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STUDENTS' DIGITAL LITERACY ON CHEMISTRY–STEAM PROJECT-BASED LEARNING: A GENDER PERSPECTIVE

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Abstract
This study aims to analyze students' digital literacy in STEAM project-based chemistry learning based on a gender perspective. This study uses a quantitative descriptive method with data collection techniques through a questionnaire instrument on 30 students of class XI science who were selected by purposive sampling. The research instrument consisted of 6 indicators, which were developed into 18 questionnaire items, which were arranged using a Likert scale. Research data were analyzed quantitatively descriptively by calculating scores and percentages. The results of the analysis of students' digital literacy data as a whole showed an average of 81.75% in the excellent category. The study based on gender showed an average gain of 81% for female students and 82.6% for male students, both of which did not have a significant difference, and both were in the excellent category. These results indicate that the STEAM project approach can be an alternative learning that can maximize students' digital literacy.

Keywords: digital literacy, chemistry learning, gender perspective, STEAM project.

Abstrak
Penelitian ini bertujuan untuk menganalisis literasi digital siswa pada pembelajaran kimia berbasis STEAM project berdasarkan perspektif gender. Penelitian ini menggunakan metode deskriptif kuantitatif dengan teknik pengambilan data melalui instrumen kuesioner pada 30 siswa kelas XI IPA yang dipilih secara purposive sampling. Instrumen penelitian terdiri dari 6 indikator yang dikembangkan menjadi 18 item kuesioner yang disusun menggunakan skala likert. Data penelitian dianalisis secara kuantitatif deskriptif dengan menghitung skor dan persentase. Hasil analisis data literasi digital siswa secara keseluruhan menunjukkan rata-rata 81,75% pada kategori baik. Sedangkan analisis berdasarkan gender menujukkan perolehan rata-rata 81% pada siswa perempuan dan 82,6% pada siswa laki-laki, keduanya tidak memiliki perbedaan yang begitu signifikan dan keduanya berada pada kategori yang baik. Hasil tersebut menunjukkan bahwa pendekatan STEAM project dapat menjadi alternatif pembelajaran yang dapat memaksimalkan literasi digital siswa.

Kata Kunci: literasi digital, pembelajaran kimia, perspektif gender, STEAM project

INTRODUCTION

Internet users in Indonesia increased by +16%, namely as many as 27 million people. Meanwhile, social media users increased by 170.0 million, an increase of +6.3% or as many as 10 million people. The rise in Internet and social media users occurred between January 2020 and January 2021, which was caused by the shift in community activities during the pandemic (DataReportal, 2021). The increase in internet users in Indonesia is not necessarily in line with the rise in digital literacy. According to the Economist Intelligence Unit, Indonesia ranks 61st out of 100 countries in terms of education level and readiness to use the Internet. Indonesia's position is lower than that of neighboring countries such as Singapore and Malaysia, which are ranked 22nd and 33rd. The low level of digital literacy in the education sector in Indonesia is currently driving several government initiatives, such as the National Literacy Movement and the reintroduction of ICT into the school curriculum. However, it has not been implemented effectively, with a focus on improving students' digital literacy skills (Azzahra & Amanda, 2021). Digital literacy is very important for students, a generation whose lives are very close to digital information, communication, and technology.

According to the results of previous research, students had difficulty learning chemistry on acid-base titration material. These difficulties include the difficulty in determining the appropriate acid-base indicator, the difficulty in determining the type of titration based on the titration curve and the difficulty in determining the equivalence point in weak acid and strong base titrations (Marzuki & Tri Astuti, 2018; Priyatni et al., 2020). The results of an analysis of students' needs in research (Misrochah, 2021) show that students are less interested in learning chemistry because they find it challenging to understand chemical concepts and material. Therefore, to increase students' interest and motivation in learning chemistry, it will be more exciting and easy to understand if there are learning innovations using art and digital technology in their implementation (Priyatni et al., 2020).

The STEAM learning project is one of the developments of learning innovations that involve all aspects needed to support students' 21st-century skills and digital literacy. (Suryaningsih et al., 2022). Research (Purnamasari et al., 2020) states that STEAM is one of the best methods for facilitating the strengthening of digital literacy, which is suitable for improving students' skills. This can be done by giving projects to students; students can play an active role in exploring learning material. Students can also be creative by using computational skills in digital technology to make exciting products that help them understand chemical material. Students can do a project to create learning content on social media as an effort to increase interest and motivation (Suryaningsih et al., 2022), mastery concept (Liliawati et al., 2018; Wandari et al., 2018), as well as to support students' digital literacy (Suryaningsih & Nisa, 2021). So that the implementation of STEAM project-based chemistry learning by utilizing digital technology needs to be carried out as a means to support students' digital literacy.

Students' digital literacy can be influenced by several factors, one of which is gender differences. Men and women have different hormones and, of course, have various ways of thinking, acting and feeling things (Ayu et al., 2018); (Winata & Friantini, 2020). According to research (Samputri, 2019), the digital literacy of male students is slightly higher than that of female students. The difference is not that significant, so the average percentage of digital literacy levels of male and female students is relatively the same; it's just that there are different tendencies in each indicator.

In an effort to support the national digital literacy movement, learning innovations are needed by utilizing digital art and technology. In this case, the STEAM (Science, Technology, Engineering, Art, Mathematics) project-based learning model and approach are used. The implementation of the STEAM project by carrying out students' digital literacy in chemistry learning acid-base titration material provides different innovations in the implementation of chemistry learning. Therefore, based on the explanation of the background above, the researcher aims to analyze students' digital literacy based on gender in the STEAM project-based chemistry learning on acid-base titration material.

METHOD

The method used in this study is descriptive quantitative with data collection techniques through questionnaires prepared using a Likert scale. The research sample was selected by purposive sampling, namely 30 students (15 boys and 15 girls) in class XI IPA SMA Cendekia 2021/2022 who have carried out STEAM project-based chemistry learning.

In this study, the implementation of the STEAM project was carried out to analyze students' digital literacy in chemistry learning acid-base titration material. The PjBL STEAM implementation in chemistry learning uses project-based learning stages by integrating the five STEAM aspects into learning activities. The results of the empirical validity test calculated using SPSS version 22.0 showed that the 18 questionnaire items obtained r count > r table, with r table (n = 76) of 0.294. This indicates that the questionnaire instrument is declared valid so that it can be used to collect research data. The results of the reliability test on the 18 questionnaire statement items showed the Cronbach Alpha test value of 0.917, so the research instrument has excellent reliability.

The research data obtained was then analyzed quantitatively descriptively to obtain a percentage score. The score results from collecting questionnaire data are then calculated using the following formula:

$$P = f/N \times 100\% \quad (1)$$

Information:

P = Percentage number

f = Raw score obtained

N = Highest score in the flow questionnaire.

RESULT AND DISCUSSION

The implementation of the STEAM project learning is carried out according to the project-based learning stages by integrating the STEAM approach into the implementation of acid-base titration chemistry learning. Such learning can train students to have more proactive participation in science-related learning by implementing project-based learning (Lin & Tsai, 2021). The project, in the form of creating creative content in the form of a learning poster design related to acid-base titration material, is able to integrate the five aspects of STEAM.

From a scientific perspective, theoretically and conceptually, students will understand acid-base titration material through this project. Students study the theory and concepts of acid-base titration material and discuss it with their groups. The results of the discussion are then briefly outlined in an attractive learning poster design. This is in line with research (Oner et al., 2016), which states that project-based learning can invite students to collaborate, communicate and discuss among students to find solutions to a problem.

In the technology aspect, students can make the most of all the technology they have to find information related to learning materials, design learning posters, conduct online quizzes, and so on. Students are trained to sort information obtained from digital sources and evaluate it with their group mates. In this case, students are able to manage information obtained from digital sources and know official sites or websites managed by certain agencies or institutions. In addition, students can also use and utilize existing technology to be able to present learning posters. The application of STEM/STEAM can encourage students to design, develop and use technology in applying their knowledge (Bahriah & Irwandi, 2020); (Lu et al., 2022). STEM/STEAM learning can be the key to creating the next generation of nations that are able to compete in the global arena, so STEM learning needs to be developed in the learning process (Rihhadatul et al., 2020).

In the engineering aspect, students are more emphasized on how to use and operate everything related to STEAM project-based acid-base titration learning. Students can utilize digital technology well and wisely, can take online quizzes without significant obstacles, can make attractive learning poster designs, and can learn about acid-base titration practicum techniques through practicum videos. Students can only find virtual acid-base titration practicum techniques via video due to limited school facilities and limited learning time. Therefore, practicum activities can be maximized through acid-base titration practicum videos so that students' digital literacy can be maximized by utilizing existing technology in urgent situations and conditions.

In the art aspect, students can maximize their creativity and creative thinking skills by learning STEAM project-based acid-base titrations. Students can express their creative thinking skills in solving a problem and problem related to acid-base titration material. Students can freely express their innovation and creativity in making attractive learning poster designs. Aesthetics in learning materials can also increase students' interest and motivation in understanding the content or content of

the material being taught. Having pictures and colours in a reading text will create a unique attraction for students to read and understand it. Combining art with technology can make learning more interactive, spark innovation, and result-oriented (Chung et al., 2022).

In STEAM learning, students are encouraged to think creatively and critically from an aesthetic perspective, engage in creative interactions with teachers and peers, analyze material topics from various angles, explain and evaluate findings, and learn from feedback to acquire more skills. (Ozkan & Umdu Topsakal, 2019). Students have the opportunity to use their creativity not only during project design but they are also able to incorporate creative aspects into their interactive activities and laboratories (Domenici, 2022). The implementation of STEAM learning can highlight aspects of student art, such as design skills, creativity, innovation, and imagination (Suryaningsih et al., 2022; Vicente et al., 2021).

In the mathematics aspect, students can understand, process, and operate numerical data based on the titration results of an acid and a base (Suryaningsih & Nisa, 2021). Not only these mathematical abilities but students are also asked to translate the results of their understanding into a learning poster design related to acid-base titration arithmetic operations. Of course, it is not easy to display mathematical calculation operations in attractive form. With the STEAM project in the form of a learning poster design, students can be creative mathematically and systematically in turning acid-base titration calculation operations into interesting learning content.

In this study, the number of male and female students in class XI IPA was the same, namely 15 female students and 15 male students. In Figure 1, it can be seen that male students have a higher average score than female students on all digital literacy indicators. All of them scored in good and excellent categories. Thus, the digital literacy of male students is better than that of female students, with a not-so-significant difference in scores.

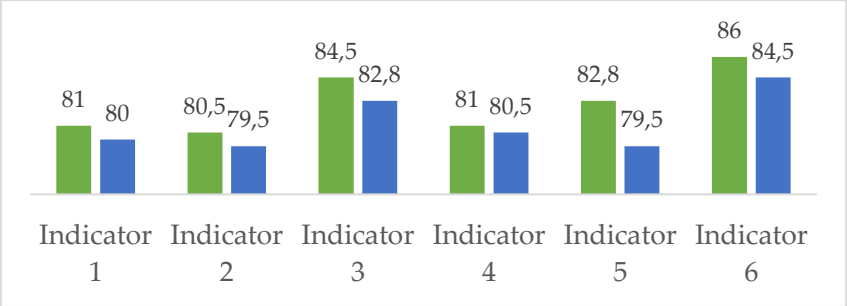

Figure 1. Results of Data Analysis of Student Digital Literacy Based on Gender

The results of this study are in line with (Bayrakci, 2020; Ocak, 2015 Schonard, 2018), which also states that men get higher digital literacy scores. Possible reasons behind this difference can be attributed to factors such as male interest in higher technology, for example, in operating computers, mobile applications, and so on. Their preference for work related to technology is higher than that of women (Brata et al., 2022; Mariscal et al., 2019), although with a not-so-significant difference.

The results of this research are also in line with the research of Saha & Zaman (2017), which shows that there are no significant differences between men and women. This indicates that today, women and men have gender equality so that in all respects and fields, women and men have the same abilities. If there are differences, the value will not be far away, and there is no significant difference. Different trends in several indicators or sectors can cause these differences.

According to Abbas et al. (2019), it is difficult to measure the actual level of people's digital literacy skills. Therefore, many studies point to confidence in self-perceived measures of digital skills. Based on the presentation of the results of the data analysis above, the following is a discussion of each student's digital literacy indicator developed by researchers based on digital literacy indicators (Phipps et al., 2018):

ICT skills are the basis or foundation that everyone must have in digital literacy. ICT skills include the ability to use hardware (laptops, gadgets, computers, etc.), applications, software, and ICT-based services. Not only that, good ICT users must also be able to operate it wisely and responsibly (Monggilo et al., 2021). At the same time, ICT productivity includes students' skills in utilizing ICT-based tools to carry out tasks effectively, productively, and with attention to quality. This skill is measured by the ability to use various ICT tools, platforms, and applications to achieve learning goals (Phipps et al., 2018).

These basic skills can improve a person's standard of living, enabling them to interact with others and access educational, public, commercial, and financial services available online (Spante et al., 2018). Meanwhile, advanced digital literacy skills, according to (Abbas et al., 2019), include skills needed by experts in the ICT profession, such as computer programming and network management. Having a STEAM project to create digital content in the classroom can increase engagement and also encourage the development of the skills needed for a digital society. These digital project activities can optimize student involvement in digital literacy (Spires & Bartlett, 2012).

Information, data, and media literacy are the three most common concepts that focus on critical understanding of information, data, and media from digital sources (Wardhani et al., 2019). This is interpreted as a skill aimed at building student knowledge regarding the processing of a source of data or information from digital media (Sagitaa et al., 2019; Park et al., 2021; Liana & Alpindo, 2021; Tania et al., 2020). An understanding of copyright rules is also fundamental to correctly reference digital works in the form of learning e-posters in different contexts (Phipps et al., 2018). In this indicator, students are encouraged to hone their thinking skills by analyzing, organizing, and evaluating information (Rahmawati et al., 2022).

The use of interactive and fun learning methods in the educational process is an essential factor in developing student creativity and innovation (Matraeva et al., 2020). The results of this study are also in line with the thinking (Hanif et al., 2019)

and Ummah et al., 2019) that implementing project-based learning can improve student skills, especially creativity. Students who have digital creativity and innovation can produce digital work and adopt and develop something new with digital technology in different forms of work (Phipps et al., 2018). Chung et al. (2020) stated that combining art and technology can make learning more flexible and can trigger student innovation and creativity.

In learning the STEAM project, students are encouraged to think creatively, analyze a problem creatively, express ideas, and learn to develop skills (Ozkan & Umdu Topsakal, 2019). Students become more active, creative, and skilled in producing valuable products (Andriyani et al., 2019; Nasir et al., 2019; Suwarno et al., 2020). The characteristics of project-based learning have advantages in developing intelligent, superior, critical, creative, and competitive generations (Didin & Wiji, 2020).

Creativity and innovation are among the most essential skills in demand by academics around the world (Abedini, 2020). Creativity is considered a driving force in the world of education to increase scientific literacy (Imran et al., 2020). In several recent documents, UNICEF calls for a holistic approach to digital literacy, namely in terms of skills, emphasizing that students must be empowered technically, cognitively, and in their abilities to be productive in the digital era (Nascimbeni & Vosloo, 2019).

Digital communication trains students to communicate effectively in digital media and spaces such as text-based posts, images, videos, and social media (Phipps et al., 2018). In this case, students have excellent communication skills through text and images contained in the learning e-poster design, which is distributed to digital communication media, namely Instagram social media. Digital collaboration and participation enable students to build digital networks and participate in social and cultural life by using digital media and services (Phipps et al., 2018). In this study, students created positive content in the form of learning e-poster designs, which were distributed to digital communication media, namely Instagram social media. This is an optimistic digital participation step that spreads learning content. Creating and communicating information is an increasingly important skill to maximize student engagement in digital literacy. Within the framework of 21st-century digital literacy, communication, and creation in digital media will become the center of attention in the world (Karpati, 2011).

In this STEAM project-based chemistry learning, students learn how to think critically, creatively solve problems, and express their ideas in exciting ways. As students work on learning poster designs, they engage more deeply with the content, which helps them better understand the material and visually communicate their knowledge in engaging ways, as digital literacy competencies have become the learning objectives of the national curriculum in Indonesia (Hafifah & Sulistyo, 2020).

Digital literacy education is now a means of developing students' computational thinking abilities and the use of digital in learning (Kim et al., 2021). In addition, new technological innovations assist students and teachers in presenting information in an engaging, effective, and efficient manner so that information can be more easily understood (Alsaadoun, 2021). Interactive and exciting learning media can also increase students' interest and motivation in learning (Delita et al., 2022). Several studies confirm that digital literacy skills have a significant influence on students' cognitive abilities (Pertiwi & Musthafa, 2021).

Digital wellbeing is achieved by maintaining safety, social relations, and personal life balance on social media (Phipps et al., 2018). In this case, students have excellent well-being and relationships with humans in the digital social environment and the surrounding environment.

As technology advances, the ability to develop self-identities will continue to be influenced by digital media. Thus, students need to have the capacity to become intelligent and wise users of ICT to maintain digital health and well-being. Students can actively seek information related to learning, communicate or represent it in different forms, and share it with the larger community of their class, such as social media, thereby creating a greater sense of pride and responsibility for their work (Chambers et al., 2019).

CONCLUSION

Based on the results of data analysis of students' digital literacy research in STEAM project-based chemistry learning, the results of the data analysis show that the implementation of the STEAM project in chemistry learning uses the PjBL learning stage by integrating the five STEAM aspects into learning material through a project. Overall, student digital literacy shows an average of 81.75% in the excellent category. The analysis based on gender showed an average gain of 81% for female students and 82.6% for male students; the two did not have such a significant difference, and both were in the excellent category. These results indicate that the implementation of the STEAM project can be an alternative learning that can maximize students' digital literacy.

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