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RESEARCH ARTICLE

The effectiveness of android-based budiran game assisted by smart apps creator 3 to improve science learning outcomes of fourth graders in theme 1

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Abstract: Educational games are learning educational tools, where these tools can encourage students to think creatively and perform actions with fellow students by playing games in a learning activity. This research aims to analyze the effectiveness of an android-based budiran game assisted by SAC3 to improve science learning outcomes of fourth-graders in theme 1. Budiran stands for bunyi dan indra pendengaran. This game is educative in the form of an android-based game made by SAC3. It was developed with Borg & Gall's R&D model, adapted from Sugiyono with seven stages. The game's effectiveness in the fourth graders' science learning outcome was done with pretest and posttest control group design. The researchers took the experimental group of fourth-graders from Public Primary School Bendanpete 2 and Public Primary School Ngetuk 3. Then, the researcher took fourth-graders from Public Primary School 1 and 3 Bendanpete as the control group. The researcher obtained the data from the test. The data analysis included an n-gain test and t-test with a significant level of 0.05. The results showed improvement in the posttest score of the experimental group, higher than the control group's posttest score. The N-gain posttest of the experimental group is 64%, categorized as moderate. The t-test score on the posttest obtained t-count = 8.803, with significant level $0.000 < \alpha$ with $\alpha = 0.05$. Thus, the developed game effectively improved the science learning outcomes of fourth-graders on theme 1.

Keywords: Android, budiran game, learning outcome, SAC3

1 Introduction

During the Covid-19 pandemic, distance learning has become a method used in almost all schools in Indonesia (Kallou & Kikilia, 2021; Karakose et al., 2021). This is necessary to protect students from the risk of the spread and spread of the coronavirus. Covid-19 causes were learning activity shifts, from face-to-face meetings to distance learning. Distance learning is not a new matter in the educational world. In 2014, distance learning was stated in the Ministerial Regulation of Education and Culture Minister, Number 119. The promotion of distance learning for learners should involve five stages. Teachers must use these stages to realize meaningful learning during the Covid-19 pandemic by involving parents in the learning process. The five steps are 1) making individuals into real humans, 2) understanding the concepts, 3) promoting the sustainable establishment, 4) providing challenges, and 5) providing contexts.

These stages in distance learning could realize meaningful learning as expected by the primary principle of distance learning. Learning activities must continue, although the situation is under the Covid-19 pandemic. The learners must be active and motivated to learn to keep their learning outcomes. This stability is indicated by achieving a minimum standard mastery score of 70. However, during distance learning, many teachers found difficulties, and they primarily focused on distance learning without considering the primary stages of distance learning.

In some cases, many teachers were not aware of these stages. They also lacked knowledge about selecting an appropriate application for distance learning to provide specific context. Appropriate application selection becomes a determinant for distance learning success.

The problem facing teachers is the learning process challenges in conducting distance learning during the pandemic. Therefore, efforts need to be made to overcome these difficulties. Given the revolutionary era of Industry 4.0, distance learning during the pandemic is a significant challenge (Katsaris & Vidakis, 2021). However, in the age of the Industrial Revolution 4.0, teachers and learners need to adapt quickly to existing changes (Ladias et al., 2021). Initially, classroom-based face-to-face learning systems are now being replaced by systems-integrated learning over the Internet (Arizona et al., 2020). Nevertheless, educators/teachers need to understand that

more sophisticated technological developments are an excellent means of achieving educational goals (Dahal et al., 2022; Talizaro, 2018). In other words, the development of technology must be seen by teachers as an opportunity to carry out learning during a pandemic to improve their ability to utilize technology (Kapaniaris & Zampetoglou, 2021).

One of the biggest challenges in implementing distance learning during the pandemic is the availability of facilities (Papadakis et al., 2020). Not all faculty and students have adequate distance learning facilities (Vidakis et al., 2020). A study conducted by Suni Astini showed that 50% of students still do not have a laptop (Astini, 2020). If this is the case, it can be estimated that many students still do not participate optimally in online learning. Overcoming this problem will require hard work, cooperation, and actual government attention so that the issue of distance learning does not become an ongoing debate in the education community because today's distance learning requires many devices that can be used to connect everyone while learning online (Lazarinis et al., 2022; Papadakis, 2022). Depending on the type, the device is divided into hardware and software. Distance learning typically uses laptops/computers and mobile phones/tablets. At the same time, device Software that is often used includes WhatsApp, Quipper School, Ruangguru, Google for Education, Zenius, Google Classroom, Google Forms, Zoom, and many more.

One of the well-known and frequently used distance learning media is WhatsApp media. WhatsApp (WA) social media is a communication media currently loved by all walks of life. The use of WA social media has become one of the social media covering the general interests of the community for communication to meet their individual needs. Kusuma & Hamidah (2020) defines WhatsApp as a chat application capable of sending text messages, images, voice, location, and video to others using any smartphone. WhatsApp is a digital chat medium, including text messages, images, videos, and the ability to integrate calls into a complete entity to help people worldwide communicate. Sidiq (2019) adds that if you look at the functionality of WhatsApp, it is almost the same as the SMS application commonly used on older phones. However, WhatsApp does not use pulses like SMS fees in general but uses the internet network per technological developments currently connected to the network and identified with a cellphone number.

The WA group is currently used as a discussion forum to address various issues, questions, and important content that needs to be communicated to those who belong to it. The discussion in the WA group is constructive for users to communicate in distance learning (Sidiq, 2019). When implemented, however, some students complained about the app due to the lack of interaction, and educators tend to assign assignments so frequently that students feel burdened with these assignments (Tambunan, 2021). Hariani (2021) suggests using WhatsApp social media so that students can discuss with their teachers, for example, by sending the results of solving practice questions based on the material, if they want to know if the results are accurate or not. Students can also ask questions about the practice questions. All group members can see the image or photo sent via smartphones. So that other students can try to solve or answer the problem before it is solved or answered by the teacher.

The researchers found that distance learning could not last as smoothly as expected from the preliminary studies on five primary schools in the Ki Hajar Dewantara cluster in the Nalumsari district, Jepara regency. For example, science learning for fourth graders, with the first theme about the beauty of diversity, sounds, and auditory sense, was difficult for the learners. Distance learning used WhatsApp as the platform. The researchers found it in five schools in the cluster. However, the learning did not run smoothly. In the beginning, the learners were interested in studying via WhatsApp. However, after two weeks, they found it boring and became passive. The researchers found the original reason for the learners was not their interest in studying with WhatsApp. However, they were interested in using the Android application. This intention made the learning not run maximally. Thus, the learning outcomes were low. It could be seen from the evaluation results of the learners. Many learners did not reach the minimum standard mastery score of 70.

In Public Primary School 1 Bedanpete, only six out of 15 learners could reach the minimum standard mastery score, 40%. In Public Primary School 2 Bedanpete, only eight learners from 18 could get the minimum mastery standard score, 44%. In Public Primary School 3 Bedanpete, only 11 learners from 21 could reach the minimum mastery standard score, 52%. In Public Primary School 2 Ngetuk, only nine learners from 19 could get the minimum mastery standard score, 47%. In Public Primary School 3 Ngetuk, only nine out of 15 learners could reach the minimum mastery standard score, 60%.

It shows the low learning achievement of the fourth graders in science learning with the first theme, the beauty of diversity, sound, and auditory sense (Tzagkaraki et al., 2021). This low achievement during online learning occurred due to the materials and tasks that only included written chats and voice notes. Thus, learning activities became monotonous and boring

(Lazarinis et al., 2022). The teachers did not use relevant learning media for the learning material. Teachers could not create learning with digital technology, such as Android, as interactive media. They also could not use relevant learning media with the applied learning model. These situations made the learning achievement of the learners low. The learners also argued that the science lesson was difficult to understand, so their eagerness to study was low.

The explanation showed that online learning via WhatsApp for studying science lessons did not apply relevant learning media. According to Ernawati (2017), learning media is an essential aspect of five primary elements in the learning activity. These five aspects are important, objective, material, method, media, and evaluation, and they are correlated and inseparable.

By utilizing technology, teachers can equate perceptions between educators and students, concretize abstract concepts, present dangerous or hard-to-find objects in the surrounding environment, display objects that are too large or even too small, and can show movements that are too big or too small, fast or too slow (Agnanda et al., 2012). Thus, a teacher can facilitate the delivery of material and create an exciting learning environment to stimulate students' interest and curiosity about the material presented by the teacher. Thus, previously boring learning can be overcome by using technology.

1.1 Conceptual framework

Firdaus & Yermiandhoko (2020) mention that learning activities could last effectively if teachers' and learners' communications were done with learning media to deliver information. Besides, learning media could motivate learners to learn because various learning media could attract learners' attention. Thus, they are motivated to be active and follow the learning activities (Verawati et al., 2022). The importance of motivation in learning and learning pedagogy cannot be overemphasized (Kalogiannakis & Papadakis, 2017; Papadakis & Kalogiannakis, 2019). Motivation has been related to actual classroom studying scenarios numerous times, and it is an essential and critical contributing element in classroom settings (Idris et al., 2021). Erfan et al. (2020) also mention that the developed learning media could train the cognitive levels of learners and build their character. Besides that, teachers must also use information and communication technology that is quickly developing.

Karo-Karo & Rohani (2018) argue that relevant learning media type selection is vital for educators. Learning activities could run optimally in case educators could select relevant learning media. Learning media helps create concrete concepts and abstract notions and makes learners active in learning. It is a bridge for learners to think critically and to receive instructions to do something. Therefore, educators must be aware of appropriate learning media for their learning activities and to use them maximally. Tafonao (2018) argues that excellent learning media could autonomously improve learners' motivation and reduce boredom during classroom learning. Therefore, teachers must develop applicable learning media both indoors and outdoors. They also must use it optimally for learning activities. Learning media makes teachers encourage learners to be more active even when they have to learn in rich contexts (Ladias et al., 2022). This notion is in line with a board game to acquire knowledge. In this game, teachers and learners confirm the effects of a board game to improve learning motivation and experience joy within the content and theoretical context (Taspinar, 2016).

In this era, individuals are already familiar with Android gadgets, tablets, PDAs, etc. Android is not only for communicating but also for socializing and playing games. Azman et al. (2022) argue that an individual spends time up to 7 hours a day accessing Android. Childwise (2017) also argues that children spend Android mostly playing the game (41%), listening to music (14%), watching videos (21%), and accessing Google (24%). Today, many android users cannot leave their android phones in their daily lives. With information and communication technology development, teachers should not prohibit learners from using android phones to play the game. They should direct the learners to use Android for learning media by selecting educative games to play. Thus, learners will be happy to follow the learning activities. Therefore, learning media does not only function to improve learners' learning outcomes but also the learners' well-being.

Turan, Koldukaya & Yildrim (2020) found that educative games improved learners' focus better than other learning media. It also attracted the learners to study (Kikilias et al., 2009). Hidayah, Utaminingsih, & Pratama (2022) also found that games could positively influence learning and lead to effective learning outcomes. Ekawati & Falani (2016) argue that information and communication technology development positively impact the educational world, especially with the learning media utility and the use of information and communication technology. The technology could facilitate the development of interactive and exciting learning media for learners (Barianos et al., 2022). One of them is an educative game. The game as learning media or educative game suits the nature of children who like playing rather than learning. With the educative game, learners remain learning but do not realize that they are learning (Mohammed, 2022). In this state, they experience learning by playing the game.

Liu (2016) explains that game-based learning combines learning activities with a particular game to improve learning outcomes. Erfan & Ratu (2018) explain that game-based learning combines educative content or learning principles into a game, and it has the purpose of allowing learners to participate in the learning activity. Rais et al. (2018) explain that game-based learning could attract learners to play the game and learn. This state makes learners memorize and retain it longer because it involves cognitive, affective, psychomotor, emotional, and social skills (Aguayo et al., 2022). Khotima & Pratama (2022) explain that an educative game makes learners more active. They found some learning strategies to facilitate the learning activities and make the learning efficient by interacting in learning activities. Selvi & Cosan (2018) state that educative games could improve the learners' interest in learning and learning outcomes. From the explanation, applying the educative game as learning media during distance learning is essential. Thus, the researcher did an R&D about the Budiran game based on Android and assisted with SAC3.

Scientists have done some previous studies about developing games. For example, Khoirudin, Ashadi, & Masykuri (2021) developed games using the Smart Apps Creator 3 application to improve student learning outcomes during the COVID-19 pandemic. Kholida, Suprianto, & Mahardika (2019) developed an educational game using Macromedia flash to improve student learning outcomes in guided inquiry learning. Harun et al. (2021) developed an Android-based fourth-grade science learning media to improve student learning outcomes. Budyastomo (2020) developed an Android-based educational game for introduction to the Solar System created using the Smart App Creator application. The results of the research conducted by the researchers showed that the educational games developed could increase interest in learning and student learning outcomes. This is relevant to research that the Android-Based Budiran Game Assisted by SAC3 (Smart Apps Creator3) effectively improves the Science Learning Outcomes of Class IV Students in Theme 1.

Smart App Creator 3 is a desktop-based application to create interactive content on a cellular device. The authors used HTML5 and .exe extensions in the research to create the application. Thus, the application was applicable and compatible with various computer and laptop software devices. The application has similar looks to MS Office's display. It does not need specific skills to use the programming language. The application can be operated by anyone, such as newbie, moderate, or expert users, to produce various applications. Smart App Creator 3 could develop learning applications, such as quizzes, tourism, company profile, regional branding applications, etc. The use of the application only needs logical thinking. Therefore, it could also be used for learners to train their logical thinking skills. This application is also helpful for STEM-based learning integration (Hamid, 2020). The selection of Android-based learning with SAC3 allows the content designing process without programming or HTML, HyperText Markup Language. Thus, it facilitates the users to make teaching materials in offline and online modes to use everywhere (Muhlas & Marwani, 2020).

Budiran stands for "bunyi dan indra pendengaran". Budiran, the educative game, is packaged in the form of an android-based application with SAC3. It was used for science learning with sound and auditory sense materials. The game contains various menus that make the game complete and unique from other games. The menu of the games is competent with the learning objective, game tutorial, material menu with texts and figures, video menu with two learning videos, game menu with six choices, training menu with three-level multiple choice and essay, developer menu with a bibliography of the developer. This game allowed learners to learn everywhere because this android-based application was flexible to use everywhere. Learners could activate the game with six stages. The first stage was - downloading the game via WhatsApp Group. Secondly, the learners could activate the game on android-based devices. Third, the learners followed the direction to use the game. Fourth, learners could try to use the game autonomously. Fifth, learners could report the level values while using the game. Sixth, teachers verified the cognition and concluded the results via WAG.

This research analyzed the effectiveness of the android-based game, budiran, assisted with SAC3 to improve the science learning outcomes of fourth graders with theme 1 in Ki Hajar Dewantoro cluster, Nalumsari district, Jepara regency.

2 Methodology

This Research & Development (R&D) aims to create an applicable product for learning science in fourth grade with theme one and to improve the learners' learning outcomes. Sugiyono (2016) also mentions that education and development is a research method to produce a product and test its effectiveness.

The type of research conducted is quasi-experimental research to see the consequences of a treatment by comparing the learning outcomes of two class groups (independent class) and

(dependent class) (Sugiyono, 2010). Experiment I does not use android-based Budiran games by smart apps creator three, and experimental group II uses android-based Budiran games by smart apps creator 3. The research design uses a pretest-posttest design.

The research population comprised 88 respondents from the fourth grades of five Ki Hajar Dewantoro cluster schools, Nalumsari district, Jepara regency, Indonesia. This research used seven stages of the Borg & Gall model, adapted by Sugiyono (2016). The researcher only used seven steps due to limited time, funds, and the number of learners granted by principals and school advisors in the cluster. The researcher tested the instrument's effectiveness with multiple choice, consisting of 20 items with four options for each item. The test was used in pretest and posttest. The effectiveness of an android-based budiran game assisted by smart app creator **three** was calculated based on the student's feedback. Data collection of scientific literacy is in the form of quantitative results from learning daily test scores. Data in values are then analyzed by determining the N-Gain category, as shown in Table 1.

Table 1 The average and qualitative descriptions of the checklists to determine the effectiveness of the Budiran game based on the N-gain test

Mean	Qualitative Description
0.71 – 1.00	High
0.31 – 0.70	Moderate
0.00 – 0.30	Low

Data were processed using SPSS 25 software by calculating the mean, median, maximum value, minimum value, and standard deviation (descriptive analysis of sample data), testing sample data's normality, and testing the average difference.

3 Findings

Here are the data collection results in figuring out the game's effectiveness in improving science learning outcomes of fourth graders with theme 1 in Ki Hajar Dewantoro cluster, Nalumsari district, Jepara regency. The development of the Android-Based *Budiran* game with the help of SAC3 (Smart Apps Creator 3) effectively improves the Science Learning Outcomes of Class IV Theme 1 student. Table 2 shows pretest and posttest learning outcomes. The results were analyzed with the N-gain test. The results show experimental group obtained an increased score of 0.64, categorized as moderate.

On the other hand, the control group received an improved score of 0.29, categorized as low. Thus, the use of the game met the effectiveness criteria based on Sugiyono (2016), as shown in Table 1. Purba et al. (2019) also found that using games effectively motivates learners and improves learning outcomes.

Table 2 The average and quantitative descriptions of pretest-posttest scores of control and experimental groups

Groups	Pretest score	Posttest score	N-gain test results	Qualitative descriptions
Control	30.00	50.00	0.29	Low
Experimental	30.67	74.83	0.64	Moderate

Source: Sugiyono (2016)

The observation showed that many learners were enthusiastic and focused on the game in the *budiran* game application. Azizah et al. (2022) found that educative games could support learners' learning process with positive and creative approaches. Kumanan & Periakka (2019) explain the function of games. They were 1) providing knowledge for children via the learning process; 2) stimulating cognitive and creative developments, 3) creating an exciting playground environment, security, joy, and improved learning quality for children, and 4) improving the logic and understanding of the users, and 5) being an educative media with the learning-by-doing pattern. Therefore, developing educative and applicable games to improve learners' interest was necessary.

Table 3 shows the t-test, aided with the SPSS program, to evaluate control and experimental groups' learning outcomes before and after the trial run. The effectiveness criteria were the t-test of pretest score should have a score of Sig. (2-tailed) $> \alpha$ = 0,05; while the posttest score criteria were Sig. (2-tailed) $< \alpha$ = 0,05 (Arifin, 2017). The t-test results on pretest of both groups obtained t-$_{count}$= 0.286 with Sig.(2-tailed) 0.776 $> \alpha$ = 0.05. It means no learning outcome differences in the pretest of both groups. After the trial run, twice via online and offline media, the researchers conducted a posttest. The result of the t-test in the posttest obtained $_{count}$ = 8.803 with Sig. (2-tailed) 0000 $< \alpha$ = 0,05. It shows the differences between control

and experimental groups' posttest results. The experimental group's posttest was higher than the control group's posttest score. Thus, the developed game was effective.

Table 3 The average score and the qualitative descriptions of control and experimental groups' pretest-posttest based on the t-test

		t-test for Equity of Means		
		t	Df	Sig. (2-tailed)
Pretest	Equal Variances Assumed	0.286	58	0.776
Posttest	Equal Variances Assumed	8.803	58	0.000

Tabulation refers to quantitative and qualitative data displayed via visual aids. The researcher put all findings under the three revisions to extract the data. Figure 1 shows the Pre-test-Post-test Scores of Control and Experimental Groups.

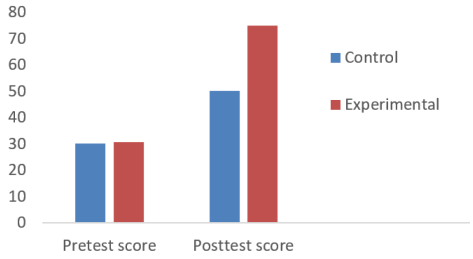

Figure 1 The pretest-posttest scores of control and experimental groups

4 Conclusion

From the study results, the game of the budiran can effectively improve the learning outcomes of fourth graders in sound and the sense of hearing. This is relevant to the research conducted by Mahuda (2021) that the Android-based mathematics learning media aided by Smart Apps Creator is effective in improving students' mathematical problem-solving abilities. In addition, it is also relevant to research conducted by Azizah (2020) that using Smart Apps Creator (SAC) to teach global warming effectively improves student learning outcomes. Yuberti's (2021) research is also relevant to this study that the development of mobile learning based on Smart Apps Creator as an effective physics learning medium improves student learning outcomes. From the findings and discussion, the developed game was effective. It was visible in the increased average score of learning outcomes from the pretest and posttest of control and experimental groups. The average pretest score of the control group was 30.00. It improved to 50.00. On the other hand, the average score of the experimental group was 30.67. It improved within two meetings to 74.83. The increased score of the control group was 20.00, while the experimental group was 44.16. The results showed improvement in the posttest score of the experimental group, higher than the control group's posttest score. The N-gain test showed the posttest score of the experimental group was 64%, categorized as moderate. The t-test of posttest score obtained t-count = 8.803 with significant level of 0,000 $< \alpha =$ 0,05. Thus, the developed game effectively improved the science learning outcomes of fourth-graders on theme 1. The researcher recommends for 1) Learners use the Budiran game properly based on the teachers' instructions; 2) teachers optimize the use of the Budiran game and develop the game to be better; 3) schools provide ICT facilities to develop ICT-based learning media for Android; 4) for future researchers to develop accessible Budiran game with wider scopes, such as with IOS, to conduct a more extensive trial run test to find the effectiveness, to develop the game's design to be more attractive with local wisdom, and to upload the game in play store.

Several studies have shown the effectiveness of using smart apps and creator media to improve student learning outcomes (Maharjan et al., 2022; Nugroho et al., 2022; Papadakis et al., 2021). The study's results (Pebriani et al., 2021) found that using STREAM-based teaching materials developed using Smart Apps Creator 3 effectively improved students' scientific literacy. The use of Android in the science learning process during the current pandemic makes it easier for students to follow the teaching and learning process wherever they are (Can & Bardakci, 2022). Providing exciting content in the SAC 3 application can streamline the process of learning activities so that students do not get bored with the presentation of the material being taught.

Meanwhile (Suhartati, 2021), with the SAC-based flipped classroom learning model, students are more active and enthusiastic in taking part in learning. At SAC, students learn with exciting content, so they do not feel bored. This application has subject matter and evaluation questions

in the form of games. The SAC-based flipped classroom learning model is recommended for elementary school students (Mamolo, 2022). SAC-based reverse classroom improves the learning atmosphere so that the activity and student learning outcomes increase, but teachers still face challenges from flipped classrooms in using and managing technology.

It concludes that implementing the mobile learning model using the Smart Apps Creator 3 application effectively improves student learning outcomes.

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Conflicts of interest

The authors declare that they have no conflict of interest.

References

Agnanda, F., Farida, N., & Nurseto, S. (2012). Pengaruh Nilai Pelanggan, Kesadaran Merek Dan Switching Barrier Terhadap Loyalitas Pelanggan Kartu Telkom Flexi (Studi Kasus Pada Mahasiswa Fakultas Ilmu Sosial Dan Ilmu Politik Universitas Diponegoro Semarang). Jurnal Ilmu Administrasi Bisnis, 1(2), 305-313.

Aguayo, J. M., Valdes, J., Cordoba, V. H., Nájera, M., Vázquez, F. R., Muñoz, E., & García Lirios, C. (2022). Digital activism in students of a university in central Mexico in the COVID-19 era. Advances in Mobile Learning Educational Research, 2(1), 297-307. https://doi.org/10.25082/AMLER.2022.01.014

Arifin, J. (2017). SPSS 24 untuk Penelitian dan Skripsi. (SPSS 24 for Research and Thesis). Elex Media Komputindo.

Arizona, K., Abidin, Z., & Rumansyah, R. (2020). Pembelajaran online berbasis proyek salah satu solusi kegiatan belajar mengajar di tengah pandemi covid-19. (Project-based online learning is one of the solutions for teaching and learning activities in the midst of the covid-19 pandemic). Journal Ilmiah Profesi Pendidikan, 5(1), 64-70. https://doi.org/10.29303/jipp.v5i1.111

Astini, N. K. S. (2020). Tantangan dan peluang pemanfaatan teknologi informasi dalam pembelajaran online masa covid-19. (Challenges and opportunities for using information technology in online learning during the COVID-19 period). Cetta: Jurnal Ilmu Pendidikan, 3(2), 241-255. https://doi.org/10.37329/cetta.v3i2.452

Azizah, A. R. (2020). Penggunaan Smart Apps Creator (SAC) untuk Mengajarkan Global Warming. (Using Smart Apps Creator (SAC) to Teach Global Warming). Seminar Nasional Fisika (SNF), 72-80. Universitas Negeri Surabaya.

Azizah, S., Widjanarko, M., Darmanto, E., & Pratama, H. (2022). Interactive Learning Media 2D Educational Game to Improve Learning Effectiveness in Kindergarten Students. ICCCM Journal of Social Sciences and Humanities, 1(1), 23-28. https://doi.org/10.53797/icccmjssh.v1i1.4.2022

Azman, M. N. A., Tamrin, R., Ab Latif, Z., Permana, S. A., & Pratama, H. (2022). Android-Based Application for Subtopic Based on Form 4 Home Science Clothing Selection. Journal of Higher Education Theory and Practice, 22(4), 41-51. https://doi.org/10.33423/jhtep.v22i4.5128

Barianos, A. K., Papadakis, A., & Vidakis, N. (2022). Content manager for serious games: Theoretical framework and digital platform. Advances in Mobile Learning Educational Research, 2(1), 251-262. https://doi.org/10.25082/AMLER.2022.01.009

Budyastomo, A. W. (2020). Gim edukasional untuk pengenalan tata surya. (An educational game for the introduction of the solar system). Teknologi: Jurnal Ilmiah Sistem Informasi, 10(2), 55-66. https://doi.org/10.26594/teknologi.v10i2.1955

Can, Y., & Bardakci, S. (2022). Teachers' opinions on (urgent) distance education activities during the pandemic period. Advances in Mobile Learning Educational Research, 2(2), 351-374. https://doi.org/10.25082/AMLER.2022.02.005

Childwise. (2017). Press release: childhood 2017 for children and teenagers, it is increasingly all about mobile.

Dahal, N., Manandhar, N., Luitel, L., Luitel, B., Pant, B., & Shrestha, I. (2022). ICT tools for remote teaching and learning mathematics: A proposal for autonomy and engagements. Advances in Mobile Learning Educational Research, 2(1), 289-296. https://doi.org/10.25082/AMLER.2022.01.013

Ekawati, P. L., & Falani, A. Z. (2016). Pemanfaatan teknologi game untuk pembelajaran mengenal budaya Indonesia berbasis android. (The use of game technology to introduce Indonesia's culture based on android). Universitas Narotama, 22 (1), 30-36.

Erfan, M., & Ratu, T. (2018, March). Meningkatkan minat dan hasil belajar mahasiswa pada perkuliahan elektronika dasar melalui digital game-based learning. (Improving the interest and learning outcomes for basic electronic courses via digital game-based learning). In Prosiding Seminar Nasional Pendidik dan Pengembang Pendidikan Indonesia, (pp. 332-337).
https://doi.org/10.31227/osf.io/ahvm8

Erfan, M., Widodo, A., Umar, U., Radiusman, R., & Ratu, T. (2020). Pengembangan Game Edukasi "Kata Fisika" Berbasis Android untuk Anak Sekolah Dasar pada Materi Konsep Gaya. (Development of an Android-Based "Physics Word" Educational Game for Elementary School Children on the Material Concept of Style). Lectura: Jurnal Pendidikan, 11(1), 31-46.
https://doi.org/10.31849/lectura.v11i1.3642

Ernawati, I. (2017). Uji kelayakan media pembelajaran interaktif pada mata pelajaran administrasi server. (The reliability test of interactive learning media for administrative server learning material). Elinvo (Electronics, Informatics, and Vocational Education), 2(2), 204-210.
https://doi.org/10.21831/elinvo.v2i2.17315

Firdaus, Y. A., & Yermiandhoko, Y. (2020). Pengembangan Media Game Edukasi Petualangan Si Isaac Berbasis Android pada Materi Gaya Kelas IV Sekolah Dasar. (The Development of Si Isaac's Adventure Educational Media Game Based on Android on Grade IV Elementary School Style Materials). Jurnal Penelitian Pendidikan Guru Sekolah Dasar, 8(2), 240-249.

Hariani, N. M. M. (2021). Efektivitas Pembelajaran Sains Sd Secara Daring Melalui Media Whatsapp Group Selama Pandemi Covid-19. (The Effectiveness of Online Elementary School Science Learning Through Whatsapp Group Media During the Covid-19 Pandemic). Widya Genitri: Jurnal Ilmiah Pendidikan, Agama Dan Kebudayaan Hindu, 12(1), 1-13.
https://doi.org/10.36417/widyagenitri.v12i1.384

Harun, F., Suparman., Hairun, Y., Machmud, T., & Alhaddad, I. (2021). Improving Students' Mathematical Communication Skills through Interactive Online Learning Media Design. Journal of Technology and Humanities, 2(2), 17-23.
https://doi.org/10.53797/jthkkss.v2i2.3.2021

Hidayah, R. E., Utaminingsih, S., & Pratama, H. (2022). The Effectiveness of Game-Based Learning in The Media Android-Based Artificial Vegetative Plant Propagation Based on Natural Science Subject. Uniglobal Journal of Social Sciences and Humanities, 1(1), 61-67.
https://doi.org/10.1080/10494820.2014.917109

Idris, M. O., Yusuf, M., Hanif, M. H. M., Adekunle, S. M., & Kayode, B. K. (2021). An Appraisal of the Attitudes and Achievement Motivation of Arab Postgraduate Students Towards the Learning of the English Language in Selected Malaysian Public Universities. Asian Journal of Assessment in Teaching and Learning, 11(1), 34-46.
https://doi.org/10.37134/ajatel.vol11.1.4.2021

Kallou, S., & Kikilia, A. (2021). A transformative educational framework in tourism higher education through digital technologies during the COVID-19 pandemic. Advances in Mobile Learning Educational Research, 1(1), 37-47.
https://doi.org/10.25082/AMLER.2021.01.005

Kalogiannakis, M., & Papadakis, S. (2017). An evaluation of Greek educational Android apps for preschoolers. In proceedings of the 12th Conference of the European Science Education Research Association (ESERA), Research, Practice and Collaboration in Science Education, Dublin City University and the University of Limerick, Dublin, Ireland (pp. 21-25).

Kapaniaris, A., & Zampetoglou, G. (2021). Visual programming for the creation of digital shadow play performance using mobile devices in times of Covid-19. Advances in Mobile Learning Educational Research, 1(2), 162-170.
https://doi.org/10.25082/AMLER.2021.02.010

Karakose, T., Polat, H., & Papadakis, S. (2021). Examining teachers' perspectives on school principals' digital leadership roles and technology capabilities during the COVID-19 pandemic. Sustainability, 13(23), 13448.
https://doi.org/10.3390/su132313448

Karo-Karo, I. R., & Rohani. (2018). Manfaat media dalam pembelajaran. (The use of media in learning). Axiom:jurnal pendidikan dan matematika, 7(1), 91-96.
https://doi.org/10.22219/jpbi.v7i1.13993

Katsaris, I., & Vidakis, N. (2021). Adaptive e-learning systems through learning styles: A review of the literature. Advances in Mobile Learning Educational Research, 1(2), 124-145.
https://doi.org/10.25082/AMLER.2021.02.007

Kholida, S. I., Suprianto., & Mahardika, I. K. (2019). Development of worksheet students in guided inquiry-based on the game education using Macromedia flash. Journal of Physics: Conference Series (International Conference on Science and Technology). 1569 (022006), 1-8.
https://doi.org/10.1088/1742-6596/1569/2/022006

Khotima, D. A., & Pratama, H. (2022). The Effectiveness of Android-Based Science Learning Model to Increase Student Learning Outcomes. Asian Pendidikan, 2(1), 33-41.
https://doi.org/10.53797/aspen.v2i1.5.2022

Kikilias, P., Papachristos, D., Alafodimos, N., Kalogiannakis, M. & Papadakis, St. (2009). An Educational Model for Asynchronous E-Learning. A case study in a Higher Technology Education, In D. Guralnick (ed.) Proceedings of the International Conference on E-Learning in the Workplace (ICELW-09), 10-12 June 2009, New York: Kaleidoscope Learning (CD-Rom).

Kumanan, R., & Periakka, R. (2019). The role of children's game in developing Tamil language among Tamil school students. Muallim Journal of Social Sciences and Humanities, 3(4), 501-510. https://doi.org/10.33306/mjssh/40

Kusuma, J. W., & Hamidah, H. (2020). Comparison of mathematics learning outcomes with the use of the Whatsapp Group platform and Zoom webinars in distance learning during the Covid 19 pandemic. JIPMat, 5(1). https://doi.org/10.26877/jipmat.v5i1.5942

Ladias, A., Karvounidis, T., & Ladias, D. (2021). Classification of the programming styles in scratch using the SOLO taxonomy. Advances in Mobile Learning Educational Research, 1(2), 114-123. https://doi.org/10.25082/AMLER.2021.02.006

Ladias, A., Karvounidis, T., & Ladias, D. (2022). Forms of communications in scratch and the SOLO taxonomy. Advances in Mobile Learning Educational Research, 2(1), 234-245. https://doi.org/10.25082/AMLER.2022.01.007

Lazarinis, F., Boididis, I., Kozanidis, L., & Kanellopoulos, D. (2022). An adaptable multi-learner serious game for learning cultural heritage. Advances in Mobile Learning Educational Research, 2(1), 201-215. https://doi.org/10.25082/AMLER.2022.01.004

Lazarinis, F., Karatrantou, A., Panagiotakopoulos, C., Daloukas, V., & Panagiotakopoulos, T. (2022). Strengthening the coding skills of teachers in a low dropout Python MOOC. Advances in Mobile Learning Educational Research, 2(1), 187-200. https://doi.org/10.25082/AMLER.2022.01.003

Liu, T. Y. (2016). Using educational games and simulation software in a computer science course: learning achievements and flow experiences. Interactive Learning Environments, 24(4), 724-744. https://doi.org/10.1080/10494820.2014.917109

Maharjan, M., Dahal, N., & Pant, B. P. (2022). ICTs into mathematical instructions for meaningful teaching and learning. Advances in Mobile Learning Educational Research, 2(2), 341-350. https://doi.org/10.25082/AMLER.2022.02.004

Mahuda, I., Meilisa, R., & Nasrullah, A. (2021). Development of android-based mathematics learning media assisted by smart apps creators in improving problem solving skills. Aksioma: Jurnal Program Studi Pendidikan Matematika, 10(3), 1745-1756. https://doi.org/10.24127/ajpm.v10i3.3912

Mamolo, L. A. (2022). Students' evaluation and learning experience on the utilization of Digital Interactive Math Comics (DIMaC) mobile app. Advances in Mobile Learning Educational Research, 2(2), 375-388. https://doi.org/10.25082/AMLER.2022.02.006

Mohammed, D. Y. (2022). The web-based behavior of online learning: An evaluation of different countries during the COVID-19 pandemic. Advances in Mobile Learning Educational Research, 2(1), 263-267. https://doi.org/10.25082/AMLER.2022.01.010

Muhlas, M., & Marwani, L. (2020). Development of e-learning Smart Apps Creator (SAC) learning media for selling employees on paid tv. Akademika: Jurnal Teknologi Pendidikan, 9(2), 129-143. https://doi.org/10.34005/akademika.v9i02.819

Nugroho, S. A., Trisniawati, T., & Rhosyida, N. (2022). Developing powerpoint-based interactive multimedia of mathematics learning multiples and factors materials for elementary school. Advances in Mobile Learning Educational Research, 2(2), 411-420. https://doi.org/10.25082/AMLER.2022.02.009

Papadakis, S. (2022). Apps to promote computational thinking concepts and coding skills in children of preschool and pre-primary school age. In Research Anthology on Computational Thinking, Programming, and Robotics in the Classroom (pp. 610-630). IGI Global. https://doi.org/10.4018/978-1-6684-2411-7.ch028

Papadakis, S., & Kalogiannakis, M. (2019). Evaluating the effectiveness of a game-based learning approach in modifying students' behavioural outcomes and competence, in an introductory programming course. A case study in Greece. International Journal of Teaching and Case Studies, 10(3), 235-250. https://doi.org/10.1504/IJTCS.2019.102760

Papadakis, S., Vaiopoulou, J., Sifaki, E., Stamovlasis, D., & Kalogiannakis, M. (2021). Attitudes towards the use of educational robotics: Exploring pre-service and in-service early childhood teacher profiles. Education Sciences, 11(5), 204. https://doi.org/10.3390/educsci11050204

Papadakis, S., Trampas, A., Barianos, A., Kalogiannakis, M., & Vidakis, N. (2020). Evaluating the Learning Process: The "ThimelEdu" Educational Game Case Study. In Proceedings of the 12th International Conference on Computer Supported Education - Volume 2: CSEDU, ISBN 978-989-758-417-6, pages 290-298. https://doi.org/10.5220/0009379902900298

Pebriani, F., Heliawati, L., & Ardianto, D. (2022). The Effect of STREAM-Based Teaching Materials Using Smart Apps Creator 3 on Students' Scientific Literacy. International Journal of STEM Education for Sustainability, 2(1), 78-93. https://doi.org/10.53889/ijses.v2i1.29

Purba, L. S. L., Sormin, E., Harefa, N., & Sumiyati, S. (2019). Effectiveness of use of online games Kahoot! Chemical to improve student learning motivation. Jurnal Pendidikan Kimia, 11(2), 57-66. https://doi.org/10.24114/jpkim.v11i2.14463

Rais, M., Aryani, F., Ahmar, A. S., Arfandi, H., & Ahmad, W. K. (2018). Learning media edu-games "my profession as an effort to introduce various types of profession in early childhood education students. Journal of Physics: Conference Series, 1028, 012091. https://doi.org/10.1088/1742-6596/1028/1/012091

Selvi, M., & Çosan, A. Ö. (2018). The Effect of Using Educational Games in Teaching Kingdoms of Living Things. Universal Journal of Educational Research, 6(9), 2019-2028. https://doi.org/10.13189/ujer.2018.060921

Sidiq, R. (2019). Utilization of Whatsapp Group in Implementing Pancasila Character Values in the Era of Disruption. Puteri Hijau: Jurnal Pendidikan Sejarah, 4(2), 145-154. https://doi.org/10.24114/ph.v4i2.16304

Sugiyono. (2016). Metode penelitian pendidikan pendekatan kuantitatif, kualitatif, dan R&D. (The educational research methods for quantitative, qualitative, and R&D approaches). Bandung. Alfabeta

Suhartati, O. (2021). Flipped Classroom Learning Based on Android Smart Apps Creator (SAC) in Elementary Schools. Journal of Physics: Conference Series, 1823(1), 012070. https://doi.org/10.1088/1742-6596/1823/1/012070

Tafonao, T. (2018). Peranan media pembelajaran dalam meningkatkan minat belajar mahasiswa. (The learning media role to improve students' learning interest). Jurnal Komunikasi Pendidikan, 2(2), 103. https://doi.org/10.32585/jkp.v2i2.113

Talizaro, T. (2018). Application of Learning Media in Increasing Students' Interest in Learning. Jurnal Komunikasi, 2(2). https://doi.org/10.32585/jkp.v2i2.113

Tambunan, N. (2021). The use of the whatsapp application in distance learning for students class V. Jurnal Pionir, 7(2).

Taspinar, B., Schmidt, W., & Schuhbauer, H. (2016). Gamification in education: a board game approach to knowledge acquisition. Procedia Computer Science, 99, 101-116. https://doi.org/10.1016/j.procs.2016.09.104

Turan, G. Y., Koklukaya, A. N., & Y1ldirim, E. G. (2020). Improving matter and heat subject learning through genuinely designed educational games. International Journal of Science and Mathematics Education, 18(1), 19-42. https://doi.org/10.1007/s10763-018-09945-0

Tzagkaraki, E., Papadakis, S., & Kalogiannakis, M. (2021). Exploring the Use of Educational Robotics in primary school and its possible place in the curricula. In Educational Robotics International Conference (pp. 216-229). Springer, Cham. https://doi.org/10.1007/978-3-030-77022-8_19

Verawati, A., Agustito, D., Pusporini, W., Utami, W., & Widodo, S. (2022). Designing Android learning media to improve problem-solving skills of ratio. Advances in Mobile Learning Educational Research, 2(1), 216-224. https://doi.org/10.25082/AMLER.2022.01.005

Vidakis, N., Barianos, A. K., Trampas, A. M., Papadakis, S., Kalogiannakis, M., & Vassilakis, K. (2020) in-Game Raw Data Collection and Visualization in the Context of the "ThimelEdu" Educational Game. In: Lane H.C., Zvacek S., Uhomoibhi J. (eds) Computer Supported Education. CSEDU 2019. Communications in Computer and Information Science, vol 1220. Springer, Cham. https://doi.org/10.1007/978-3-030-58459-7_30

Yuberti, Y., Wardhani, D. K., & Latifah, S. (2021). Development of Mobile Learning Based on Smart Apps Creator as Physics Learning Media. Physics and Science Education Journal (PSEJ), 1(2), 90-95. https://doi.org/10.30631/psej.v1i2.746