Jurnal Pedagogi dan Pembelajaran
Volume 7, Number 2, Tahun 2024, pp. 211-222
P-ISSN: 2614-3909 E-ISSN: 2614-3895
Open Access: https://doi.org/10.23887/jp2.v7i2.68594

Student Scientific Literacy Skills of Competence Aspect in Human Reproductive System Material

Alfiya Damayanti[1*], Paramita C Kuswandi[2]

[1,2] Pendidikan Biologi, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

ARTICLE INFO

Article history:
Received September 29, 2023
Accepted April 17, 2024
Available online July 25, 2024

Kata Kunci:
Kemampuan Literasi Sains, Keterampilan Abad Ke-21, Sistem Reproduksi

Keywords:
Scientific Literacy Skills, 21st Century Skills, Reproductive System

ABSTRAK

Perkembangan teknologi memudahkan guru untuk mengembangkan strategi, metode, bahan ajar untuk meningkatkan keterampilan abad 21 siswa. Namun, tidak semua sekolah memiliki fasilitas yang baik dan guru yang dapat memanfaatkan fasilitas tersebut untuk mengembangkan strategi pembelajaran yang mendukung keterampilan tersebut. Keadaan ini bertolak belakang dengan kondisi sekolah yang sebagian besar memiliki fasilitas sekolah yang baik dan guru yang dapat mengikuti perkembangan teknologi. Oleh karena itu, tujuan penelitian ini adalah menganalisis pencapaian keterampilan literasi sains pada materi sistem reproduksi manusia pada siswa SMA dan mengetahui perbedaan keterampilan literasi sains pada materi sistem reproduksi manusia antarsekolah akibat faktor fasilitas sekolah dan guru. Populasi penelitian ini adalah siswa kelas XI SMA, dengan sampel sebanyak 189 siswa yang diambil dari enam sekolah. Penelitian ini merupakan penelitian deskriptif dengan menggunakan metode survei untuk mendeskripsikan pencapaian keterampilan literasi sains siswa. Instrumen yang digunakan adalah angket dan tes pilihan ganda. Data yang terkumpul dianalisis menggunakan statistik deskriptif dan uji Kruskal-Wallis. Hasil penelitian menunjukkan bahwa kemampuan literasi sains siswa SMA berada pada kategori baik dan terdapat perbedaan yang signifikan pada kemampuan literasi sains masing-masing sekolah akibat dari ketersediaan fasilitas sekolah. Kesimpulan dari penelitian ini adalah terdapat perbedaan yang signifikan pada pencapaian kemampuan literasi sains siswa akibat dari faktor fasilitas sekolah.

ABSTRACT

Technological developments facilitate teachers to develop strategies, methods, teaching materials to enhance students' 21st-century skills. However, not all schools have excellent facilities and teachers who can utilize these facilities to develop learning strategies that support these skills. This situation contrasts with the condition, most of which have good school facilities and teachers who can keep up with technological developments. Therefore, the purpose of this research is to analyze the attainment of scientific literacy skills in human reproductive system material among senior high school students and to investigate the differences in scientific literacy skills in human reproductive system material among schools as a result of school facility and teacher factors. The population for this research comprises class XI senior high school, with a sample of 189 students selected from six schools. This research is descriptive research using a survey method to describe the achievement of students' scientific literacy skills. The instruments used were questionnaires and multiple-choice tests. The collected data were analyzed using descriptive statistics and the Kruskal-Wallis test. The result indicates that the scientific literacy skills of senior high school student in Yogyakarta are good category and there are significant differences in the scientific literacy skills of each school as a result of the availability of school facilities. The conclusion of this research is that there are significant differences in the achievement of students' scientific literacy skills as a result of school facility factors.

1. INTRODUCTION

Education is a platform for student to acquire knowledge, experience, skills and character development. The rapid advancement of technology can be effectively harnessed through education enhance the learning process. Good facilities at school are one factor in learning achievement (Khalid, 2011;

Corresponding author
*E-mail addresses: alfiyad08@gmail.com (Alfiya Damayanti)

Lampropoulos et al., 2019). Good facilities will help teachers prepare adequate technology-based teaching materials so that they can improve students' knowledge and skills. The importance of school facilities is proven by previous research which shows that school facilities have a positive effect on student learning outcomes. Previous research states that the use of learning facilities affects students' biology learning outcomes (Sekarwati, 2020). This shows that before utilizing learning facilities, the school must provide the school facilities first. This is also supported by other study in their research which showed that learning facilities had a positive and significant effect on student learning outcomes (Gebre, 2018; Made et al., 2022). Other study also stated that learning facilities partially have a positive effect on the quality of learning, adequate facilities will influence student learning success (Mantika, S.P & Purwanto, 2022). The school facilities referred to in this research include classrooms, laboratories, computers and projectors, LMS platforms or similar applications, learning tools such as teaching aids, teaching materials such as books, e-books and e-modules.

Good school facilities, capable of supporting the achievement of 21st-century skills. The importance of 21st-century skills for students is to be able to compete globally. The four domains of 21st-century skills are digital era literacy, inventive thinking, interpersonal and social skills and productivity in production (Turiman et al., 2012; Tyan et al., 2020). Based on research conducted by other study it is stated that there are many factors that can influence student academics, but the most important factor is the teacher (Zubaidah, 2016). The teacher's role in 21st-century skills-based learning is to guide students to develop student knowledge and support students to achieve learning goals. One way is by utilizing school facilities in the learning process to improve students' 21st century skills.

One of the 21st-century skills is scientific literacy skills. One of the goals of science education in schools is to develop these skills. The Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA) defines scientific literacy skills as the ability to be involved in issues related to science (Irhandayaningsih, 2020). A person who is scientifically literate has the desire to be involved in scientific and technological phenomena, requires competence to explain phenomena scientifically, evaluate and design scientific phenomena, and interpret scientific data and evidence. The results of the research show that students' responses regarding one of the issues raised in the PISA questions were that 55.7% of students knew about the greenhouse gas phenomenon, 24.6% did not have enough information and 9.8% did not know (Fatimah & Santiana, 2017; Oliver & Adkins, 2020). This shows that scientific literacy skills must be implemented in the school curriculum so that students better understand scientific phenomena in everyday life.

One of the scientific phenomena in class XI biology material is found in the reproductive system material. The human reproductive system is an important subject to study because it is related to reproductive health, immoral behaviour and promiscuity. The reproductive system is still rarely socialized to the public, resulting in minimal knowledge about the reproductive system. Based on research conducted by other study state that some teenagers do not receive enough information about reproductive health, which causes confusion when physical and emotional changes occur during puberty (Permatasari & Suprayitno, 2021). Apart from that, lack of knowledge about reproductive health is one of the factors causing immoral acts and promiscuity. So in this research, the material used to measure students' scientific literacy skills is reproductive system material.

Scientific literacy skills in reproductive system material were explained in research conducted by other study which stated that the low scientific literacy skills in reproductive system material were caused by the material being irreversible, causing students to have difficulty understanding the concepts of the material (Khairunnisa et al., 2019). This has an impact on students' inability to apply concepts learned at school to phenomena that occur in everyday life. The importance of understanding reproductive system phenomena in everyday life according to other study is to help students select the truth of information circulating in society, considering that reproductive system issues such as pregnancy rituals, rules during menstruation and reproductive health have various meanings point of view, not only from a biological one (Temuningsih et al., 2017).

The research by other study showed that 50% of students had low scientific literacy skills (Suhadi et al., 2023). Several other studies stated that the category of students' scientific literacy skills was low, including high school students with the 2013 curriculum (Sukowati et al., 2017), high school students in Sragen city (Bagasta et al., 2018), high school students in Sumenep district (Tulaiya & Wasis, 2020), high school students River city is full (Sutrisna, 2021). However, several studies also show that students' scientific literacy skills are in the medium category, including students at senior high school in Cirebon city (Rohman et al., 2017), students at senior high school in Yogyakarta city (Mayasari, 2022). From the results of these studies, it is necessary to analyze scientific literacy skills at students in Yogyakarta city to find out how students' scientific literacy skills are seen from the completeness of school facilities and the role of teachers in utilizing these school facilities.

The demand for mastery of 21st-century skills is certainly a challenge for teachers to be able to facilitate a learning process that can improve these skills, especially scientific literacy. To improve students' scientific literacy skills, teachers must be able to choose appropriate learning strategies. Research conducted by other study showed that by using discovery learning-based modules students' scientific literacy skills could increase (Ariana et al., 2020). Apart from that, models that can improve scientific literacy skills are PBL (Widiana et al., 2020), a scientific approach based on the WtL strategy (Damayanti et al., 2021), guided inquiry learning model (Ogan-Bekiroğlu & Arslan, 2014) and many other learning strategies. Based on this research, it is important for teachers to use a scientific literacy-based learning approach so that students' scientific literacy skills can increase. These studies show that scientific literacy skills can be improved using various types of strategies and learning models.

Based on interviews with biology teachers in the city of Yogyakarta, information was obtained that biology learning has used several strategies, teaching materials and media that facilitate 21st century skills. Most teachers have used the HOTS question type but have not specifically measured scientific literacy skills. Apart from using various learning methods, teachers are supported by adequate school facilities that make it easier to deliver learning material, fairly spacious classrooms and good air circulation that provide comfort for students to study, complete laboratory equipment so that students can carry out practicums and complete book collections in the library. Biology teachers in the city of Yogyakarta have made good use of these facilities. School facilities and the role of teachers influence learning outcomes, but there has been no research that focuses on the influence of school facilities and the role of teachers in utilizing these school facilities on students' scientific literacy skills. So this research purposes to determine the achievement of students' literacy skills in terms of the completeness of school facilities and the role of teachers in utilizing these school facilities.

2. METHOD

This research is included in descriptive research with a survey method to describe the achievement of scientific literacy skills of class XI students of Senior High Schools in Yogyakarta City on reproductive system material. Descriptive research is research that describes a phenomenon that actually occurs (Rukajat, 2018). The population is all the elements being analyzed while the sample is the sub-elements selected to be studied (Handayani et al., 2017). The population in this study is all high schools in Yogyakarta City with a total of 11 schools. The sample for this research consisted of 189 students consisting of 6 schools including SMAN 1 Yogyakarta, SMAN 3 Yogyakarta, SMAN 4 Yogyakarta, SMAN 6 Yogyakarta, SMAN 7 Yogyakarta and SMAN 10 Yogyakarta who were selected using a purposive sampling technique. The selection of this sampling technique was due to consideration of the class used for research in accordance with the suggestions of the biology teacher at school.

The instruments in this research are a school facilities questionnaire and a 30-item multiple-choice test about the human reproductive system which has been validated by experts. The test covers several topics including the structure and function of the reproductive organs, the mechanism of gametogenesis, the mechanism of the menstrual cycle, the function of hormones, the mechanism of fertilization, pregnancy and birth, the causes of disorders and diseases in the reproductive organs, the causes of sexually transmitted diseases, the impact of promiscuity and the application of technology in the human reproductive system. The test instrument consists of three indicators of scientific literacy skills in the competency aspect, namely identifying scientific issues, explaining scientific phenomena and using scientific evidence. The distribution of scientific literacy aspects in the questions is adjusted to the results of expert validation and statistical validation to produce different percentages. The distribution of scientific literacy aspects in the questions is presented in Table 1, while the validity of the question items is can be seen in Table 2.

Table 1. Distribution of Aspects Scientific Literacy Skills in Test

Topic Number	Item Number of Test			Amount
	Identifying Scientific Issues	Explaining Phenomena Scientifically	Using Evidence Scientifically	
1.		5,8,11,24,27,28,29		7
2.		1,2		2
3.		6	7,26	3
4.		3,10,13,12		4
5.		20		1
6.	16,19	4,9		4
7.	18,23,25,30	17		5

Topic Number	Item Number of Test			Amount
	Identifying Scientific Issues	Explaining Phenomena Scientifically	Using Evidence Scientifically	
8.	14,22			2
9.		21	15	2
Total	8	19	3	**30**
Percentage	27%	63%	10%	**100%**

Table 2. Item Analysis

Number Question	Analisis Statistik			
	Validity (Sig Value)	Reliability	Difficullty Level	Discriminating Power
1	0.025 (valid)	0.902 (high)	0.20 (difficulty)	0.274 (enough)
2	-0.004 (valid)	0.910 (high)	0.10 (very difficulty)	-0.496 (good)
3	0.002 (valid)	0.898 (high)	0.37 (medium)	0.499 (good)
4	0.000 (valid)	0.897 (high)	0.60 (medium)	0.564 (good)
5	0.037 (valid)	0.901 (high)	0.53 (medium)	0.338 (enough)
6	0.040 (valid)	0.901 (high)	0.10 (very difficulty))	0.312 (enough)
7	0.009 (valid)	0.899 (high)	0.47 (medium)	0.458 (good)
8	0.003 (valid)	0.898 (high)	0.83 (easy)	0.522 (good)
9	0.014 (valid)	0.900 (high)	0.93 (very good)	0.372 (good)
10	0.004 (valid)	0.899 (high)	0.23 (difficulty)	0.430 (good)
11	0.000 (valid)	0.895 (high)	0.60 (medium)	0.631(good)
12	0.001 (valid)	0.898 (high)	0.67 (medium)	0.509 (good)
13	0.000 (valid)	0.895 (high)	0.70 (medium)	0.627 (good)
14	0.000 (valid)	0.894 (high)	0.83 (easy)	0.738 (very good)
15	0.017 (valid)	0.899 (high)	0.73 (easy)	0.465 (good)
16	0.001 (valid)	0.897 (high)	0.63 (medium)	0.569 (good)
17	0.000 (valid)	0.897 (high)	0.83(easy)	0.593 (good)
18	0.000 (valid)	0.896 (high)	0.83 (easy)	0.608 (good)
19	0.000 (valid)	0.896 (high)	0.80 (easy)	0.646 (good)
20	0.007 (valid)	0.899 (high)	0.87 (very easy)	0.419 (good)
21	0.003 (valid)	0.898 (high)	0.50 (medium)	0.493 (good)
22	0.009 (valid)	0.899 (high)	0.70 (medium)	0.439 (good)
23	0.006 (valid)	0.898 (high)	0.67 (medium)	0.498 (good)
24	0.018 (valid)	0.901 (high)	0.37 (medium)	0.345 (enough)
25	0.002 (valid)	0.898 (high)	0.90 (very easy)	0.582 (good)
26	0.033 (valid)	0.899 (high)	0.37 (medium)	0.433 (good)
27	0.032 (valid)	0.900 (high)	0.50 (medium)	0.397 (enough)
28	0.000 (valid)	0.899 (high)	0.63 (medium)	0.457 (good)
29	0.049 (valid)	0.902 (high)	0.40 (medium)	0.266 (enough)
30	0.000 (valid)	0.895 (high)	0.83 (easy)	0.723 (very good)

Apart from that, this research used an instrument in the form of a questionnaire to determine the completeness of school facilities at each school used as the research sample. The questionnaire uses a likert scale with 5 categories. The data obtained was converted into percentage form, then the results were interpreted using a Likert category as show in Table 3.

Table 3. Likert Scale Category

Interval Category	Category
0% – 20%	Very low
21% – 40%	Low
41% – 60%	Enough
61% – 80%	Good
81% – 100%	Very good

3. RESULT AND DISCUSSION

Result

Based on research, the results obtained from the school facilities questionnaire show the completeness of the school facilities owned by each school in the city of Yogyakarta. School facility categories are presented in Table 4.

Table 4. Categories of School Facilities at Senior High School in Yogyakarta

No.	Aspects of School Facilities	School					
		1	2	3	4	5	6
1	Classroom conditions	4	4	2	3	5	4
2	Complete laboratory equipment	4	3	4	2	4	4
3	Availability of computers and projectors in the classroom	4	5	4	5	5	5
4	Complete library book collection	4	3	3	3	5	4
5	Library convenience for studying	4	4	4	3	5	5
6	Availability of an LMS platform or similar application	4	4	1	4	5	4
7	Availability of learning tools (props)	5	4	5	4	5	5
8	availability of printed teaching materials	3	2	3	2	3	4
9	Availability of digital-based teaching materials	3	2	2	2	3	3
Total		**35**	**31**	**28**	**28**	**40**	**38**
Percentage (%)		**77.77**	**68.88**	**62.22**	**62.22**	**88.88**	**84.44**
Category		**Good**	**Good**	**Good**	**Good**	**Very Good**	**Very Good**

Based on Table 4, the results show that there are 4 schools that have school facilities in the good category and 2 schools in the very good category. The completeness of the school facilities shows that the school has provided infrastructure that supports the biology learning process. Apart from that, based on the results of interviews, it was found that all biology teachers at Yogyakarta Senior High School had made maximum use of these facilities. These results will influence students' learning achievements, one of which is the achievement of scientific literacy skills. Adequate school facilities will support the achievement of students' scientific literacy skills.

Based on the results of descriptive statistical analysis of the achievement of scientific literacy skills in the competency aspect of students' reproductive system material at Yogyakarta Senior High School, it shows that there are differences in the achievement of scientific literacy skills in each school. The achievement of students' scientific literacy skills in each school is presented in Table 5.

Table 5. Descriptive Analysis of Students' Science Literacy Skills

School	N	Min	Max	Mean	S	Category
School 1	33	33	87	74.25	11.131	Good
School 2	35	77	97	86.17	4.737	Very Good
School 3	29	53	83	78.79	7.336	Good
School 4	26	47	87	72.19	8.212	Good
School 5	31	77	97	89.06	5.882	Very Good
School 6	35	63	100	91.23	7.585	Very Good
Mean				**81.98**		**Good**

Based on Table 5, it presented that three schools have scientific literacy skills in the good category and the other three schools have the very good category. Schools 1, 2 and 4 with achieved scientific literacy skills in the good category have school facilities in the good category too, schools 5 and 6 with achieved scientific literacy skills in the very good category have school facilities in the very good category too, but at school 2 with achieved literacy skills science in the very good category has school facilities in the good category. This is due to the role of the teacher at school 2 who makes teaching materials independently so that the aspect of the lack of teaching materials, both printed and digital, at that school can be overcome. The test results show that the scientific literacy skills of class XI students at Senior High Schools in the city of Yogyakarta are good. However, if we look at the achievements of each student, the achievement of scientific literacy abilities is spread from very low to very good categories.

The average achievement score for the scientific literacy skills of students senior high schools in the city of Yogyakarta on reproductive system material can be seen in Figure 1.

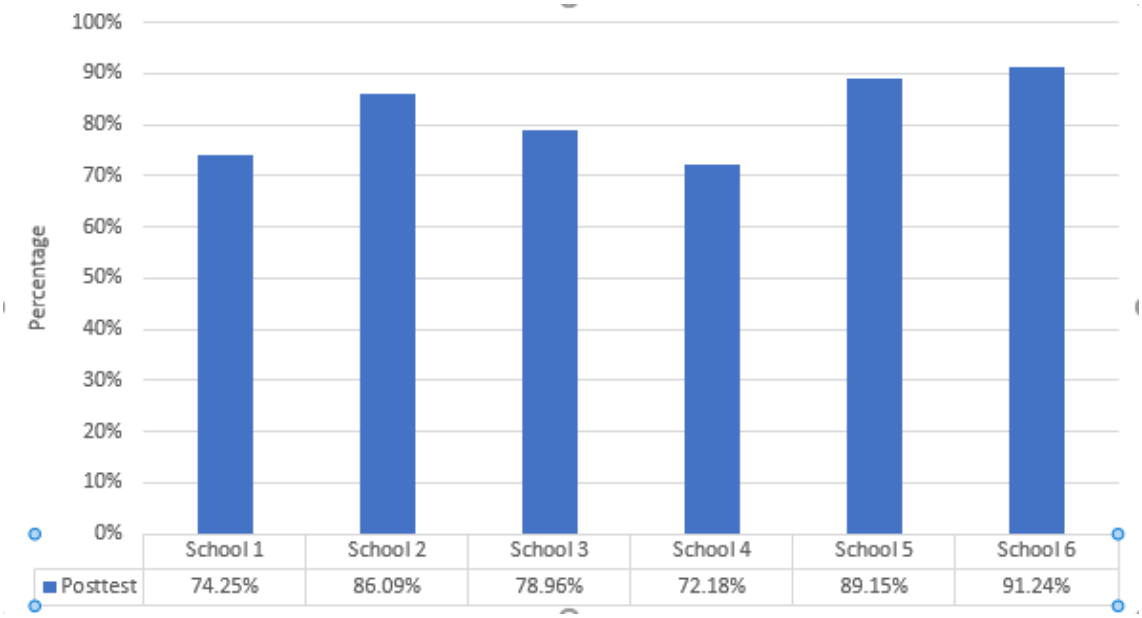


Figure 1. The Average of Students Scientific Literacy Skills Score

Based on Figure 1, it presented that the highest score on the human reproductive system material was obtained by school 6 with an average score of 91.24, while the lowest score was obtained by school 4 with a score of 72.18. The order of scientific literacy skills from the highest is school 6, followed by school 5, school 2, school 3, school 1, school 4. These results show that there is an influence of school facilities on the achievement of scientific literacy skills. These results also show that the achievement of scientific literacy skills in each school is different. To determine these differences, the Kruskall-Wallis test statistical analysis was used because the data obtained was not normally distributed. The results of the normality test are presented in table 7 and the Kruskal Wallis test can be seen in Table 6.

Table 6. Normality Test

Tests of Normality				
		Shapiro-Wilk		
	School	Df	Sig.	Information
Posttest	School 1	33	0.000	Not normal
	School 2	35	0.040	Not normal
	School 3	29	0.000	Not normal
	School 4	26	0.094	Normal
	School 5	31	0.013	Not normal
	School 6	35	0.000	Not normal

a. Lilliefors Significance Correction

Based on Table 6 the results of the analysis using IBM SPSS statistics 26, the results obtained at school 4 had a sig of 0.09 > 0.05, which indicates that the data came from a normally distributed population, but in the other samples it had a sig < 0.05, which indicated that the data came from a population. which is not normally distributed. The result of kruskal wallis test is show in Table 7.

Table 7. Kruskal Wallis Test

Test Statistics[a,b]	
	Posttest
Kruskal-Wallis H	108.609
Df	5
Asymp. Sig.	0.000

a. Kruskal Wallis Test; b. Grouping Variable : School

Based on Table 7 it can be concluded that there are significant differences in students' scientific literacy skills in each school. These results show that the achievement of scientific literacy skills between schools has different levels of achievement of scientific literacy skills. In accordance with the results of different school facilities in each school, the results of the literacy skills obtained are also different.

The indicators observed in this research are the competency aspects which consist of identifying scientific issues, explaining scientific phenomena and using scientific evidence. The achievement of scientific literacy skills for each indicator can be seen in Figure 2.

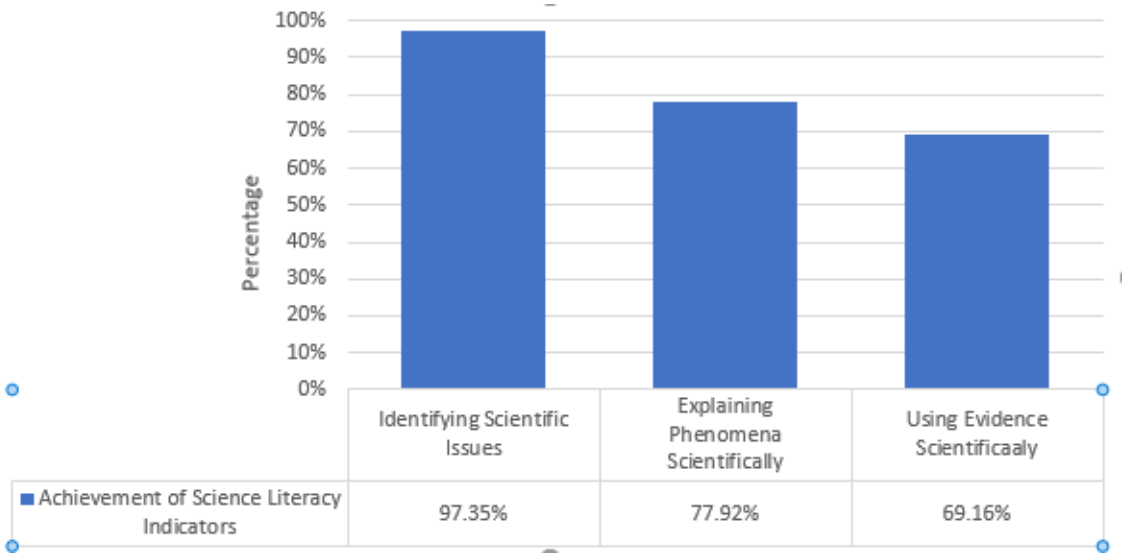
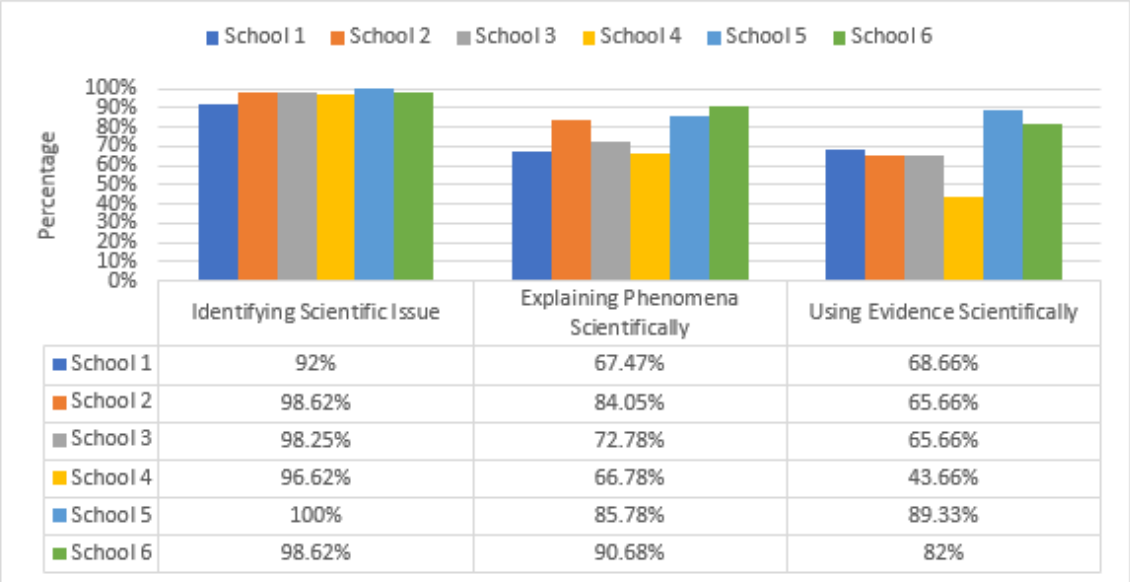


Figure 2. Achievement of Science Literacy Indicators

Based on Figure 2, it can be seen that the highest indicator achievement is in identifying scientific issues, while the lowest achievement is in using scientific evidence. These results illustrate that students have a very good category in identifying scientific issues, have a good category in explaining scientific phenomena and have a fair category in using scientific evidence. The achievement of competency aspect indicators in each school can be seen in Figure 3.



	Identifying Scientific Issue	Explaining Phenomena Scientifically	Using Evidence Scientifically
School 1	92%	67.47%	68.66%
School 2	98.62%	84.05%	65.66%
School 3	98.25%	72.78%	65.66%
School 4	96.62%	66.78%	43.66%
School 5	100%	85.78%	89.33%
School 6	98.62%	90.68%	82%

Figure 3. Achievement of Scientific Literacy Indicators for Each School

Based on Figure 3, on the indicator for identifying scientific issues, the largest percentage was obtained by school 5 with a score of 100%, while the lowest percentage was obtained by school 1 with a score of 92%. In terms of indicators explaining scientific phenomena, the highest indicator was obtained by

school 6 with a score of 90.68%, while the lowest percentage was obtained by school 4 with a score of 66.78%. On the indicator of identifying scientific issues, the highest percentage was obtained by school 5 with a score of 89.33%, while the lowest percentage was obtained by school 4 with a score of 43.66%.

Discussion

School facilities can influence student learning success, one of which is influencing the achievement of scientific literacy skills of senior high school students in the city of Yogyakarta. The results of the school facilities completeness questionnaire that was distributed to biology teachers showed that school 1, school 2, school 3 and school 4 had school facilities in the good category, while school 5 and school 6 had school facilities in the very good category. School facilities in this research have 9 aspects including classroom conditions, completeness of laboratory equipment, availability of computers and projectors to support the learning process, completeness of book collections in the library, comfort of the library for studying, availability of LMS platforms or similar applications, availability of learning tools, availability of materials, print and digital teaching (Abdullah, 2017; Bima et al., 2021). All aspects of this school facility can support the achievement of students' scientific literacy skills, especially reproductive system material. This is because school facilities support the implementation of the learning process, making it easier for teachers to deliver material, facilitating students to learn comfortably, the availability of references that help students understand the concepts of the material and the existence of a learning process outside the classroom which is supported by the LMS platform or similar applications (Muhammad & Widyanto, 2019; Weiss et al., 2022). The existence of school facilities must be supported by the role of teachers in utilizing these facilities. Based on the results of interviews with biology teachers, it was found that all biology teachers at Yogyakarta senior high school had made maximum use of school facilities, so this would certainly influence the achievement of students' scientific literacy skills (Jang et al., 2021; Shanks et al., 2017).

Based on the results of the descriptive analysis, it was found that school 5 and school 6 had higher scientific literacy skills scores than other schools. This shows that school facilities and the role of teachers in utilizing these facilities can influence student learning success. In accordance with the results of the school facilities questionnaire, school 5 and school 6 have school facilities in the very good category. These results are supported by research stating that educational facilities and infrastructure can have a significant effect on student learning outcomes (Wiranto & Slameto, 2021; Yildirim, 2017). If school facilities are adequate, students' scientific literacy abilities will be achieved well. In accordance with research that has been conducted, the overall achievement of scientific literacy skills of students in the city of Yogyakarta is in the good category, namely 81.98. Apart from the influence of the availability and use of school facilities, the teacher's role in preparing learning strategies and teaching materials is a factor in achieving students' scientific literacy skills (Fatimah & Santiana, 2017; Priyastuti, M. T., 2020). One example of the role of teachers in educating students based on interview results is that following current trends, teachers create learning media based on the TikTok platform to motivate students to learn because this application is very popular among students. Apart from that, teachers at Yogyakarta senior high school have also developed teaching materials independently to help students in the learning process. So this is the cause of the achievement of students' scientific literacy skills at Yogyakarta senior high school in the good category (Fatimah & Santiana, 2017; Wibowo & Ariyatun, 2020).

The highest attainment of scientific literacy skills was found at school 1. Apart from having school facilities in the very good category and the role of teachers who make maximum use of these facilities, school 1 is the favorite school in the city of Yogyakarta. In accordance with research conducted by previous study which states that school 1 is the favorite school based on public perception (Widowati et al., 2019). Favorite schools have many achievements, have good infrastructure, good college graduation rates and have high interest in enrolling. Based on community perception, the school is said to be a favorite because it has good quality to support student learning outcomes. This is one of the causes of low students' scientific literacy scores, because the school does not provide enough teaching materials, both printed and digital, so students have to look for references that support the learning materials themselves. Apart from that, school 4 is the least favorite school based on public perception, but even though students' scientific literacy skills are lower than other schools, this score is in the good category (Adam et al., 2022; Asrial et al., 2020).

The competency aspect of scientific literacy skills has three indicators, namely identifying scientific issues, explaining scientific phenomena and using scientific evidence. Based on the research results, it was found that the highest indicator of scientific literacy skills was achieved in the indicator using scientific evidence, while the lowest indicator achievement was in the use of scientific evidence (Bosica et al., 2021; Csanadi et al., 2021). As many as 97.35% of the total students who took the test had mastered the indicators for identifying scientific issues. Each question in scientific literacy on PISA is adapted to real life so that it can open students' horizons in understanding the context of science and applying it in life. One of the

questions developed by PISA is about scientific issues in society (Hendri & Hasriani, 2019; Stacey & Turner, 2015). In line with PISA, the questions created in this research raise issues regarding the reproductive system including diseases both sexually transmitted and not, issues of promiscuity and family planning. These are issues that are already familiar in society, so that during the learning process students gain new knowledge that can increase their understanding of reproductive system issues. This is the main influence on students' high understanding of the indicator of identifying scientific issues.

The indicator achievement in explaining scientific phenomena was 77.92%. In contrast to identifying scientific issues, in explaining scientific phenomena, especially regarding the reproductive system, students are asked to better describe the phenomena that occur. According to other study what needs to be considered in indicators explaining scientific phenomena is a person's skills to apply scientific knowledge, describe phenomena that occur, predict changes, identify relevant information and estimate appropriate results (Rini et al., 2021). Based on this, the questions created in this research aim at students' conceptual knowledge about the reproductive system. Students are required can to explain various phenomena in this material, such as analyzing the mechanisms of the menstrual cycle, fertilization, gametogenesis, spermatogenesis, oogenesis and other phenomena.

The third indicator in the competency aspect of students' scientific literacy skills is using scientific evidence. This indicator is the indicator with the lowest achievement compared to the other two indicators. As many as 69.16% of all students who took the test had mastered indicators using scientific evidence. In line with research that state scientific evidence is the indicator with the lowest achievement which shows that students' ability to make efforts to solve problems from presenting phenomena is still lacking (Mulyani et al., 2020). According to other study the indicator of using scientific evidence requires students to interpret scientific findings as evidence in making conclusions, identifying evidence and communicating the reasons for drawing conclusions (Rini et al., 2021). In this research, the use of questions to measure indicators using scientific evidence consists of questions that lead to conclusions about a phenomenon, so it requires a more complex understanding to answer them. This is the biggest possibility of lower mastery of this indicator compared to the other two indicators.

Each school has achieved different aspects of scientific literacy competency aspects. This is influenced by internal factors that come from within the student, which include interest in reading and interest in learning. Based on interviews with biology teachers in the city of Yogyakarta, it was stated that students have low interest in learning so teachers need various methods to increase this interest in learning. Apart from that, it is influenced by external factors including the facilities provided by the school. The results of interviews with biology teachers in the city of Yogyakarta showed that the school had used digital-based learning, the school facilitated the technology needed to apply this learning. So that the overall results of students' scientific literacy abilities are in the good category, this is due to the impact of the completeness of school facilities and the role of teachers in making maximum use of the available facilities. When school facilities are complete and utilized optimally, students' scientific literacy skills will improve.

The achievement of indicators of scientific literacy skills in each school is different, but overall the highest mastery of the indicator is identifying scientific issues. This is in accordance with research state that the highest indicator of achievement in scientific literacy is identifying scientific questions (Putri et al., 2022). However, several studies have shown that the highest achievement of indicators is found in explaining scientific phenomena (Rahmadani et al., 2022). Meanwhile, the indicator using scientific evidence is one of the lowest indicators in several of these studies. These differences are of course influenced by various factors, including school facilities and teachers. Based on research conducted by other study stated that the cause of low scientific literacy skills is the use of textbooks that has not been maximized, contextual learning and students' reading abilities have not been implemented (Fuadi et al., 2020). Apart from that, another cause is the learning method. So this is related to the teacher's readiness in preparing learning tools. In line with the interview results, teachers use appropriate teaching materials and learning media, such as e-modules, power points, videos, LKPD and several educational games. The differences in achievement of scientific literacy ability indicators in each school are caused by the use of different teaching materials and learning media by teachers in each school. Apart from the important role of teachers, scientific literacy abilities are also influenced by learning infrastructure. If learning facilities are adequate, learning will be maximized and students' scientific literacy skills can be well trained.

4. CONCLUSION

Based on the research results, it can be concluded that the scientific literacy skills of grade XI students at State High Schools in the city of Yogyakarta are in the good category. This result is influenced by the completeness of school facilities and the role of teachers in utilizing these facilities. If the school facilities are good, students' scientific literacy skills will be achieved well too. The highest achievement of scientific

literacy skills in the competency aspect is in identifying scientific issues, while the lowest achievement is in using scientific evidence. The scientific literacy skills between schools have significant differences, which means that there are differences in the average value of students' scientific literacy skills at each school.

5. REFERENCES

Abdullah, R. (2017). Pembelajaran Dalam Perspektif Kreativitas Guru Dalam Pemanfaatan Media Pembelajaran. *Lantanida Journal*, *4*(1), 35. https://doi.org/10.22373/lj.v4i1.1866.

Adam, T., Bugis, H., & Rohman, N. (2022). Implementasi Pengetahuan, Persepsi, Dan Penerapan Kesehatan Dan Keselamatan Kerja (K3) Pada Pembelajaran Praktik Program Keahlian Teknik Pemesinan Dan Teknik Ototronik Di SMK Negeri 2 Karanganyar. *NOZEL Jurnal Pendidikan Teknik Mesin*, *4*(1), 12. https://doi.org/10.20961/nozel.v1i1.63595.

Ariana, D., Situmorang, R. P., & Krave, A. S. (2020). Pengembangan Modul Berbasis Discovery Learning Pada Materi Jaringan Tumbuhan Untuk Meningkatkan Kemampuan Literasi Sains Siswa Kelas XI IPA SMA. *Jurnal Pendidikan Matematika Dan IPA*, *11*(1), 34. https://doi.org/10.26418/jpmipa.v11i1.31381.

Asrial, Syahrial, Maison, Kurniawan, D. A., & Piyana, S. O. (2020). Ethnoconstructivism E-Module to Improve Perception, Interest, and Motivation of Students in Class V Elementary School. *JPI (Jurnal Pendidikan Indonesia)*, *9*(1), 30–41. https://doi.org/10.23887/jpi-undiksha.v9i1.19222.

Bagasta, A. R., Rahmawati, D., M, D. M. F. Y., Wahyuni, I. P., & Prayitno, B. A. (2018). Profil Kemampuan Literasi Sains Peserta Didik di Salah Satu SMA Negeri Kota Sragen. *Pedagogia : Jurnal Pendidikan*, *7*(2), 121–129. https://doi.org/10.21070/pedagogia.v7i2.1551.

Bima, M., Saputro, H., & Efendy, A. (2021). Virtual Laboratory to Support a Practical Learning of Micro Power Generation in Indonesian Vocational High Schools. *Open Engineering*, *11*(1), 508–518. https://doi.org/10.1515/eng-2021-0048.

Bosica, J., Pyper, J. S., & MacGregor, S. (2021). Incorporating problem-based learning in a secondary school mathematics preservice teacher education course. *Teaching and Teacher Education*, *102*, 103335. https://doi.org/10.1016/j.tate.2021.103335.

Csanadi, A., Kollar, I., & Fischer, F. (2021). Pre-service teachers' evidence-based reasoning during pedagogical problem-solving: better together? *European Journal of Psychology of Education*, *36*(1), 147–168. https://doi.org/10.1007/s10212-020-00467-4.

Damayanti, A., Juanda, A., & Umami, M. (2021). Pengaruh Pendekatan Scientific Berbantuan Strategi Writing to Learn (WtL) terhadap Kemampuan Literasi Sains dan Hasil Belajar Siswa pada Materi Sistem Reproduksi. *Prosiding Seminar Nasional Biologi, Saintek, Dan Pembelajarannya*, 155–172.

Fatimah, A. S., & Santiana, S. (2017). Teaching in 21St Century: Students-Teachers' Perceptions of Technology Use in the Classroom. *Script Journal: Journal of Linguistic and English Teaching*, *2*(2), 125. https://doi.org/10.24903/sj.v2i2.132.

Fuadi, H., Robbia, A. Z., & Jufri, A. W. (2020). Analisis Faktor Penyebab Rendahnya Kemampuan Literasi Sains Peserta Didik. *Jurnal Ilmiah Profesi Pendidikan*, *5*(2), 108–116. https://doi.org/10.29303/jipp.v5i2.122.

Gebre, E. (2018). Learning with multiple representations: Infographics as cognitive tools for authentic learning in science literacy. *Canadian Journal of Learning and Technology*, *44*(1), 1–24. https://doi.org/10.21432/cjlt27572.

Handayani, D., Laksono, D. E., & Novitiana, L. (2017). Pengaruh Perilaku Agresif Terhadap Potensi Kecelakaan Pengendara Sepeda Motor Remaja Dengan Studi Kasus Pelajar Sma Kota Surakarta. *Jurnal Riset Rekayasa Sipil*, *1*(1), 64. https://doi.org/10.20961/jrrs.v1i1.14724.

Hendri, S., & Hasriani, M. (2019). Identifikasi Literasi Sains Mahasiswa (Studi Kasus Mahasiswa STISIP Amal Ilmiah Yapis Wamena). *Journal of Natural Science and Integration*, *2*(1), 95–104. https://doi.org/10.24014/jnsi.v2i1.7117.

Irhandayaningsih, A. (2020). Pengukuran Literasi Digital Pada Peserta Pembelajaran Daring Di Masa Pandemi Covid-19. *Anuva*, *4*(2), 231–240. https://demo.dspacedirect.org/bitstream/handle/10673/1975/8073-25123-1-SM.pdf?sequence=1&isAllowed=y.

Jang, M., Aavakare, M., Nikou, S., & Kim, S. (2021). The Impact of Literacy on Intention to Use Digital Technology for Learning: A Comparative Study of Korea and Finland. *Telecommunications Policy*, *45*(7). https://doi.org/10.1016/j.telpol.2021.102154.

Khairunnisa, Yogica, R., Selaras, G. H., & Syamsurizal. (2019). Pengaruh Model Pembelajaran KooperatifTipe Course Review Horay Bermuatan Literasi Sains terhadap Kompetensi Belajar Peserta Didik Pada Materi Sistem Reproduksi Manusia di SMAN 4 Pariaman. *Atrium Pendidikan Biologi*, *4*(3), 35–43.

http://dx.doi.org/10.24036/apb.v4i3.6461.

Khalid, M. S. (2011). ICT in Education: Secondary Technical Vocational Education and Training Institute Centered Diffusion of Innovation in Rural Bangladesh. In *International Technology, Education and Development Conference* (pp. 1126–1134). International Association of Technology, Education and Development (IATED). https://vbn.aau.dk/en/publications/ict-in-education-secondary-technical-vocational-education-and-tra.

Lampropoulos, G., Siakas, K., & Anastasiadis, T. (2019). Internet of Things in the Context of Industry 4.0: An Overview. *International Journal of Entrepreneurial Knowledge*, *7*(1), 4–19. https://doi.org/10.2478/ijek-2019-0001.

Made, I., Dharma, A., Ayu, N., & Lestari, P. (2022). The Impact of Problem-based Learning Models on Social Studies Learning Outcomes and Critical Thinking Skills for Fifth Grade Elementary School Students. *Jurnal Ilmiah Sekolah Dasar*, *6*(2), 263–269. https://doi.org/10.23887/JISD.V6I2.46140.

Mantika, S.P & Purwanto, A. (2022). Pengaruh Fasilitas Belajar, Kompetensi, Dan Kinerja Guru Terhadap Mutu Pendidikan Di Smk Kabupaten Bogor. *ACADEMIA: Jurnal Inovasi Riset Akademik*, *2*(3), 204–213. https://doi.org/10.51878/academia.v2i3.1508.

Mayasari, T. (2022). Analisis Kemampuan Literasi Sains Siswa Kelas Xi SMA Negeri di Kota Yogyakarta Mata Pelajaran Biologi Ditinjau dari Kefavoritan Sekolah. *Jurnal Edukasi Biologi*, *8*(1), 86–97. https://doi.org/10.21831/edubio.v8i2.18212.

Muhammad, U., & Widyanto, A. (2019). Internalisasi Nilai-Nilai Toleransi dalam Pembelajaran Pendidikan Agama Islam di SMA Negeri 1 Lhokseumawe. *DAYAH: Journal of Islamic Education*, *2*(1), 36–52. http://dx.doi.org/10.22373/jie.v2i1.2939.

Mulyani, R., Fadlika, R. H., & Dewi, T. N. S. (2020). Profil Kemampuan Literasi Sains Berdasarkan Gender di Kelas X. *Quagga (Jurnal Pendidikan Dan Biologi)*, *12*(2), 104–109. https://doi.org/10.25134/quagga.v12i2.2326.

Ogan-Bekiroğlu, F., & Arslan, A. (2014). Examination of the Effects of Model-based Inquiry on Students' Outcomes: Scientific Process Skills and Conceptual Knowledge. *Procedia - Social and Behavioral Sciences*, *141*, 1187–1191. https://doi.org/10.1016/j.sbspro.2014.05.202.

Oliver, M. C., & Adkins, M. J. (2020). "Hot-headed" students? Scientific literacy, perceptions and awareness of climate change in 15-year olds across 54 countries. *Energy Research and Social Science*, *70*, 1–9. https://doi.org/10.1016/j.erss.2020.101641.

Permatasari, D., & Suprayitno, E. (2021). Pendidikan Kesehatan Reproduksi pada Remaja. *Jurnalempathy*, *2*(1), 8–12. https://doi.org/10.37341/jurnalempathy.v2i1.46.

Priyastuti, M. T., & S. (2020). Kepuasaan Mahasiswa Terhadap Pembelajaran Daring Selama Pandemi Covid-19. *Journal of Language and Health*, *1*(2), 49–56. https://doi.org/10.37287/jlh.v1i2.383.

Putri, T. R., Masriani, Rasmawan, R., Hairida, & Erlina. (2022). Analisis Kemampuan Literasi Sains Mahasiswa Pendidikan Kimia di Universitas Tanjungpura. *Jurnal IPA & Pembelajaran IPA*, *6*(2), 164–179. https://doi.org/10.24815/jipi.v6i2.25460.

Rahmadani, F., Setiadi, D., Yamin, M., & Kusmiyati, K. (2022). Analisis Kemampuan Literasi Sains Biologi Peserta Didik SMA Kelas X di SMAN 1 Kuripan. *Jurnal Ilmiah Profesi Pendidikan*, *7*(4b), 2726–2731. https://doi.org/10.29303/jipp.v7i4b.1059.

Rini, C. P., Dwi Hartantri, S., & Amaliyah, A. (2021). Analisis Kemampuan Literasi Sains Pada Aspek Kompetensi Mahasiswa PGSD FKIP Universitas Muhammadiyah Tangerang. *Jurnal Pendidikan Dasar Nusantara*, *6*(2), 166–179. https://doi.org/10.29407/jpdn.v6i2.15320.

Rohman, S., Rusilowati, A., & Sulhadi. (2017). Analisis Pembelajaran Fisika Kelas X SMA Negeri di Kota Cirebon Berdasarkan Literasi Sains. *Journal Physics Communication*, *1*(2), 12–18. https://doi.org/10.15294/physcomm.v1i2.10402.

Rukajat, A. (2018). *Pendekatan Penelitian Kuantitatif: Quantitative Research Approach*. Deepublish.

Sekarwati, A. (2020). Implementasi Pembelajaran Discovery Learning yang Terintegrasi Pendidikan Karakter dalam Pelajaran Biologi. *Jurnal Pendidikan Edutama*, *7*(1). https://doi.org/10.30734/jpe.v7i1.819.

Shanks, J. D., Izumi, B., Sun, C., Martin, A., & Shanks, C. B. (2017). Teaching undergraduate students to visualize and communicate Public Health data with infographics. *Frontiers in Public Health*, *5*(NOV), 1–6. https://doi.org/10.3389/fpubh.2017.00315.

Stacey, K., & Turner, R. (2015). Assessing mathematical literacy: The PISA experience. *Assessing Mathematical Literacy: The PISA Experience*, 1–321. https://doi.org/10.1007/978-3-319-10121-7.

Suhadi, A. P., Ristanto, R. A., Sigit, D. V, & Supriyatin. (2023). Assessment of Biological Literacy for High School Student. *Biosfer: Jurnal Pendidikan Biologi*, *16*(1), 25–36. https://doi.org/10.21009/biosferjpb.24765.

Sukowati, D., Rusilowati, A., & Sugianto. (2017). Analisis Kemampuan Literasi Sains Dan Metakogntif

Peserta Didik. *Physics Communication*, *1*(1), 16–22. https://doi.org/10.15294/physcomm.v1i1.8961.

Sutrisna, N. (2021). Analisis Kemampuan Literasi Sains Peserta Didik SMA di Kota Sungai Penuh. *Jurnal Inovasi Penelitian*, *1*(12), 2683–2694. https://doi.org/10.47492/jip.v1i12.530.

Temuningsih, Peniati, E., & Marianti, A. (2017). Pengaruh Penerapan Model Problem Based Learning Berpendekatan Etnosains Pada Materi Sistem Reproduksi Terhadap Kemampuan Berpikir Kritis Siswa. *Journal of Biology Education*, *6*(1), 70–79. https://doi.org/10.15294/jbe.v6i1.14060.

Tulaiya, & Wasis. (2020). Analisis Kemampuan Literasi Sains Sains Peserta Didik SMA/MA di Kabupaten Sumenep. *IPF: Inovasi Pendidikan Fisika*, *9*(3), 417–427. https://doi.org/10.26740/ipf.v9n3.p417-427.

Turiman, P., Omar, J., Daud, A. M., & Osman, K. (2012). Fostering the 21st Century Skills through Scientific Literacy and Science Process Skills. *Procedia - Social and Behavioral Sciences*, *59*, 110–116. https://doi.org/10.1016/j.sbspro.2012.09.253.

Tyan, P. H., Rahman, F. A., & Sarvestani, M. S. (2020). Teachers' readiness in implementing and facilitating 21st century learning. *Universal Journal of Educational Research*, *8*(1 A), 24–29. https://doi.org/10.13189/ujer.2020.081304.

Weiss, K. A., McDermott, M. A., & Hand, B. (2022). Characterising immersive argument-based inquiry learning environments in school-based education: A systematic literature review. *Studies in Science Education*, *58*(1), 15–47. https://doi.org/10.1080/03057267 .2021.1897931.

Wibowo, T., & Ariyatun, A. (2020). Kemampuan Literasi Sains Pada Siswa Sma Menggunakan Pembelajaran Kimia Berbasis Etnosains. *Edusains*, *12*(2), 214–222. https://doi.org/10.15408/es.v12i2.16382.

Widiana, R., Maharani, A. D., & Rowdoh. (2020). Pengaruh Model Problem Based Learning terhadap Kemampuan Literasi Sains Siswa SMA. *Jurnal Ta'dib*, *23*(1), 87–94. https://doi.org/10.31958/jt.v23i1.1689.

Widowati, A., Widyastuti, L., & Widodo, E. (2019). The profile of students' scientific literacy in competence aspect in junior high school of Yogyakarta city. *Journal of Physics: Conference Series*, *1321*(3). https://doi.org/10.1088/1742-6596/1321/3/032070.

Wiranto, R., & Slameto, S. (2021). Alumni satisfaction in terms of classroom infrastructure, lecturer professionalism, and curriculum. *Heliyon*, *7*(6), e06679. https://doi.org/10.1016/j.heliyon.2021.e06679.

Yildirim, S. (2017). Approaches of Designers in the Developed Educational Purposes of Infographics ' Design Processes. *European Journal of Education Studies*, *3*(1), 248–284. https://doi.org/10.5281/zenodo.231283.

Zubaidah, S. (2016). Keterampilan abad ke-21: Keterampilan yang diajarkan melalui pembelajaran. *Seminar Nasional Pendidikan*, 1–17. https://www.researchgate.net/profile/siti-zubaidah-7/publication/318013627.