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Development of E-Static Learning Media Based on Smart Apps Creator (SAC) on Static Electricity Topic

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Abstract: This research aims to describe e-static learning media products based on Smart Apps Creator (SAC) on static electricity topic that meets the criteria in terms of validity, practicality, and effectiveness. This type of research is development research (Research and Development/R&D) using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model. The research results show that SAC-based e-static learning media products have met the learning media quality criteria with an average percentage score obtained for material experts of 95% and an average percentage score obtained for media experts of 98.44%, each of which is categorized as valid or suitable for use. The practical aspect shows that observations of learning implementation obtained an average percentage of 93% with very good criteria and student responses obtained an average percentage of 96.65% with very good criteria. The results obtained indicate that the e-static learning media based on SAC that was developed is practical. The effectiveness aspect is determined through student activity, which reaches 92.52% with very good criteria and learning outcomes for the cognitive domain in static electricity topic reach an N-gain value of 0.70, which is in the high category. The results of this research can be concluded that e-static learning media based on SAC on static electricity topic at SMP Negeri 2 Suwawa has met the criteria of being valid, practical, and effective.

Keywords: E-static; Learning media; Smart Apps Creator; Static electricity.

Introduction

Education has an important role, namely to ensure the development and continuity of the nation's activities in the future. Education makes humans try to develop themselves to face the changes that occur due to the development of science and technology (Dirsa et al., 2022). Changes in education will continue to happen and grow along with the development of information technology (Nurfadhillah et al., 2021). Information technology is a tool to convey information. Current technological advances cannot be avoided because technological advances will always coexist with advances in knowledge. In education, especially in schools, the development of science and technology plays a vital role in the learning process (Turkmen, 2006). Technology is a tool and approach that can enrich and facilitate students' learning experiences. The application of technology in education opens up opportunities to create a learning environment that is more interactive, dynamic and relevant to everyday life (Manca & Ranieri, 2013).

At school, students will participate in learning activities designed by the teacher. As an educational staff, teachers have a crucial role in improving the quality of student learning outcomes in the classroom (Iswanto et al., 2022). According to Podungge et al. (2020), several things can support the success of quality education, namely the presence of technology. Technology and education cannot be separated because

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the role of technology is crucial in the world of education. Therefore, teachers are currently required to be able to integrate technology into learning, one of which is by using learning media. Technology-based learning media is considered appropriate as a teaching tool because it facilitates interaction between teachers and students (Adiyanto & Yermiandhoko, 2021).

According to Yuberti et al. (2021), learning media is a communication tool for conveying information and facilitating the learning process and interaction between teachers and students. The learning media currently being developed are very diverse. Starting from audio, audio-visual, conventional, and so on. Along with the times and technological advances, application-based digital learning media is becoming popular with teachers. Various software and websites are available to create learning media in the form of easy and enjoyable applications, where the learning media used must attract students' attention in following the learning process and can motivate students. This can overcome students' difficulties in mastering subject matter, including the science and physics content.

Natural Science Physics is material that student's study, not just a collection of facts, concepts or principles, but physics is a learning process that provides practical experience for students to learn about the surrounding natural environment (Jannah et al., 2022). According to Amaliyah et al. (2021), internal and external factors influence students' learning difficulties in junior high school. Internal factors include interest, talent, motivation and intelligence, while external factors include school facilities, teachers, infrastructure and student activities. This is based on the study by Amaliah et al. (2021), which states that the factors that cause students to experience difficulties learning science are interest, motivation, concentration, study habits, and intelligence.

Based on the observations and interviews conducted by researchers at SMP Negeri 2 Suwawa School with one of the science teachers, he said that the science learning process had never been implemented using the Smart Apps Creator (SAC) learning media. Teachers stated that they often use school textbooks and sometimes PowerPoint without any other engaging media that can stimulate students to learn optimally. Hence, students tend to be passive and pay less attention to the material, making it difficult to receive and understand the learning material. The lack of technology in the teaching and learning process, such as this, certainly dramatically affects the effectiveness of student learning, resulting in student learning outcomes that are still relatively low.

According to Fitriya & Faizah (2021), To facilitate the delivery of material, there is a need for learning media. This limitation in learning media causes teachers to have difficulty delivering topic, especially about static electricity, where this topic requires supporting media so that students can easily understand the concept. Another statement was put forward by Akuba et al. (2023), learning will run well if practical assistance and learning resources support it. In the current era of digitalization, learning media leads to digital technology (Pramesti & Mashabi, 2023). Almost every student is proficient in using gadgets; students are more interested in gadgets than textbooks. In this way, learning media can help maximize students' receipt of teaching material (Handayuni et al., 2023).

In connection with this, it is necessary to develop learning media by utilizing technology, namely gadgets or Android. One is developing interactive learning media based on SAC. SAC is a desktop application for creating Android-based applications without programming code (Ferlianti et al., 2022). This application can contain animated images, videos, music and other menus to motivate students in the learning process, making learning more active, meaningful and fun (Syadida & Erita, 2022). Apart from that, the SAC can also be accessed anytime and anywhere by students, even without an internet quota, and making the application itself does not require special skills in computer programming, so it will not make it difficult for teachers to implement it.

In line with research conducted by Nurmila et al. (2023) with the research about development of learning media using sac based on local wisdom in work and energy topic, the results of the research conclusions show that learning media uses SAC based on local wisdom on business and energy topic has proven to be valid, practical and effective for learning. Referring to SAC research also conducted by Suleman et al. (2024) with the research topic about improving student learning outcomes through the application of a SAC-based Jire collaborative learning model on temperature and heat topic at senior high school. The conclusions for these research findings show that applying the Jire collaborative learning paradigm based on the SAC can improve student academic achievement in temperature and heat topic.

By paying attention to the above, researchers are interested in developing a SAC learning media to facilitate students' understanding of science concepts and material. For this reason, this research is topic about development of e-static learning media based on SAC in natural science learning with static electricity topic at SMP Negeri 2 Suwawa.

Method

This research was carried out at SMP Negeri 2 Suwawa. This research was carried out over six months in the odd semester of 2023/2024. The research was conducted during science learning hours and by the teaching and learning activities scheduled at school. This research uses the Research and Development (R&D) method. Research and Development (R&D) or research and development is the type of research used in this research, using the ADDIE development model. The subjects in this research were class IX 2 students in science subjects at SMP Negeri 2 Suwawa, with a total of 28 respondents using limited trials. Data analysis on learning media using SAC for static electricity topic includes validity, practicality, and effectiveness analysis.

The validity test of learning tools is determined by expert opinion through the results of a review of the learning tool instruments that have been developed. The validator expert wrote his assessment of the learning media on a validation sheet carried out by two validators use validity average value of learning media data and validation criteria (Arikunto 2002; Sukardi, 2013). Product criteria assessment can be used if it meets valid or very valid criteria based on expert assessment.

The practicality test of e-magnetic learning media based on SAC on the magnetism topic developed in this research was obtained based on an analysis of student responses and an analysis of the implementation of learning. The assessment of student responses uses a scale of 1 to 4, the Likert scale. Analysis of learning implementation consists of two options, "Implemented" or "Not Implemented," based on the syntax of the Discovery Learning model. Two observers assessed the implementation of the learning process steps using the learning implementation observation sheet.

Analysis of the practicality of student response and learning implementation involves the number of student responses for each aspect, number of students, number of steps carried out, and number of steps planned. A product can be practical if the average score for the percentage of learning implementation at each meeting achieves the criteria "Very Good" or "Good" (Sukardi, 2013).

Testing the effectiveness of learning media using the developed SAC will result in activities and student learning outcomes obtained from student observations involves the total score obtained the maximum score. Then, the effectiveness of students' cognitive learning outcomes data will be analyzed using gain (increased ability), which involves pre-test and post-test scores. The module is said to be effective if the average score is the percentage of students' N-Gailn criteria scores with the criteria "High" and "Medium" (Hake, 1999).

Result and Discussion

Expert Validation

The first stage in this research was the validation stage. The experts/validators in developing this media are lecturers within the Department of Natural Sciences Education Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo. The results of the validators' validation of media and other learning tools shows Table 1.

Table 1. Learning Device Validation Results

Learning tools	Average percentage		Average percent of all validators	Criteria
	Validator 1	Validator 2		
Teaching materials	95.00	95.00	95.00	Valid
Media	96.88	100	98.44	Valid
Module	97.92	95.83	96.88	Valid
Student worksheet	97.50	97.50	97.50	Valid
Learning Results Test	95.00	100	97.50	Valid

Table 1 shows that the average validation value for the percentage of eligibility for teaching materials 95%, learning media is 98.44%, modules 96.88%, student worksheet 97.50% and learning results test 97.50%. E-static learning media based on SAC, which has been validated by two validators, is declared to meet the valid category and is suitable for use "with minor revisions." This validation focuses on the validity of the material and media.

Material validity, during the expert validation process, researchers were given advice from expert validators, where the e-static learning media based on SAC that was developed had several that needed to be revised, namely: There was still material that needed to be improved, and the simplicity of the sentence

structure needed to be reviewed again. The suggestions given by the validator are then used as guidelines by researchers to make improvements/revisions. As stated in the opinion of Anjelia et al. (2023), "The results of material expert validation are used as a basis for revising the material."

Table 1 shows that the average validation value for the percentage of feasibility in the validity of Learning Media is 98.44%. Based on this percentage, e-static learning media based on SAC meets the valid category and is suitable for use "with minor revisions." This indicates that the e-static learning media developed is ideal for use in the learning process because it meets the aspects of material validity. This is in line with research conducted by Ardiansyah et al. (2023) with the research title Development of SAC Based Learning Media in Informatics Subjects, stated that the SAC based learning media developed obtained a material validity score of 89.2% with the criteria "Very Appropriate." The results of this validation show that the media is suitable for use in learning after revisions have been made based on suggestions from the validators.

Media validity, during the expert validation process, researchers were advised expert validators, where the e-static learning media based on SAC that was developed had to be revised, namely: The background of the media had to be adjusted based on the material to be used, several navigation buttons/icons needed to be repaired because they were not yet functioning, learning videos would be better to make yourself, and the arrangement of sentences in quizzes needed to be corrected so that they did not contain duplicate sentences. This input is used as a basis for making revisions and improvements to the learning media being developed. As the opinion expressed by Prasetio & Musril (2022) states, "Validation results are in the form of validation scores, corrections, criticism and suggestions which are used as a basis for revising and improving the device."

Table 1 shows that the average validation value of the feasibility percentage for the validity of Learning Media is 98.44%. Based on this percentage, e-static learning media based on SAC meets the valid category and is suitable for use "with minor revisions." This indicates that the e-static learning media developed is ideal for use in the learning process because it meets the aspects of media validity. This is in line with research conducted by Rianti & Dermawan (2022) the title research on the development of online learning media based on the SAC application, stated that the learning media developed based on the results of validator assessments with an achievement score of 95% with very good criteria is said to be valid and good for use in the learning process and meets the very appropriate criteria.

Implementation of Learning

The implementation of learning in this research was carried out in three meetings at SMP Negeri 2 Suwawa. Twenty-eight students attended and were observed by two observers. The following average results of learning implementation data can be seen in Figure 1.

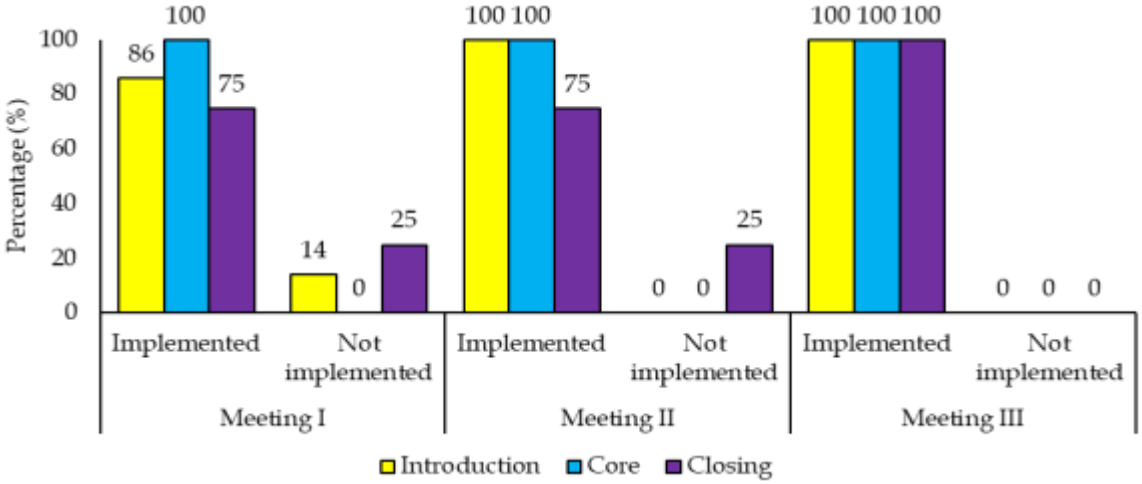

Figure 1. Learning Implementation Diagram

Based on Figure 1, indicators of learning implementation are divided into three stages: Introduction Activities, Core Activities, and Closing Activities. The picture shows that there were activities that were not carried out at meeting I and meeting II. At the meeting I, the activities that were not carried out included preparing students physically and psychologically to start learning (preliminary activities)

as well as providing evaluations in the form of quizzes via e-static media related to the material studied (closing activities). Meanwhile, at meeting II, the activity that was not carried out was reflecting on students regarding today's learning material (closing activity).

During the limited trial, observations of learning implementation were carried out with 28 students at SMP Negeri 2 Suwawa. The results obtained were the average percentage of learning implementation, as shown in Figure 1. The average percentage of learning implementation during three meetings was 93%, according to the criteria "Very Good." The explanation of these criteria can conclude that learning using the SAC -based e-static learning media developed is classified as practical, and this shows that this media is very practical to use in learning. In line with research by Kartika et al. (2024) entitled SAC based learning media with a Discovery Learning approach on sound wave topic shows a practicality level of 88.26% so this result shows that the learning media has met the practicality criteria set based on the requirements according to Sukardi (2013).

In the picture, it can be seen that several meetings had activities that were not carried out. The existence of indicators that were not implemented was caused by a lack of preparation and mastery of researchers regarding indicators of learning implementation. This is in accordance with Iman et al. (2023) that teachers must make thorough preparations, master all the material presented well, and provide clear illustrative examples. However, the results of the learning implementation of the Discovery Learning Model, which has been designed using e-static learning media based on SAC, are practical so that they can be applied in the science learning process.

Student Response

Data regarding student responses was obtained through a questionnaire sheet consisting of 16 questions related to the development of e-static learning media. Assessment for each statement uses a Likert scale. The results of data analysis of students' responses to the SAC-based e-static learning media developed are described in Figure 2. Based on Figure 2, the percentage of respondents who gave good and very good ratings shows that the results of the student questionnaire meet the practicality criteria with an average percentage of 96.65%. This indicates that the majority of students stated that SAC-based e-static learning media agreed and strongly agreed when used in the learning process.

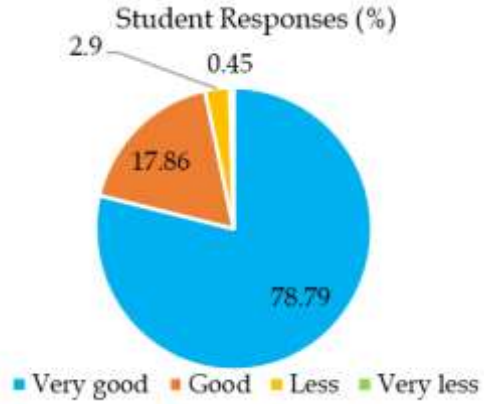

Figure 2. Percentage of Student Responses

This is in line with the research that was carried out by Adam (2023), which stated that the results of student responses show practicality or support if the product that has been developed has been successfully developed by the research team. The same thing is also explained by Sukardi's (2013) view that a device is said to be practical if it is in the good and very good range. The positive response given by students proves that the use of e-static learning media based on SAC, which was developed, is practical to apply in the classroom learning process.

Student Activities

Student activities in this research were carried out in three meetings during the learning process. A total of 28 students attended and were observed by two observers. Student activities include listening (AA), reading (AB), doing student worksheets (AC), group discussions (AD), presentations (AE), asking questions (AF), and concluding (AG). The following results of student activity data can be seen in Figure 3.

Based on Figure 3, it can be seen that the indicators of student activity in questioning skills decreased at the 3rd meeting. This occurs due to a mismatch in time allocation; the Discovery Learning model requires sufficient time for exploration, discussion, and reflection. In the field, there is limited time, which means teachers cannot facilitate the learning process optimally, so essential stages, such as asking questions, are often neglected. This is in accordance with Sandra et al. (2013) opinion that the Discovery Learning model can take up a lot of time because it changes the learning method that is usually used. This shows that without adequate time allocation, the implementation of this model can be hampered, thereby affecting the development of students' questioning skills.

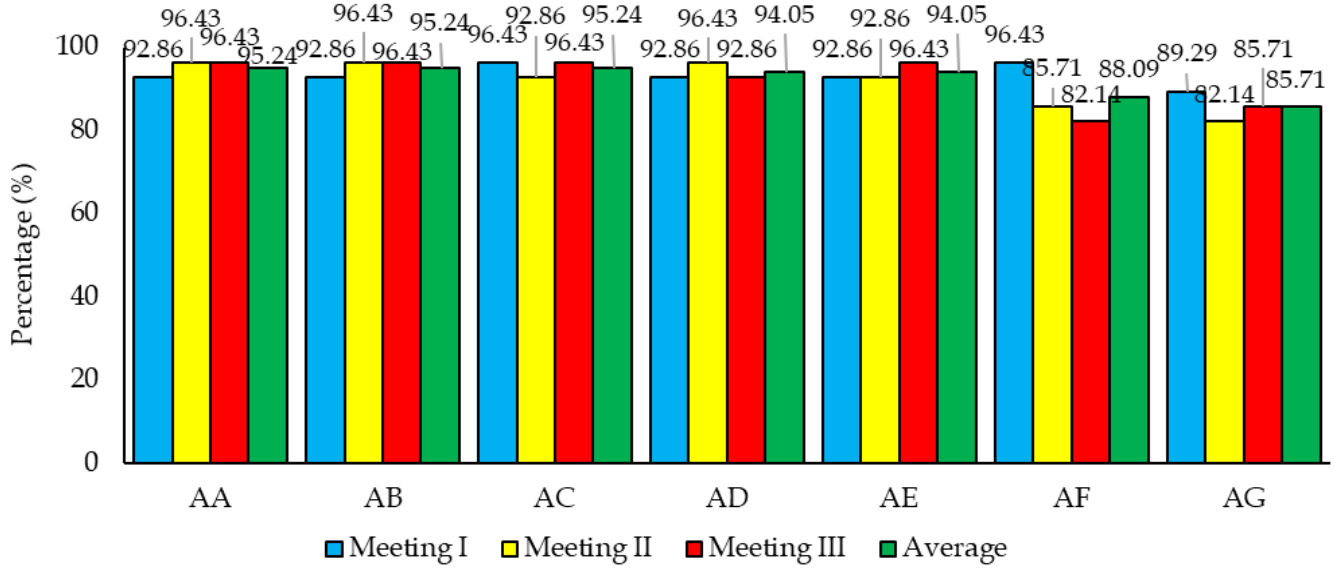

Figure 3. Percentage of Student Activities

However, Figure 3 shows that the results of the sales activity analysis result have an average value of all indicators of 92.52%, which is included in the "Very Good" category, where the very good category is within the 86% - 100% value range (Sukardi, 2013). The achievement of mobile learning in limited trials is that learning using e-static learning media based on SAC is included in the category of knowing if it is seen from the student's activities during the learning process.

Cognitive Learning Outcomes

The cognitive domain is measured using a test consisting of 11 essay questions. This test is given before the learning process (pre-test) and after learning is completed (post-test). Cognitive domain improvements are offered to students starting from C1-C4 and then analyzed using the N-gain method. Below is a table of average pre-test and post-test scores, the difference between the two, and the N-gain of cognitive learning outcomes in learning that uses e-static learning media based on SAC in Table 2.

Table 2. The average value of pre-test, post-test, difference, and n-gain

Respondents	Pre-test (%)	Post-test (%)	Difference (%)	N-gain	Criteria
28	42.21%	83.51%	41.29%	0.71%	High

Based on the Table 2, the test of student learning results obtained from the distribution of essay tests carried out before learning (Pre-test), the average percentage received by the 28 students was 42.21%. In contrast, the results after learning (Post-test) obtained an average percentage of 83.51% with a difference of 41.29%, and the N-gain value was 0.71% (N-gain ≥ 0.70), including the high N-gain criteria. This is in line with research by Susilo et al. (2023), with the title research on developing interactive learning media based on Android using SAC; the research results show an increase in learning outcomes with an N-Gain score of 0.70, which includes the high category. This indicates that the learning media developed is effective in increasing students' understanding.

Fitnanto et al. (2024), conducted further research. This research shows an increase in cognitive learning outcomes, with an N-Gain of 0.70 for those in the high category. This research shows the effectiveness of the Discovery Learning model in improving learning outcomes. Rohmah (2015) supports these results, stating that the discovery learning model provides more experience for students in learning.

Conclusion

The validity of e-static learning media based on SAC was validated using a validation sheet by two validators, namely two science education lecturers. The research results show that SAC-based e-static learning media products have met the learning media quality criteria with an average percentage score obtained for material experts of 95% and an average percentage score obtained for media experts of 98.44%, each of

which is categorized as valid or suitable for use. The practical aspect shows that observations of learning implementation obtained an average percentage of 93% with very good criteria and student responses obtained an average percentage of 96.65% with very good criteria. The results obtained indicate that the e-static learning media based on SAC that was developed is practical. The effectiveness aspect is determined through student activity, which reaches 92.52% with very good criteria and learning outcomes for the cognitive domain in static electricity topic reach an N-gain value of 0.70, which is in the high category. The results of this research can be concluded that e-static learning media based on SAC on static electricity topic has met the criteria of being valid, practical, and effective.

References

Adam, J., Yunginger, R., Uloli, R., Paramata, D. D., Abdjul, T., & Ntobuo, N. E. (2023). Pengembangan Media Berbasis Smartphone Menggunakan Smart Apps Creator untuk Mendukung Pembelajaran Daring pada Materi Fluida Statis di SMA Negeri 1 Telaga. *Jurnal Pendidikan Fisika Undiksha*, *13*(2), 305-316. https://ejournal.undiksha.ac.id/index.php/JJPF/article/view/60162

Adiyanto, Y., & Yermiandhoko, Y. (2021). Pengembangan Multimedia Interaktif" Click and Learn" Pada Mata Pelajaran IPA Materi Sistem Pernapasan Manusia Bagi Siswa kelas V SD. *Jurnal Penelitian Pendidikan Guru Sekolah Dasar*, *9*(7), 2905-2917. https://ejournal.unesa.ac.id/

Akuba, S. W., Abdjul, T., Ntobuo, N. E., & Payu, C. S. (2023). Pengembangan Lembar Kerja Peserta Didik Berbantuan Google Sites pada Materi Getaran, Gelombang, dan Bunyi. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *9*(1), 125-134. https://doi.org/10.32884/ideas.v9i1.1117

Amaliyah, M. (2021). *Analisis Kesulitan Belajar Dan Faktor-Faktor Penyebab Kesulitan Belajar Ipa Siswa Smp Negeri 4 Singaraja Pada Materi Tekanan Zat Dan Penerapannya Dalam Kehidupan Sehari-Hari* (Doctoral dissertation, Universitas Pendidikan Ganesha).

Anjelia, L., Marlina, L., & Atika, N. (2023). Pengembangan Media Busy Book Terhadap Kemampuan Membaca Anak Usia 5-6 Tahun Di PAUD Kencana Desa Tanjung Lubuk Oki. *Jurnal Pendidikan dan Konseling (JPDK)*, *5*(2), 805-811. https://doi.org/10.31004/jpdk.v5i2.12523

Ardiansyah, Risnita, & Jailani, M. S. (2023). Teknik pengumpulan data dan instrumen penelitian ilmiah pendidikan pada pendekatan kualitatif dan kuantitatif. *IHSAN: Jurnal Pendidikan Islam*, *1*(2), 1-9. https://doi.org/10.61104/ihsan.v1i2.57

Arikunto, S. (2002). *Prosedur Penelitian Sumber Daya Manusia dan Praktek*. Jakarta: Rineka Cipta.

Dirsa, A., Bp, S. A., Diananseri, C., & Setiawan, I. (2022). Teacher role as professional educator in school environment. *International Journal of Science Education and Cultural Studies*, *1*(1), 32-41. https://doi.org/10.58291/ijsecs.v1i1.25

Ferlianti, S., Rusdiana, D., Suwarma, I. R., & Nurbani, A. R. (2022). Pengembangan multimedia pembelajaran interaktif SAC pada materi tekanan hidrostatis. *Jurnal Pendidikan Indonesia*, *3*(1), 13-24. https://doi.org/10.36418/japendi.v3i1.479

Fitnanto, E. C. A., Soimatussa'diyah, & Dewi, N. R. (2024, May). Peningkatan Hasil Belajar Melalui Model Pembelajaran Discovery Learning Berbasis TaRL pada Pembelajaran IPA Kelas VIII. In *Prosiding Seminar Nasional Pendidikan dan Penelitian Tindakan Kelas* (pp. 442-451). https://proceeding.unnes.ac.id/snpptk/article/view/3170

Fitriya, F. F., & Faizah, S. (2021). Pengembangan Media Pembelajaran Matematika Berbasis Android pada Materi Trigonometri. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, *1*(2), 104-114. https://Doi.Org/10.51574/Kognitif.V1 i2.108

Hake, R. R. (1999). Analyzing Change/Gain Scores. Dept. of Physics Indiana University. *Unpublished.[Online] URL: http://www. Physics. Indiana. Edu/~ Sdi/AnalyzingChange-Gain. pdf*, *1*(1), 1-4.

Handayuni, D., Zainil, M., & Amini, R. (2023). Pengembangan Media Pembelajaran Smart Apps Creator pada Materi Perkalian dan Pembagian Bilangan Desimal di Sekolah Dasar. *E-Jurnal Inovasi Pembelajaran Sekolah Dasar*, *11*(2), 291-303.

Iman, S. H., Yusuf, M., Abdjul, T., & Odja, A. H. (2023). Pengembangan E-Modul Kearifan Lokal Berbantuan Aplikasi Flipping Book Pada Materi Getaran, Gelombang Dan Bunyi Di SMP Negeri 3 Kabila. *ORBITA: Jurnal Pendidikan dan Ilmu Fisika*, *9*(2), 294-304. https://doi.org/10.31764/orbita.v9i2.16812

Iswanto, Maryam, S., & Amina, F. (2022). Meningkatkan Kualitas Pembelajaran Melalui Strategi Supervisi Pendidikan di SMAN 1 Sangatta Utara. *An-Nafis: Jurnal Ilmiah Keislaman dan Kemasyarakatan*, 157-164. https://doi.org/10.62196/nfs.v1i2.61

Jannah, M., Arrahma, A., Erlinawati, E., Rahmad, M., & Yennita, Y. (2022). Analisis Faktor Kesulitan Belajar IPA Siswa Sekolah Menengah Pertama. *Quantum: Jurnal Inovasi Pendidikan Sains*, *13*(2), 202-214. http://dx.doi.org/10.20527/quantum.v13i2.14230

Kartika, D. M., Yanti, I. R., & Rahmi, A. (2024). Pengembangan media pembelajaran menggunakan smart apps creator berbasis discovery learning pada materi Gelombang Bunyi di SMA Kelas XI MIPA. *Jurnal Ilmiah Fisika*, 15(1), 44. http://dx.doi.org/10.12928/bfi-jifpa.v15i1.24748

Manca, S., & Ranieri, M. (2013). Is it a tool suitable for learning? A critical review of the literature on F acebook as a technology-enhanced learning environment. *Journal of Computer Assisted Learning*, *29*(6), 487-504. https://doi.org/10.1111/jcal.12007

Nurfadhillah, S., Ningsih, D. A., Ramadhania, P. R., & Sifa, U. N. (2021). Peranan Media Pembelajaran Dalam Meningkatkan Minat Belajar Siswa Sd Negeri Kohod Iii. *PENSA : Jurnal Pendidikan Dan Ilmu Sosial*, *3*(2), 243–255. https://ejournal.stitpn.ac.id/index.php/pensa

Nurmila, N., Abdjul, T., & Uloli, R. (2023). Development of Learning Media Using Smart Apps Creator Based on Local Wisdom in Work and Energy Materials. *Jurnal Penelitian Pendidikan IPA*, *9*(12), 11603-11612. https://doi.org/10.29303/jppipa.v9i12.5818

Podungge, N., Paramata, D. D., & Odja, A. H. (2020). Penerapan e-learning berbantuan media pembelajaran edmodo terhadap hasil belajar siswa pada konsep gejala pemanasan global. *Konstan-Jurnal Fisika Dan Pendidikan Fisika*, *5*(2), 77-85. https://doi.org/10.20414/konstan.v5i2.55

Pramesti, A. C., & Mashabi, N. A. (2023). Pengembangan Media Pembelajaran Teknik Pembuatan Minuman Berbasis Smart Apps Creator (Sac) Pada Mata Kuliah Bartending. *Jurnal Teknologi Pembelajaran Indonesia*, *13*(1), 44-55. https://doi.org/10.23887/jurnal_tp.v13i1.1623

Prasetio, I., & Musril, H. A. (2022). Perancangan Media Pembelajaran Fisika Berbasis Android Menggunakan Smart Apps Creator 3. *Jurnal manajemen informatika 8*(2). https://doi.org/10.51530/jumika.v8i2.546

Rianti, H. R., & Dermawan, D. A. (2022). Studi literatur penggunaan mobile game sebagai media pembelajaran pada mata pelajaran matematika terhadap hasil belajar siswa sekolah menengah atas. *IT-Edu: Jurnal Information Technology and Education*, *7*(2), 46-57. https://doi.org/10.26740/it-edu.v7i2.49144

Rohmah, L. (2015). Retrieved August 30, 2016, from Neliti. *Interactwebsite: https://www. neliti. com/publications/251104/implementasi-model-pembelajaran-guided-discovery-untuk-meningkatkan-keterampilan*.

Sandra, T. M., Mashudi, M., & Aminuyati, A. (2013). Efektifitas Penerapan Model Pembelajaran Discovery Learning Dan Penilaian Autentik Terhadap Keterampilan Berpikir Kritis Siswa. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa (JPPK)*, *7*(3). https://doi.org/10.26418/jppk.v7i3.24269

Sukardi. (2013). *Metodologi Penelitian Pendidikan*. Jakarta: PT Bumi Aksara

Suleman, S., Yusuf, M., & Ntobuo, N. E. (2023). Improving Student Learning Outcomes Through the Application of a Smart App Creator-Based Jire Collaborative Learning Model on Temperature and Heat Material at Senior High School. *Jurnal Geliga Sains: Jurnal Pendidikan Fisika*, *11*(2), 114-121. https://jes.ejournal.unri.ac.id/index.php/jgs/en/article/view/997

Susilo, B., Wijanarko, D., & Sutopo, Y. (2023). Development of Android-Based Interactive Learning Media on the Application of Electronic Systems in Automotive Technology. *Journal of Vocational and Career Education*, *8*(2), 28-37. https://journal.unnes.ac.id/journals/jvce/article/view/6347

Syadida, Q., & Erita, Y. (2022). Pengembangan Media Pembelajaran Menggunakan Aplikasi Smart Apps Creator pada Pembelajaran Tematik Terpadu. *Journal of Practice Learning and Educational Development*, *2*(1), 17–25. https://doi.org/10.58737/jpled.v2i1.31

Turkmen, H. (2006). What Technology Plays Supporting Role in Learning Cycle Approach for Science Education. *Turkish Online Journal of Educational Technology-TOJET*, *5*(2), 71-76. https://eric.ed.gov/?id=EJ1102483

Yuberti, Y., Wardhani, D. K., & Latifah, S. (2021). Pengembangan mobile learning berbasis smart apps creator sebagai media pembelajaran fisika. *Physics and Science Education Journal (PSEJ)*, 90-95. https://doi.org/10.30631/psej.v1i2.746