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Analysis of Students Scientific Literacy in Integrated Acid-Base Learning Socioscientific Issues

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Abstract
This study aims to obtain the profile of students' scientific literacy in acid-base learning through the integration of socioscientific issues. The study was conducted on grade 11 students of SMA Negeri 33 Jakarta. The research methodology used was qualitative. Research data were obtained through observation, reflection journals, science literacy tests, student worksheets, and interviews. The socioscientific issues approach begins with introducing acid-base issues, introducing concepts, playing roles, and learning reflections. The results of the study showed that students can develop their ability to express opinions and foster concern for environmental conditions. The profile of students' scientific literacy is quite good in terms of knowledge and competence. In terms of context, most students are at the scientific illiteracy and nominal scientific literacy levels. Based on the results of the science literacy test, the majority of students are at the scientific illiteracy and nominal scientific literacy levels.

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INTRODUCTION

A citizen needs to deeply understand the importance of science in various aspects of life. Science not only functions as academic insight, but also as a tool to form critical, analytical and rational thinking patterns. With a good understanding of science, a person can make more appropriate and responsible decisions, both for themselves and society. Scientific literacy not only includes mastery of scientific concepts, but also the ability to apply them in everyday life and understand the implications and risks posed. This ability is very important in dealing with various social, political, economic, environmental and public policy issues. With strong scientific literacy, individuals can act more wisely in responding to technological developments, climate change, public health and other social dynamics. Therefore, increasing scientific literacy is not only an individual need, but also a necessity for society to build a more advanced and sustainable civilization.

Education in Indonesia still lags behind other countries, especially in terms of scientific literacy. The PISA (Program for International Students Assessment) assessment found that learning in Indonesia has not guided students to achieve scientific literacy. The PISA assessment in 2022 shows that Indonesia's scientific literacy ranking is in 67th position out of 81 countries with a score of 383. The resulting trend shows a dominant decline in scores over the last 20 years.

Low scientific literacy is caused by several factors. One of them is students' low interest in reading which has an impact on less than optimal understanding of science concepts (Juwita, et al., 2022). Apart from that, science learning is still minimal in connecting science with real

life phenomena, so students have difficulty applying the concepts learned in everyday contexts (Yusmar and Fadilah, 2023). Another factor is that learning methods are still dominated by conventional and teacher-centered approaches, thus providing less space for students to be active in the learning process (Erayanti and Jampel, 2022).

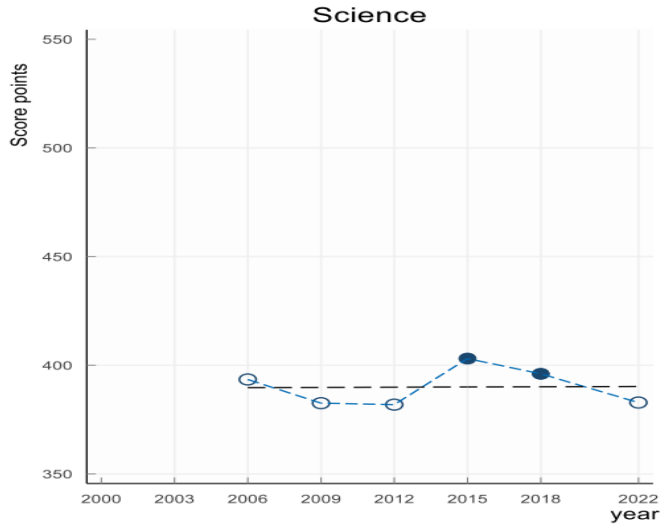

Figure 1. Student Science Literacy Results in Indonesia from Year to Year

In science learning, an approach is needed that can involve students to relate science to everyday life phenomena to improve scientific literacy. One learning approach that can be applied is socioscientific issues (SSI), which is a learning approach by linking social issues with scientific explanations. Socioscientific issues in science education enable students to think at a high level (Hulyadi, Bayani, et al., 2023; Hulyadi, Muhali, et al., 2023) and pay attention to social issues (Afrianis, 2022).

Several studies have stated that the application of socioscientific issues has an effect on students' scientific literacy. The results of Hestiana and Rosana's (2020) study showed that socioscientific issues-based learning has an effect on scientific literacy and problem-solving skills. Positive results were also shown in a study conducted by Nazilah (2019) which showed that socioscientific issues-based teaching materials can improve scientific literacy scores. For teachers themselves, the selection of socioscientific issues can be an effort to improve students' scientific literacy (Mudawamah, 2020).

Acid-base material as a chemistry lesson is very likely to be connected to socioscientific issues because of its contextual nature to everyday life problems. Based on this background, the aim of this research is to determine the profile of students' scientific literacy when learning acids and bases through a socioscientific issues approach. The profile is known through scientific literacy test questions to obtain literacy levels from students' answers based on aspects compiled by PISA, including attitudes, context, competence and knowledge. It is hoped that the exploration of these four aspects can provide an illustration of the extent to which students can apply their scientific understanding in dealing with real problems related to acids and bases.

METHOD

This research was conducted on class 11 students of SMA Negeri 33 Jakarta. Research subjects were selected using the convenience sampling method because this school has affordable access and ease of obtaining research permits. The research methodology used is a qualitative method. The research was carried out in the initial stages of creating a learning plan, conducting

research, and collecting data. The data obtained came from interviews, student worksheets (LKPD), scientific literacy tests, and reflection journals. Qualitative data will then be analyzed descriptively.

This research uses a socioscientific issue approach which consists of five stages: 1) problem analysis by presenting everyday issues through videos, 2) conveying the concept of acid and base through scientific clarification, 3) refocusing the concept of acid and base on dilemmatic socioscientific issues through group discussions small, 4) doing roleplaying to bring out students' arguments, and 5) providing conclusions and carrying out meta-reflective activities on the ongoing learning. After completing learning through socioscientific issues, students are given scientific literacy test questions.

Qualitative data was analyzed using the Miles & Huberman model, through three stages: 1) Data reduction: the data obtained was categorized based on relevant themes, 2) Data presentation: after reduction, the data was arranged in tables, interview transcripts and narrative descriptions to facilitate interpretation, 3) drawing conclusions: conclusions obtained from data analysis are reconfirmed through data triangulation.

All instruments have been validated by chemistry education lecturers. To ensure the validity of the data, this research uses triangulation of sources and methods. Source triangulation was carried out by comparing the results of interviews, LKPD, scientific literacy tests, and reflection journals to see the consistency of the findings. Meanwhile, method triangulation was carried out by analyzing data from various data collection techniques in order to increase the validity of research results. In addition, the member checking strategy was carried out by asking students to confirm the results of the interview again to ensure the suitability of the researcher's interpretation with the students' understanding.

RESULTS AND DISCUSSION

Application of Socioscientific Issues to Acid Base Learning

a. Problem Analysis

In the problem analysis stage, students are introduced to the issues that will be discussed during the learning process. This problem analysis stage introduces the issues presented through video displays on the issues of acid rain and ocean acidification, while the issue of alkaline drinking water is presented through text.

"My feelings after attending yesterday's lesson, I was happy and pleased because I was not only given theory but also given examples in everyday life. So we can increase our insight." **(Interview, Student 03, March 16, 2022)**

Based on Student 03's answer, the selected issue is quite close to the students. Issues that are close to students can increase motivation in learning (Puspita & Subiantoro, 2022). Phenomena that are close to everyday life allow for experiences from students, so that students can provide attitudes and responses to a problem as expected in the socio-scientific issue approach.

b. Clarification of the Science

At this stage, the teacher explains the main material of acids and bases related to the issues presented. This stage explains the material on acids and bases, ionic equilibrium, and buffer solutions.

"Acid is a substance that produces H^+ ions, base is a substance that produces OH- ions. Acidic properties have a pH of less than 7, while bases have a pH of more than 7." **(Interview, Student 03, March 16, 2022)**

Students 03's answer can explain the basic concept of acids and bases. Swedish chemist Svante Arrhenius defined acids as substances that ionize in water to produce H^+ ions and bases as substances that ionize in water to produce OH^- ions (Chang, 2010). This is in accordance with students' understanding.

c. Refocus on the scientific dilemma

At this stage, students are refocused on the issue presented after previously being presented with a chemical concept that is relevant to the issue. Students are given a text containing an issue to discuss. The researcher facilitates students to determine their attitudes and views on a problem. The researcher also guides students to discuss in breakout rooms during online sessions and form groups in offline sessions. Students are assisted with questions in the LKPD to refocus and provide responses. The discussion process aims to encourage students to use their experience and knowledge to participate more in solving problems (Haryadi, 2022).

At the discussion stage, students will determine the attitude of their group towards the issue given. The attitudes and views of each individual are elaborated into a group idea. The discussion process gives different results in terms of student activity. When the discussion is carried out online, students do not produce too much discussion interaction. This is different from offline sessions where students can face their group members directly and can immediately respond to each opinion. This difference is due to the distraction factor experienced by students during online learning. According to Wang (2022), online learning distractions include multitasking, mind-wandering, and signal problems.

d. Roleplaying Task

After outlining the problems, students are divided into five groups. Each group prepares all the roles involved in the discourse text, then they will be played randomly. The researcher becomes a facilitator and moderator to enliven the discussion atmosphere. Students play roles according to the context of the issues presented. LKPD helps students in determining attitudes and preparing arguments to be presented. At the roleplaying task stage, student activities are filled with arguments in order to encourage students' thinking and discussion skills related to contemporary issues (Sabekti, et al, 2020).

"Discussing is an exciting thing because with differences of opinion, I can cover a wider range of my knowledge in solving a problem." **(Reflection journal 2, Student 30, February 7, 2022)**

The answers expressed by Student 30 show that discussions or debates can bring out students' skills, including respecting other people's opinions, caring for the environment, and empathy (Rahmawati, et al., 2020). The application of roleplaying allows students to explore the perspectives of group members and other group members, manage differences, and make suggestions in resolving a conflict.

e. Metareflective Activity

At this stage, students write down learning reflections at each meeting through Google Form. Students are given several reflective questions about what they get and how they feel after participating in learning.

"I feel satisfied because I can gain more insight into acid rain, starting from the views of each party, the causes of acid rain, and others." **(Reflection Journal 2, Student 18, February 7, 2022)**

From the reflection expressed by Student 18, students can be more open to differences of opinion, provide a stance on the environmental issues discussed, and so on. Learning through a socio-scientific issues approach can foster empathy and positively influence students' emotional regulation (Herman, et al., 2021), as well as provide experience in being involved in

socioscientific decision-making, and develop knowledge and critical thinking skills (Yacoubian, 2015).

Aspect Analysis of Scientific Literacy

In this study, researchers analyzed four aspects of students based on PISA assessments based on five levels proposed by Shwartz, Ben-Zvi, and Hofstein (2006): (1) scientific illiteracy, (2) nominal scientific literacy, (3) functional scientific literacy, (4) conceptual scientific literacy, and (5) multidimensional scientific literacy. Scientific illiteracy is a level obtained from the answers of students who cannot respond to reasonable questions about science. Nominal scientific literacy is possible students recognize a concept related to science, but the level of understanding clearly indicates a misunderstanding. Functional scientific literacy makes it possible the student describes a concept correctly, but has limited understanding of it. Conceptual scientific literacy allow students develop an integrated understanding of scientific disciplines with general scientific concepts, and master the procedures and processes of scientific investigation. Multidimensional scientific literacy includes abilities that transcend scientific disciplines and scientific methods, enabling students to appreciate science and technology in everyday life.

Analysis of students' scientific literacy using a science literacy test. The test was conducted on 30 students. The researcher first provided an explanation of the acid base concept with a socioscientific issue approach. After that, students worked on science literacy questions. Based on the test results, the following data were obtained.

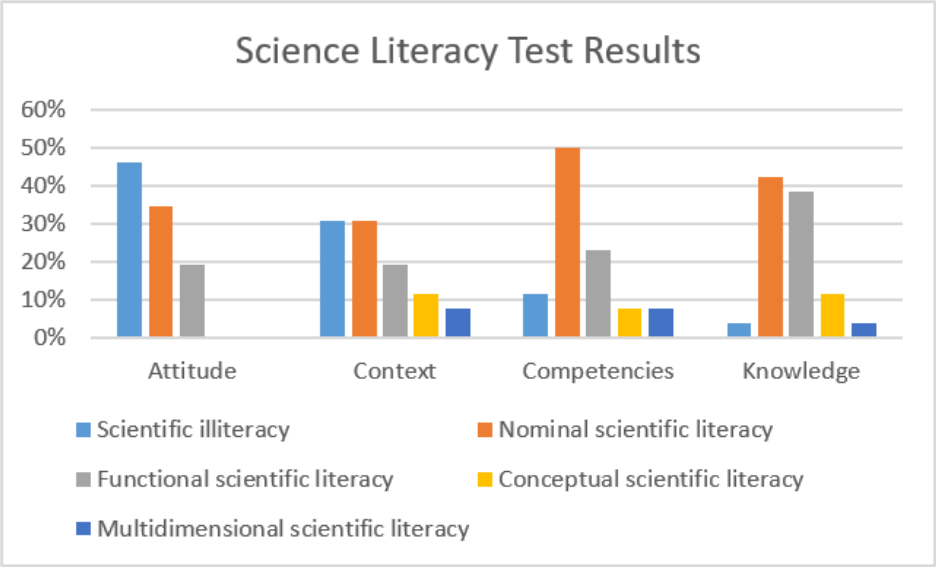

Figure 2. Science Literacy Test Results

Based on the diagram, in terms of attitude, the majority of students' scientific literacy levels are at the scientific illiteracy level. In terms of context, the scientific literacy levels of scientific illiteracy and nominal scientific literacy occupy the same number of students. As for the competency and knowledge aspects, the level of scientific literacy of nominal scientific illiteracy is at the highest level.

a. Attitude

The attitude aspect in assessing scientific literacy according to PISA shows students' interest in science and technology, respect for science for appropriate investigations, and perceived awareness of environmental issues.

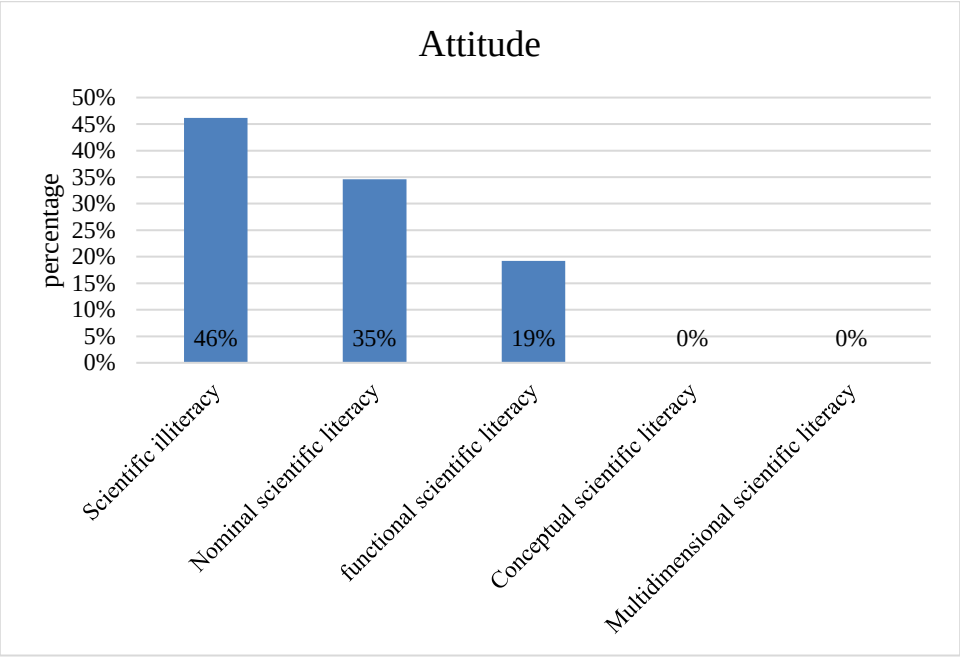

Figure 3. Science Literacy Results Attitude Aspect

The diagram in the image above shows the results of the science literacy test on the attitude aspect: 46.2% at the scientific illiteracy level, 34.6% nominal scientific literacy, 19.2% functional scientific literacy, 0% conceptual scientific literacy and 0% multidimensional scientific literacy. At the scientific illiteracy level, there are 46.2% of students who are included in this level. The answers given by students are as follows:

"Buildings collapsed, damage to plants, polluted irrigation channels and dams, soil damage." **(Science Literacy Test, Student 08, March 23, 2022)**

The answers given by the students could not be answered scientifically so that it was categorized as scientific illiteracy. The answers presented were limited to mentioning the losses caused by acid rain, without explaining the causes and processes of the damage. This is because students are not used to explaining a phenomenon with scientific concepts.

At the nominal scientific literacy level, there were 34.6% of students. At this level, students are able to recognize a concept related to science, but their level of understanding clearly shows misconceptions. The following are the answers written by students:

"The losses caused by acid rain to infrastructure in Tangerang City are that many facilities are damaged, such as rust, especially facilities or objects made of metal. This happens because acid rain has corrosive acidic properties or can erode other particles." **(Science Literacy Test, Student 22, March 23, 2022)**

The answers given show an interest in science. Student 22 highlighted his concern about infrastructure affected by acid rain. Students answer already linked the concept of acidic properties, but did not explain in more depth the rust phenomenon that occurs in facilities.

At the functional scientific literacy level, there are 19.2% of students. At this level, students can describe a concept correctly, but have limited understanding of it.

"The losses caused by acid rain to infrastructure in the city of Tangerang are infrastructure damage. Acid rain can damage objects and infrastructure made of limestone and marble, such as statues or historic buildings" **(Science Literacy Test, Student 11, March 23, 2022)**

The answer given by Student 11 has not provided an explanation of the process of why acid rain can damage infrastructure. Acid rain can damage rocks because it will dissolve calcium

carbonate, leaving crystals on the rocks that have evaporated (Budiyono, 2010). That is what will damage rocks as the basic material for infrastructure.

At the conceptual scientific literacy and multidimensional scientific literacy levels, there are 0% of students. The failure to achieve the conceptual scientific literacy and multidimensional literacy levels is likely because the chemical concepts taught have not yet reached the level of raising awareness of the environment and everyday life.

b. Context

Context in the assessment of scientific literacy according to PISA is an understanding of personal, local/national and global issues, both current and historical, which require some understanding of science and technology.

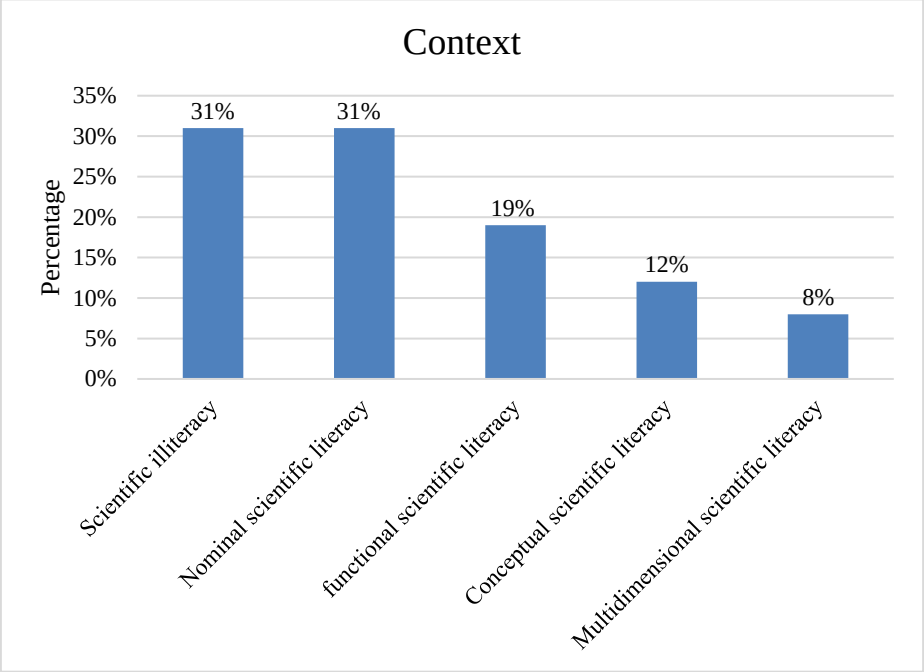

Figure 4. Science Literacy Results Context Aspect

The results of the contextual aspect of the science literacy test are as follows: 30.8% at the scientific illiteracy level, 30.8% nominal scientific literacy, 19.2% functional scientific literacy, 11.5% conceptual scientific literacy, and 7.7% multidimensional scientific literacy. At the scientific illiteracy level, there are 30.8% of students who are included in this level. The answers given by students are as follows:

"From human activities such as producing CO_2, CO, and SO gases." **(Science Literacy Test, Student 13, March 23, 2022)**

From the answers given, students are unable to answer questions scientifically and do not answer the problems faced. Students do not associate the properties of acid rain solutions with city infrastructure.

At the nominal scientific literacy level, there are 30.8% of students. The following are the answers written by students:

"Acid rain contains SO_2 and NO_2 which then reacts with water, oxygen, and other chemicals so that when it falls to the ground and hits infrastructure made of marble, limestone, iron metal, it will make it porous." **(Science Literacy Test, Student 12, March 23, 2022)**

At this level, students are able to recognize a concept related to science, but their level of understanding still shows misconceptions. Students have been able to mention the impact of acid rain on infrastructure damage.

At the functional scientific literacy level, there are 19.2% of students. At this level, students can describe a concept correctly, but have limited understanding of it.

"Acid rain is acidic with a pH of 4.8 which can cause corrosion or erosion of metal materials. When acid rain occurs, acidic water will wet buildings whose frames consist of metal which will rust and erode over time causing the building to be damaged." **(Science Literacy Test, Student 18, March 23, 2022)**

The answer given by Student 18 has shown the right concept of the impact of acid rain and its nature. However, Student 18 has not explained the reaction that occurs so that acid rain can erode or rust metal. There are 11.5% of students at the conceptual scientific literacy level. At this level, students can develop some understanding of conceptual schemes. The schemes that are understood are connected to the phenomena that occur.

"CO_2 gas reacts with rainwater to form H_2CO_3 or a weak acid, while SO_2 gas can react with rainwater to form H_2SO_4 (a strong acid. This will lower the pH of the rain to around 4.8 (a weak acid). Acidic water can dissolve limestone and marble, sulfur and nitrogen oxides also have a negative impact on metal materials, stones, and even paint. When the material is not exposed to acid rain, the metal corrodes and rusts, and the paint can also fade." **(Science Literacy Test, Student 19, March 23, 2022)**

The answers given by Student 19 were able to explain the chemical reactions that occur during acid rain, mention the nature of the solution, the pH strength of the solution, and the negative impacts of acid rain on infrastructure. From these answers, it was concluded that acid rain can damage infrastructure made of limestone and metal.

At the multidimensional scientific literacy level, 7.7% of students were able to develop an understanding and appreciation of science and technology related to their relationship to everyday life.

"Acid rain occurs when sulfur dioxide (SO_2) and nitrogen oxides (NO_X) spread in the atmosphere after being transported by the wind into the atmosphere. SO_2 and NO_x can react with water, oxygen, and other chemicals to form sulfuric and nitric acids. These elements then mix with water and other materials before falling to the earth's surface. So after falling to the earth, the impact that can be caused by this acid rain is that it can affect plants, soil, infrastructure, and other objects on the earth's surface." **(Science Literacy Test, Student 03, March 23, 2022)**

The more acid rain or the lower the pH of the water, the more abnormal plant growth will be, not only will growth be abnormal but many plants will not be able to grow (Nasihah, 2018).

c. Competencies

The competency aspects in the assessment of scientific literacy according to PISA are the ability to explain phenomena scientifically, interpret data and evidence scientifically, and evaluate and design scientific investigations.

The following diagram shows the results of students' scientific literacy in the competency aspects as follows: 11.5% at the scientific illiteracy level, 50.0% nominal scientific literacy, 23.1% functional scientific literacy, 7.7% conceptual scientific literacy, and 7.7% multidimensional scientific literacy. In the competency aspect, the level of scientific literacy is at the intermediate level.

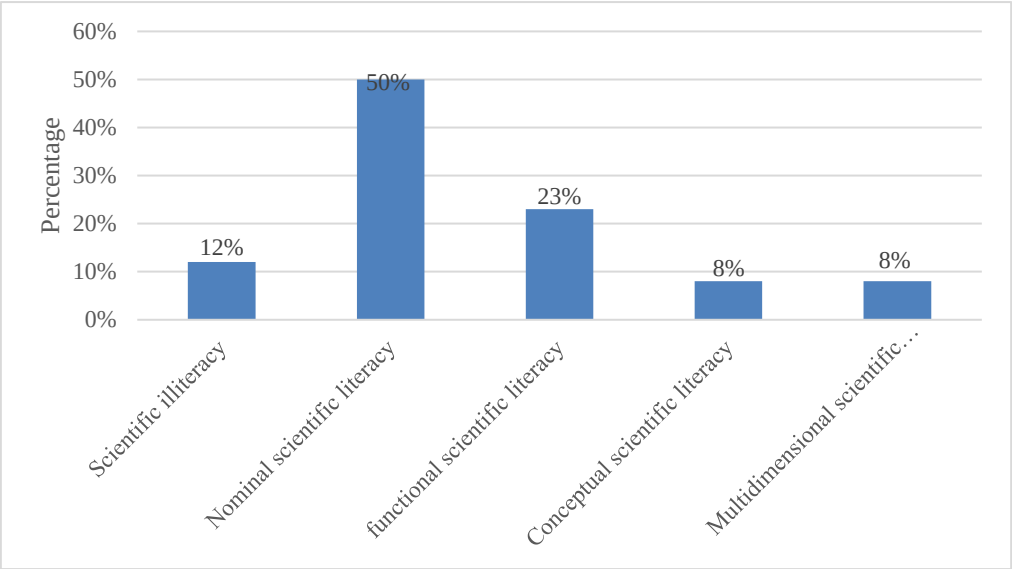

Figure 5. Science Literacy Results Competency Aspects

At the scientific illiteracy level, there are 11.5% of students who are included in this level. The answers given by students are as follows:

"From the dust of pollution that evaporates and acid rain falls on the sea. It can also be from the disposal of garbage and waste from polluted water flowing into the sea." **(Science Literacy Test, Student 13, March 23, 2022)**

The answers given have not been able to answer the phenomenon of ocean acidification scientifically, so they are categorized as scientific illiteracy.

At the nominal scientific literacy level, there are 50% of students. At this level, students are able to recognize a concept related to science, but their level of understanding clearly shows misconceptions. The following are the answers written by students:

"The process of ocean acidification begins with pollution produced by humans, especially CO_2. If CO_2 gas increases, then H_2CO_3 will increase. H_2CO_3 will ionize to produce H^+ ions which will increase the concentration of H^+ which causes the pH to drop. This is what makes the ocean acidic." **(Science Literacy Test, Student 24, March 23, 2022)**

The answers given by students show the causes of ocean acidification. Students answer only mentions the amount of CO_2 in the atmosphere due to human activities, then explains the impact of CO_2 accumulating in the ocean, which then causes a decrease in ocean pH.

At the functional scientific literacy level, there are 23.1% of students. At this level, students can describe a concept correctly, but have limited understanding of it.

"Ocean acidification occurs due to the reaction of CO_2 with H_2O in water which forms H_2CO_3 (carbonic acid). Carbonic acid has destructive properties especially on shelled animals. Carbonic acid will dissolve the shells into the water." **(Science Literacy Test, Student 10, March 23, 2022)**

Students answer is able to mention the process of ocean acidification, but Student 10 has not explained the reaction that occurs with CO_2 in the sea. Students answer directly mentions the results of the reaction of CO_2 with seawater. The more CO_2 in the atmosphere, the more CO_2 will dissolve in the sea, making the sea more acidic. The accumulation of H^+ in the sea will inhibit the absorption of calcium and CO_3^{2-} and make the formation of aragonite, the mineral form of the $CaCO_3$ molecule, more difficult (Irham, 2021).

At the conceptual scientific literacy level, there are 7.7% of students. Students develop some understanding of the main conceptual schemes of a discipline and relate these schemes to their general understanding of science.

"When CO_2 is absorbed by the ocean, chemical reactions occur specifically carbonic acid is formed and hydrogen ions are released. As a result the pH of the sea surface water decreases making it more acidic when hydrogen ions are released in the sea water they combine with carbonate ions to form bicarbonate this process decreases the concentration of carbonate ions." **(Science Literacy Test, Student 09, March 23, 2022)**

Students answer has demonstrated the ability to explain the phenomenon of ocean acidification scientifically. This is indicated by the explanation of the reaction of the release of hydrogen ions in the sea and its consequences.

At the multidimensional scientific literacy level, 7.7% of students developed an understanding and appreciation of science and technology related to their relationship to everyday life.

"Specifically, carbonic acid is formed and hydrogen ions are released; as a result, the pH of ocean surface waters decreases, making them more acidic. When hydrogen ions are released into seawater, they combine with carbonate ions to form bicarbonate. This process decreases the concentration of carbonate ions. The reduction in available carbonate ions is a problem for marine calcifiers, such as corals, crustaceans, and mollusks that require carbonate ions to build their shells and skeletons." **(Science Literacy Test, Student 11, March 23, 2022)**

The answer given by Student 11 shows concern for the environment by providing the impact of reduced carbonate ions for shelled and skeletal creatures. Perisha (2022) in his research stated that ocean acidification has negative effects on calcareous organisms, such as lower saturation, reduced organism growth, increased shell dissolution, and decreased health of marine organisms.

d. Knowledge

The knowledge aspect in the assessment of scientific literacy according to PISA is an understanding of the main facts, concepts and explanatory theories that form the scientific basis of knowledge.

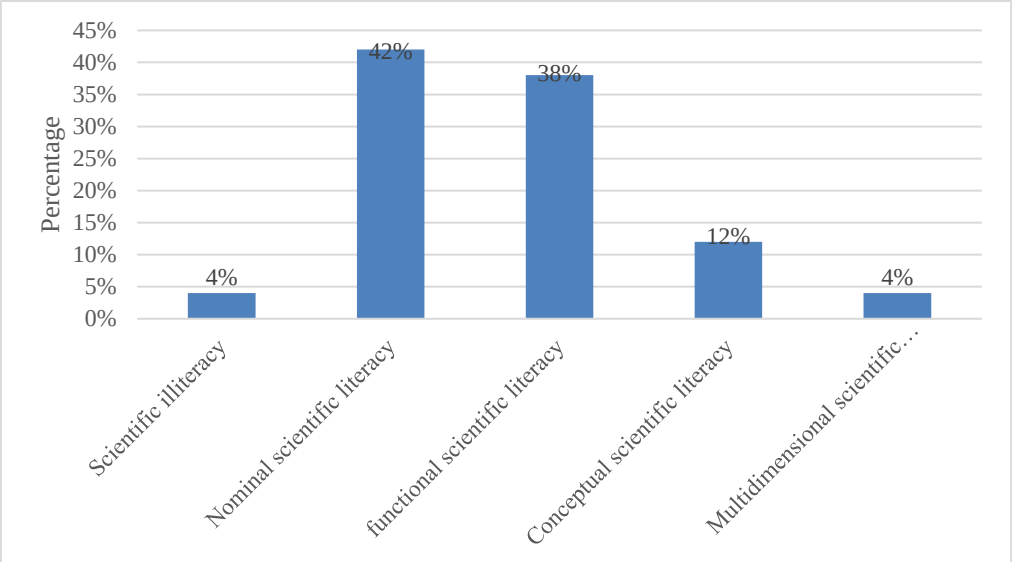

Figure 6. Science Literacy Results Knowledge Aspect

The following diagram shows the results of students' scientific literacy tests on the knowledge aspect with the following details: 3.8% at the scientific illiteracy level, 42.3% nominal

scientific literacy, 38.5% functional scientific literacy, 11.5% conceptual scientific literacy, and 3.8% multidimensional scientific literacy. In the knowledge aspect, the level of students' scientific literacy is at the intermediate level.

At the scientific illiteracy level, there are 3.8% of students who are included in this level. The answers given by students are as follows:

"Because ocean acidification causes reef damage." **(Science Literacy Test, Student 13, March 23, 2022)**

The answers given by the students are classified as scientific illiteracy because they are unable to explain the phenomenon scientifically. Student 13 does not explain why ocean acidification can damage coral reefs. Student 13 also does not mention the process of ocean acidification.

At the nominal scientific literacy level, there are 42.3% of students. At this level, students are able to recognize a concept related to science, but their level of understanding clearly shows misconceptions. The following are the answers written by students:

"The more CO_2 that is dissolved, the more carbonic acid and hydrogen ions are released. This will increase the production of bicarbonate. This bicarbonate will reduce the concentration of carbonate ions. Reducing carbonate ions will damage the structure of coral reefs." **(Science Literacy Test, Student 20, March 23, 2022)**

The answer from Student 20 can explain the reason for the large amount of CO_2 as the cause of the damage to the coral reef structure, but there is still a misconception because it does not explain the cause of the decrease in carbonate ions. Carbonate ions decrease because they react with hydrogen ions released from bicarbonate which causes the sea to become more acidic (Haiqal, 2021).

At the functional scientific literacy level, there are 38.5% of students. At this level, students can describe a concept correctly, but have a limited understanding of it.

"The process of marine pollution begins with pollution produced by humans, especially CO_2 gas. CO_2 gas will react with seawater to produce carbonic acid (H_2CO_3) if CO_3 gas increases, then H_2CO_3 will increase. H_2CO_3 will ionize a lot to produce H^+ ions which will increase the concentration of H^+ which will increase the concentration of H^+ which causes the pH to drop, this is what makes the sea acidic." **(Science Literacy Test, Student 08, March 23, 2022)**

The answer given by Student 08 does not explain the impact of reduced carbonate ion concentrations that can inhibit coral reef growth. Carbonate ions are essential for calcification, which is the process required by marine animals to create calcium carbonate skeletons, such as coral (Ruslie & Surya, 2022). If the concentration of carbonate ions decreases, the calcification process will be inhibited so that coral reefs have difficulty growing.

At the conceptual scientific literacy level, there are 11.5% of students. At this level, students develop some understanding of the main conceptual schemes of a discipline and relate these schemes to their general understanding of science.

"Because initially corals use carbonate ions (CO_3^{2-}) to form their skeletons. However, hydrogen released by carbon dioxide binds it, causing a carbonate ion deficit. CO_2 releases H^+ and then forms bicarbonate ions (HCO^{3-}). Of course, this causes many coral reefs to be damaged if a lot of CO_2 is absorbed." **(Scientific Literacy Test, Student 29, March 23, 2022)**

The answers given by the students are categorized as conceptual scientific literacy because students can develop more than one understanding of the acid base reaction that occurs in the phenomenon of ocean acidification. Students can also mention the impacts caused by the large amount of CO_2 absorbed by the sea. CO_2 absorbed by the atmosphere by the sea will produce carbonic acid (H_2CO_3).

At the multidimensional scientific literacy level, 3.8% of students develop an understanding and appreciation of science and technology related to their relationship to everyday life.

"Carbonate ions are the main substances found in coral reefs to build their structure. Therefore, when the concentration of carbonate ions decreases and CO_2 is increasingly dissolved, the structure of the coral reef will also be problematic later." **(Science Literacy Test, Student 03, March 23, 2022)**

The answer given by Student 03 is an answer that is included in the multidimensional scientific literacy level because students are able to develop their understanding of the ocean acidification process, and relate its relationship to everyday life through expressions of the ongoing impact if CO_2 increases in the atmosphere.

CONCLUSION

The implementation of integrated acid-base learning with socio-scientific issues provides positive results for students in the form of meaningful learning by linking chemical concepts to everyday life. Through this approach, students can develop their ability to express opinions, foster concern for environmental conditions, be able to see problems from various perspectives, and so on. In the science literacy test, students were quite good in terms of knowledge and competence. Only the attitude aspect did not reach the level of conceptual scientific literacy and multidimensional scientific literacy, marked by the lack of answers that showed interest and solutions to the phenomena that occurred. The nominal scientific literacy level was the highest in terms of knowledge (42%) and competence (50%). This can be seen from the ability of students to explain a concept, but there are still limited insights and misconceptions. Based on the results of the science literacy test which still show a lot at the level of scientific illiteracy and nominal scientific literacy, students have not mastered the concept of chemistry and integrated science into everyday life phenomena.

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