Scientific writing: A way to improve students' information literacy and reasoning ability

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ABSTRACT

The abilities students need to fulfill the SDGs are current information literacy and reasoning skills. Apart from going through the learning process, this ability can be developed by the participation of students in extracurricular activities related to scientific writing. This service activity aims to provide scientific writing assistance for students at Batu Islam High School to improve information literacy and reasoning skills. The form of training carried out is to provide material related to various research that can be carried out by students both inside and outside the classroom and provide assistance to take part in scientific writing competitions at the national level. The instruments for community service activities used are information literacy questions and observation sheets. Data analysis was carried out descriptively. The results of community service activities show that there is an increase in students' information literacy and reasoning abilities. The results of the participation of students in the national competition won the third prize.

Penulisan ilmiah: Cara untuk meningkatkan literasi informasi dan kemampuan penalaran siswa. Kemampuan yang dibutuhkan siswa saat ini untuk memenuhi SDGs adalah keterampilan literasi informasi dan kemampuan menalar. Selain melalui proses pembelajaran, kemampuan ini dapat dikembangkan dengan keikutsertaan siswa dalam kegiatan ekstrakurikuler yang berkaitan dengan karya tulis ilmiah. Kegiatan pengabdian ini bertujuan untuk memberikan pendampingan penulisan ilmiah bagi siswa SMA Islam Batu untuk meningkatkan literasi informasi dan kemampuan menalar. Bentuk pelatihan yang dilakukan adalah memberikan materi terkait berbagai penelitian yang dapat dilakukan oleh siswa baik di dalam maupun di luar kelas serta memberikan pendampingan untuk mengikuti lomba karya tulis ilmiah tingkat nasional. Instrumen kegiatan pengabdian masyarakat yang digunakan adalah soal literasi informasi dan lembar observasi. Analisis data dilakukan secara deskriptif. Hasil kegiatan pengabdian kepada masyarakat menunjukkan adanya peningkatan kemampuan literasi informasi dan penalaran siswa. Hasil keikutsertaan mahasiswa dalam lomba tingkat nasional tersebut meraih juara ketiga.

INTRODUCTION

The existence of technological and scientific developments demands changes in schools and learning processes. It must be based on basic principles in the form of simultaneous achievement of quality and equality in learning (Sato, 2013). The learning must accommodate the ability to think, develop skills, and form a mindset. One of the skills needed by students to deal with today's developments is information literacy (Banik & Kumar, 2019; Erich & Popescu, 2010; Hulett et al., 2013; Soleymani, 2014) and reasoning skills (Kim & Pegg, 2019; Osborne, 2013; Talman et al., 2020). These skills support the

achievement of the goals outlined in the Sustainable Development Goals (SDGs) (Dzerefos, 2020). Literacy is one of the world's major agendas issued by the United Nations which is summarized in the Sustainable Development Goals (SDGs). Goal 4 of the SDGs is related to quality education which is the UNESCO framework to be achieved in 2030 in building literacy, namely ensuring that all people, both men and women have literacy and numeracy skills (Care & Kim, 2018; Dzerefos, 2020).

Information literacy, in general, is defined as an individual's capacity to recognize when information is needed and as a set of abilities to seek, find, analyze, evaluate, and communicate information that is needed as a solution to various problems (Chu et al., 2011; Çoklar et al., 2017; Flierl et al., 2018; Klucevsek & Brungard, 2016). They need skills to use various information tools and primary sources of information for problem-solving. Information literacy must be implemented due to the urgency that cannot be avoided in predicting the evolution of the amount of information in terms of volume, media, and technology. Information literacy can be said to be a process of lifelong learning which will guide and prepare students to sustain life, not just in the scope of education (Karimi et al., 2015; Ranaweera, 2017; Soleymani, 2014). Someone literate knows how to learn because they know or understand how to find information, organize knowledge, fulfill tasks from information obtained, and use it for lifelong learning. By utilizing accessible resources, information literacy needs to assist a person in meeting his information demands in everyday life.

Important information literacy needs to be developed in schools, both in curricular and extracurricular activities. This ability can be developed with the participation of students in youth scientific work (*Karya Ilmiah Remaja* - KIR). KIR is one of the extracurricular activities that can accommodate and develop students' creativity and knowledge (Permana & Fatmawati, 2019). This activity aims to instill a scientific attitude and honesty in solving problems encountered with high sensitivity and using systematic methods to develop oneself in life. Thus, the existence of KIR can create a generation of students who have a scientific attitude. Students can provide solutions to problems that arise around them (Sagala et al., 2017). In addition, this scientific problem analysis activity can affect students' literacy skills (Permana & Fatmawati, 2019; Suwono et al., 2021). Students who have literacy skills can use scientific knowledge, identify questions, draw conclusions based on evidence, and explain and predict natural phenomena to overcome problems (Hestiana & Rosana, 2020; Prastika et al., 2019; Xiao et al., 2019). The activity of producing scientific work will have an impact on students' reasoning abilities. Reasoning ability is one of the principal thinking skills for students. The ability to reason is closely related to solving a problem (problem-solving) (Casanoves et al., 2017; Kinslow et al., 2018; Osborne, 2013). This ability is important for students to have as a provision to solve everyday problems.

But in fact, not all schools can guide their students to be able to produce scientific works. As is the case with SMA Islam Batu based on observations that extracurriculars related to KIR are still not running optimally. Therefore, it is necessary to assist in writing scientific papers for SMA Islam Batu students to improve their information literacy and reasoning abilities. The form of assistance that is carried out is to provide an introduction and implementation of how to compose a scientific work following the scientific method to improve the information literacy and reasoning abilities of SMA Islam Batu students. In addition, it also provides assistance to take part in scientific writing competitions for high school students. Therefore, this community service in SMA Islam Batu aims to improve students' information literacy and reasoning ability through extracurricular assistance activities in producing scientific work (scientific writing). Therefore, this community service in SMA Islam Batu aims to improve students' information literacy and reasoning ability through extracurricular assistance activities in producing scientific work (scientific writing). The benefits of this community service activity are to equip students to face the challenges of development in the current era. Students' information literacy and reasoning abilities are competencies that students must have in today's generation. These skills support the goals outlined in the Sustainable Development Goals (SDGs).

METHOD

SMA Islam Batu is a private school located on Jl. Mustard No. 7, Ngaglik, Batu City, East Java 65311. The distance from the University of Muhammadiyah Malang the school is 10.7 km, 24 minutes by car. This school is one of the schools under the Muhammadiyah Association. SMA Islam Batu is still classified as a foundation school that has not developed optimally with a limited number of students. Each class level consists of only two classes. Extracurricular activities at school were temporarily vacuumed during the COVID-19 pandemic, including youth scientific work (*Karya Ilmiah Remaja* - KIR). The school map can be seen in Figure 1. The observation results show that extracurricular activities related to KIR are still not running optimally. It is necessary to assist in writing scientific papers for SMA Islam Batu students to improve their information literacy and reasoning abilities. The form of assistance that is carried out is to provide an introduction and implementation of how to compose a scientific work following the scientific method to improve the information literacy and reasoning abilities of SMA Islam Batu students.

The solutions offered to solve the problems faced in school are: 1) determine the teacher whose role is to continue assisting in producing scientific work at SMA Islam Batu; 2) form a group of students who become the KIR extracurricular team; and 3) provide assistance to produce several scientific works of students to be included in competitions at the national level. Participation provided by school partner in the implementation of this community service program is providing human resources (teacher and student) as participants in assisting youth scientific writing. Students who are the main target of this community service activity will also be analyzed for their information literacy and reasoning abilities.

The school also provides a representative place and space for the program implementation. Schools as partners must also provide facilities and convenience to students who will take part in competitive activities, both at the regional and national levels.
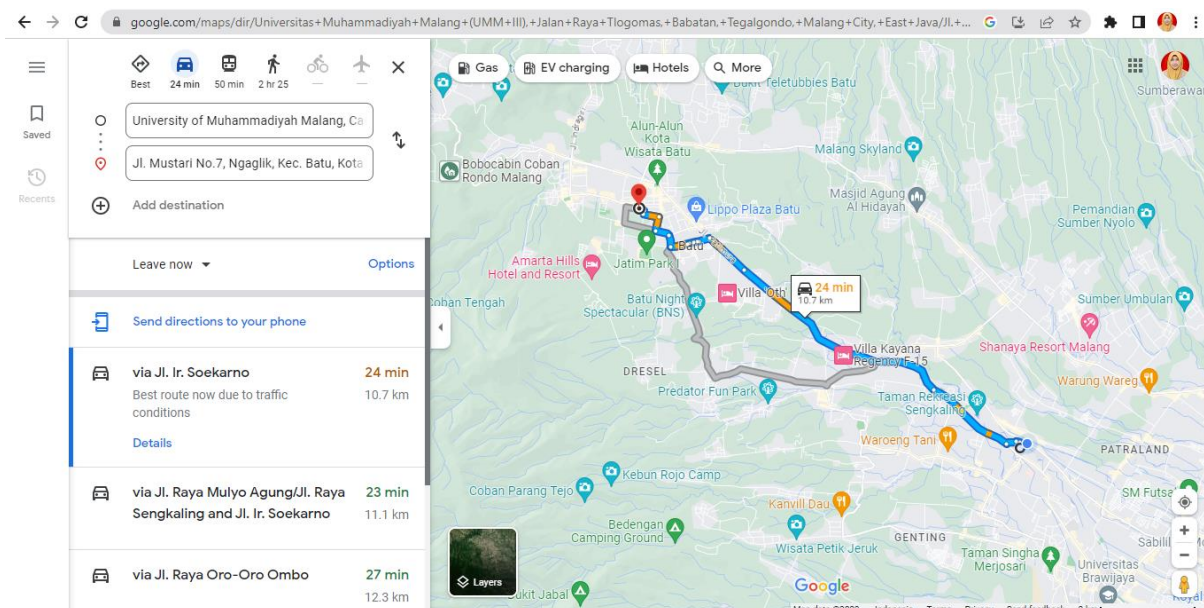

Figure 1. The location of SMA Islam Batu

In overcoming the problems faced by the school, the method of this community service activity that has been discussed and mutually agreed upon with partner schools is as follows:

Program Outreach to School

This socialization activity was carried out to design activities in eight months. At this stage an agreed schedule for the implementation of mentoring and job descriptions for each party, namely the community service team, teachers, and students of science class. The job description referred to as follows:

a. The task of the community service team is as a facilitator in developing scientific work. It also assists and provides an evaluation of the result of students' scientific work.
b. The task of the accompanying teacher is as a guide for students to provide direction on the students' scientific work.
c. The student's task is to act as executors in the development of scientific work in collaboration with peers.

Training and Assistance in Producing Scientific Work

In activities designed for eight (8) meetings, teachers and students will receive assistance and training in developing scientific work. The initial meeting is conducting a pre-test to measure information literacy and students' reasoning abilities. At the end of the program activity, a post-test was carried out to measure information literacy and students' reasoning abilities after the training and mentoring process. Reasoning ability is the process of using existing knowledge to conclude, make predictions, or construct explanations. Furthermore, the indicators of information literacy that are measured consist of five aspects, namely:

a. Identifying reliable sources of information
b. Finding sources of information that match the needs to solve the problem
c. Evaluating the sources of information found
d. Implementing appropriate information sources to solve the problem
e. Acknowledging the source of information.

The Program Analysis and Publication

The results of the pre-test and post-test will be analyzed to see the impact of the community service activities. The number of teachers expected to participate in this assistance is as many as science teachers (Mathematics, Biology, Physics, and Chemistry) at Batu Islam High School. It is to enrich creative ideas in the KIR extracurricular member group. Students will be given material about the stages in the preparation of scientific work following the scientific method. Furthermore, students are given the time and opportunity to create or compile scientific work with the accompanying teacher following the field of interest. This activity ends with an evaluation of scientific work compiled by a team of service lecturers, teachers, and each group of students (self-evaluation) to measure the success of the work produced. Furthermore, students make revisions to improve scientific work that is compiled and then included in scientific writing competitions at the national level. The findings of this community service activity are published in the mass media so that the general public can also read them.

RESULTS AND DISCUSSION

Program Outreach to School

In the socialization activities for the community service program at SMA Islam Batu, an initial measurement was carried out related to the literacy abilities of students participating in KIR extracurricular activities. Measurements were made by spreading the written test (Figure 2).

Figure 2. Pre-test activities for students

Furthermore, the results of the activity were the selection of a teacher whose role was to continue assisting in the creation of scientific work at SMA Islam Batu, namely Mrs. Nindi, an Indonesian language teacher. This accompanying teacher will later play a role in coordinating the continuation of the KIR extracurricular at SMA Islam Batu. Figure 3 shows coordination activities with accompanying teachers. This activity was also carried out together with students who carried out PMM Mitra Dosen activities. Coordination is carried out to determine the schedule of community service activities and mentor students in compiling scientific work.

Figure 3. The coordination of the program with the teacher and student (PMM Mitra Dosen)

The community service results also revived KIR's extracurricular activities at SMA Islam Batu. The student team that became the KIR extracurricular team consisted of 10 students. It includes tenth, eleventh, and twelfth graders from science and social majors. Community service programs at school also motivate students to compile scientific work. This motivational activity is given by lecturers to students. Documentation of motivational activities is presented in Figure 4. The motivational activities also measure the students' information literacy who participate in KIR extracurricular activities at SMA Islam Batu. The measurement of information literacy skills is done by providing a pre-test (Figure 2). The results of measurements using these pre-test questions become the basis for determining the level of students' information literacy. Then, the data will be compared with the post-test result conducted after the community service programs end. It is hoped that the community service programs can improve the students' information literacy skills and their reasoning ability. Furthermore, students are given the time and opportunity to create or compile scientific work with the accompanying teacher following the field of interest.

Figure 4. The motivational activities for students to compile scientific work

Training and Assistance in Producing Scientific Work

In activities designed for eight (8) meetings, teachers and students will receive assistance and training in developing scientific work. Some of the documentation of training activities and mentoring in the creation of scientific work at SMA Islam Batu is presented in Figure 5.

Figure 5. The training activities in compiling scientific work

The pre-test and post-test results related to students' information literacy and reasoning abilities are presented in Table 1. Based on Table 1, there is an improvement in the average information literacy and reasoning ability of students who are members of the extracurricular KIR. The average pre-test score of 50 rises to 64 during the post-test. The training activities in producing scientific work affected students' information literacy skills. (Klucevsek & Brungard, 2016) states that group discussions to find research ideas will make students explore various sources. Source exploration is carried out online and offline related to day life problems. This exploratory activity requires students to read many references in the form of data and information (Al-Aufi et al., 2017; Çoklar et al., 2017; Shao & Purpur, 2016). It is one of the indicators related to students' information literacy skills that are trained continuously.

Table 1. Results of pre-test and post-test scores for information literacy skills and reasoning abilities of the KIR team

No.	Student Name	Pre-test Score	Post-test Score
1.	Antok Suhermawan	35	50
2.	Natasya Salsabila	40	60
3.	Savira Tri Chaya Ningtias	60	75
4.	Andika Surya Putra	40	50
5.	Rona Fadilaturrizky	40	60
6.	Aulia Ananda	45	60
7.	Zahra Arzeta H.	80	90
8.	Mayta Dwi M.	55	70
9.	Nadya Dwi A.	55	65
10.	Gadis Yanuarian G.	50	60
	Average	50	64

Furthermore, student activities carry out mini-research to solve problems facilitating them to understand the finding data and information. When they make analysis and discussion studies to perfect their scientific work, information literacy skills will continue to be honed. So, it will have a significant effect on students' information literacy (Klucevsek & Brungard, 2016). In line with information literacy skills, students' reasoning abilities are also accommodated through research activities carried out by students (Kinslow et al., 2018; Lobato & Zimmerman, 2019). Students will be able to make reason when they find out the facts from the experiment themselves. The preparation of scientific work with mini-research facilitates students to read data and analyze information that is relevant to the data obtained. The improvement in the average score is none other due to producing scientific papers that require them to search, read, understand, evaluate, and apply appropriate information to solve their problems. However, this activity must continue to increase information literacy significantly (Klucevsek & Brungard, 2016; Shao & Purpur, 2016; Soleymani, 2014). Through the KIR extracurricular at SMA Islam Batu, it is hoped that it can become a place for students to continue to develop themselves and achieve various achievements outside of school. The results of mass media publications for the achievement of community service programs are linked in the following two links: (1) https://tabloidmatahati.com/pmm-94-mitra-dosen-umm-tingkatkan-prestasi-kti-smai-batu/#.Y6_5GJxkdwI.whatsapp; (2) https://tabloidmatahati.com/pmm-mitra-dosen-umm-sukses-kembalikan-prestasi-kti-smai-kota-batu/#.Y-SW6p5wgxU.whatsapp.

The results of the mentoring activities for producing scientific works also resulted in two papers that submit to national competitions, Student Science Week (PILAR) at Mahasaraswati University Denpasar in 2022. One of the works won 3rd prize with the title "Flowsida (Utilization of Flower Waste as a Natural Larvicidal): Efforts to Eradicate Dengue Fever in Batu City". The existence of these community service programs increases students' motivation to write scientific papers and participate in competitions at the national level. This achievement will make students more active and passionate about diligently writing scientific papers. It becomes an opportunity for schools to improve non-academic achievements for students. On the other hand, the existence of KIR extracurriculars can also be one more point for schools to be able to compete with other schools.

CONCLUSION

Based on the community service program activities at SMA Islam Batu, there are three conclusions for the programs. First, one teacher becomes an accompanying teacher to continue assisting in producing scientific work at SMA Islam Batu. Second, the formation of the KIR extracurricular team consists of 10 students. Third, two papers were submitted in national competitions in Student Scientific Week (PILAR) at Mahasaraswati University Denpasar in 2022 and won the 3rd prize. The results of the community service activities showed that there was an improvement in students' information literacy and reasoning abilities. As a follow-up effort to the community service program, suggestions for optimizing community service activities are to remain active in assisting at SMA Islam Batu so that scientific paper writing activities can continue. The assistance activities through discussion forums on social media (WhatsApp Group) are also carried out continuously as a continuation of the program.

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