

An Analysis of Students' Scientific Literacy Skills in State Senior High Schools throughout Central Tapanuli District

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Abstract— This study was conducted for students in State High Schools throughout Central Tapanuli District with the aims were to find out: (1) the students' scientific literacy skills; (2) the correlation between the parents' formal educational background and students' scientific literacy skills; (3) the correlation between the science learning intensity and students' scientific literacy skills; and (4) the correlation between the science learning processes in schools and students' scientific literacy skills. The population were all students of XI-Science Program in State Senior High Schools throughout Central Tapanuli District with the sample was taken randomly with 256 students. This type of research was descriptive correlative research. The research instruments were tests of students' scientific literacy skills, and questionnaires of students' scientific literacy factors, namely: the parents' formal educational background, the learning science intensity, and the students' science learning processes. Data analysis techniques used in this study included descriptive analysis and correlative analysis using multiple regression analysis at a significant level $\alpha = 0.05$. The results showed that: (1) the students' scientific literacy skills of XI-Science Program in State Senior High Schools throughout Central Tapanuli District belong to the poor category; (2) there was a significant correlation between the parents' formal educational background and students' scientific literacy skills throughout Central Tapanuli District ($t_{count} = 2.603$; $P = 0.010$); (3) there was a significant correlation between the learning science intensity and students' scientific literacy skills throughout Central Tapanuli District ($t_{count} = 4.083$; $P = 0.000$); and (4) there was a significant correlation between the science learning processes and students' scientific literacy skills throughout Central Tapanuli District ($t_{count} = 12.644$; $P = 0.000$). The results of this study implied that the role and parents' educational backgrounds, science learning intensity, and scientific literacy-based students' learning process in schools had a significant correlation and influence that could improve students scientific literacy skills.

Keywords— *Scientific Literacy; Parents' Formal Education; Science Learning Intensity; Science Learning Process*

I. INTRODUCTION

In the Era of Industrial Revolution 4.0 provides opportunities and challenges for Human Resources, especially

in Indonesia. The role of human beings is gradually taken over by automatic machinery which results in an increasing number of unemployed people. This of course will add to the burden of local and national problems. Therefore, to take advantage of opportunities and answer the challenges of industrial revolution 4.0, human resources need to be enhanced in literacy capabilities which include data literacy, technology literacy, and human literacy.

Data literacy skills aim to improve skills in processing and analyzing data in the interest of improving public and business services. Technology literacy aims to demonstrate the ability to utilize digital technology to process data and information. Whereas compulsory human literacy is mastered because it aims to show the elements of soft skills or individual character development to be able to collaborate, be adaptive and be wise in this digital information age. Therefore the importance of scientific literacy in humans in utilizing technology in the era of the Industrial Revolution 4.0 at this time.

Scientific literacy is an ability related to the use of science and technology. Program for International Student Assessment (PISA) (2010) states that scientific literacy is the ability to use science knowledge, identify questions, draw conclusions based on evidence to understand and help make decisions regarding nature and changes made to nature through human activities. Gormally, *et al.* (2012) interpreted that scientific literacy ability as a person's ability to distinguish scientific facts from various information, recognize and analyze the use of scientific inquiry methods and the ability to organize, analyze, interpret quantitative data and scientific information.

Through scientific literacy, students can improve their ability to think critically, logically, reflective, metacognitive, and creative called High Order Thinking Skills, which are students able to solve problems, make decisions, think critically and think creatively. The results of the PISA (Program for International Student Assessment) are developed

by several developed countries in the world that are members of the Organization for Economic Cooperation and Development (OECD) which is a literacy study that aims to periodically examine students' ability to read (reading literacy), mathematics (literacy literacy), and science (scientific literacy) concluded that in general science literacy abilities of Indonesian students are still low. The results of the PISA (Program for International Student Assessment) Study Based on Science Literacy of Indonesian students from 2006 ranked 50th out of 57 countries with a score of 395. Ranking of scientific literacy abilities of Indonesian students continued to decline which in 2009 was ranked 60th out of 65 countries with score 383, and in 2012 ranked 64th out of 65 countries with a score of 382, while in 2015 the score of Indonesian students' literacy skills increased by 403 by ranking 62nd out of 70 countries (source: www.oecd.org/pisa).

The survey conducted by the Trends in International Mathematics and Science Study, TIMSS (every four years) showed that students' average science achievement scores were below the International score average. The results of the 2007 TIMSS (Trends in International Mathematics and Science Study) survey showed that the average score of Indonesian students' science achievements was 427 with a ranking of 35 out of 49 countries. The scientific achievements of Indonesian students continued to decline, which in 2011 ranked 40th out of 42 countries with a score of 406, and in 2015 ranked 45th out of 48 countries with a score of 397 (source: www.iewa.nl/timss).

The Province of North Sumatra continues to work to overcome literacy problems, read, write, count to eradicate illiteracy. This is revealed from the 2016 Most Littered Nation In the World study data that reading interest in Indonesia occupied rank 60 from 61 countries (webcapp.ccsu.edu). The low index of reading interest of Indonesian people must be resolved especially in the Province of North Sumatra in order to be able to become a province of literacy. The problem of the low reading interest of the Indonesian people comes from the absence of a place or reminder for the public to read. North Sumatra is the fourth province to declare itself a province of literacy after DKI Jakarta, Riau and West Nusa Tenggara. This is evidenced by the existence of two regional districts in North Sumatra, namely Labuhanbatu and Serdangbedagai Districts that have been set by the Minister of Education and Culture as a national literacy pilot district. Both regions have a high commitment to promoting literacy. Even Serdangbedagai District got the highest score in the regional literacy development index survey conducted by the Minister of Education and Culture (source: *Kompas*, 2017).

In the Middle School of Central Tapanuli District, it was found that the learning process carried out was still conventional, namely the question and answer lectures, and the contents of the evaluation instrument assessment of student learning outcomes had not yet referred to scientific literacy. So that these results lead to a low ability of students to use or use scientific concepts, principles, laws, and theories contained in biological matter in solving problems in everyday life, and

making decisions. This states that the ability of students is still weak in science, even though with the development of the times the foundation of science is needed to communicate and develop technology. This shows that students have difficulty in getting meaning and using science to solve various problems that occur in everyday life that actually require a good understanding of science (Haristy, Enawaty & Lestari, 2013), therefore, scientific literacy is in the form of ability use science knowledge to describe conclusions based on scientific facts. So that these conclusions need to be outlined in the evaluation of science learning in the classroom.

II. RESEARCH AND METHOD

This study was carried out in State Senior High Schools throughout Central Tapanuli District from February to November 2018. The population were all students of XI-Science Program in State Senior High Schools (SMA Negeri) throughout Central Tapanuli District with the sample was taken randomly with 256 students presented in Table 3.1.

TABLE 1. POPULATION AND SAMPLE OF THE STUDY

No	Schools	Population	Samples
1	SMA Negeri 1 Andam Dewi	88	33
2	SMA Negeri 1 Barus	68	36
3	SMA Negeri 1 Pinangsori	173	26
4	SMA Negeri 1 Sorkam	46	21
5	SMA Negeri 1 Sorkam Barat	138	35
6	SMA Negeri 1 Tukka	107	34
7	SMA Negeri 2 Tukka	38	35
8	SMA Negeri 1 Sibabangun	102	36
Total		760	256

This type of research was descriptive correlative research. The research instruments were tests of students' scientific literacy skills, and questionnaires of students' scientific literacy factors, namely: the parents' formal educational background, learning science intensity, and students' science learning processes. Data analysis techniques used in this study included descriptive analysis and correlative analysis using multiple regression analysis at a significant level $\alpha = 0.05$.

III. RESULTS AND DISCUSSION

A. The Correlation between Parents' Formal Educational Background and Students' Scientific Literacy Skills

Based on the results of a simple correlation analysis (r), the correlation between the parents' formal educational background and students' scientific literacy skills was 0.161. This showed that there was a strong correlation between the parents' formal educational background with students' scientific literacy skills of class XI-Science Program in State Senior High Schools throughout Central Tapanuli District.

Due to the value of r was positive, it means that the higher the parents' formal educational background, the more it increases students' scientific literacy skills.

Based on the analysis of the Model Summary obtained: (1) the value of R was positive 0.161, then there was a positive correlation between the parents' formal educational background with students' scientific literacy skills in State Senior High Schools throughout Central Tapanuli District; and (2) determination coefficient value R^2 was 0.026, then the parents' formal educational background contributes to the students' scientific literacy skills of 2.6%.

Based on the results of the analysis of variance obtained F_{count} value of 6.778 with a significant value of 0.010 smaller than 0.05. Furthermore, the parents' formal educational background influences simultaneously (jointly) the students' scientific literacy skills ($F_{\text{count}} = 6.778$; $P = 0.010$).

Based on the results of the coefficient analysis between the variables of parents' formal educational background on scientific literacy skills, students of class XI-Science Program in State Senior High Schools throughout Central Tapanuli District were obtained: (1) value calculated for parents' formal educational background variable of 2,603 with significance level of 0.010 was smaller than 0.05. Furthermore, partially the parents' formal educational background variable had a significant effect on students' scientific literacy skills ($t_{\text{count}} = 2.603$; $P = 0.010$); and (2) the coefficient value of the parents' formal educational background variable of 0.847 with a constant value of 32.177. Furthermore, the linear line equation in this study was $\hat{Y} = 0.847X + 32.177$. The correlation between parents' formal educational background and students' scientific literacy skills was presented in Figure 1.

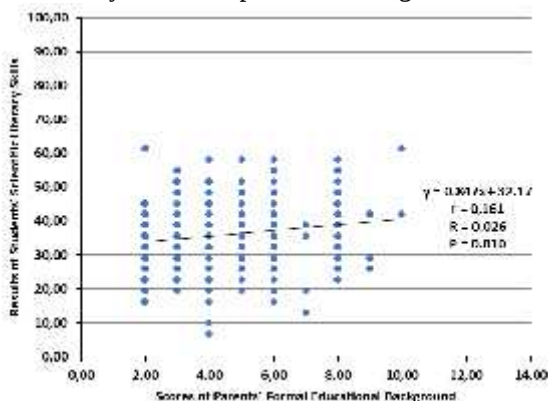


Fig. 1. The Correlation between Parents' Formal Educational Background and Students' Scientific Literacy Skills of Class XI-Science Program in State Senior High Schools throughout Central Tapanuli District

B. The Correlation between the Science Learning Intensity and Students' Scientific Literacy Skills

Based on the results of simple correlation analysis (r), the correlation between the science learning intensity and students' scientific literacy skills was 0.248. This showed that there was a strong correlation between the science learning intensity with students' scientific literacy skills of class XI-

Science Program in State Senior High Schools throughout Central Tapanuli District. Due to the value of r was positive, it means that the higher the science learning intensity, the more it increases students' scientific literacy skills.

Based on the results of the Model Summary analysis, it was obtained: (1) the value of R was positive 0.248, then there was a positive correlation between the science learning intensity with students' scientific literacy skills of XI-Science Program in State Senior High School throughout Central Tapanuli District; and (2) the coefficient of determination R^2 was 0.062, furthermore the science learning intensity contributes to the students' scientific literacy skills of 6.2%.

Based on the results of the analysis of variance obtained F_{count} value of 16,667 with a significant value of 0,000 smaller than 0.05. Furthermore, the science learning intensity had a simultaneous (jointly) influence on students' scientific literacy skills ($F_{\text{count}} = 16,667$; $P = 0,000$).

Based on the results of the coefficient analysis between the science learning intensity on scientific literacy skills, students of class XI-Science Program in State Senior High Schools throughout Central Tapanuli District were obtained: (1) the value calculated for science learning intensity variable of 4,083 with a significance level of 0,000 smaller than 0, 05. Furthermore, partially the science learning intensity variable had a significant effect on students' science literacy skills ($t_{\text{count}} = 4.083$; $P = 0,000$); and (2) the coefficient value of the science learning intensity variable of 0.964 with a constant value of 24.728. Furthermore, the linear line equation in this study was $\hat{Y} = 0.964X + 24.728$. The correlation between science learning intensity and students' science literacy skills of Class XI-Science Program in State Senior High Schools throughout Central Tapanuli District was presented in Figure 2.

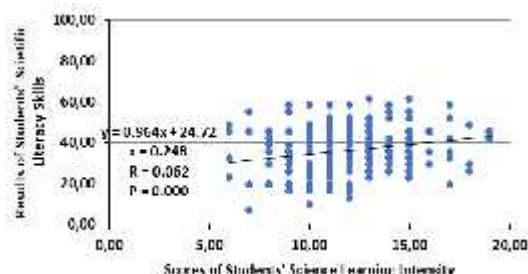


Fig. 2. The Correlation between Science Learning Intensity and Students' Scientific Literacy Skills of Class XI-Science Program in State Senior High Schools throughout Central Tapanuli District

C. The Correlation between Science Learning Processes in Schools and Students' Scientific Literacy Skills

Based on the results of a simple correlation analysis (r), the correlation between the science learning processes in schools and students' scientific literacy skills was 0.622. This showed that there was a strong correlation between the science learning processes in schools with students' scientific literacy skills of class XI-Science Program in State Senior High Schools throughout Central Tapanuli District. Due to the value

of r was positive, it means that the higher the science learning processes in schools, the more it increases students' scientific literacy skills.

Based on the analysis of the Model Summary obtained: (1) the value of R value was positive 0.622, then there was a positive correlation between the science learning processes in schools with students' scientific literacy skills of class XI-Science Program in State Senior High Schools throughout Central Tapanuli District; and (2) the coefficient of determination R^2 was 0.386, furthermore the science learning processes in schools contributes to the students' scientific literacy skills of 38.6%.

Based on the results of the analysis of variance obtained F_{count} value of 159,870 with a significance value of 0,000 smaller than 0.05. Furthermore, the science learning processes in schools had a simultaneous (jointly) influence on students' scientific literacy skills ($F_{\text{count}} = 159,870$; $P = 0,000$). Based on the results of the coefficient analysis between the variable of the science learning processes in schools towards students' scientific literacy skills were obtained: (1) the calculated value for the science learning processes in schools was 12,644 with significance level of 0,000 smaller than 0.05. Furthermore, partially the science learning processes in schools had a significant effect on students' scientific literacy skills ($t_{\text{count}} = 12,644$; $P = 0,000$); and (2) the variable coefficient value of the science learning processes in schools was 0.724 with a constant value = -7.737. Furthermore, the linear line equation in this study was $\hat{Y} = 0.724X - 7.737$. The correlation between science learning processes in schools and students' scientific literacy skills of Class XI-Science Program in State Senior High Schools throughout Central Tapanuli District was presented in Figure 3.

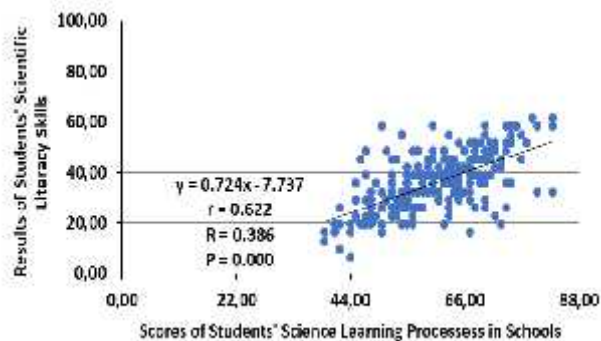


Fig. 3. The Correlation between Science Learning Processes in Schools and Students' Scientific Literacy Skills of Class XI-Science Program in State Senior High Schools throughout Central Tapanuli District

IV. CONCLUSION

Based on the results of the study that has been described, it can be concluded that: (1) the students' scientific literacy skills of Class X-Science Program in State Senior High Schools throughout Central Tapanuli District belong to the poor category; (2) there was a significant correlation between parents' formal educational background and students' scientific literacy skills of class XI-Science Program in State Senior High Schools throughout Central Tapanuli District ($r = 0,161$); (3)

there was a significant correlation between science learning intensity and students' scientific literacy skills of class XI-Science Program in State Senior High Schools throughout Central Tapanuli District ($r = 0,248$); and (4) there was a significant correlation between the science learning processes in schools and students' scientific literacy skills of class XI-Science Program in State Senior High Schools throughout Central Tapanuli District ($r = 0,622$)

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