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# The Socio-scientific Issues in PjBL: Impact on Digital Literacy of Senior High School Students

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**Abstract**: Digital literacy can be provided by the implementation of the project-based learning (PjBL) model in the learning process. This research aims to obtain information regarding the effect of socio-scientific issues (SSI)-integrated PjBL on high school students' digital literacy, especially on Circulatory System material. The method used is a pre-experiment with a one-group pre-test-post-test research design. The research subjects are 35 grade XI students of one of the senior high schools in Bandung. Data on students' scientific literacy abilities were collected by using a digital literacy questionnaire containing statements based on six digital literacy indicators, namely communication and collaboration, critical thinking, data literacy, ICT familiarity, device security, and personal security. Processing and analysis of research data uses the Wilcoxon test. The research results show the implementation of SSI-integrated PjBL by creating projects in the form of popular articles can increase students' digital literacy as indicated by an increase in the average percentage of pre-test and post-test scores from 78.45% to 88.66%. The increase in the average percentage of pre-test and post-test scores based on the N-Gain calculation results is in the medium category with an N-Gain score of 0.5069. The implementation of SSI-integrated PjBL can increase the average percentage score for each digital literacy indicator with the highest average score increase obtained by the ICT familiarity indicator. Therefore, it is concluded that the implementation of SSI-integrated PjBL has an effect on digital literacy and can be used as an alternative learning model that can encourage the improvement of students' digital literacy.

**Keywords**: blood circulatory system, digital literacy, project-based learning, socioscientific issues

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## INTRODUCTION

The development of information and communication technology (ICT) has had a lot of effects on human life, one of which is in the field of education. In education, the development of ICT has reconstructed and changed the learning and teaching context so that the quality of education can improve. Changes in the world of education occur in several aspects, such as increasing student activity in learning, providing important tools and technology to access learning resources, increasing teacher professional development, and increasing administrative efficiency and accessibility of learning resources (Sharma et al., 2018; Kumar & Mohite, 2017; Reddy et al., 2017). This statement shows that the development of the digital world has an impact on human life, one of which is in the field of education, so students need to be equipped with 21st-century skills.

One of the 21st-century skills that students must have is digital literacy. List (2019) states that digital literacy is a series of skills or competencies needed to interact in a digital environment successfully. This digital literacy includes understanding and skills in using various digital media, whether digital communication devices or internet networks, to search for, evaluate, create information, use information wisely, and foster good digital interaction and communication (Hanik, 2020).

In Indonesia, skills and knowledge in using digital media have not yet reached a good level. This is shown by the national digital literacy survey in 2022 conducted by the Ministry of Communication and Information in collaboration with the Katadata Insight Center (KIC), showing that

the digital literacy status of Indonesian society in 2022 is still at a moderate level (Agustini, 2023). The results of research conducted by Perdana et al. (2019) show that the digital literacy of grades X and XI students of high schools is still at a low level so learning that utilizes ICT needs to be developed in the high school curriculum. Research conducted by Oktavia (2021) also shows that high school students' digital literacy is in the low category because there is still a lack of use of information technology by teachers in schools. In Biology learning, students' digital literacy is still relatively low. This is shown by the research results of Ananda et al. (2023) which reveal that students' digital literacy in biology learning is relatively low with an average score percentage for each digital literacy indicator of 37.68%. Based on this explanation, it can be stated that students' digital literacy in Indonesia still needs to be improved towards a better direction. Increasing digital literacy is needed because digital literacy brings many benefits to human life, including students, one of which is preparing students to be able to interpret global information so that it can increase their understanding of learning (Tierney, 2018).

One effort to provide digital literacy is by the implementation of an appropriate learning model. The learning model that can be applied to increase digital literacy in high school students is the project-based learning (PjBL) model (Suminarsih, 2023). The implementation of the PjBL model can help students to increase digital literacy, including in choosing the media used to do assignments, looking for appropriate literature sources for completing assignments, assessing the truth of information, and analyzing and interpreting various information, as a tool for communicating ideas, being responsible in terms of security in using digital platforms, developing abilities in problem-solving, and using various technological devices in creating digital information (Kustini et al., 2021). Research by Saraha et al. (2022) also shows that most students use various devices, such as laptops to create projects, especially in looking for sources of information to solve problems and collaborate with other students. This means that as long as project-based learning is carried out, students will be in contact with the digital world from the project design stage to project creation so their digital literacy will be increasingly strained. Kendrick et al. (2022) state that project activities using digital storytelling can improve communication skills and complex critical thinking, increase digital literacy, and increase identity affirmation.

In its application, PjBL involves students in investigating problems that will ultimately produce a product. The problems presented in learning can be issues that develop in society and these issues develop over time or are usually called socio-scientific issues (SSI). SSI is a type of issue often highlighted by mass media (Ratcliffe & Grace, 2003) so good digital literacy skills are needed to interpret information globally (Tierney, 2018). The information students get from digital media helps them solve existing problems (Gok, 2010). Thus, it can be said that SSI can be integrated into the PjBL model so that learning becomes more meaningful.

One of the materials that can be taught using the SSI-integrated PjBL model is the human circulatory system. Issues related to SSI in this material can include disorders of the circulatory system, for example, issues related to stroke and heart disease which are the main causes of death in Indonesia. In their learning activities, students can discuss in groups to find solutions to either prevent or overcome the disease. The product of PjBL activities can be in the form of popular articles about how to overcome/prevent disorders or abnormalities in the circulatory system through several online articles.

Based on the background described above, it can be stated that the PjBL model can affect digital literacy. However, research combining PjBL with SSI is still rare. Therefore, it is necessary to research the effect of the SSI-integrated PjBL model on high school students' digital literacy. The problem in this research is how the SSI-integrated PjBL model affects high school students' digital literacy. The problem is further explained in the following two research questions.

1) What does students' digital literacy before and after the implementation of the SSI-integrated PjBL model look like?
2) What is students' digital literacy like based on indicators before and after the implementation of the SSI-integrated PjBL model?

## METHOD

The method used in this research is pre-experimental with a one-group pre-test-post-test design. In this design, the researcher uses one sample group to serve as the experimental group and does not involve a control group as a comparison. In its implementation, research subjects did a pre-test (O1) in the form of a digital literacy questionnaire to see their initial abilities regarding digital literacy. Next,


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the student group was given treatment X, namely the use of the SSI-integrated PjBL model in the Circulatory System material. At the end of the lesson, students did a post-test (O2) in the form of a student digital literacy questionnaire to see whether there was an increase in scores from the pre-test results they obtained. An overview of the research design used is listed in Table 1 below.

**Table 1.** Research design

| *Pre-test* | Treatment (X) | *Post-test* |
|---|---|---|
| $O_1$ | X | $O_2$ |

Notes:

O1: Pre-test students' digital literacy before learning
O2: Post-test of students' digital literacy after learning
X: Implementation of the SSI-integrated PjBL model

The sample in this research is 35 grade XI students of one of the high schools in Bandung. The sample was established by using the purposive sampling technique with the consideration that all students involved in the research had cellphones or laptops that were used to using them, and had cognitive abilities that tended to be homogeneous in biology learning.

The type of instrument used is a non-test instrument in the form of a digital literacy questionnaire containing 24 statements with a four-point Likert scale arranged based on six digital literacy indicators, namely communication and collaboration, critical thinking, data literacy, ICT familiarity, device security, and personal security (CSIS, 2022). The description of the digital literacy indicators can be seen in Table 2.

**Table 2.** Digital Literacy Indicators

| No | Indicators | Indicator Definition |
|---|---|---|
| 1 | *Communication and collaboration* | Ability to interact with other people through various types of digital technology, determine the means of communication in certain contexts, and use digital technology for collaborative processes |
| 2 | *Critical thinking* | Ability to critically analyze, compare, and evaluate data sources, information, and digital content |
| 3 | *Data literacy* | Ability to store, manage, organize, and retrieve data, information, and content in digital media. |
| 4 | *ICT familiarity* | Ability to use digital technology tools, such as the ability to connect to a Wi-Fi network and download software/applications, and basic internet skills |
| 5 | *Device security* | Ability to protect digital devices from risks and threats in the digital environment |
| 6 | *Personal security* | Ability to protect personal data and privacy in the digital environment to protect against digital crime |

This questionnaire is given in the form of a pre-test and post-test to students. Before being used to collect data, the questionnaire was tried out and a validity test was carried out to ensure that the questionnaire was valid. The digital literacy questionnaire data obtained were converted into percentages and interpreted using digital literacy criteria according to Arikunto (2013). The details of the digital literacy percentage criteria are listed in Table 3.


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**Table 3** Category of Digital Literacy Percentages

| % Literacy Score | Category |
|---|---|
| $x \leq 20$ | Very Low |
| $20 < x \leq 40$ | Low |
| $40 < x \leq 60$ | Average |
| $60 < x \leq 80$ | High |
| $x > 80$ | Very High |

The data from the pre-test and post-test results were then subjected to statistical tests in the form of normality test, Wilcoxon test, and N-Gain using SPSS Version 25. The N-Gain calculation used the following calculation formula.

$$N - Gain = \frac{Posttest\ Score - Pretest\ Score}{Maximum\ Score - Pretest\ Score}$$

Next, the calculated N-Gain values were grouped into three categories according to Hake (1999). N-Gain categories are listed in Table 4.

**Table 4** N-Gain Score Categories

| % Literacy Score | Categories |
|---|---|
| $g > 0.70$ | High |
| $0.30 > g < 0.70$ | Fair |
| $g < 0.30$ | Low |

## FINDINGS AND DISCUSSION

In the SSI-integrated PjBL model, the project given is in the form of creating a popular article on how to overcome/prevent disorders/abnormalities in the human circulatory system. The results of the digital literacy questionnaire in the form of the scores of a pre-test administered at the start of the lesson and those of a post-test administered at the end of the lesson were analyzed to determine the effect of the SSI-integrated PjBL model on human circulatory system material on digital literacy. The scores obtained were converted into percentages. The data obtained were then analyzed using SPSS Version 25. Descriptive analysis for student pre-test and post-test data can be seen in Table 5.

**Table 5.** Recapitulation of Student Digital Literacy Statistic Analysis

| Data Type | | *Pre-test* | *Post-test* |
|---|---|---|---|
| N | | 35 | 35 |
| Mean | | 78.45% | 88.66% |
| Standard Deviation | | 6.18% | 6.96% |
| Maximum Score | | 89.58% | 97.92% |
| Minimum Score | | 65.63% | 73.96% |
| Normality Test | Sig | 0.337 | 0.008 |
| (*Shapiro Wilk*) | Int | Normal | Not Normal |
| Hypothesis Test | Sig | 0.000 | |
| *Wilcoxo*n | Int | Significant diffence | |
| Calculating N-Gain | Mean | 0.5069 | |
| | Int | Fair | |

Table 5 shows that there has been an increase in the average digital literacy score from 78.45% (High Category) to 88.66% (Very High Category). This shows that there has been an increase in the average digital literacy score percentage of 10.21%. The finding that the average digital literacy score of students was already in the high category before the implementation of the SSI-integrated PjBL model was because during the pandemic students were required to be able to use technology in learning so that learning took place well. This condition means that students already have good digital literacy skills. These findings follow the results of A'yun's research (2021) which revealed that the use of digital platforms, such as Zoom, Google Meet, Google Drive, and Google Documents during online learning


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trains students' digital literacy as evidenced by the students' digital literacy scores, most of which are in the high category.

The data from the pre-test and post-test results then underwent a normality test. This normality test aimed to find out whether or not the data obtained were normal. The level of significance used was 5% as the basis for the decisions taken. If the significance value was greater than 0.05 then the data were normal. The normality test results can be seen in Table 5. The normality test results in Table 5 show that the pre-test data are normally distributed because it obtained a significant value of 0.337. Fairly, the post-test data are not normally distributed because it obtained a significant value of 0.008. Because there were abnormal data, the test continued with non-parametric hypothesis testing. The non-parametric test carried out was the Wilcoxon test. The results of the Wilcoxon test can be seen in Table 5. The results of testing using the Wilcoxon test show that the significance value of the data is 0.000, where this value is smaller than α (0.05), so it can be concluded that there is a significant difference between the digital literacy of high school students before and after the implementation of the SSI-integrated PjBL model. The significant difference in digital literacy scores can be seen from the increase in the average percentage of digital literacy scores of 10.21% in Table 5. These results are also supported by processing the results of students' digital literacy questionnaires based on digital literacy percentage categories according to Arikunto (2013). The digital literacy score percentage category consists of very low, low, fair, high, and very high. The percentage distribution of students in each digital literacy category during the pre-test and post-test is presented in Figure 1.

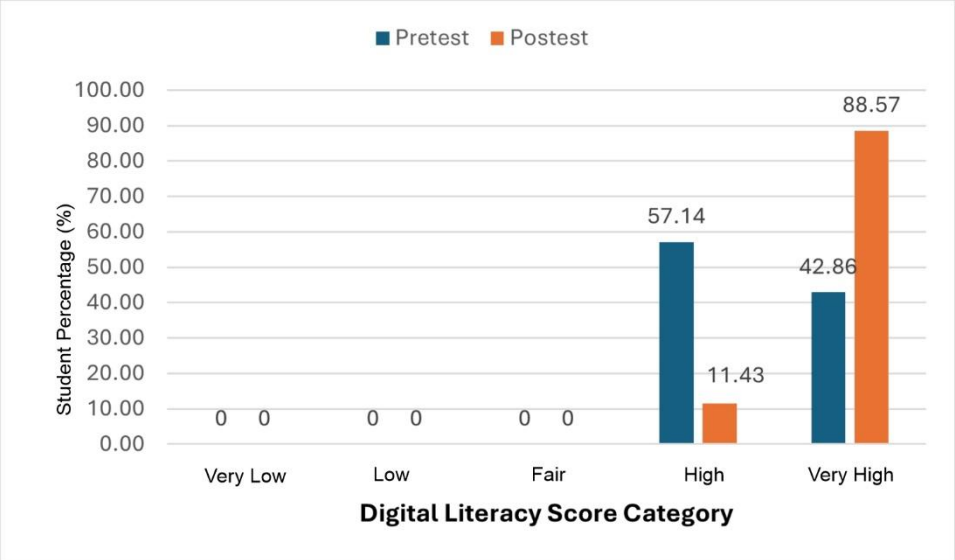


Figure 1. Percentage distribution of students in each digital literacy category during pre-test and post-test

Figure 1 shows the percentage of students in each digital literacy category before and after the implementation of the SSI-integrated PjBL model on blood circulatory system material. Figure 4.9 shows that the digital literacy of students in the high category has decreased in percentage from 57.14% before the implementation of the SSI-integrated PjBL model to 11.43% after the implementation of the SSI-integrated PjBL model. However, it can be seen in the figure that the percentage of digital literacy of students in the very high category has increased from 42.86% before treatment to 88.57% after the implementation of the SSI-integrated PjBL model. These results show that after the implementation of the SSI-integrated PjBL model, more students had a digital literacy score in the very good category so it can be stated that the implementation of the SSI-integrated PjBL model can improve students' digital literacy. Because there was an increase between the pre-test and post-test results, an N-gain calculation was carried out to see the criteria for increasing students' digital literacy scores. The N-Gain calculation carried out using SPSS as shown in Table 5 shows a figure of 0.5069, meaning that the effectiveness of the implementation of the SSI-integrated PjBL model in increasing digital literacy is in the fair category according to the N-Gain score criteria developed by Hake (1999). The N-Gain results are classified in


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the fair category because most of the N-Gain values from the students' digital literacy scores are in the fair category as shown in Figure 2 below.

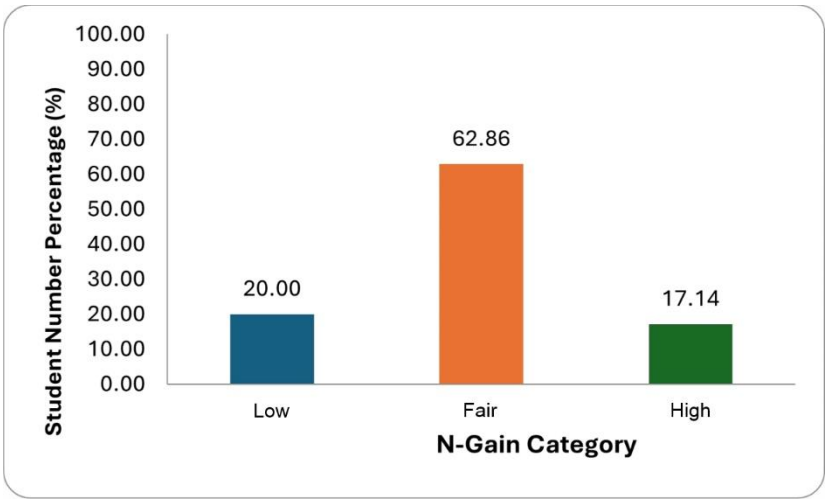


**Figure 2.** Percentage Distribution of Students in Each N-Gain Category

Figure 2 shows the distribution of students' N-Gain digital literacy scores. Figure 2 shows that the N-Gain score for students' digital literacy is dominated by the fair category with the percentage of students included in the fair category being 62.86% of students. There are 17.14% of students with an N-Gain score in the high category and 20% with an N-Gain score in the low category. The overall N-Gain calculation results as shown in Table 5 and the graph in Figure 2 show that the implementation of the SSI-integrated PjBL model in circulatory system material can increase students' digital literacy with the criteria for improvement being in the fair category.

Based on the results obtained, it is known that the SSI-integrated PjBL model affects high school students' digital literacy. The impact given is to improve students' digital literacy for the better. This finding follows research by Nanni & Pusey (2020) which revealed that PjBL can increase the digital literacy of students who were previously underdeveloped to become well-developed. Research by Suminarsih (2023) also states that the implementation of PjBL in learning in the form of video projects can increase students' digital literacy and mastery of concepts. Similar results were also shown by research by Samsi et al. (2023) who revealed that the use of PjBL was effective in increasing student digital literacy.

The article writing project carried out by students in this research makes students connected to the digital world because, in the process, students work by looking for sources from the Internet and processing the information into a popular article. Student involvement with the Internet and digital platforms can increase their digital literacy because all aspects of digital literacy are involved. These findings are in line with the findings of Kustini et al. (2021) who reveal that the implementation of PjBL can increase students' digital literacy because in PjBL students relate to digital technology in working on their projects, such as in designing project activities, looking for sources for project work, analyzing information on social media, and using digital technology safely. Research by Rodrigues et al. (2021) also reports that students' digital literacy can increase when teachers facilitate them to follow a series of processes in digital-based learning. The more frequently students are involved in using technology for the learning process, the more their digital literacy will increase. This statement is in line with Misir's (2018) statement saying that digital literacy competence can be improved through the use of technology as a learning medium that is used by students directly and accompanied by active participation in learning.

In PjBL learning in this research, the problems given are social problems that develop in the community and are scientific, also called socioscientific issues (SSI). This socioscientific issue is an issue that is often discussed on social media, thus allowing students to frequently engage with the digital world. The issues presented in this research are issues related to disorders/diseases that attack the human circulatory system and have dangerous impacts on sufferers. Students' digital literacy in terms of


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analyzing content and information will increase with SSI's presence on social media. Solving these problems also requires students to search for sources on the Internet so that the solutions formulated can solve the problem. These findings are supported by research by Ting (2015) which explains that if in the learning process, students have good digital literacy, then they can solve existing problems by exploring via the Internet.

In this research, digital literacy was also measured for each indicator. The indicators in this research consist of six digital literacy indicators according to CSIS (2022), namely communication and collaboration, critical thinking, data literacy, ICT familiarity, device security, and personal security. The average pre-test and post-test percentage results for each digital literacy indicator can be seen in Table 6.

**Table 6.** Percentage of Pre-test and Post-test Average Score

| Components | Percentage of Mean Score (%) | | | |
|---|---|---|---|---|
| | *Pre-test* | Int. | *Post-test* | Int. |
| *Communication and Collaboration* | 78.93 | High | 87.50 | Very High |
| *Critical Thinking* | 78.75 | High | 83.57 | Very High |
| *Data Literacy* | 78.92 | High | 90.00 | Very High |
| *ICT Familiarity* | 78.80 | High | 93.09 | Very High |
| *Device Security* | 77.50 | High | 89.28 | Very High |
| *Personal Security* | 78.33 | High | 89.52 | Very High |

Table 6 shows that the percentage of students' digital literacy scores has increased for each indicator. The average percentage that was initially in the high category increased to the very high category in the post-test results. The ICT familiarity indicator obtained the highest average increase compared to other indicators. This can be seen from the average percentage score of the ICT familiarity indicator on the pre-test, which was 78.80% and 93.09% on the post-test. This means there was an increase in the average percentage of 14.29%. Meanwhile, the critical thinking indicator obtained the lowest average percentage increase compared to other indicators. The average percentage of indicator scores during the pre-test was 78.75% (high category) and increased to 83.57% (very high category) during the post-test. This means that the critical thinking indicator has increased in percentage by 4.82%. The high average score before treatment was because students were used to using technology in learning during the pandemic (A'yun, 2021). However, the implementation of the SSI-integrated PjBL model still affects the improvement of the digital literacy score. These results are supported by processing digital literacy data based on the category for each digital literacy indicator. The percentage distribution of students in each digital literacy category for each indicator during the pre-test and post-test can be seen in Figure 3.

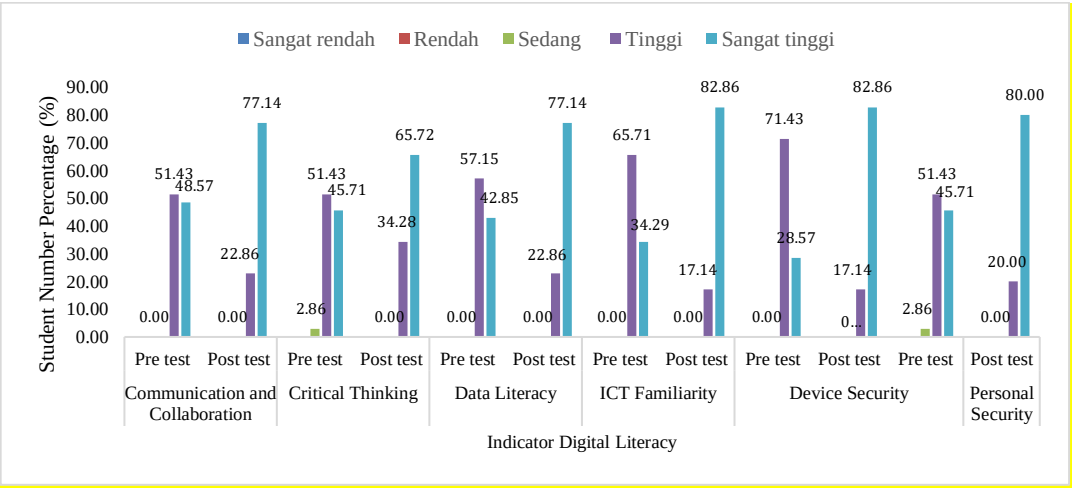


**Figure 3.** Percentage distribution of students in each digital literacy category for each indicator during the pre-test and post-test


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Figure 3 shows that during the pre-test, most students had a digital literacy score percentage in a high category on each digital literacy indicator. Meanwhile, after the implementation of the SSI-integrated PjBL, most students obtained a percentage score in a very high category on each digital literacy indicator. This means that the implementation of the SSI-integrated PjBL model increases the percentage of digital literacy scores for the better. To see the increase in each digital literacy indicator after the implementation of the SSI-integrated PjBL model, the N-Gain was calculated for each digital literacy indicator. The N-Gain results for each indicator can be seen in Figure 3 below.

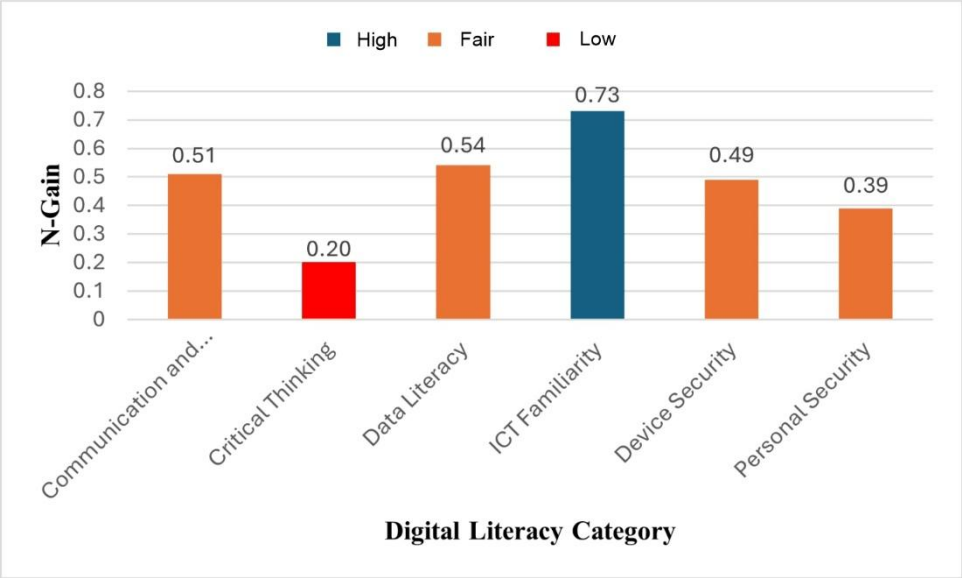


**Figure 4.** N-Gain Score for Each Digital Literacy Indicator

The N-Gain score results in Figure 4 show that the N-Gain score for the ICT familiarity indicator is in the high category with a score of 0.73, while the critical thinking indicator obtained an N-Gain score of 0.20 (low category). Based on the N-Gain results, it can be concluded that after the implementation of the SSI-integrated PjBL model, the ICT familiarity indicator obtained the highest N-Gain score compared to other indicators, while the critical thinking indicator obtained the lowest N-Gain score compared to other indicators.

Based on Table 6, Figure 3, and Figure 4, ICT familiarity is the aspect of digital literacy that received the highest N-Gain score and has the highest percentage increase compared to other indicators. ICT familiarity is related to students' ability to operate social media tools, especially in searching for information via the Internet. In this research, there are three statements developed from ICT familiarity indicators. The statements developed include skills in connecting devices with a Wi-Fi connection or cellular data, students' skills in downloading applications needed to create assignments, such as Google Documents, as well as students' skills in operating Google, Safari, and other browsers during work on popular article writing projects. Thus, it can be stated that the implementation of the project in this research facilitates the improvement of the skills in operating Google, downloading applications, and using technology very well so that the ICT familiarity indicator gets the highest N-Gain score compared to other indicators.

The project of creating popular articles can increase ICT familiarity skills because students are used to using digital tools and also take advantage of the various features of these digital tools. This finding is supported by research by Kustini et al. (2021) which shows that PjBL facilitates students to use technological devices to create digital information so that students become more familiar with technology. The use of technological devices in this popular article project is by utilizing Google Documents in its creation so that all members can access the files, then using drives for storing and collecting assignments, using WhatsApp groups on each cellphone to discuss during assignments, and using Google to search for online articles for project work. Increasing ICT familiarity skills through this project can encourage students to be active in learning and create a healthy learning climate. This


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statement follows research by Hammerstein et al. (2021) who state that familiarity with technology creates a healthy learning climate and encourages students to be active in learning

The more often students use digital platforms to find information on the Internet, the more their digital literacy can increase. This statement follows research by Syah et al. (2019) who reveal that active use of online media, learning achievement, and reading intensity have a significant effect on students' digital literacy. This can happen because when students search for information in completing their assignments, they train their abilities in using various forms of digital platforms such as Google, Safari, and browsers so that students become more competent at using these various platforms.

Students' skills in utilizing digital tools to search for information on the Internet are needed in project-based learning to solve problems related to socioscientific issues given in learning. This is in line with the findings of Hendaryan et al. (2022) which state that the application of skills in the field of information and technology can provide opportunities for interaction, the existence of interesting reading material, communication, and a problem-solving process. Solutions to problems related to socioscientific issues can be formulated because students can use technology to find reading sources that can generate thoughts to solve a problem.

Meanwhile, based on Figure 2 and Table 8, the digital literacy indicator which has the lowest N-Gain score and post-test percentage is the critical thinking indicator. This finding is different from the results of research by Kristiyanto (2020) which shows that the application of the PjBL model is effective in improving students' critical thinking skills. The findings of Marlangen et al. (2023) also show that the implementation of PjBL in learning can encourage improvements in students' critical thinking skills. Widyastuti & Andika (2021) state that the implementation of writing projects can improve students' critical thinking skills.

The low increase in students' critical thinking indicators in this research was because during learning students were not active in asking questions. This is shown from the results of observations of the implementation of the PjBL syntax which shows that during the presentation of the results of popular articles and video performances on the syntax for determining basic questions, students were not active in asking questions. Zahranie et al. (2020) reveal that students who actively ask questions can improve their critical thinking skills. This means that when students do not actively ask questions during learning, they tend to have weak critical thinking skills.

Apart from students being less active in asking questions, students' low critical thinking skills regarding digital information are likely due to their poor physical condition during learning. This can be seen during the learning process, where there are students who are not focused on learning. Dores et al. (2020) state that feeling anxious, afraid, or not having the courage to ask questions to the teacher can limit a person's ability to think, and students who experience physical problems such as concentrating during learning can make it difficult for them to think critically. Several of these things cause the implementation of the SSI-integrated PjBL model in learning to be less effective in providing students with critical thinking skills regarding existing information.

## CONCLUSION

Based on the results obtained, it can be concluded that the SSI-integrated PjBL model in circulatory system material affects high school students' digital literacy. This can be seen from the increase in students' digital literacy scores from the high category with a percentage of 78.45% to the very high category with a percentage of 88.66%. The increase in students' digital literacy is in the fair category based on the N-Gain score obtained, which is 0.5069. Each digital literacy indicator experienced an increase after the implementation of the SSI-integrated PjBL model as seen from the pre-test and post-test results. The results of the N-Gain calculation show that the ICT familiarity indicator has increased to the highest score with an N-Gain score of 0.73, while the critical thinking indicator has increased to the low category with an N-gain score of 0.20. The results of this research indicate that the implementation of the SSI-integrated PjBL model can be used as a learning model that can encourage increased students' digital literacy.


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## REFERENCES

A'yun, Q. (2021). Analisis Tingkat Literasi Digital dan Keterampilan Kolaborasi Siswa dalam Pembelajaran IPA Kelas VII secara Daring. *Jurnal Didaktika Pendidikan dasar*, *5*(1), 271–290. https://doi.org/10.26811/didaktika.v5i1.286

Agustini, P. (2023). *Indeks Literasi Digital Indonesia Kembali Meningkat Tahun 2022*. https://aptika.kominfo.go.id/2023/02/indeks-literasi-digital-indonesia-kembali-meningkat-tahun-2022/.

Ananda, O. T., Mahanal, S., & Susanto, H. (2023). Literasi Digital Siswa : Studi Deskriptif pada Pembelajaran Biologi di SMA. *Bioscientist : Jurnal Ilmiah Biologi*, *11*(2), 1100. https://doi.org/10.33394/bioscientist.v11i2.8815

Arikunto, S. (2013). *Prosedur Penelitian suatu Pendekatan Praktik*. Rineka Cipta.

CSIS. (2022). *G20 Toolkit for Measuring Digital Skills and Digital Literacy A Compilation of Reports Priority Issue 2-Digital Skills and Digital Literacy ii G20 Toolkit for Measuring Digital Skills and Digital Literacy Overview* (Nomor 2).

Dores, O. J., Wibowo, D. C., & Susanti, S. (2020). Analisis Kemampuan Berpikir Kritis Siswa Pada Mata Pelajaran Matematika. *J-PiMat : Jurnal Pendidikan Matematika*, *2*(2), 242–254. https://doi.org/10.31932/j-pimat.v2i2.889

Gok, T. (2010). Using Computer-Assisted Personalized Assignment System in a Large-Enrollment General Physics. *European Journal of Physics Education*, *1*, 28–43. http://libaccess.mcmaster.ca/login?url=http://search.proquest.com/docview/1697490732?accountid=12347

Hake, R. R. (1999). *Analyzing Change/Gain Scores.AREA-D American Education Research Association's Devision.D, Measurement and Reasearch Methodology.* 1–4.

Hammerstein, S., König, C., Dreisörner, T., & Frey, A. (2021). Effects of COVID-19-Related School Closures on Student Achievement-A Systematic Review. *Frontiers in Psychology*, *12*(September), 1–8. https://doi.org/10.3389/fpsyg.2021.746289

Hanik, E. U. (2020). Self Directed Learning Berbasis Literasi Digital Pada Masa Pandemi Covid-19 Di Madrasah Ibtidaiyah. *ELEMENTARY: Islamic Teacher Journal*, *8*(1), 183–208. https://doi.org/10.21043/elementary.v8i1.7417

Hendaryan, R., Hidayat, T., & Herliani, S. (2022). Pelaksanaan Literasi Digital Dalam Meningkatkan Kemampuan Literasi Siswa. *Jurnal Penelitian Bahas dan Sastra Indonesia serta Pembelajarannya*, *6*(1), 142–151.

Kendrick, M., Early, M., Michalovich, A., & Mangat, M. (2022). Digital Storytelling With Youth From Refugee Backgrounds: Possibilities for Language and Digital Literacy Learning. *TESOL Quarterly*, *56*(3), 961–984. https://doi.org/10.1002/tesq.3146

Kristiyanto, D. (2020). Peningkatan Kemampuan Berpikir Kritis dan Hasil Belajar Matematika dengan Model Project Based Learning (PJBL). *Mimbar Ilmu*, *25*(1), 1. https://doi.org/10.23887/mi.v25i1.24468

Kumar, B. A., & Mohite, P. (2017). Usability study of mobile learning application in higher education context: An example from Fiji national university. *Education in the Asia-Pacific Region*, *40*(June), 607–622. https://doi.org/10.1007/978-981-10-4944-6_29

Kustini, S., Herlinawati, H., & Indrasary, Y. (2021). Implementasi Pembelajaran Berbasis Project-Based Learning Untuk Meningkatkan Keterampilan Literasi Digital Mahasiswa Politeknik Negeri Banjarmasin. *Jurnal INTEKNA : Informasi Teknik dan Niaga*, *21*(1), 30–40. https://doi.org/10.31961/intekna.v21i1.1122

List, A. (2019). Defining digital literacy development : An examination of pre- service teachers ' beliefs. *Computers & Education*, *138*(April), 146–158.

Marlangen, E. W., Bahri, S., & Raodah, S. (2023). Penerapan Model Pembelajaran Pjbl ( Project Based Learning ) Untuk Meningkatkan Keterampilan Berfikir Kritis Siswa Kelas X. *Jurnal Asimilasi Pendidikan*, *1*(2), 87–91.

Misir, H. (2018). Digital Literacies and Interactive Multimedia-. *International Online Journal of Education and Teaching (IOJET)*, *5*(September), 514–523. http://iojet.org/index.php/IOJET/article/view/178/250

Nanni, A., & Pusey, K. (2020). Leveraging Students' Digital Literacy through Project-Based Learning.


ISSN 2406-9205 (print), ISSN 2477-4820 (online)

*The Asian EFL Journal*, *24*(1), 141–164. http://www.asian-efl-journal.com

Oktavia, R. (2021). Tingkat Literasi Digital Siswa Ditinjau Dari Penggunaan Teknologi Informasi Sebagai Mobile Learning Dalam Pembelajaran Biologi Pada Siswa Mengengah Atas (Sma) Kecamatan Kuala Nagan Raya. *Bionatural*, *VII*(2), 26–34.

Perdana, R., Yani, R., Jumadi, J., & Rosana, D. (2019). Assessing Students' Digital Literacy Skill in Senior High School Yogyakarta. *JPI (Jurnal Pendidikan Indonesia)*, *8*(2), 169. https://doi.org/10.23887/jpi-undiksha.v8i2.17168

Ratcliffe, M., & Grace, M. (2003). Science education for citizenship: Teaching socio-scientific issues. In *Mary Ratcliffe Marcus Grace*.

Reddy, E., Reddy, P., Sharma, B., Reddy, K., & Khan, M. G. M. (2017). Student Readiness and Perception to the Use of Smart Phones for Higher Education in the Pacific. *Proceedings - Asia-Pacific World Congress on Computer Science and Engineering 2016 and Asia-Pacific World Congress on Engineering 2016, APWC on CSE/APWCE 2016, January 2019*, 258–264. https://doi.org/10.1109/APWC-on-CSE.2016.049

Rodrigues, A. L., Cerdeira, L., Machado-Taylor, M. de L., & Alves, H. (2021). Technological skills in higher education—different needs and different uses. *Education Sciences*, *11*(7). https://doi.org/10.3390/educsci11070326

Samsi, S., Ahman, E., H, D., & Sobandi, A. (2023). The Effectiveness of Internet-Based Project Based Learning (PjBL) Learning Models on 21st Century Digital Literacy Capabilities. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4322747

Saraha, A. R., Abu, S. H. N., Ibrahim, F., Sugrah, N., & Rakhman, K. A. (2022). Video project in distance learning during the pandemic: Readiness, processes, and benefits. *Jurnal Inovasi Pendidikan IPA*, *8*(2), 164–173. https://doi.org/10.21831/jipi.v8i2.45285

Sharma, B. N., Nand, R., Naseem, M., Reddy, E., Narayan, S. S., & Reddy, K. (2018). Smart Learning in the Pacific: Design of New Pedagogical Tools. *Proceedings of 2018 IEEE International Conference on Teaching, Assessment, and Learning for Engineering, TALE 2018*. *1*, 573–580. https://doi.org/10.1109/TALE.2018.8615269

Suminarsih, S. (2023). Peningkatan Pemahaman Konsep Fisika Dan Keterampilan Literasi Digital Melalui Proyek Video Pembelajaran Menggunakan Model Project Based Learning. *Orbith: Majalah Ilmiah Pengembangan Rekayasa dan Sosial*, *19*(1), 27–35.

Syah, R., Darmawan, D., & Purnawan, A. (2019). Analisis Faktor yang Memengaruhi Literasi Digital. *Jurnal AKRAB*, *10*(2), 60–69.

Tierney, R. J. (2018). Toward a model of global meaning making. *Journal of Literacy Research*, *50*(4), 397–422. https://doi.org/10.1177/1086296X18803134

Ting, Y. L. (2015). Tapping into students' digital literacy and designing negotiated learning to promote learner autonomy. *Internet and Higher Education*, *26*, 25–32. https://doi.org/10.1016/j.iheduc.2015.04.004

Widyastuti, W. T., & Andika, Y. (2021). Pengaruh Project-Based Learning terhadap Keterampilan Berpikir Kritis dan Keaktifan Mahasiswa dalam Pembelajaran Menulis Bahasa Prancis. *Jurnal Ilmiah Profesi Pendidikan*, *6*(2), 227–236. https://doi.org/10.29303/jipp.v6i2.169

Zahranie, M., Andayani, Y., & Loka, I. N. (2020). Hubungan Keaktifan Bertanya dengan Kecenderungan Berpikir Kritis Siswa Kelas XI IPA di SMA/MA Se-Kecamatan Narmada Tahun Ajaran 2019/2020. *Chemistry Education Practice*, *3*(1), 5. https://doi.org/10.29303/cep.v3i1.1426


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