The development of android-based learning media on vibrations and waves topic for junior high school students

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Abstract. Instilling abstract concept of vibrations and waves into students requires proper learning media and this research intended to develop such learning media. The Android-based learning media on Vibrations and Waves topic for VIII grade junior high school students have been successfully created through the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The interactive research product entitled “Vibrations and Waves” packed in Application Package File (.apk) is downloadable on Google Play Store. The application contains texts, figures, and animations that can be accessed on the Objective, Materials, Simulation, Exercise, and Evaluation menu. This product has been through a validation test and product trial. The validation was performed by materials expert, media expert, and teachers while the trial was done to VIII grade junior high school students. There were three students in the One-to-One Trial, twelve students in the Small-Scale Trial, and twenty-eight students in the Field Trial. The validity and practicality of the product were respectively 4.24 (excellent); and 4.43 (excellent). Also, the students stated that this learning media could be used as an independent learning source while the teachers convinced that this product is a supportive school learning source.

1. Introduction
Integrated science is a discipline discussing a particular natural phenomenon which contains abstract theories and concepts. Integrated science study is reviewed based on at least three underlying fields; physics, chemistry, and biology. Therefore, integrated science learning has to provide explanations of the abstract concepts and theories in those three fields. This is in line with the mandate on the 2013 Curriculum which integrated science is taught in the junior high school level.

Numerous factors influence the success of abstract concept provision in integrated science learning, one of them is the learning media as it is a very crucial component in education. Proper learning media can enhance students’ understanding of learning materials. This fact is in line with interview results with several teachers and VIII graders on a field study revealing that learning media much help them in the integrated science lesson.

Other than that, the researchers also found some other things, they were: the need of learning media on vibrations and waves topic for Junior High School students, grade VIII; the abstractness of vibrations and waves concept underlies the demand of proper media; the media should support the students’ self-regulated learning; the media have to meet the learning objectives; and the media must be interesting and able to raise the students’ motivation.

This research supports the development of learning media using the Android system. Learning using the media Learning system based on Android on smartphones is called mobile learning. Mobile
learning means electronic devices for learning in various contexts, through social interaction and content [1]. Cellular learning is able to complement learning. The presence of mobile learning allows students to study anywhere and anytime [2]; and can be used as a means to increase access to information and personalize learning [3].

Learning activities that support smartphones also support supporting comfort for students [4]. In addition, technology-based learning media makes students deal with technology. Required, students are challenged to be able to process, support, and utilize effective information technology [5], which is very much needed in the Industrial 4.0 era. Android-based learning media in accordance with 21st century learning styles [6]. Android system-based learning media can be a solution to encourage independent learning by students [7]; allows learning outside of school, enriches student learning experiences and supports spontaneous learning [8]. The successful use of the Android system as a supporter of learning in various scientific fields has been widely supported including in science [9-13].

Based on the field research and literature studies, this research intended to establish a valid and practical Android-based learning media on Vibrations and Waves topic for VIII graders. Furthermore, animations were inserted to explain abstract concepts. The product is a software available on the Google Play Store and free to be used either online or offline.

2. Methods
This research adopted the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model in developing the application. According to Sumarti (2015), the ADDIE model could be referred to as a reference in developing a dynamic and useful learning tool or infrastructure [14,15]. Therefore, it suits this study well.

Interview and documentation were performed in the analysis stage during the field research and literature review. Media selection, flowchart production, program outline drafting, and material collection were done in the design phase. In the development stage, the researchers arranged a storyboard and developed the media. This phase was when the application produced in the form of Application Package File (.apk). Following the production, validation of the product was carried out by the material expert, media expert, and educational practitioner (teacher). After that, the product was tested to the students through one-to-one trial, small-scale trial, and field trial. These tests, which focused on the validity and practicality, were done to 28 VIII grade students of SMP Islam Ar-Rahmah Suruh, Semarang Regency.

3. Results and Discussion
3.1. Results
This developmental research resulted in an application software named Vibrations and Waves. It is packed in 19 MB of application package format (.apk) and downloadable via Google Play Store.

The application icon, opening page, homepage, material menu, material map, and simulation menu are shown respectively in Figure 1, 2, 3, 4, 5, 6. The main menu contains objectives, materials, simulations, exercises, and evaluations. The material menu covers material map, vibrations, waves, sound waves, and applications to technology. Animations and interactive quizzes are added in the simulation menu which contains pendulum vibrations, transverse waves, longitudinal waves, sound waves, and sonar. The evaluation page can be used as an interactive competency test which provides multiple choice questions and live score.
Prior to product testing, the product has been validated by the material expert, media expert, and teacher. Product validation was to know the validity and practicality level. The validity aspect included content and presentation, while the practicality aspects consisted of quality, graphic design and aesthetic, as well as ease of use. These qualitative data were then converted into a number ranging from 1 to 5 as displayed in Table 1. The minimum score of the product was “good”.

| 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      |

Information: X = Actual Score

The validity and practicality scores of the product are presented in Figure 7 and 8. The average validity value was 4.24 and categorised as “excellent”, while the average practicality value was 4.43 and classified as “excellent”.

Figure 1. The application’s icon
Figure 2. Opening page
Figure 3. Homepage
Figure 4. Material menu
Figure 5. Material map
Figure 6. Simulation menu
Assessment and suggestion from the material expert, media expert, and teacher were referred to as the constructive improvement of the product before being tested to students. There were three students involved in the one-to-one trial, twelve students participated in the small-scale trial, and 28 students in the field trial. The average score of the three tests was 4.41 or categorised as “excellent”. Each test’s data is shown in Figure 9.
### 3.2. Discussion

This research was based on the demand of the teachers and students revealed during the field research and literature review. Moreover, an Android-based learning media is seen to be fitted the newest trend and millennial students’ characters. The learning objectives were arranged considering the higher-order thinking skills and the materials inserted have been adjusted to the current curriculum so that it could support the integrated science learning for grade VIII particularly on the vibrations and waves topic. Seen from the determined minimum criteria, this product has been declared valid and practical.

The characteristics of the product are: (1) containing learning objectives, materials, simulations, quizzes, exercises, and evaluations; (2) the learning objectives have been in line with the latest curriculum; (3) enabling students to do independent digital literacy and competency test; (4) available online; (5) free-downloaded; and (6) offline friendly. Nevertheless, the weaknesses of the product are: (1) it has not been able to display 3D animations; (2) it is inappropriate to be employed as a virtual lab; and (3) its effectivity and influence on the higher-order thinking skills have not been measured.

### 4. Conclusion

This study has succeeded in developing a valid and practical Android-based learning media on vibrations and waves topic for junior high school students grade VIII. The average values of validity and practicality were respectively 4.24 (excellent) and 4.43 (excellent) while the result of student assessment of the product was 4.41 (excellent). The results of this study can be further developed as there is a need to measure its effectivity and influence on the students’ increase in learning outcomes and higher-order thinking skills.

### References

[1] Crompton H 2013 A historical overview of m-learning: Toward learner-centered education Handbook of Mobile Learning (New York: Routledge) 3–14
[2] Agustin R D and Ambarawati M 2019 *Int. J. Sci. Technol. Res.* 8 1
[3] Zimmerman H T and Land S M 2014 *TechTrends* 58 77
[4] Gonzalez M A, Martin M E and Llamas C 2015 *J. Cases Inf. Technol.* 17 31
[5] Kazanidis I, Pellias N, Fotaris P and Tsinakos A 2018 *Int. J. Human–Computer Interact.* 34 932
[6] Calimag J N, Mugel P A, Conde R S and Aquino L B 2014 *Int. J. Res. Eng. Technol.* 2 119
[7] Jengathe G and Rojatkar D V 2015 *Int. J. Electr. Electron. Res.* 3 133
[8] Bai H 2019 *Tech Trends* 63 723
[9] Land S M and Zimmerman H T 2015 *Educ. Technol. Res. Dev.* **63** 229
[10] Liu T C, Lin Y C and Paas F 2014 *Comput. Educ.* **72** 328
[11] Ahmed S and Parsons D 2013 *Comput. Educ.* **63** 62
[12] Song Y, Wong I H and Looi C K 2012 *Educ. Technol. Res. Dev.* **60** 679
[13] Looi et al. C K 2014 *Comput. Educ.* **77** 101
[14] Suana W, Maharta N, Nyeneng I D P and Wahyuni S 2017 *J. Pendidik. IPA Indones.* **6** 170
[15] Sumarti S S, Supardi K I, Sumarni W and Saptorini 2015 *J. Pendidik. IPA Indones.* **4** 11