Development of Project-Based Learning Microsite Media for Improving Critical Thinking Skills of Elementary School Students

Choirun Nadlifah
Elementary School Teacher Education Study Program, Faculty of Education
University of PGRI Kanjuruhan Malang
Malang, Indonesia
choirunnadlifah1@gmail.com

Farida Nur Kumala
Elementary School Teacher Education Study Program, Faculty of Education
University of PGRI Kanjuruhan Malang
Malang, Indonesia
faridankumala@unikama.ac.id

Arnelia Dwi Yasa
Elementary School Teacher Education Study Program, Faculty of Education
University of PGRI Kanjuruhan Malang
Malang, Indonesia
arnelia@unikama.ac.id

Abstract—Critical thinking skills are an important competency in the 21st century, but the limitations of learning media pose a challenge in their development.This research aims to develop and analyze the effectiveness of a project-based learning microsite media in enhancing the critical thinking skills of elementary school students.The research method is Research and Development (R&D) and the ADDIE model.The research subjects involved teachers and fifth-grade students at one of the elementary schools in Malang City.The research instruments in the form of questionnaires and tests were analyzed qualitatively and quantitatively.The results of the expert validation show an average score of 91.2% (very feasible), while the student and teacher response questionnaires reached 95.8% (very practical).The N-Gain value of 0.64 (64 %) indicates the effectiveness of the media, while the Wilcoxon Signed Ranks Test result of 0.000 shows a significant improvement in students' critical thinking skills.Thus, the project-based learning microsite media is suitable and effective for use in education.

Keywords— Microsite; Project-Based Learning; Critical Thingking

I. INTRODUCTION

In today's era, technological development is progressing very rapidly, including in the field of education.In IPAS learning, teachers must be able to equip their students to be ready to face life in the digital era, one of which is by linking the knowledge possessed by students with lesson materials and technology through learning media as stated by (Hayu & Suciptaningsih, 2024).According to Karo-Karo & Rohani (2018), learning media are teaching aids to enhance the interaction process between teachers, students, and the learning environment.Learning media are tools used by teachers to present material effectively, so that students can understand and receive learning better, as stated by (Junaidi, 2019). The relationship between the use of learning media and technology has become a significant challenge for teachers today as a form of 21st-century learning integration, as stated by (Akhwani & Rahayu, 2021), that the learning conducted by teachers must be able to integrate content understanding, teaching skills, and the ability to utilize technology in the learning process, known as TPACK (Technological Pedagogical Content Knowledge).

According to Lusidawaty et al. (2020), IPAS is a subject at the elementary school level that helps students understand their surrounding environment and its contents.In IPAS learning, there are two main components: understanding of IPAS and science process skills.Both main components in IPAS learning can be fulfilled if supported by students' abilities and skills in learning, one of which is critical thinking.Critical thinking is a skill that encourages students to actively think using logic rationally to solve a problem, which is then reconstructed into new knowledge possessed by the learners (Susanto et al., 2021) (Kusumawati et al., 2022).Five indicators of critical thinking include the delivery of simple explanations, the development of basic skills, drawing conclusions, making further explanations, and the application of strategies and tactics.(Ihamdi et al., 2020).MeanwhileAt the elementary school level, critical thinking includes several indicators.First, the ability to identify problems, the ability to gather information, the ability to analyze information, the ability to draw conclusions, and the ability to evaluate solutions.

One of the learning models that directly encourages students to think critically and solve a problem is the Project Based Learning (PjBL) model.The Project Based Learning (PjBL) model is effective in training students to work independently or in groups to create and produce a work by understanding and finding solutions to problems in the students' environment, developing critical thinking skills, problem-solving abilities, and the capacity to evaluate situations from various perspectives.(Natty et al., 2019)(Fitriyah & Ramadani, 2021).According to Anggraini & Wulandari (2021), the Project Based Learning model includes six syntax elements, namely: (1) project determination through problem presentation as a stimulus; (2) project planning in the form of group work and discussion; (3) preparation of an implementation schedule; (4) project execution with teacher monitoring; (5) preparation of project outcome reports; and (6) evaluation through presentation, reflection, and formulation of findings.The Project-Based Learning (PjBL) model has various advantages, such as increasing learning motivation, skills, collaboration abilities, communication, time management, and creating a more enjoyable learning atmosphere. However, this model also has several weaknesses, such as difficulties in managing the class, challenges for students in conducting experiments and gathering information, as well as the possibility of having less active students in group work (Fahrezi et al., 2020).(Setiawan et al., 2021).

Based on the facts on the ground, the use of technology-based learning media has room for more optimal development.The results of observations and interviews conducted by the researcher in the fifth grade at one of the elementary schools in Malang City indicate that the IPAS Phase C learning has the potential to use more varied and innovative learning media.Students only use textbooks and worksheets as the main sources of learning.In the interview results, the class teacher stated that IPAS learning could be more effective if given the opportunity for direct practice.Additionally, the class teacher added that the students' critical thinking skills are still low.In relation to the existing problem, the researcher developed a learning media that also integrates TPACK in learning, namely a microsite learning media.

According to Nurfalah & Rahayu (2023), a microsite is a complementary website with an independent address or link that can be accessed from the main site.A microsite can be described as an individual, independent website because it stands alone and has its own domain, and it serves as a center for all information or promotion specifically for certain purposes as explained (Kumala et al., 2023).In learning activities, a microsite can assist teachers in using media for teaching.The use of microsite media has been widely implemented in education, as research conducted by (Hayu & Suciptaningsih, 2024) also shows effective results in improving learning outcomes.Then further reinforced through research on elementary school IPAS learning conducted by (Safitri et al., 2024), which shows that microsites are effective in increasing student interest, enthusiasm, and participation in the learning process.

The development of this media is based on the problem in learning, namely the lack of technology-based media integrated through microsite media, while students' low thinking skills are innovated using project-based learning microsite media designed based on students' skills to solve a problem through a project.

II. RESEARCH METHOD

This research was conducted at one of the elementary schools in Malang City.This research uses a Research and Development (R&D) approach with the aim of producing and testing the effectiveness of the developed product (Sugiyono, 2017).This research follows procedures based on the ADDIE development model with five main stages, namely analysis, design, development, implementation, and evaluation.
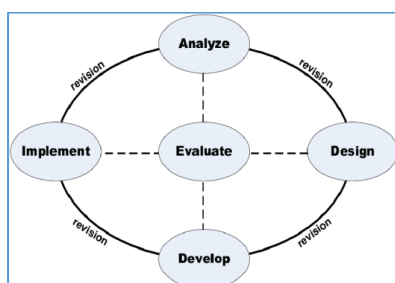
Picture 1. ADDIE Development Steps (Sugiyono, 2017)

Based on the above steps, the analysis stage is conducted to understand the background, needs, and the extent to which a project-based learning microsite is necessary, tailored to the indicators of critical thinking at the elementary school level, including the ability to identify problems or questions, gather relevant information, analyze information to find relationships or patterns, draw conclusions based on evidence, and evaluate solutions or opinions with logical reasoning.At the design stage, the researcher develops the product according to the learning needs of the students by adapting the stages of the project-based learning model.The stages include project planning, schedule preparation, project implementation, report preparation, and project evaluation.In the implementation stage, the researchers conducted limited trials and field tests directly with students under the guidance of the classroom teacher.The final stage is evaluation, which aims to analyze the effectiveness of the developed product in supporting the learning process.

This research involves fifth-grade students as subjects.A limited trial was conducted in Malang involving 5 students, while a field trial involved 20 students with the guidance of one class teacher.The testing of the project-based learning microsite media aims to assess the validity, practicality, and effectiveness of the media.Media validation is conducted by subject matter experts, media experts, and language experts.The researcher used a questionnaire instrument to assess the practicality level of the media, while the effectiveness of the media was evaluated through a test instrument that included a pretest and posttest.This research uses qualitative and quantitative data analysis techniques.The validity of the media is analyzed based on the results of expert validation tests, while the practicality of the media is measured through the responses of teachers and students during the learning process.The practicality assessment is calculated using a Likert scale with a score range of 1 to 4.After obtaining the score data, the researcher determines the feasibility criteria for the learning media, which can be seen in Table 1.

Table 1. Media Eligibility Criteria

Criteria	Very good	Good	Not good enough	Very poor
Percentage	76% - 100%	51% - 75%	26% - 50%	1% - 25%

Source (Yasa & Cahyawanti, 2021)

The developed media is deemed suitable for use if it achieves a result percentage of more than 75%.The analysis of media effectiveness is calculated based on the measurement of student learning outcomes through pretest and posttest using the N-Gain test.

Table 2. Category N-Gain Percentage

Criteria	Very effective	Effective	Less effective	Not effective
Percentage	76% - 100%	56% - 75%	40% - 55%	1% - 40%

Source (Prasetyo & Nugraheni, 2024)

The analysis of media effectiveness is conducted by comparing the improvement in test results based on the average pretest and posttest scores.If the data meet the parametric statistical prerequisites, the analysis is conducted using the parametric statistical t-test.However, if the data do not meet these prerequisites, the researcher uses the non-parametric statistical test Wilcoxon Signed Ranks Test with the help of SPSS 23 for Windows at a significance level of 0.05.The hypothesis (Ha) is accepted if the significance value is less than 0.05, while Ha is rejected if the significance value is more than 0.05.

Ho : There is no significant difference in students' critical thinking skills before and after using a project-based learning microsite media.

Ha : There is a significant difference in students' critical thinking skills before and after using a project-based learning microsite media.

III. RESULTS AND DISSCUSION

This research resulted in the development of a product, namely a microsite media based on project-based learning (PjBL), which was developed using the ADDIE model with five stages that the researchers had to follow.In the initial stage, the researcher analyzed the conditions and problems in the learning process by conducting observations and interviews with fifth-grade students, which showed that the IPAS Phase C learning has the potential to use more varied and innovative learning media.Students only use textbooks and worksheets as the main sources of learning.In the interview results, the class teacher stated that IPAS learning could be more effective if given the opportunity for direct practice.Additionally, the class teacher added that the students' critical thinking skills are still low.In the next stage, designing learning media according to the needs and problems present in the school with the aim of providing solutions to the existing problems and making it easier for students to understand the lessons well through the development of a project-based learning microsite media.

The next step is to design an engaging project-based learning microsite media that aligns with the learning objectives and indicators of the IPAS Phase C Grade V Chapter 4 "*Ayo, Berkenalan Dengan Bumi Kita*".

Picture 2. Design of a Media Microsite Based on Project-Based Learning

After the media design process, the next stage is development.The product that has been designed is then tested by validator lecturers, including media experts, subject matter experts, and language experts.The results of the testing from each validator are as follows:

Table 3. Expert Validation Results

Validator	Precentage of Assesment	Criteria
Content Expert	87,5%	Very Good
Language Expert	91,1%	Very Good
Media Expert	95%	Very Good
Average	**91,2%**	**Very Good**

Based on the research results, this media has met the standards of validity, practicality, and effectiveness.The validity test was conducted by three experts, namely HDA as the content expert, AG as the media expert, and DAS as the language expert.The validation results show that the average validity percentage of the project-based learning microsite media reached 91.2%, which is categorized as "very good or suitable" for use after revision.

After passing the validation and product revision stage, the next step is implementation through limited trials and field trials.The results of the media practicality test in the limited trial were obtained through a questionnaire conducted by one teacher and five fifth-grade students.The results obtained show a practicality level of 95.8% from the teacher and 88.1% from the students, indicating that this media falls into the "very good or practical" category and can be used after revisions based on input from the class teacher.Next, after passing the validation stage by expert lecturers, class teachers, and students, the research proceeded to the field trial stage.The results of the student practicality test in the field trial showed a score of 95.8% in the "very good or practical" category, used in learning.

The final stage in this research is assessment or evaluation, which serves as an indicator to measure the effectiveness of the developed product and becomes the final outcome of the learning media.The effectiveness of the media is analyzed using the N-Gain test, and further tested with the parametric t-test or the non-parametric Wilcoxon Signed Ranks Test.Here are the results of the media effectiveness analysis using the N-gain Test:

Table 4. Results of Effectiveness Test Using N-Gain Test

Aspect	Average	Criteria
Pretest	54	-
Posttest	83,75	-
N-Gain Score (%)	64,5%	Effective

The results of the media effectiveness test were obtained from the students' test results, namely the pretest and posttest conducted by 20 fifth-grade students.From the test results, the data were analyzed using the N-Gain test, which showed an N-Gain Score of 0.64 or 64.5%, indicating that the measurement of student learning outcomes through pretest and posttest using the media can be considered "effective" in learning.

Next, to test the difference in test score improvement between the average pretest and posttest, the researcher conducted data analysis using the parametric t-test statistic.Parametric statistics is a branch of statistical science that takes into account the type of data distribution as stated by (Siregar & Fitriawan, 2022).In parametric statistics, prerequisite tests include checking the normality and homogeneity of data distribution.The normality test is a test to determine whether a data distribution is normal or not (Suciani et al., 2022) (Aditiya et al., 2023).From the results of data analysis using the SPSS 23 for Windows program, it shows that the pretest normality test is 0.242 and the posttest is 0.116, indicating that the data distribution is normal because the significance level is >0.05. Next, the researcher conducted a prerequisite test for data homogeneity.From the results of the data

analysis using the SPSS 23 for Windows program, it shows that the homogeneity value of the data has a significance level of 0.00.This indicates that the data obtained by the researcher depicts a non-homogeneous distribution because 0.00 < 0.005.Thus, the results indicate that the obtained data cannot be analyzed using parametric tests because the prerequisites for parametric statistical tests are not met, namely, the data is normally distributed but not homogeneous as stated by (Siregar & Fitriawan, 2022).

In the next stage, the researchers applied an alternative data analysis method using non-parametric statistics.Based on consideration, the researcher chose the non-parametric Wilcoxon Signed Ranks Test with the help of SPSS 23 for Windows software.This test is used to analyze data from paired samples, particularly in research that compares conditions before and after treatment.

Table 5. Results of Effectiveness Testing Using Non-Parametric Methods
(*Wilcoxon Signed Ranks Test*)

		N	Mean Rank	Sum of Ranks
Pretest - Posttest	Negative Ranks	0[a]	0,00	0,00
	Positive Ranks	20[b]	10,50	210,00
	Ties	0[c]		
	Total	20		
Test Statistics[a]				
Z				-3,928[b]
Asymp. Sig. (2-tailed)				**0,000**

 Based on Table 5 of the Wilcoxon Signed Rank Test results, the analysis shows a significance value (Sig. 2-tailed) of **0.000**, which is less than 0.05.This indicates that the alternative hypothesis **(Ha) is accepted**, meaning there is a significant difference in students' critical thinking skills before and after using the project-based learning microsite media.

The analysis results show that the improvement in students' critical thinking skills is influenced by the differences in treatment before and after the use of Project Based Learning (PjBL)-based microsite media.This media is effective because it presents contextual problems and is supported by the PjBL learning syntax that encourages rational and solution-oriented thinking.Research conducted by Fitriyah and Ramadani (2021) shows that the PjBL learning model significantly enhances students' critical thinking skills.The steps in the PjBL model according to Anggraini & Wulandari (2021) include project determination, planning, scheduling, implementation, report preparation, and project evaluation.Students' critical thinking skills in the PjBL model are more prominently displayed when they are faced with a problem and asked to find a solution through the development of a product.This is in line with the research conducted by Natty et al. (2019), which states that at the initial stage of project determination, the teacher provides a stimulus in the form of a problem that must be solved by the students.Next, students ask the teacher questions regarding how to solve the problem.Thus, the use of learning media plays a key role in enhancing students' critical thinking skills as stated by Sa'adilla et al. (2020), critical thinking skills can develop optimally if teachers choose and apply appropriate strategies and learning models.Thus, critical thinking skills develop optimally with the right strategies and learning models, as they involve the process of connecting knowledge for students, and the application of project-based learning microsite media can be an effective solution in packaging learning attractively and supporting the enhancement of students' critical thinking skills.

IV. CONCLUSION

The project-based learning microsite media is a technology-based learning medium that combines the use of microsite learning media and the project-based learning model.This media consists of a mini web containing learning materials, student worksheets, practice questions or evaluations arranged based on the syntax or steps in the project-based learning (PjBL) model, which are determining the project, planning the project, scheduling the project, completing the project, compiling the report, and evaluation.The project-based learning microsite media has undergone three tests: validity, practicality, and effectiveness, measured using questionnaires and tests.The results obtained indicate that the product in the form of a project-based learning microsite media is declared very good or effective for use in student learning.In addition, this study shows that the alternative hypothesis (Ha) is accepted, indicating a difference in critical thinking skills using the project-based learning microsite media.

V. ACKNOWLEDGMENT

REFERENCES

[1] Aditiya, N. Y., Evani, E. S., & Maghfiroh, S. (2023). Konsep Uji Asumsi Klasik Pada Regresi Linier Berganda. *Jurnal Riset Akuntansi Soedirman*, *2*(2), 102–110. https://doi.org/10.32424/1.jras.2023.2.2.10792

[2] Akhwani, & Rahayu, D. W. (2021). Analisis Komponen TPACK Guru SD sebagai Kerangka Kompetensi Guru Profesional di Abad 21. *Jurnal Basicedu*, *5*(4), 1918–1925. https://doi.org/https://doi.org/10.31004/basicedu.v5i4.1119 ISSN

[3] Anggraini, P. D., & Wulandari, S. S. (2021). Analisis Penggunaan Model Pembelajaran Project Based Learning Dalam Peningkatan Keaktifan Siswa. *Jurnal Pendidikan Administrasi Perkantoran (JPAP)*, *9*(2), 292–299. https://doi.org/10.26740/jpap.v9n2.p292-299

[4] Fahrezi, I., Taufiq, M., Akhwani, & Nafia'ah. (2020). Meta-Analisis Pengaruh Model Pembelajaran Project Based Learning Terhadap Hasil Belajar Siswa Pada Mata Pelajaran IPA Sekolah Dasar. *Jurnal Ilmiah Pendidikan Profesi Guru*, *3*(3), 408. https://doi.org/http://dx.doi.org/10.23887/jippg.v3i3

[5] Fitriyah, A., & Ramadani, S. D. (2021). Pengaruh Pembelajaran STEAM Berbasis PJBL (Project-Based Learning) Terhadap Keterampilan Berpikir Kreatif Dan Berpikir Kritis. *Journal of Education*, *10*(1), 209–226. https://doi.org/10.26737/jpmi.v1i1.76

[6] Hayu, R., & Suciptaningsih, O. A. (2024). Pengembangan Media Pembelajaran Berbasis Microsite pada Materi Pancasila Kelas V Sekolah Dasar. *Jurnal Educatio*, *10*(2), 553–559. https://doi.org/10.31949/educatio.v10i2.8568

[7] Hikmah, N., Kuswidyanarko, A., & Lubis, P. H. M. (2020). Pengembangan Media Pop-Up Book pada Materi Siklus Air di Kelas V SD Negeri 04 Puding Besar. *Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, *15*(2), 137–148.

[8] Ilhamdi, M. L., Novita, D., & Rosyidah, A. N. K. (2020). Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Kemampuan Berpikir Kritis IPA SD. *Jurnal KONTEKSTUAL*, *1*(02), 49–57. http://jurnal.umus.ac.id/index.php/kontekstual

[9] Junaidi. (2019). Peran Media Pembelajaran Dalam Proses Belajar Mengajar. *Jurnal Manajemen Pendidikan dan Pelatihan*, *3*(1).

[10] Karo-Karo, I. R., & Rohani. (2018). Manfaat Media Dalam Pembelajaran. *Jurnal Pendidikan dan Matematika*, *11*(1), 1–14. https://jurnal.uinsu.ac.id/index.php/axiom/article/view/1778/1411

[11] Keumala, M. F., Hartinah, S., & Suriswo, S. (2024). Pengembangan Media Pembelajaran Berbasis Microsite Mata Pelajaran Informatika untuk Meningkatkan Hasil Belajar Peserta Didik Fase E SMK. *Journal of Education Research*, *5*(3), 4115–4120. https://doi.org/10.37985/jer.v5i3.1567

[12] Kumala, F. N., Yasa, A. D., Wibawa, A. P., & Hidayah, L. (2023). *Model Pembelajaran Hybrid Learning Microsite Project Steamer*.

[13] Kusumawati, I. T., Soebagyo, J., & Nuriadin, I. (2022). Studi Kepustakaan Kemampuan Berpikir Kritis Dengan Penerapan Model PBL Pada Pendekatan Teori Konstruktivisme. *Jurnal MathEdu (Mathematic Education Journal)*, *5*(1), 13–18. http://journal.ipts.ac.id/index.php/MathEdu

[14] Lestari, N. A. P., Kurniawati, K. L., & Dewi, M. S. A. (2023). *Model-Model Pembelajaran untuk Kurikulum Merdeka di Era Society 5.0.* NILACAKRA. https://books.google.co.id/books?id=7F69EAAAQBAJ&newbks=0&printsec=frontcover&pg=PR7&dq=TUJUAN+MODEL+PJBL&hl=en&source=newbks_fb&redir_esc=y#v=onepage&q&f=false

[15] Lusidawaty, V., Fitria, Y., Miaz, Y., & Zikri, A. (2020). Pembelajaran IPA Dengan Strategi Pembelajaran Inkuiri Untuk Meningkatkan Keterampilan Proses Sains Dan Motivasi Belajar Siswa Di Sekolah Dasar. *Jurnal Basicedu*, *4*(1), 168–174. https://doi.org/10.31004/basicedu.v4i1.333

[16] Natty, R. A., Kristin, F., & Anugraheni, I. (2019). Peningkatkan Kreativitas Dan Hasil Belajar Siswa Melalui Model Pembelajaran Project Based Learning Di Sekolah Dasar. *Jurnal Basicedu*, *3*(4), 1082–1092. https://doi.org/10.31004/basicedu.v3i4.262

[17] Nurfalah, E., & Rahayu, P. (2023). Microsite-Based Mathematical Statistics Educational Media to Increase Student Study Motivation after the Covid-19 Pandemic. *Jurnal Riset Pendidikan dan Inovasi Pembelajaran Matematika (JRPIPM)*, *7*(1), 67–74. https://doi.org/10.26740/jrpipm.v7n1.p67-74

[18] Prasetyo, D. A., & Nugraheni, N. (2024). Pengembangan Media Pembelajaran Matematika Berbasis Video Animasi pada Pokok Bahasan Luas dan Keliling Bangun Datar Berbantuan Software Synfig di SDN Denanyar 3. *JagoMIPA: Jurnal Pendidikan Matematika dan IPA*, *4*(1), 127–135. https://doi.org/10.53299/jagomipa.v4i1.461

[19] Sa'adilla, S., Sofiyan, & Fadilah. (2020). Analisis Kemampuan Berpikir Kritis Matematis Siswa Dengan Menggunakan Model Teams Games Tournament (TGT) Pada Pembelajaran Matemtika. *Jurnal Ilmiah Matematika Realistik (JI-MR)*, *3*(1), 28–35.

[20] Safitri, S. R., Hidayah, Q. N., & Kaswaraningsih, D. (2024). Pengembangan Media Pembelajaran Interaktif Berbasis Microsite Canva pada Mata Pembelajaran IPAS Harmoni dalam Ekosistem Kelas V SD. *Journal of Comprehensive Science*, *3*(8). https://doi.org/10.25130/sc.24.1.6

[21] Setiawan, L., Wardani, N. S., & Permana, T. I. (2021). Peningkatan Kreativitas Siswa Pada Pembelajaran Tematik Menggunakan Pendekatan Project Based Learning. *Jurnal Basicedu*, *5*(4), 1879–1887. https://doi.org/10.31004/basicedu.v5i4.1068

[22] Siregar, N., & Fitriawan, D. (2022). Media Pembelajaran Matematika Menggunakan Smart Apps Creator pada Materi Bilangan Bulat di Sekolah Dasar. *Plusminus: Jurnal Pendidikan Matematika*, *2*(3), 345–356. https://doi.org/10.31980/plusminus.v2i3.2194

[23] Suciani, A., Ruhiat, D., & Rahayu Septiani, S. D. (2022). Komparasi hasil analisis beda rata-rata menggunakan metode statistik parametrik dan nonparametrik. *Jurnal Riset Matematika dan Sains Terapan*, *2*(2), 76–91.

[24] Sugiyono. (2017). *Metode Penelitian Kuantitatif Kualitatif Dan R Dan D / S*. Alfabeta.

[25] Susanto, H., Irmawati, Akmal, H., & Abbas, E. W. (2021). Media Film Dokumenter dan Pengaruhnya Terhadap Keterampilan Berpikir Kritis Siswa. *HISTORIA: Jurnal Program Studi Pendidikan Sejarah*, *9*(1). https://doi.org/10.24127/hj.v9i1.2980

[26] Yasa, A. D., & Cahyawanti. (2021). Pengembangan Media Interaktif Berbasis Android Pada Aplikasi I-Spring Untuk Siswa Sekolah Dasar. *In Prosiding Seminar Nasional PGSD UNIKAMA*.