An elementary school project-based learning program based on a Javanese comic

Galih Istiningsih [1]**,** Yogyakarta State University, Primary Education Doctoral Program, Graduate School, Number 1 Colombo Street, Sleman City, Yogyakarta 55281, Indonesia. https://orcid.org/0000-0002-5833-6258

Sugito Sugito, Yogyakarta State University, Primary Education Doctoral Program, Graduate School, Number 1 Colombo Street, Sleman City, Yogyakarta 55281, Indonesia. https://orcid.org/0000-0001-5711-922X

Cepi Safruddin Abd Jabar, Yogyakarta State University, Primary Education Doctoral Program, Graduate School, Number 1 Colombo Street, Sleman City, Yogyakarta 55281, Indonesia. https://orcid.org/0000-0003-1876-2866

Abstract

Students are not equipped with the cognitive skills to face today's problems in the real world. Previous research showed that Indonesian elementary students lack critical thinking skills. This research aims to analyze the effect of the Javanese comics project to improve critical thinking and interpersonal skills in fifth-grade students. This study was conducted using a quasi-experimental design with 60 elementary school students in a pre-and post-test group for six weeks. Data was collected using a questionnaire. The data were analyzed using the N-gain score, Mann-Whitney U test, and Spearman rho correlation at the significance level of 0.05. The result revealed that 60 students improved their critical thinking and interpersonal communication skills. Thus, teachers could use Javanese comics project-based learning to increase students' critical thinking and communicative performance skills, as well as interpersonal communication skills in the innovative education of the 21st century.

Keywords: Critical thinking skills; interpersonal communication; Javanese comics; project-based learning

* ADDRESS FOR CORRESPONDENCE: Galih Istiningsih, Yogyakarta State University, Primary Education Doctoral Program, Graduate School, Number 1 Colombo Street, Sleman City, Yogyakarta 55281, Indonesia.
Email address: galih@ummgl.ac.id

1. Introduction

The learning system requires improvements in curriculum, teaching, and learning in the 21st century (Hasanah & Malik, 2020; Johnson, Walton, Strickler & Elliott, 2023). Changes in learning have to follow the development of digital technology that has changed people's interaction, particularly interaction between students, students with theory, and students with teachers (Coman et al., 2020; Oke & Fernandes, 2020; Villena-Taranilla et al., 2022). Teachers must not only deliver knowledge to students, but also they must facilitate cultural values, communication, collaboration, creativity, dialogic, and critical thinking through project learning in class (Hasanah & Malik, 2020; Rozal et al., 2021; Loyens, Van Meerten, Schaap & Wijnia, 2023). In addition, teacher dominance as the center of learning has decreased, so students have to respond to this change quickly and teachers need to prepare students to be lifelong learners following technological development (Diadjeng, 2021; Nurhana & Abdullah, 2021; Li et al., 2023).

Critical thinking involves not only knowledge but also the application skills and attitude of students through communication and collaboration learning (Ishtiaq Khan et al., 2021; Supena et al., 2021). It has to be owned by students such as interpretation, analysis, evaluation, explanation, and self-regulation (Novita et al., 2019). Teachers have to develop the learning process with innovative learning that facilitates project learning models based on online problems (Novita et al., 2019; Panfilova et al., 2019; Situmorang et al., 2020). These skills correlate with the affective dimensions which are interpersonal communication and responsibility (Hwang et al., 2019). The challenges in critical thinking implementation are students' skills, learning methods, the structure of class and community, and the teacher's lack of competent and unsupported curriculum (Amin et al., 2020; Tathahira, 2020).

The alternative to facing challenges in primary school is by applying a project based-learning model. According to Tsybulsky & Muchnik-Rozanov (2019), project based-learning is an instructional approach focusing on a student as the center to promote active and deep learning by involving students in investigating real-world problems in a collaborative environment (Burnard, Colucci-Gray & Cooke, 2022; Azevedo et al., 2023). The superiority of the project based-learning model is the potential to help students to learn because it shows the factors in project design that affects motivation and thought, examines the difficulty, as well as illustrates support technology to support students and teachers during working on projects (Abidin et al., 2021; Chen et al., 2019). In addition, project based-learning increases the motivation of students, reach learning goals, develops social and affective capacities, as well as enriches the linguistic knowledge and communication of students to create original and useful projects (Greenier, 2020). A distinctive characteristic of the project based-learning model is an authentic assessment (Aksela et al., 2019).

To develop critical thinking, students have to own communication and problem-solving skills in learning and community (Hwang et al., 2019). Critical thinking and communication skills in Indonesian elementary schools are still weak based on previous researchers (Irwanto et al., 2019; Syahrin et al., 2019). It is because elementary school students are not provided with methods to foster critical thinking skills in learning. Learning in elementary schools in Indonesia still only pushes students for memorizing concepts, centering on the teacher, so students do not get the chance to solve problems critically. Besides, rather than encourage them to explore new ideas or rethink conclusions that already exist, schools only encourage students to give correct answers (Abidin et al., 2021). Project based-learning with teams is more effective in improving the academic skills and performance of students (Al-Shaye, 2021; Plotnikova & Strukov, 2019).

Besides themes to foster critical thinking skills in learning, teachers can use discussion and debate methods. It provides opportunities and stimulates students to ask questions. Discussion and debate can motivate students to examine a particular theme deeply and comprehensively. Students also can identify

problems without teacher intervention, so that students feel free to explore diverse perspectives. On the other hand, asking questions is a core part of learning and finding knowledge. The curiosity of students as an initiative for critical thinking has to be developed by teachers (Baier et al., 2019; Aman & Wallner, 2022). It will provoke students by asking with various methods and finding their answers (Greenier, 2020; Moghaddas & Khoshsaligheh, 2019).

Students who have problem-solving skills have critical thinking skills because they have the ability and disposition to involve prior knowledge, mathematical reasoning, and cognitive strategies to generalize, and prove or evaluate mathematical situations (Ahdhianto et al., 2020; Mohammadi, Abbasian & Siyyari, 2022). The successes of project based-learning to improve critical thinking skills have been reported in some countries such as Iran, Australia, and Portugal (Sumarni & Kadarwati, 2020). Moreover, In Indonesia, there are no studies on the impact of project learning to improve critical thinking and interpersonal communication skills in elementary schools.

The curriculum in elementary schools has to be integrative cognitive, affective, and psychomotor learning. Besides, students have to be equipped with work together interpersonal communication skills (Pardede, 2020; Succi & Canovi, 2020). The research aim is to analyze the effect of Javanese comics-based learning to improve critical thinking and interpersonal skills in fifth-grade students.

1.2. Purpose of study

In previous research about project-based learning, Günay et al., (2019) and Nugraeni (2014) concluded that the project-based learning model influences critical thinking skills. While the research conducted (Asih & Ellianawati, 2019) stated that the project-based learning model was an influence on communication skills. The results of the research concluded that the project-based STEM model can improve critical thinking skills and communication skills (Oktavia & Ridlo, 2020). Meanwhile, (Kurnia, 2020; Yonanda et al., 2019) concluded that, from their research results comic media can be used to improve critical thinking skills. Furthermore, research results (Ghofur, 2022), show that comic media can effectively improve communication skills. Therefore, this study intends to complement previous research by integrating Project Based learning models and Javanese comic media to improve students' critical thinking skills and interpersonal communication.

2. Materials and Methods

This study was conducted using a quasi-experimental design pre- and post-test with groups for six weeks in elementary school. The experimental research design was used to evaluate the effectiveness and impacts of programs that emphasize the use of comparative data as a context for interpreting findings (Funder & Ozer, 2019). This study compares critical thinking and interpersonal communication skills between experimental group students who were taught using Javanese comics project-based learning and control group students who were taught using the conventional method for six weeks in one semester (Table 1).

Table 1

Design of nonequivalent pre-test and post-test control groups

Group	Pre-test	Treatment	Post-test
Experimental	O1	Javanese comics project-based learning	O2
Control	O3	conventional method	O4

2.1. Participants

The implementation time of this research was the even semester in the 2019/2020 academic year. The research procedure starts from selecting the population of this study were students of class IVA, IVB, IVC, IVD, IVE, and IVF totaling 185 at IT Ikhsanul Fikri, Magelang, Indonesia. The sample is part of the number and characteristics of the population. technique is a sampling technique to determine the sample to be used in the study. The sampling used in this research is random group sampling. This technique is used because the research will be conducted using involves 60 students two classes 6A and 6B out of a total of 6 classes. One class is treated as project-based learning supported by Javanese comics as an experimental class and one class was treated with the conventional model. The samples were 60 students (30 boys and 30 girls) in the fifth-grade elementary school in the first semester of the 2018/2019 academic year in Indonesia. The experimental group and the control group each consisted of 30 students (11 male, 19 female). The average age of the sample was 12 years.

2.2. Data collection instruments

Two instruments were used in this research that was critical thinking and interpersonal communication skills. It consisted of 15 essay questions that covered the concept of Wayang. This tool was designed according to the revised version of Bloom's taxonomy that includes analysis, evaluation, and creation levels (Succi & Canovi, 2020). The instrument of critical thinking skills consisted of making an observation, formulating a hypothesis, conducting a discussion, asking a question, answering a question, making a conclusion, and applying a concept. The minimum and maximum values were obtained by each student that was 0 points and 100 points, respectively. Cronbach's alpha reliability coefficient was calculated as $\alpha = .81$. While interpersonal communication skills were developed by a questionnaire that contained empathy, prosocial attitudes, self-awareness, understanding of social situations and social ethics, problem-solving effectively, and speaking skills with others.

2.3. Procedure

The research was conducted for four months that were from February to May 2019. During the study, students in the experimental group were taught the project model based on javanese comics, while students in the control group were taught the conventional method (Table 2 and Figure 10).

Table 2

Javanese comics project-based learning syntax in experimental groups

Phase model of javanese comics project-based learning	Learning activities
First phase: Problem presentation	Teachers present actual problems and involve students
Second phase: Planning	Through Javanese comics analysis, students were asked to observe texts and to design puppet works according to their intelligence. Study groups based on student characteristics.
	Groups define and identify problems through the project planning guide based on intelligence with javanese comics worksheets
Third phase: Scheduling	Assigning the research schedule: (1) conducting the initial observation, (2) implementing the treatment/research, (3) analyzing data, (4) making the report, and (5) presenting the research results
Fourth phases: Project implementation and monitor	Students conduct observation, investigation, and other activities based on the schedule
	Teachers conduct monitoring learning processes, do research, assist and facilitate groups to develop networks, and others.
	Students organize, analyze hypotheses, and make the generalization

Figure 1
Java Comics

Data on critical thinking and interpersonal communication skills were collected four times through the pre-test and post-test. Before starting the research, the two instruments were applied to both groups as a pre-test. Then, students begin learning for one sub-theme. During the treatment, both groups were taught by the same teacher. After all treatments, the post-test was given to the experimental and control group as an evaluation program.

2.4. Data analysis

Firstly, data analyzes were started by assessing the student's answers on each instrument. Because the sample size was small (less than 30 students), quantitative data was analyzed data by using non-parametric statistics (Mirabbasi et al., 2020). While descriptive statistics are used to obtain sample characteristics which include mean, standard deviation, maximum and minimum scores. The Mann-Whitney U test was carried out to test the average difference between the two groups, and the Spearman rho correlation was used to analyze the correlation between academic achievement and scientific skills. N-gain was used to measure the difference between the pre-test and post-test (Yoga et al., 2020). That was conducted at the 0.05 significance level using the SPSS 26.0 statistical program.

3.   Results

The result showed that the pre-test regarding critical thinking scores was different between both groups based on the U test (Table 3). The critical thinking score of the experimental groups was higher than the control groups. However, the sum of ranks between both groups was not significantly different (U = 250.5; p> 0.05), as well as it was not significantly different between both groups in all sub-dimensions (p> .05). Thus, before treatment, students had the same skills.

Table 3

The pre-test score of critical thinking skills between experimental and control groups

Sub-Dimensions	Group		Mean Rank	Sum of Ranks	Mann-Whitney U	p
Making Observation	Experimental	30	22,75	546	246	0,237
	Control	30	26,25	630		
Formulating hypotheses	Experimental	30	24,42	586	286	0,96
	Control	30	24,58	590		
Conducting discussion	Experimental	30	23,29	559	259	0,501
	Control	30	25,71	617		
Asking skills	Experimental	30	26,06	625,5	250,5	0,29
	Control	30	22,94	550,5		
Answer question skills	Experimental	30	25.50	612.00	264	0,566
	Control	30	23.50	564.00		
Making conclusions	Experimental	30	23,67	568	268	0,675
	Control	30	25,33	608		
Applying concepts	Experimental	30	23,29	559	259	0,501
	Control	30	25,71	617		
Entirety	Experimental	30	26,06	625,5	250,5	0,29
	Control	30	22,94	550,5		

The pre-test score of interpersonal communication skills showed that the control groups were higher than the experimental groups, as well as the same result in all sub-dimensions (Table 4). The mean between both groups was not significantly different (U = 259; p> 0.05). Thus, before treatment, students had the same interpersonal communication skills.

Table 4

The pre-test score of interpersonal communication skills between experimental and control groups

Sub-Dimensions	Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	p
Able to show empathy	Experimental	30	25.50	612.00	264	0,566
	Control	30	23.50	564.00		
Able to show a proportional attitude	Experimental	30	23,67	568	268	0,675
	Control	30	25,33	608		
Able to show self-awareness	Experimental	30	23,29	559	259	0,501
	Control	30	25,71	617		
Able to understand social situations and social ethics	Experimental	30	26,06	625,5	250,5	0,29
	Control	30	22,94	550,5		
Able to solve problems effectively	Experimental	30	24,42	586	286	0,96
	Control	30	24,58	590		
Able to listen effectively	Experimental	30	23,29	559	250,5	0,29
	Control	30	25,71	617		
Able to speak with other people	Experimental	30	25.50	612.00	264	0,566
	Control	30	23.50	564.00		

We evaluated after treatment through post-test, and the result showed that both groups were significantly different (U = 46.50; p <0.05) (Table 5). In detail, there were significantly different between both groups in all sub-dimensions (p <0.05). Students of the experimental groups had sum ranks higher than control groups (the difference was 26.9). This result exhibited the learning of critical thinking intervening in the learning model during application. So that Javanese comics project-based learning significantly affected the critical thinking of students.

Table 5

The achievement score of critical thinking skills through post-test between experimental and control groups

Sub-Dimensions	Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	p
Making Observation	Experimental	30	39,92	1197,50	167,50	0,00
	Control	30	21,08	632,50		
Formulating hypotheses	Experimental	30	41,33	1240,00	125,00	0,00
	Control	30	19,67	590,00		
Conducting discussion	Experimental	30	38,95	1168,50	196,50	0,00
	Control	30	22,05	661,50		
Asking skills	Experimental	30	41,82	1254,50	110,50	0,00
	Control	30	19,18	575,50		
Answer question skills	Experimental	30	40,00	1200,00	165,00	0,00
	Control	30	21,00	630,00		
Making conclusions	Experimental	30	40,88	1226,50	138,50	0,00
	Control	30	20,12	603,50		
Applying concepts	Experimental	30	38,60	1158,00	207,00	0,00
	Control	30	22,40	672,00		
Entirety	Experimental	30	43,95	1318,50	46,50	0,00
	Control	30	17,05	511,50		

The post-test score of interpersonal communication skills between both groups was significantly different (U = 5,00; p <0,05) (Table 6). Students of the experimental groups had a higher mean than the control groups (the difference was 26.9). So that Javanese comics project-based learning significantly affected students' motivation.

Table 6

The post-test score of interpersonal communication skills between experimental and control groups

Sub-Dimensions	Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	p
Able to show empathy	Experimental	30	42,50	1275,00	90,00	0,00
	Control	30	18,50	555,00		
Able to show a proportional attitude	Experimental	30	40,18	1205,50	159,50	0,00
	Control	30	20,82	624,50		
Able to show self-awareness	Experimental	30	36,50	1095,00	270,00	0,003
	Control	30	24,50	735,00		
Able to understand social situations and social ethics	Experimental	30	39,55	1186,50	178,50	0,00
	Control	30	21,45	643,50		
Able to solve problems effectively	Experimental	30	39,40	1182,00	183,00	0,00
	Control	30	21,60	648,00		
Able to listen effectively	Experimental	30	40,30	1209,00	156,00	0,00
	Control	30	20,70	621,00		
Able to speak with other people	Experimental	30	45,33	1360,00	5,00	0,00
	Control	30	15,67	470,00		

Table 7

The N-gain score between experimental and control groups

Critical thinking			Interpersonal communication	
Group	Experimental	Control	Group	Kontrol
Post-test	88.15	70.45	Post-test	15,48
Pre-test	55.65	55.45	Pre-test	10,90
N-Gain	0.75	0.36	N-Gain	0,45
Category	High	Moderate	Category	Moderat

Table 8

The rho Spearman correlation between critical thinking and interpersonal communication skills

	Critical thinking	N	p
Interpersonal communication	r = 0.643**	60	0.005

** p <0.01

The N-gain score of the experimental groups (0.79) was higher in both dependent variables than in the control groups (0.75) (Table 7). Moreover, communication interpersonal, and critical thinking skills had a strong positive correlation (r = 0.643; p <0,05) (Table 8). Thus, the increase of communication skills through javanese comics project-based learning can improve the critical thinking of students.

4. Discussion

Critical thinking in the learning classroom requires the right method (Maison et al., 2020). In this study, both groups showed the same score of critical thinking and interpersonal communication skills. Students who are taught by conventional methods will lack critical thinking skills (Al-Husban, 2020; Mardi, 2021). Students lack interpersonal communication skills because they do not have a pro-social attitude and problem-solving skills. Furthermore, in conservative teaching, students are taught passively. Thus, they do not develop their cognitive, affective, and psychomotor skills (Ardhyantama & Widodo, 2020; Susanti et al., 2019).

The results of the analysis showed that the N-gain scores of students in the control groups increase slightly, but both their pre-test and post-test were moderate. Moreover, students in the experimental groups had an increased score from moderate to high after learning. Further research is needed to examine the effect of the project learning model on critical thinking and interpersonal communication skills in terms of junior, senior, or university level. In this research, there were no methods applied to the control groups. The next similar research can compare this method with other constructivist learning methods, such as problem-based learning, inquiry-based learning, guided inquiry based-learning, group investment based-learning, or other methods that have the potential impact. The teaching method is one of the most important factors in improving the learning outcomes of knowledge, attitudes, and skills and the key to being a lifelong learner (Luka, 2019).

The results of the analysis showed that the n-gain scores of students in the control group slightly increased, but both their pre-test and post-test were moderate. In addition, students in the experimental group experienced an increase in critical thinking skills and interpersonal communication scores from moderate to high after learning. This research is supported by (Oktavia & Ridlo, 2020) concluding that the Project Based STEM model influences critical thinking skills and communication skills. Meanwhile, (Ghofur, 2022; Kurnia, 2020; Yonanda et al., 2019) concluded that from the results of their research comic media improved critical thinking skills and communication skills. Therefore, the researcher intends to complement the previous research by combining Project Based learning models and Javanese comic media to improve critical thinking skills and interpersonal communication in Javanese language subjects.

This project with comics aims to improve students' critical thinking and interpersonal communication skills. Aspects of critical thinking that are measured include: making observations, formulating hypotheses, conducting discussion, asking skills, answering questions skills, making conclusions, applying concepts, and entirety. Therefore, Aspects of interpersonal communication that are measured include the ability to show empathy, able to show proportional attitude, able to show self-awareness, able to understand social situations and social ethics, able to solve problems effectively, able to listen effectively, and able to speak with other people. The results of the development are carried out in seven stages, namely: Problem presentation, Planning, Scheduling with comic Java, Project implementation, and monitoring.

5. Conclusion

In conclusion, the use of Javanese comics-based projects on critical thinking and interpersonal communication skills have been compared with conventional teaching models. Based on the analysis at the end of learning, Javanese comics project-based learning has a positive impact on critical thinking and interpersonal communication skills. There was a high increase that knowledge and skills in the experimental groups than in the control groups.

Further research is needed to examine the effect of the project learning model on critical thinking skills and interpersonal communication in terms of junior, senior high, or tertiary education levels. In this study, there were no methods applied to the control group. Subsequent similar studies can compare this with other constructivist learning methods, such as problem-based learning, inquiry-based learning, guided inquiry learning, group investment learning, or other methods that have the potential to have a large impact. The teaching method is one of the most important factors in improving the learning outcomes of knowledge, attitudes, and skills and the key to being a lifelong learner.

As for the recommendation from the research that has been carried out by the researcher, it is hoped that the reader can analyze more deeply the ways to increase critical thinking and communication interpersonal skills in learning. This can be supported by other research studies that collaborate models and media in learning.

Acknowledgments

References

Abidin, Z., Sutama, Herman, T., Jupri, A., Farokhah, L., Apuanor, & Sonedi. (2021). Gifted Children's Mathematical Reasoning Abilities on Problem-Based Learning and Project-Based Learning Literacy. *Journal of Physics: Conference Series*, 1720(1), 0–6. https://doi.org/10.1088/1742-6596/1720/1/012018

Ahdhianto, E., Marsigit, Haryanto, & Nurfauzi, Y. (2020). Improving fifth-grade students' mathematical problem-solving and critical thinking skills using problem-based learning. *Universal Journal of Educational Research*, 8(5), 2012–2021. https://doi.org/10.13189/ujer.2020.080539

Aksela, M., Haatainen, O., Aksela, M., & Haatainen, &. (2019). Project-Based Learning (PBL) in Practice: Active Teachers' Views of Its' Advantages and Challenges. 9–16.

Al-Husban, N. A. (2020). Critical Thinking Skills in Asynchronous Discussion Forums: A Case Study. *International Journal of Technology in Education*, 3(2), 82. https://doi.org/10.46328/ijte.v3i2.22

Al-Shaye, S. (2021). Cypriot Journal of Educational skills, and self-regulated learning skills. *Cypriot Journal of Educational Sciences,* 16(4), 2049–2069. https://www.ceeol.com/search/article-detail?id=1013147

Aman, R., & Wallner, L. (2022). Introduction: Teaching with Comics: Empirical, Analytical, and Professional Experiences. In *Teaching with Comics: Empirical, Analytical, and Professional Experiences* (pp. 1-13). Cham: Springer International Publishing. https://link.springer.com/chapter/10.1007/978-3-031-05194-4_1

Amin, A. M., Corebima, A. D., Zubaidah, S., & Mahanal, S. (2020). The correlation between metacognitive skills and critical thinking skills at the implementation of four different learning strategies in animal physiology lectures*. European Journal of Educational Research*, 9(1), 143–163. https://doi.org/10.12973/eu-jer.9.1.143

Ardhyantama, & Widodo. (2020). Creativity Skill Proses in Project Based Learning: A Case Study of Distance Learning in Pacitan. *Randwick International of Education and Linguistics*, 1(2), 152–158. http://www.randwickresearch.com/index.php/rielsj/article/view/82

Asih, N. F., & Ellianawati, E. (2019). The Enhancement of Verbal Communication Skills for Vocational Students through Project-Based Learning Physics. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, 5(1), 21–28. https://doi.org/10.21009/1.05103

Azevedo, R., Rosário, P., Núñez, J. C., Vallejo, G., Fuentes, S., & Magalhães, P. (2023). A school-based intervention on elementary students' school engagement. *Contemporary Educational Psychology*, 102148. https://www.sciencedirect.com/science/article/pii/S0361476X23000024

Baier, F., Decker, A.-T., Voss, T., Kleickmann, T., Klusmann, U., & Kunter, M. (2019). What makes a good teacher? The relative importance of mathematics teachers' cognitive ability, personality, knowledge, beliefs, and motivation for instructional quality. *British Journal of Educational Psychology*, 89(4), 767–786. https://doi.org/10.1111/bjep.12256

Burnard, P., Colucci-Gray, L., & Cooke, C. (2022). Transdisciplinarity: Re-visioning how sciences and arts together can enact democratizing creative educational experiences. *Review of Research in Education*, *46*(1), 166-197. https://journals.sagepub.com/doi/pdf/10.3102/0091732X221084323

Chen, S. Y., Lai, C. F., Lai, Y. H., & Su, Y. S. (2019). Effect of project-based learning on development of student's creative thinking. *International Journal of Electrical Engineering Education*. https://doi.org/10.1177/0020720919846808

Coman, C., Țîru, L. G., Meseșan-Schmitz, L., Stanciu, C., & Bularca, M. C. (2020). Online teaching and learning in higher education during the coronavirus pandemic: Students' perspective*. Sustainability (Switzerland)*, 12(24), 1–22. https://doi.org/10.3390/su122410367

Diadjeng S, W. (2021). Team Convergence in Prevention and Reduction of Stunting Rate in Malang District, East Java, Indonesia. *Bioscience Biotechnology Research Communications*, 14(5), 133–140. https://doi.org/10.21786/bbrc/14.5/26

Funder, D. C., & Ozer, D. J. (2019). Evaluating Effect Size in Psychological Research: Sense and Nonsense. *Advances in Methods and Practices in Psychological Science*, 2(2), 156–168. https://doi.org/10.1177/2515245919847202

Ghofur, A. (2022). Digital Comic Media on Smartphones to Improve Communication Skills. *Journal of Innovation in Educational and Cultural Research*, 3(3), 432–444. http://jiecr.org/index.php/jiecr/article/view/149

Greenier, V. T. (2020). The 10Cs of project-based learning TESOL curriculum. *Innovation in Language Learning and Teaching*, 14(1), 27–36. https://doi.org/10.1080/17501229.2018.1473405

Günay, C., Doloc-Mihu, A., Gluick, T., & Moore, C. A. (2019). Project-Based Learning Improves Critical Thinking for Software Development Students. *Session 3C Lightning Talk*, 19(3–5), 105–105. https://doi.org/10.1145/3349266.3351362

Hasanah, H., & Malik, N. (2020). Cypriot Journal of Educational. *Cypriot Journal of Educational Sciences*, 15(1), 104–111. https://www.academia.edu/download/84712396/4418.pdf

Hwang, C., Liu, H., & Salusso, C. J. (2019). Social responsibility initiative: examining the influence of a collaborative service-learning project on student learning. International Journal of Fashion Design, *Technology, and Education*, 12(3), 356–363. https://doi.org/10.1080/17543266.2019.1652854

Irwanto, Saputro, A. D., Rohaeti, E., & Prodjosantoso, A. K. (2019). Using inquiry-based laboratory instruction to improve critical thinking and scientific process skills among preservice elementary teachers. *Eurasian Journal of Educational Research*, 2019(80), 151–170. https://doi.org/10.14689/ejer.2019.80.8

Ishtiaq Khan, R. M., Radzuan, N. R. M., Farooqi, S. U. H., Shahbaz, M., & Khan, M. S. (2021). Learners' perceptions on WhatsApp integration as a learning tool to develop EFL vocabulary for speaking skill. *International Journal of Language Education*, 5(2), 1–14. https://doi.org/10.26858/ijole.v5i2.15787

Johnson, C. C., Walton, J. B., Strickler, L., & Elliott, J. B. (2023). Online teaching in K-12 education in the United States: A systematic review. *Review of Educational Research*, *93*(3), 353-411. https://journals.sagepub.com/doi/abs/10.3102/00346543221105550

Kurnia, Y. P. (2020). Implementation of Problem-Based Learning Assisted with Science Comic Books to Improve Critical Thinking Skills of Elementary Students. *Journal of Primary Education*, 9(2), 186–192. https://journal.unnes.ac.id/sju/index.php/jpe/article/view/27799

Li, M., Chen, Y. T., Huang, C. Q., Hwang, G. J., & Cukurova, M. (2023). From motivational experience to creative writing: A motivational AR-based learning approach to promoting Chinese writing performance and positive writing behaviours. *Computers & Education*, 104844. https://www.sciencedirect.com/science/article/pii/S0360131523001215

Loyens, S. M., Van Meerten, J. E., Schaap, L., & Wijnia, L. (2023). Situating higher-order, critical, and critical-analytic thinking in problem-and project-based learning environments: A systematic review. *Educational Psychology Review*, *35*(2), 39. https://link.springer.com/article/10.1007/s10648-023-09757-x

Luka, I. (2019). Creating a Culture-Based Language Learning Course for Developing Adult Learners' 21st Century Skills. *Journal of Education Culture and Society*, 10(2), 151–169. https://doi.org/10.15503/jecs20192.151.169

Maison, M., Haryanto, H., Ernawati, M. D. W., Ningsih, Y., Jannah, N., Puspitasari, T. O., & Putra, D. S. (2020). Comparison of student attitudes towards natural sciences. *International Journal of Evaluation and Research in Education*, 9(1), 54–61. https://doi.org/10.11591/ijere.v9i1.20394

Mardi. (2021). Development of Students' Critical Thinking Skills Through Guided Discovery Learning (GDL) and Problem-Based Learning Models (PBL) in Accountancy Education. *Eurasian Journal of Educational Research*, 95(1), 210–226. https://eric.ed.gov/?id=EJ1321907

Mirabbasi, R., Ahmadi, F., & Jhajharia, D. (2020). Comparison of parametric and non-parametric methods for trend identification in groundwater levels in Sirjan plain aquifer, Iran. *Hydrology Research*, 51(6), 1455–1477. https://doi.org/10.2166/nh.2020.041

Moghaddas, M., & Khoshsaligheh, M. (2019). Implementing project-based learning in a Persian translation class: a mixed-methods study. *Interpreter and Translator Trainer*, 13(2), 190–209. https://doi.org/10.1080/1750399X.2018.1564542

Mohammadi, M., Abbasian, G. R., & Siyyari, M. (2022). Adaptation and validation of a critical thinking scale to measure the 3D critical thinking ability of EFL readers. *Language Testing in Asia*, *12*(1), 1-26. https://languagetestingasia.springeropen.com/articles/10.1186/s40468-022-00173-6

Novita, R., Putra, M., & Johar, R. (2019). Using scientific methods to enhance early childhood students' geometry thinking. *Elementary Education Online*, 18(4), 2078–2093. https://doi.org/10.17051/ilkonline.2019.639421

Nugraeni, D. (2014). Cerita rakyat makam Kyai Raden Santri (Pangeran Singasari) di Desa Gunungpring, kecamatan Muntilan, Kabupaten Magelang. In Universitas Negeri Yogyakarta (Vol. 8, Nomor 33).

Nurhana, F., & Abdullah, A. A. (2021). Effectiveness of Contextual Teaching and Learning on The Ability to Mathematical Relational Understanding in Junior High School. *Eduma: Mathematics Education Learning and Teaching*, 10(2), 198. https://doi.org/10.24235/eduma.v10i2.9087

Oke, A., & Fernandes, F. A. P. (2020). Innovations in teaching and learning: Exploring the perceptions of the education sector on the 4th industrial revolution (4IR*). Journal of Open Innovation: Technology, Market, and Complexity*, 6(2). https://doi.org/10.3390/JOITMC6020031

Oktavia, Z., & Ridlo, S. (2020). Critical Thinking Skills Reviewed from Communication Skills of the Primary School Students in STEM-Based Project-Based Learning Model. *Journal of Primary Education*, 9(3), 311–320. https://doi.org/10.15294/jpe.v9i3.27573

Panfilova, E. E., Demkina, O. V., Galichkina, M. A., Istomina, A. I., Latysheva, V. V., & Teymurova, V. E. (2019). Learning models based on a real project in entrepreneurial education. *Journal of Entrepreneurship Education*, 22(2), 1–6. https://www.academia.edu/download/77461018/Teymurova-Vusale-3.pdf

Pardede, P. (2020). Integrating the 4Cs into EFL Integrated Skills Learning. *Journal of English Teaching*, *6*(1), 71-85. https://eric.ed.gov/?id=EJ1266047

Plotnikova, N. F., & Strukov, E. N. (2019). Integration of teamwork and critical thinking skills in the process of teaching students. *Cypriot Journal of Educational Sciences*, 14(1), 1–10. https://doi.org/10.18844/cjes.v14i1.4031

Rozal, E., Ananda, R., Zb, A., Fauziddin, M., & Sulman, F. (2021). The Effect of Project-Based Learning through YouTube Presentations on English Learning Outcomes in Physics. *AL-ISHLAH: Jurnal Pendidikan*, 13(3), 1924–1933. http://www.journal.staihubbulwathan.id/index.php/alishlah/article/view/1241

Situmorang, M., Purba, J., & Silaban, R. (2020). Implementation of an innovative learning resource with project to facilitate active learning to improve students' performance on chemistry. *Indian Journal of Pharmaceutical Education and Research*, 54(4), 905–914. https://doi.org/10.5530/ijper.54.4.184

Succi, C., & Canovi, M. (2020). Soft skills to enhance graduate employability: comparing students and employers' perceptions. *Studies in Higher Education*, 45(9), 1834–1847. https://doi.org/10.1080/03075079.2019.1585420

Sumarni, & Kadarwati. (2020). Ethno-Stem Project-Based Learning: Its Impact to Critical and Creative Thinking Skills. *Jurnal Pendidikan IPA Indonesia*, 1(11), 11. https://journal.unnes.ac.id/nju/index.php/jpii/article/view/21754

Supena, I., Darmuki, A., & Hariyadi, A. (2021). The influence of learning model on students' learning outcomes. *International Journal of Instruction*, 14(3), 873–892. https://eric.ed.gov/?id=EJ1304598

Susanti, Susilowibowo, J., & Tantri Hardini, H. (2019). Effectiveness of Project-based Learning Models to Improve Learning Outcomes and Learning Activities of Students in Innovative Learning. *KnE Social Sciences*, 3(11), 82. https://doi.org/10.18502/kss.v3i11.4000

Syahrin, A., Dawud, Suwignyo, H., & Priyatni, E. T. (2019). Creative thinking patterns in students' scientific works. *Eurasian Journal of Educational Research*, 2019(81), 21–36. https://doi.org/10.14689/ejer.2019.81.2

Tathahira, T. (2020). Promoting Students' Critical Thinking Through Online Learning in Higher Education: Challenges and Strategies. *Englisia: Journal of Language, Education, and Humanities*, 8(1), 79. https://doi.org/10.22373/ej.v8i1.6636

Tsybulsky, D., & Muchnik-Rozanov, Y. (2019). The development of student-teachers' professional identity while team-teaching science classes using a project-based learning approach: A multi-level analysis. *Teaching and Teacher Education*, 79, 48–59. https://doi.org/10.1016/j.tate.2018.12.006

Istiningsih, G., Sugito, S. & Jabar, C. S. A. (2023). An elementary school project-based learning program based on a Javanese comic. *International Journal of Innovative Research in Education, 10*(1),90-102 https://doi.org/10.18844/ijire.v10i1.8960

Villena-Taranilla, R., Tirado-Olivares, S., Cozar-Gutierrez, R., & González-Calero, J. A. (2022). Effects of virtual reality on learning outcomes in K-6 education: A meta-analysis. *Educational Research Review*, 100434. https://www.sciencedirect.com/science/article/pii/S1747938X22000033

Yoga, P., Balamuralikrishnan, R., & Selvakumar, K. (2020). A Scientific Study on Efficacy of Yogic Package on Resting Pulse Rate Among Obese School Students. *Journal of Information and Computational Science*, 483.

Yonanda, D. A., Yuliati, Y., & Saputra, D. S. (2019). Development of Problem-Based Comic Book as Learning Media for Improving Primary School Students' Critical Thinking Ability. *Mimbar Sekolah Dasar*, 6(3), 341–348. https://doi.org/10.17509/mimbar-sd.v6i3.22892