furthermore, the materials comprise the concept of sound waves, parts of the ear, and ear disorders. This page is shown in Figure 6.

![Figure 5. Objective page](image5)

![Figure 6. Material page](image6)

The are four pages talking about the sound wave concepts as portrayed in Figure 7. Figure 8 shows that there are ten parts of the ear described in it. Figure 9 informs that there are six types of ear disorders explained. Moreover, these learning media are also equipped with an interactive simulation of quizzes which could be used as a competency test. This menu has six choices of interactive simulation as shown in Figure 10.
3.2. The validation of the learning media

The product was validated by material and media expert as well as an educational practitioner. The validation was performed to measure the product’s validity and practicality. The validity aspects included content feasibility and presentation. Meanwhile, the practicality aspect covered the program quality, ease of use; graphic design, aesthetics; and influence on individuals. The scoring results of both points are presented in Table 2 and 3. Other than that, the researchers also got some advice for the betterment of the product. Score and advice from the three experts were followed up to enhance the product’ performance and referred to as the basis of the feasibility for further trials.
The assessment results as displayed in Table 2 indicated that the product’s validity score was 4.22 and belonged to the “excellent” category. On the other hand, the practicality aspect got 4.31 and categorized as “excellent” as presented in Table 3. Therefore, the developed product has been declared valid and practical as it exceeds the minimum score of “good” for both aspects.

The material expert suggested that: (1) indicators of competency achievement be referred to the improvement of high-level thinking skills to demand the students are required to analyze the application of concepts and materials in daily life; (2) integrated natural sciences materials be provided; and (3) scores on the evaluation be submitted so that the students know how far they have understood the concepts. On the other side, the media expert also suggested that: (1) the application be available and free-downloaded on Google Play Store; (2) unnecessary animations be reduced or deleted; (3) properly-ordered links be added; and (4) the developers be periodically evaluated and updated the application so as to keep it up-to-date, for instance, by giving 3-D animations or virtual lab.

The three validators appreciated the product since it presents the integration of natural science, supports independent learning, and suits the 21st-century educational growth as well as the current students’ characters. Other than that, this technology-based learning media is also expected to assist teachers in facilitating their students’ different learning styles at a time [14].

3.3. Media trials
After examining the validity and practicality, the product was tested on students. This stage aimed to obtain empirical evidence about users’ responses. Six students involved in the one-to-one trial, twelve students attended the small-scale trial, and 30 students participated in the field trial. The three stages of the tests were carried out in succession.

Orderly, the students were asked to search the application, download, install, run, and open each page independently. Each was given a questionnaire containing 20 question items about the product. The average results of the three trials were 4.38 and classified as "excellent".
Positive responses from the students indicated that this product: (1) could be used outside the classroom, (2) is easily searched and downloaded through Google Play Store, (3) matches the school lessons, (4) is available free on Google Play Store, (5) has attractive appearance, and (6) contains beneficial exercises and evaluations.

4. Conclusion
This research has emerged an Android-based learning media on Human Auditory System for VIII grade students of junior high schools. It obtained 4.22 for the validity and classified as “excellent”, 4.31 for the practicality and categorized as “excellent”, and 4.38 for the students’ responses and belonged to “excellent”. The product could be run interactively and independently either online or offline, packed in a 15 MB Application Package File (.apk) format. It is free-downloaded and available on Google Play Store. Moreover, this application covers learning objectives, materials, simulation, and evaluation. Nevertheless, this application has not 3D-animation and virtual labs. Besides, subsequent research is necessary to measure the effectiveness and impact on high-level thinking skills.

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