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# Need Assessment Analysis on Android Based Interactive Multimedia Application in High School Geography Learning

**Nyokro Mukti Wijaya[1], Meri Herlina[1], Indah Fitria M[2]**
[1] Department of Geography Education, Faculty of Teaching Training and Education, Universitas Lampung, Bandar Lampung City, Indonesia
[2]SMA Negeri 12 Pekanbaru, Pekan Baru City, Riau, Indonesia
Indonesia
*E-mail: nyokromw@fkip.unila.ac.id

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**ABSTRACT**

*This study aims to 1) Know the ICT-based geography learning media currently used, (2) to know teachers' and students' need for Android-based geography interactive multimedia, and (3) determine the appropriate type of interactive multimedia to be developed. The type of research is qualitative research with a questionnaire as the instrument. Qualitative data was used to answer research objectives. Respondents in this study were geography teachers and students of class XI IPS of Public Senior High School 12 Pekanbaru. The results showed that; (1) the type of ICT-based learning media used in geography learning is still dominated by the use of PowerPoint slides, instructional videos, and the internet, (2) teachers and students desperately need interactive multimedia on Android-based geography to help the learning process of geography be more interesting and interactive. (3) Types of interactive multimedia based on android that can be developed are drill and practice, tutorials, simulations, and games. This research suggested developing interactive multimedia based on android geography as well as training for geography teachers to produce their own.*



## INTRODUCTION

The development of information and communication technology (ICT) in the 21st century has a profound impact on all areas of life, including in the field of education (Kurniawan et al., 2020). The use of ICT-based learning technology in the world of education is also quite massive in various worlds (Serin, 2011). This is evidenced by the number of government policies around the world that have regulated the use of ICT in educational curricula. This response also occurs in the world of education in Indonesia. The 2013 Curriculum that applies in Indonesia requires the integration of ICT in the learning process for all subjects (Mahdum et al., 2019; Ratminingsih et al., 2018)

However, it turns out that the use of ICT in the world of learning in Indonesia is still lagging behind (Syawaludin et al., 2019). It means that the development of ICT has not been fully utilized as instructed by the 2013 curriculum. This situation happens because we still think that ICT is closely related to a computer or laptop. Meanwhile, we know that not all schools have adequate computer laboratory facilities (Sudiatmika et al., 2020). Moreover, the ownership of a laptop or computer by each student can be counted on the fingers of one hand because of its high price. That reason makes the use of ICT in learning seem expensive and difficult to implement.

We must begin to change this view. The use of ICT in learning does not always have to use a computer or laptop. In fact, currently the most popular ICT products are smartphones and the internet (Kurniawan et al., 2020), not a laptop or a computer. The presence of smartphones as a technology product of the 21st century can be used to improve the quality of education and teaching (Al-Rabaani, 2018). Strengthened by data released by the Ministry of Communication and Information in 2017 shows that the level of ownership of smartphones among students, especially high school students in Indonesia, has reached 79.56% (KOMINFO, 2017). So, we cannot deny that smartphone use and internet access are also interlinked. The students even prefer to search for information on the internet with their smartphone rather than going to the library to read textbooks.

We should take advantage of this potential to increase the contribution of ICT in learning. Our learning patterns should adapt to existing technological developments. The learning process must be able to adapt to the current needs and interests of students (Djamas et al., 2018). Currently, many students spend their time playing with their smartphones, then this phenomenon should be used by academics and education practitioners in order to take advantage of smartphones as a learning resource. So that the presence of smartphones can have a positive impact on students.

**Interactive Multimedia**

One type of utilization that can be done with smartphones in learning is to access interactive multimedia applications. Multimedia is a combination of various media elements such as sound, video, images, text, animation, and so on into a synergistic and integrated unit to provide benefits to its users (Reddi et al., 2003). Meanwhile, interactive multimedia is multimedia that allows users to actively interact with the media (Surjono, 2017). The use of interactive multimedia in learning can increase learning motivation, help students understand the material more clearly, and improve the quality of learning (Leow & Neo, 2014; Neo et al., 2008; Rajendra & Sudana, 2018; Wu & Tai, 2016). Another advantage of interactive multimedia is that it can increase student interaction with material, learning performance, and learning satisfaction (Zhang, 2005).

If usually interactive multimedia is more frequently accessed via a laptop or computer, it turns out that smartphones also have the ability to access interactive multimedia. In fact, through smartphones we can learn anywhere and anytime (Chatel & Falk, 2017). Smartphones are more economical, dynamic and practical to be used as a medium for student learning, compared to laptops or computers. Interactive multimedia applications that can be accessed through smartphones must be programmed based on android. Android is an operating system smartphone most widely used in the world, including Indonesia. The android operating system has features such as storage, networking, multimedia, GPS, and phone services that can help developing applications (Murphy, 2009). Thus, an interactive multimedia application based on android can be developed to be accessed through smartphones that the students have (Rajendra & Sudana, 2018).

**Geography Learning**

Geography is one of the subjects that really needs the use of interactive multimedia based on android. The reason is because geography studies the geosphere phenomena that occur on the earth's surface which are closely related to human life (Prasetya et al., 2018). Meanwhile, we know that geosphere phenomena have a wide scope, sometimes even abstract ones. So, the presence of the media is very important in describing these phenomena in a more concrete way and easy for students to understand. The presence of learning media in explaining geosphere phenomena can make learning more meaningful and interesting (Prasetya, 2018).

Geography is one of the 9 subjects that must be studied in the 21st century (P21, 2019). It means that success in learning geography can help students face the challenges of 21st century life. Geography itself is a science that studies the Earth which includes the natural and human environments and their interactions (Schee, 2020). The study of geography is very complex, so geography learning must be varied, creative, and inspiring so that students are increasingly interested in learning it (Markuszewska et al., 2018). Basically, the process of learning geography must be able to direct students to skills and habituation, in addition to mere conceptual understanding (Sugandi, 2015).

Geography learning requires new methods and media such as interactive multimedia so that learning becomes more passionate and improves the quality of learning (Nandi, 2016). However, before developing an Android-based interactive multimedia application, we should do a needs analysis (need assessment) first. Thus, the development of interactive multimedia applications can be tailored to the needs of users, namely teachers and students. For that reason, this study aims to 1) determine the current ICT-based geography learning media, (2) determine the needs of teachers and students for Android-based geography interactive multimedia, and (3) determine the appropriate type of interactive multimedia to be developed.

# METHOD

This research is a descriptive exploratory study with a qualitative approach. The research was conducted at Public Senior High School 12 Pekanbaru, Riau Province. Respondents in this study were 4 geography teachers and 30 students of class XI IPS 1 of Public Senior High School 12 Pekanbaru. The data collection technique used was a questionnaire technique. The data analysis technique used is to use interactive analysis techniques developed by Milles and Huberman which include the stages (1) data collection, namely using a questionnaire; (2) data reduction, namely summarizing, selecting necessary data, and eliminating unnecessary, (3) data presentation, namely presenting data in the form of narrative text, matrices, diagrams, tables and graphs; and (4) Conclusion, namely interpreting the data that has been presented in depth (Sholihah et al., 2020).

# RESULTS AND DISCUSSION

Based on the results of research conducted on geography teachers and class XI IPS students of Public Senior High School 12 Pekanbaru by distributing questionnaires, the results obtained were (1) the types of ICT-based learning media currently used, (2) the needs of teachers and students for android-based interactive multimedia, and (3) types of interactive multimedia that are suitable to be developed. The following is an explanation in detail.

**ICT-Based Learning Media Used Today**

Based on the information conveyed by the geography teacher, the types of ICT-based learning media used by teachers in teaching were more dominated by presentation media with Power Points. In addition, they also occasionally use instructional video media and the internet. Meanwhile, they never used interactive multimedia. The use of ICT in learning today is still dominated by slides (Komalasari & Rahmat, 2019). It is because the presentation media with PowerPoint, instructional videos, and the internet are the easiest media for them to produce and use. It is in line with the results of the study which stated that 100% of teachers had no difficulty in using and producing these learning media.

The results also showed that 82% of students felt helped in understanding the material by the use of ICT-based learning media in geography learning. As many as 75% of teachers also admit that it is easier to teach with the help of ICT-based learning media. The use of ICT media in learning does have many benefits. These benefits are that it makes it easier for teachers to convey information and knowledge, makes it easier for students to understand the material, and makes learning interesting and fun (Basri et al., 2018; Raja & Nagasubramani, 2018; Sholihah et al., 2020). Therefore, the development of ICT media that has been carried out in schools must be improved and developed so that the benefits of technology in learning can be maximized, one of which is interactive multimedia.

**The Need for Interactive Multimedia Based on Android**

Need assessment of Android-based multimedia is carried out from the point of view of teachers and students. The data extracted was in the form of the availability of supporting facilities and facilities as well as the need for interactive multimedia based on Android. Here's the data of geography teachers' need assessment towards interactive multimedia based on android.

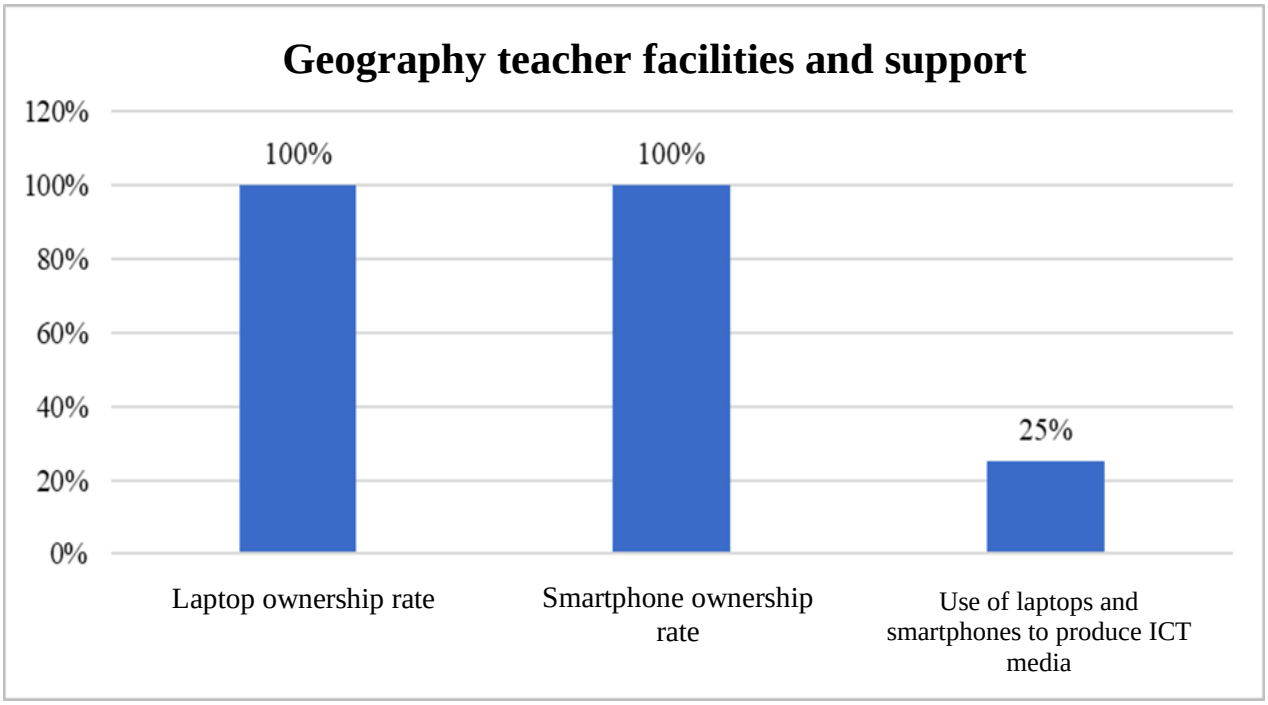


**Figure 1.** Geography Teacher Facility and Technology Support

The availability of technology facilities owned by teachers is actually quite good. It is proven that 100% of teachers own laptops and smartphones. Unfortunately, only 25% of them use the facility to produce ICT-based learning media. Even with the support of these facilities they should be able to make learning videos, power points, websites, and even interactive multimedia. One of the weaknesses of our teachers in the 21st century is the ability to use technology to produce ICT-based learning media. Though teachers have the most important role to integrate ICT in learning (Karmila & Godwin, 2013). Regarding the needs of geography teachers for Android-based interactive multimedia, it can be seen in the following table:

**Table 1.**
Frequency Distribution of Student Understanding Indicators

| Question | Answer | |
|---|---|---|
| | **Yes** | **No** |
| Do you know interactive multimedia? | 50% | 50% |
| Have you ever used interactive multimedia? | 50% | 50% |
| Have you ever made interactive multimedia? | 25% | 75% |
| Do you know that interactive multimedia can be accessed through a smartphone? | 25% | 75% |
| Can you make interactive multimedia applications based on android? | 0% | 100% |
| Are you interested in interactive multimedia based on android? | 100% | 0% |
| Do you need interactive multimedia based on android? | 100% | 0% |

Source: Research Data Processing Results in 2024

Geography teachers' understanding of interactive multimedia is still not optimal. Only 50% of geography teachers claim to understand interactive multimedia and use it in learning. Meanwhile, the other

50% do not understand and have never used it in learning. From these data it can be seen that interactive multimedia is still not familiar in our world of education. Even though the use of interactive multimedia in geography learning has many advantages. Through interactive multimedia we can easily explain geosphere phenomena to be more meaningful and interesting (Prasetya, 2018).

The low participation of teachers in using interactive multimedia is due to the teacher's understanding of interactive multimedia which is identical to applications on a computer or laptop. Meanwhile, laptops are expensive items that not all students have. In fact, with the sophistication of technology that is owned by smartphones, interactive multimedia can be accessed through smartphones owned by almost all students. As many as 75% of teachers still do not know that interactive multimedia can be accessed through smartphones. Using a smartphone in learning actually has many advantages because it is flexible to be used anywhere and anytime (Chatel & Falk, 2017).

Another problem that arises is that as many as 100% of teachers admit they do not know how to make interactive multimedia that can be accessed through smartphones. We imagine that the creation of interactive multimedia applications that are applied in smartphones is a very difficult job because it relates to programming languages. In fact, the teacher can make it using the Microsoft PowerPoint that he/she has mastered. It's just that special training is needed to teach teachers to create interactive multimedia applications based on Android with Microsoft Power Points. Training for teachers in Indonesia to improve their ability to use ICT is indeed very important in responding to the challenges of 21st century education (Mailizar & Fan, 2020).

Geography teachers in the respondents of this study were 100% interested in using interactive multimedia based on android. They also claim to need interactive multimedia based on android to make it easier for them to deliver material to students. Moreover, we know that interactive multimedia has many advantages such as increasing student motivation (Leow & Neo, 2014; Rajendra & Sudana, 2018), helps students understand the material more clearly (Wu & Tai, 2016), and improve the quality of learning (Neo et al., 2008), as well as increasing the interaction of students with the material (Zhang, 2005). So it can be concluded that geography teachers really need Android-based interactive multimedia.

Apart from teachers, we also need to know student responses to the needs of interactive multimedia based on Android. The following are the results of research on need assessment students towards interactive multimedia based on android.

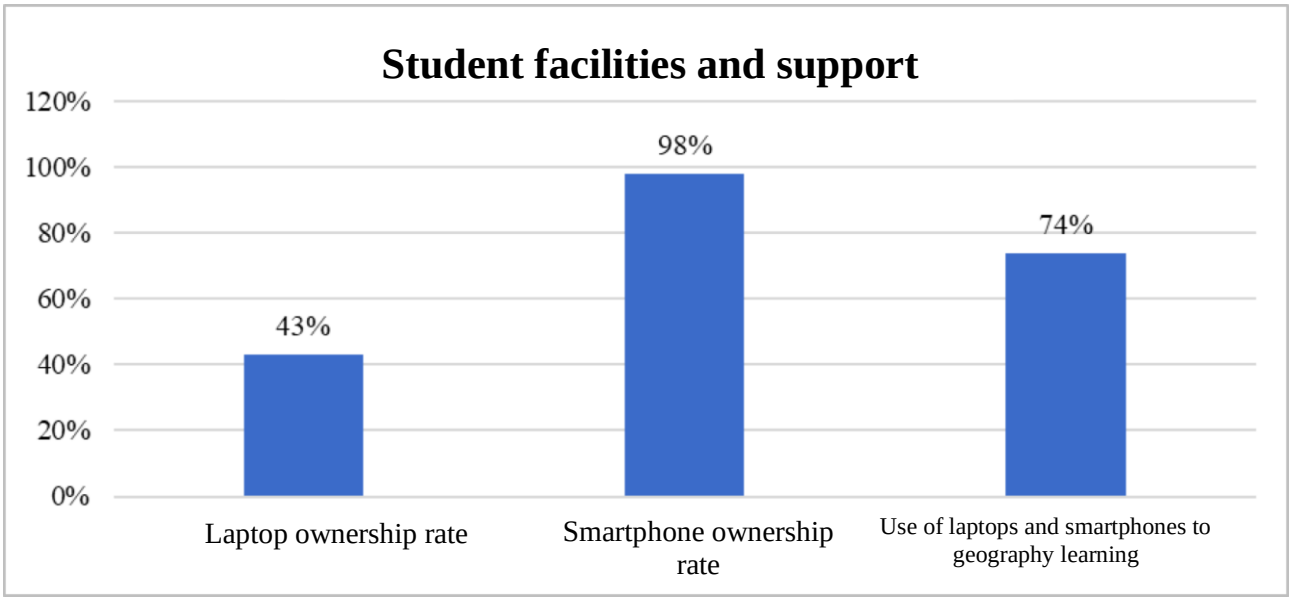


**Figure 2.** Student Facility and Technology Support Data

Based on these data, we can see that the facilities and technology support that students have are quite good. Ownership of a laptop or computer is lower than ownership of a smartphone. The level of student laptop ownership is 40%, while the ownership level of smartphones is 98%. From these data, we can conclude that smartphones are the most dominating technology support. This is in line with the Indonesian Ministry of Communication and Informatics (KOMINFO) survey in 2017 which stated that 79.56% of students in senior high schools already have one smartphone (KOMINFO, 2017). Smartphone become one of the most popular ICT products in the 21st century (Kurniawan et al., 2020).

As many as 74% of students admitted to using their smartphone frequently to study geography. They use applications such as Youtube and Google to search for geographic material in the form of videos and websites. This data indicates a pattern of smartphone utilization which is quite positive because it helps students in learning. In today's era of technological advances, students often spend a lot of time using their gadgets (Sundus, 2017). So it is very realistic if interactive multimedia based on android is suitable if it is developed to support student learning. As for the data regarding need assessment students towards android-based interactive multimedia can be seen in the following table

**Table 2.**
*Need Assessment* Students Against Android-Based Interactive Multimedia

| Question | Answer | |
|---|---|---|
| | **Yes** | **No** |
| Do you know interactive multimedia? | 20% | 80% |
| Have you ever used interactive multimedia? | 20% | 80% |
| Have you ever used an interactive multimedia application on your smartphone to study geography? (For example: Teacher Room, Zenius, Pahamify, etc.) | 61% | 39% |
| Are you interested in learning geography using interactive multimedia applications with your smartphone? | 78% | 12% |
| Do you need an interactive multimedia application on your smartphone to learn geography? | 87% | 13% |

Source: Research Data Processing Results in 2024

Students' understanding of interactive multimedia is still low. Only 20% of students claim to understand interactive multimedia. They don't understand because they never use interactive multimedia in class. Actually they have used interactive multimedia on their smartphones. It is evident from research data which shows that 61% of students use applications such as Zenius, Teacher's Room, Pahamify, and other learning applications which are actually android-based interactive multimedia. The students admitted that they were quite helped by the application. The use of interactive multimedia has the advantage of helping make it easier for students to understand learning material well (Wu & Tai, 2016).

As many as 78% of students admitted that they were interested in using interactive multimedia applications based on Android that were tailored to the geography material they were learning. As many as 87% of students stated that they needed the application to study. This means that the development of interactive multimedia based on android is really needed by students. This development can be used as an alternative solution to divert students' attention to the negative effects of gadget addiction which has become a problem for students today. As we know, technological developments have caused students to become addicted and cannot stay away from their gadgets (Sholihah et al., 2020).

**Types of Interactive Multimedia that Need to be Developed**

There are three types of strategies in presenting interactive multimedia that can be used including strategies drill and practice, tutorials, and simulations (Surjono, 2017). However, along with the development of technological advances, games have also become one type of interactive multimedia that can be developed today. The following is an explanation of the various types of interactive multimedia.

a. Drill and Practice. Method of delivery of drill and practice is a way of delivering material on interactive multimedia by providing a lot of practice questions to direct students to complete practice questions quickly (Darmawan, 2014). Learning material does not need to be included in interactive multimedia because students are considered to have studied the material directly. The interactive multimedia function is only as a medium for practicing questions so that students have the speed of thinking in solving certain subject problems according to the multimedia content being studied.

b. Tutorial Method. Interactive multimedia with the tutorial method using a computer or smartphone like a teacher. The computer plays a role in presenting the material, then students respond, after which the student's response is evaluated by the computer, then the computer provides feedback (Darmawan, 2014).
c. Simulation Method. Multimedia that is presented with the simulation method is used to simplify objects, situations, and even real natural phenomena. This simulation can reduce the risks and costs required if you see and observe it directly (Surjono, 2017).
d. Game Method. Interactive multimedia can also be packaged in the form of games to make it more interesting. Game types vary widely such as adventure, card, board and quiz. The game method characters that need to be considered are that there must be instructions, time, objectives/missions, challenges, time, rewards, punishments and scores.

In geography learning, the type of interactive multimedia delivery strategy can be adjusted to the basic competencies (KD) and the material contained in class XI and the learning objectives to be achieved. Therefore, based on the information that has been described regarding the types of interactive multimedia and their characteristics, I recommend the type of geography interactive multimedia based on android that can be developed in class XI of Senior High School as follows.

**Table 3.**
Types of Geographical Interactive Multimedia Development Based on Android in Class XI of Senior High School Based on the Distribution of Basic Competencies and Learning Materials

| **Basic Competencies** | **Learning Material** | **Interactive Multimedia Types** |
|---|---|---|
| 3.1 Understanding the Regional Conditions and Indonesia's Strategic Position as a World Maritime Axis. | Indonesia's Strategic Position as a World Maritime Axis | Tutorials and Games |
| 3.2 Analyzing the Distribution of Flora and Fauna in Indonesia and the World Based on the Characteristics of Ecosystems. | Flora and Fauna in Indonesia and the World | Simulation, Tutorial and Games |
| 3.3 Analyzing the Distribution and Management of Forestry, Mining, Marine and Tourism Resources in Accordance with the Principles of Sustainable Development. | Management of Indonesia's Natural Resources | Simulation, Tutorial and Games |
| 3.4 Analyzing National Food Security, Provision of Industrial Materials, and the Potential of New and Renewable Energy in Indonesia | Food, Industry and Energy Security | Drill and Practice and Tutorials |
| 3.5 Analyzing Population Dynamics in Indonesia for Development Planning. | Population Dynamics in Indonesia | Tutorial |
| 3.6 Analyzing National Cultural Diversity as National Identity Based on Uniqueness and Distribution. | Indonesian Cultural Diversity | Tutorials and Games |
| 3.7 Analyzing Types and Management of Natural Disasters through Education, Local Wisdom, and Utilization of Modern Technology. | Natural Disaster Mitigation | Simulation, Tutorial and Games |

Source: Research Data Processing Results in 2024

These recommendations can be used as a reference by teachers or developers to develop interactive multimedia based on Android. The recommendations for multimedia types that have been presented in table 3 are the results of the author's study of the characteristics of KD and material in geography subjects in class XI SMA and adjusted to the characteristics of interactive multimedia types such as drill and practice, tutorials, simulations and games.

## CONCLUSION

The integration of ICT in learning must be carried out to answer the learning challenges of the 21st century. One form of integrating ICT in learning is developing interactive multimedia based on android. Android, which is the operating system used on smartphones, was chosen as a platform for developing interactive multimedia because Android is already owned by 98% of students. Therefore this study seeks to reveal the needs of students and teachers for interactive multimedia in geography as an effort to answer the challenges of 21st century learning.

The results showed that; (1) the type of ICT-based learning media used in geography learning is still dominated by the use of powerpoint slides, instructional videos, and the internet. The use of ICT-based learning media is sufficient to help teachers and students in the learning process. However, they have never used interactive multimedia in learning. (2) Teachers and students really need interactive multimedia to help the learning process of geography that is more interesting and interactive with the help of technology. Unfortunately, these teachers have not been able to develop interactive multimedia based on android. They need special training to develop it. (3) The types of interactive multimedia based on android that can be developed in geography subjects in class XI SMA are in the form of drill and practice, tutorials, simulations and games.

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## BIBLIOGRAPHY

Al-Rabaani, A. H. (2018). Social studies teachers' perspectives on the advantages and challenges of interactive whiteboard application in Oman. *European Journal of Educational Research*, *7*(4), 753–762. https://doi.org/10.12973/eu-jer.7.4.753

Basri, W. S., Alandejani, J. A., & Almadani, F. M. (2018). ICT Adoption Impact on Students' Academic Performance: Evidence from Saudi Universities. *Education Research International*, *2018*, 9. https://doi.org/10.1155/2018/1240197

Chatel, A., & Falk, G. C. (2017). Smartgeo - mobile learning in geography education. *European Journal of Geography*, *8*(2), 153–165.

Darmawan, D. (2014). *Inovasi Pendidikan: Pendekatan Praktik Teknologi Multimedia dan Pembelajaran Online*. Remaja Rosdakarya.

Djamas, D., Tinedi, V., & Yohandri. (2018). Development of interactive multimedia learning materials for improving critical thinking skills. *International Journal of Information and Communication Technology Education*, *14*(4), 66–84. https://doi.org/10.4018/IJICTE.2018100105

Karmila, I., & Godwin, R. (2013). Mobile Learning for ICT Training: Enhancing ICT Skill of Teachers in Indonesia. *International Journal of E-Education, e-Business, e-Management and e-Learning*, *3*(4), 293–296. https://doi.org/10.7763/ijeeee.2013.v3.243

Komalasari, K., & Rahmat. (2019). Living Values Based Interactive Multimedia in Civic Education Learning. *International Journal of Instruction*, *12*(1), 113–126. https://doi.org/https://doi.org/10.29333/iji.2019.1218a

KOMINFO. (2017). *Survey Penggunaan TIK 2017 Serta Implikasinya Terhadap Aspek Sosial dan Budaya Masyarakat*. BALITBANG dan PSDM KOMINFO.

Kurniawan, E., Eva, B., Dafip, M., & Sriyanto, S. (2020). A teaching based technology in geography learning. *Cypriot Journal of Educational Sciences*, *15*(4), 766–776. https://doi.org/10.18844/cjes.v15i4.5058

Leow, F. T., & Neo, M. (2014). Interactive multimedia learning: Innovating classroom education in a Malaysian university. *Turkish Online Journal of Educational Technology*, *13*(2), 99–110.

Mahdum, M., Hadriana, H., & Safriyanti, M. (2019). Exploring teacher perceptions and motivations to ICT use in learning activities in Indonesia. *Journal of Information Technology Education: Research*, *18*, 293–317. https://doi.org/10.28945/4366

Mailizar, M., & Fan, L. (2020). Indonesian teachers' knowledge of ICT and the use of ICT in secondary mathematics teaching. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(1), 1–13. https://doi.org/10.29333/ejmste/110352

Markuszewska, I., Tanskanen, M., & Vila Subirós, J. (2018). New ways to learn geography - Challenges of the 21st century. *Quaestiones Geographicae*, *37*(1), 37–45. https://doi.org/10.2478/quageo-2018-0004

Murphy, L. M. (2009). *Begining Android*. Apress.

Nandi, N. (2016). Penggunaan Multimedia Interaktif Dalam Pembelajaran Geografi Di Persekolahan. *Jurnal Geografi Gea*, *6*(2), 1–9. https://doi.org/10.17509/gea.v6i2.1741

Neo, M., Neo, T. K., & Yap, W. L. (2008). Students' perceptions of interactive multimedia mediated web-based learning: A Malaysian perspective. *ASCILITE 2008 - The Australasian Society for Computers in Learning in Tertiary Education*, *1995*, 658–666.

P21. (2019). *FRAMEWORK FOR 21st CENTURY LEARNING DEFINITIONS*. http://static.battelleforkids.org/documents/p21/P21_Framework_DefinitionsBFK.pdf

Prasetya, S. P. (2018). Effect of Learning Media Variation to Increase Interest and Learning Outcomes of Geography. *Advances in Social Science, Education and Humanities Research*, *212*(ICEI), 558–561. https://doi.org/10.2991/icei-18.2018.122

Prasetya, S. P., Daryono, & Budiyanto, E. (2018). Media development effectiveness of geography 3d muckups. *Journal of Physics: Conference Series*, *953*(1). https://doi.org/10.1088/1742-6596/953/1/012172

Raja, R., & Nagasubramani, P. C. (2018). Impact of modern technology in education. *Journal of Applied and Advanced Research*, *3*(S1), 33. https://doi.org/10.21839/jaar.2018.v3is1.165

Rajendra, & Sudana. (2018). The Influence of Interactive Multimedia Technology to Enhance Achievement Students on Practice Skills in Mechanical Technology. *Journal of Physics: Conference Series*, *953*(1). https://doi.org/10.1088/1742-6596/953/1/012104

Ratminingsih, N. M., Mahadewi, L. P. P., & Divayana, D. G. H. (2018). ICT-based interactive game in TEYL: Teachers' perception, students' motivation, and achievement. *International Journal of Emerging Technologies in Learning*, *13*(9), 190–203. https://doi.org/10.3991/ijet.v13i09.8170

Reddi, U. V, Saxena, A., Dighe, A., Parhar, M., Mishra, S., Rao, A. S., Sharma, C. ., & Ramanujam. (2003). *Educational Multimedia: A Handbook for Teacher- Developers* (U. V Reddi & S. Mishra (eds.)). CEMCA. http://cemca.org/emhandbook/edmul_full.pdf

Schee, J. Van Der. (2020). Thinking through geography in times of the COVID-19 pandemic. *Journal Of Research And Didactics In Geography*, *2*(9), 21–30. https://doi.org/10.4458/3617-03

Serin, O. (2011). The effects of the computer-based instruction on the achievement and problem solving skills of the science and technology students. *Turkish Online Journal of Educational Technology*, *10*(1), 183–201.

Sholihah, A. N. S., Septiani, I., Rejekiningsih, T., Triyanto, & Rusnaini. (2020). Development of interactive multimedia learning courseware to strengthen students' character. *European Journal of Educational Research*, *9*(3), 1267–1279. https://doi.org/10.12973/eu-jer.9.3.1267

Sudiatmika, I. B. K., Fredlina, K. Q., & Septyarini, N. L. P. N. (2020). Pelatihan Keterampilan Dasar Komputer dan Teknologi Informasi Di Sekolah Dasar Negeri 3 Munduk. *Jurnal Karya Abdi*, *4*(1), 38–45. http://ejournal.urindo.ac.id/index.php/PAMAS

Sugandi, D. (2015). Pembelajaran Geografi sebagai Salah Satu Dasar Pembentukan Karakter Bangsa. *Sosio Humanika*, *8*(2), 241–252. http://www.journals.mindamas.com/index.php/sosiohumanika/article/view/608

Sundus. (2017). The Impact of using Gadgets on Children. *Journal of Depression and Anxiety*, *07*(01), 1–3. https://doi.org/10.4172/2167-1044.1000296

Surjono, H. D. (2017). *Multimedia Pembelajaran Interaktif: Konsep dan Pengembangan*. UNY Press.

Syawaludin, A., Gunarhadi, & Rintayati, P. (2019). Enhancing elementary school students' abstract reasoning in science learning through augmented reality-based interactive multimedia. *Jurnal Pendidikan IPA Indonesia*, *8*(2), 288–297. https://doi.org/10.15294/jpii.v8i2.19249

Wu, T. J., & Tai, Y. N. (2016). Effects of multimedia information technology integrated Multi-Sensory instruction on students' learning motivation and outcome. *Eurasia Journal of Mathematics, Science and Technology Education*, *12*(4), 1065–1074. https://doi.org/10.12973/eurasia.2016.1552a

Zhang, D. (2005). Interactive Multimedia-Based E-Learning : A Study of. *THE AMERICAN JOURNAL OF DISTANCE EDUCATION*, *19*(3), 149–162. https://doi.org/https://doi.org/10.1207/s15389286ajde1903_3