



## Analysis of 11<sup>th</sup>-grade Senior High School Students Scientific Literacy on Salt Hydrolysis Lesson

Masrid Pikoli\*, Wahyuningrum Istiqomah, La Alio

Department of Chemistry, Faculty of Mathematics and Natural Science, Universitas Negeri Gorontalo, Jalan Prof. Dr. Ing. Bj. Habibie, Tilongkabila, Kabupaten Bone Bolango, 96119

\* Corresponding Author e-mail: [pikolimasrid@ung.ac.id](mailto:pikolimasrid@ung.ac.id)

### Article History

Received: 21-12-2022

Revised: 07-02-2023

Published: 15-02-2023

**Keywords:** scientific literacy, test of scientific literacy skills (TOSLS), salt hydrolysis

### Abstract

This study aims to determine the scientific literacy ability of class XI science students of SMAN 1 Suwawa and SMAN 1 Kabila on salt hydrolysis material, with a sample of 243 students. This type of research is descriptive qualitative. This study measured scientific literacy skills using the Test of Scientific Literacy Skills (TOSLS) instrument. The literacy questions used in this study amounted to 20 multiple-choice questions that had been tested for validity with a high level of validity (87%). The results showed that the data obtained on the results of scientific literacy skills of class XI science students consisted of SMAN 1 Suwawa with a percentage of 33.53% and SMAN 1 Kabila with 30.44% overall in the low category.

**How to Cite:** Pikoli, M., Istiqomah, W., & Alio, L. (2023). Analysis of 11th grade Senior High School Students Scientific Literacy on Salt Hydrolysis Lesson. *Hydrogen: Jurnal Kependidikan Kimia*, 11(1), 74-81. doi:<https://doi.org/10.33394/hjkk.v11i1.5681>



<https://doi.org/10.33394/hjkk.v11i1.5681>

This is an open-access article under the [CC-BY-SA License](https://creativecommons.org/licenses/by-sa/4.0/).



## INTRODUCTION

Salt hydrolysis is included as one of the subjects in chemistry learning which is very close in application to everyday life. Applications of salt hydrolysis ranging from the food industry, and household needs to the environment include the use of monosodium glutamate salt as a food flavoring (Maluli et al., 2017), nitrate salt and nitrite used for meat-based food preservatives such as sausages (Bernardo et al., 2021), to ingredients for making household soap and water purifiers (Purnawan and Ramadhani, 2017). The salt hydrolysis material studied by class XI science students in high school includes acid-base concepts, reaction equations, mole concepts, and pH calculation formulas.

Some research results show that students find it difficult to study salt hydrolysis (Pikoli, 2017; Nusi dkk., 2021). One of the reasons is because this concept, related to the concept of acid-base, as a prerequisite concept that students must master before studying salt hydrolysis. Most students tend to experience misconceptions in salt hydrolysis material. The achievement of the percentage of student ability is not above 50% (Nusi et al., 2021). Understanding the concept of acid-base has a major influence on understanding the concept of salt hydrolysis with a relatively strong correlation. As much as 51.5% of the understanding of the concept of acid-base affects the understanding of the concept of salt hydrolysis (Irawati, 2019). Students need to be directed to be able to relate knowledge to the context or its application to make it easier to understand the subject.

The ability to use science, understand scientific concepts, identify questions and draw conclusions, based on evidence to understand making decisions related to nature and changes made to human activities is called scientific literacy (Lestari, 2020). The concept of scientific literacy expects students to have a high sense of concern for themselves and their

environment, especially facing the problems of daily life and making choices based on the knowledge of science they have mastered (Wulandari, 2016). Scientific literacy skills are essential to prepare the basic skills that learners have in the 21st century from elementary school to college level that include critical, imaginative, collaborative, and communication thinking skills. Scientific literacy can be a target in learning that must be achieved because it is able to prepare students to understand problems related to the demands of an increasingly complex era (Utami, 2021).

The aspect of scientific literacy consists of four aspects, namely the context aspect, the knowledge aspect, the competency aspect, and the attitude aspect. This aspect can be measured through a PISA study organized by the OECD (Organisation for Economic Cooperation and Development) every three years (Wulandari, 2016). Through the latest data published by the Organisation for Economic Co-Operation and Development (OECD) in 2018, Indonesia is only ranked 73rd out of 79 countries or sixth from the bottom in the field of scientific literacy (Lubis et al., 2021). To measure scientific literacy can use the Test of Scientific Literacy Skills (TOSLS) (Prabowo & Fidiastuti, 2017).. So far, scientific literacy measurements related to salt hydrolysis are very rarely carried out. Therefore, this research was conducted to find out how the scientific literacy skills of class XI high school science students on salt hydrolysis material

## METHOD

This research was conducted in two schools, namely state senior high school (SMAN) 1 Suwawa and SMAN1 Kabila for the 2021/2022 school year. The type of research used is qualitative descriptive research that aims to identify students' scientific literacy abilities on salt hydrolysis material. The instrument used is the Test of Scientific Literacy Skills (TOSLS). This validity is carried out using a checklist list by three chemistry lecturer validators. The literacy questions that will be used in this study are 20 multiple-choice questions with four alternative answer choices (a, b, c and d). In accordance with the focus of the research, the research sources are students of class XI science at SMAN 1 Suwawa and students of class XI science at SMAN 1 Kabila.

Data collection techniques can be carried out by means of dissemination of written tests. In this study, data collection techniques were carried out by conducting a written test that took place in the classroom. Assessment of student test results is carried out by assigning a score to each student's test result answer and calculating the number of scores from each question item obtained by the student. Then convert the answer score into the form of a value on a scale of 0-100 using the formula:

$$NP = \frac{R}{SM} \times 100$$

Description:

NP : Searched Percent Value

R : Score obtained by students

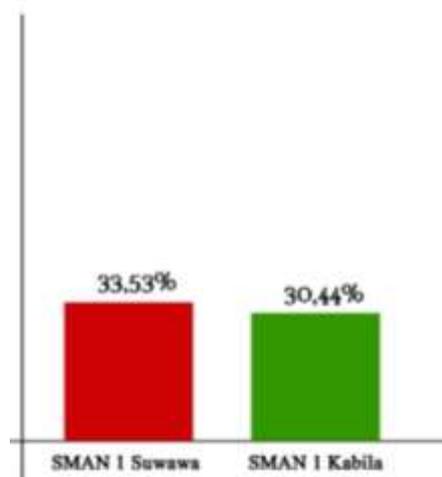
SM : Maximum score of the test in question

Table 1. Scientific literacy ability index classification.

Classification	Letter	Credit	Predicate	Category
86-100%	A	4	Excellent	High
76-85%	B	3	Good	
60-75%	C	2	Fair	Moderate
55-59%	D	1	Poor	
≤ 54%	TL	0	Bad	Low

## RESULTS AND DISCUSSION

This study is a descriptive study that aims to identify the scientific literacy abilities of class XI science students at SMAN 1 Suwawa and SMAN 1 Kabila with a total sample of 243 students. Questions are tested on students to measure scientific literacy skills using the Test of Scientific Literacy Skills (TOSLS) instrument.



**Figure 1.** Students' scientific literacy abilities

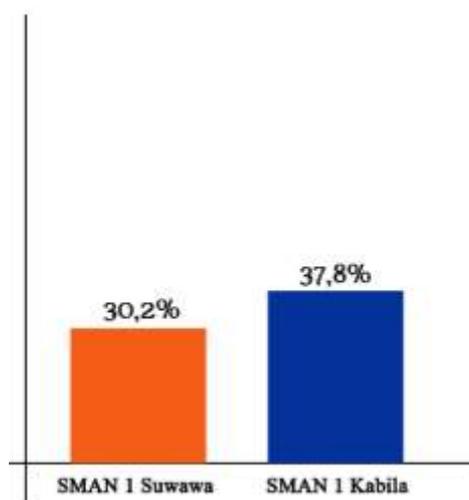
Based on Figure 1, the scientific literacy ability of students of SMAN 1 Suwawa and SMAN 1 Kabila is in a low category with consecutive percentages of 33.53% and 30.44%. The learning process at SMAN 1 Suwawa takes place online by utilizing the google classroom application. The learning process at SMAN 1 Kabila varies from practicum, group discussions, and conventional learning with lectures.

The low results of scientific literacy are in line with the findings of Kamil (2022) who measures scientific literacy in Banda Aceh City Junior High School. The learning profile at Banda Aceh City Junior High School does not have continuity between learning planning and the learning process and evaluation carried out. Profile of scientific literacy learning in Banda Aceh City in the RPP component, planning for context, knowledge, and also competency on average 30% in each school. The PBM component shows that aspects of the learning process are uneven in each school, more intense in the aspect of knowledge. The midterm evaluation component (UTS) shows that the evaluation is carried out unevenly. Only aspects of context dominate the assessment process. The achievement of competency is more than 40%.

The low results of students' scientific literacy are partly due to students not being familiar with scientific literacy questions, the low scientific literacy skills of students are also because students are not used to doing questions that use discourse. Low scientific literacy results can negatively affect students' lack of responsiveness to development and problems that exist around the environment, especially those related to natural phenomena, local advantages, and problems that exist in the surrounding environment (Nofiana & Julianto, 2018).

### Context Aspect Literacy Ability

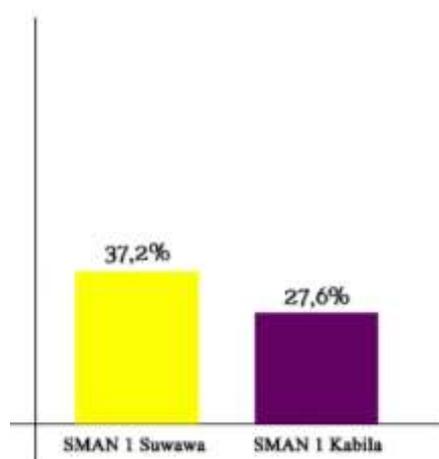
The percentage of scientific literacy skills in the context aspect in both schools showed results with a low category (Figure 2). The low results obtained are suspected to be due to students not being presented with scientific issues in everyday life. In addition, students have not been able to relate or connect the knowledge that has been gained when answering the tests/questions given.



**Figure 2.** Percentage of scientific literacy in aspects of context

Teachers need to apply learning models or approaches that can improve students' scientific literacy skills in the context aspect. The application of local excellence-based learning can be an effective option to overcome the problem of low scientific literacy (Nofiana & Julianto, 2018). In addition, it can also be through scientific learning based on socio-scientific issues or problem-based learning (Kirana et al., 2022; Mundzir et al., 2017; Alatas & Fauziah, 2020). These learning models and approaches are effective in developing students' scientific literacy.

#### Literacy Ability Aspects of Knowledge



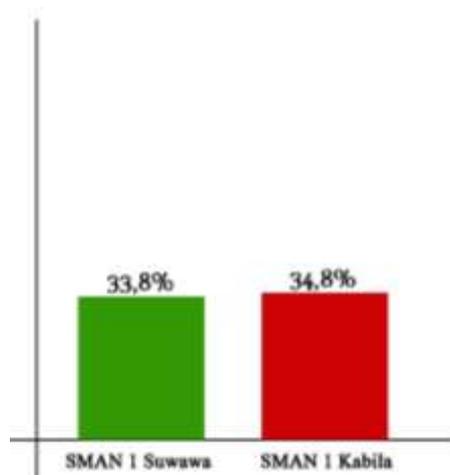
**Figure 3.** Percentage of scientific literacy in aspects of knowledge

Based on Figure 3, the percentage of scientific literacy skills in the aspect of knowledge for class XI science students of SMAN 1 Suwawa and SMAN 1 Kabila was 37.2% and 27.6%, respectively. Both belong to the low category. The low ability of scientific literacy in the aspect of knowledge is because most students only memorize concepts and are less able to relate what is learned to its application to new situations. This makes many concepts in salt hydrolysis material understood incorrectly (misconceptions) or just memorized which in the end the concept is easily forgotten.

Efforts can be taken by teachers in overcoming the low scientific literacy of students in the aspect of competency, one of which is through the implementation of scientific learning. This is in accordance with the findings of Asyhari and Hartati (2015) that scientific learning can improve the profile of students' scientific literacy abilities in the aspect of competency and aspects of knowledge in environmental pollution material. Scientific learning is designed in

such a way starting from the process of observing, questioning, collecting data/information, associating, and modernizing, so as to encourage the development and development of competencies in student attitudes, knowledge, and skills to be better and meet scientific rules. This learning can be applied to stimulate students' interest in scientific issues, improve scientific inquiry, and encourage students' sense of responsibility to the surrounding environment (Wiyanto, 2017).

### Literacy Ability on Competency Aspects



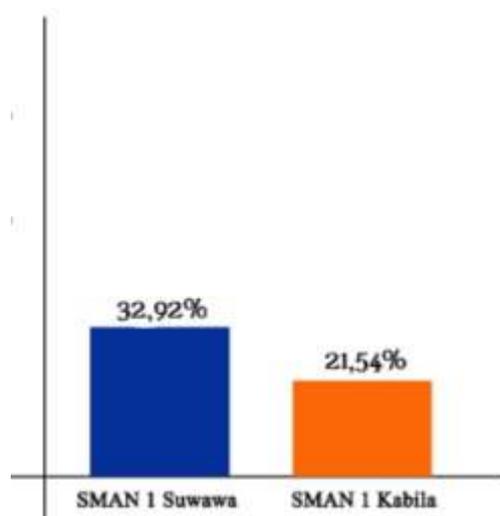
**Figure 4.** Percentage of scientific literacy in aspects of competency

Based on Figure 4. The results showed that the percentage of scientific literacy skills in the knowledge aspect at SMAN 1 Suwawa and SMAN 1 Kabila was 37.2 and 27.6%, respectively. The value falls into the low category. The low ability of scientific literacy in the aspect of competency is because the ability of students to apply scientific knowledge has not been able to understand students when analyzing scientific evidence and has not been able to draw conclusions. Scientific literacy ability is influenced by several factors, namely the approach or method of science learning used by teachers in building learning concepts.

The scientific approach is considered suitable to be used to train scientific literacy competencies because students are accustomed to using the scientific method in obtaining information. In general, the scientific approach is composed of several steps of sequential activities, namely: observing, questioning, collecting information, conducting experiments, processing data, and communicating results. This is supported by Setiawan (2019) who stated that the application of a scientific approach in learning biology on *Plantae* and *Animalia* topics can improve students' scientific literacy competencies.

### Literacy Ability Aspects of Attitudes

Based on Figure 5, The results showed that the percentage of scientific literacy skills in attitude aspects for class XI science students of SMAN 1 Suwawa was 32.92% and for class XI science students of SMAN 1 Kabila of 21.54% was classified as a low category. The attitude aspect is seen from the interest of students in science such as students' interest in science and technology. The low ability of scientific literacy in this aspect of attitude is because students' interest in science and the use of technology is still lacking, if someone is feeling interested in something, then the individual will have attention to it, but students also still do not use the media to add insight. Even so, students are also quite interested in learning chemistry.



**Figure 5.** Percentage of scientific literacy in aspects of attitude

The results of this study are in line with Degi (2021) reporting that students' scientific literacy skills are still lacking due to the inability of students to do scientific literacy questions that require understanding and analyzing questions. Students are not used to doing questions that demand understanding and analysis because the evaluation questions given by the teacher on daily tests, UTS, and UAS are questions that only demand students' memories of the material they have learned

## CONCLUSION

The scientific literacy skills of students at SMAN 1 Suwawa and SMAN 1 Kabila are still in the low category. Likewise, when viewed specifically both in terms of knowledge, context, competency, and attitude, it shows low results. Innovative efforts from teachers need to be encouraged in bridging students to have qualified literacy skills

## RECOMMENDATIONS

The learning process is important for teachers to apply effective learning to prepare for the stages of scientific literacy. The learning process so far still refers to the mastery of theory and memorization in learning which causes students' learning ability to be hampered. Learning strategies that are still teacher-oriented, should be replaced with learning methods that are fun, energized, intelligent, and encourage students' thinking ability

## ACKNOWLEDGEMENTS

Thank you to the principals and chemistry teachers of SMAN 1 Suwawa and SMAN 1 Kabila for helping to carry out the research.

## BIBLIOGRAPHY

Alatas, F., & Fauziah, L. (2020). Model problem based learning untuk meningkatkan kemampuan literasi sains pada konsep pemanasan global. *JIPVA (Jurnal Pendidikan IPA Veteran)*, 4(2), 102-113. doi:10.31331/jipva.v4i2.862

- Asyhari, A dan Hartati, R. (2015). Profil Peningkatan Kemampuan Literasi Sains Siswa Melalui Pembelajaran Saintifik. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, 4(2): 179-191.
- Bernardo, P., Patarata, L., Lorenzo, J.M., & Fraqueza, M.J. (2021). Nitrate is nitrate: the status quo of using nitrate through vegetable extracts in meat products. *Foods*, 10(12). 3019; <https://doi.org/10.3390/foods10123019>
- Irawati, R.K. (2019). Pengaruh Pemahaman Konsep Asam Basa terhadap Konsep Hidrolisis Garam Mata Pelajaran Kimia SMA Kelas XI. *Thabiea : Journal of Natural Science Teaching*, 2(1): 1-6. <https://journal.iainkudus.ac.id/index.php/Thabiea/article/view/4090/3431>
- Kamil, F.F. (2022). *Studi profil literasi sains siswa dalam pembelajarannya di SMP Kota Banda Aceh*. Tesis S2. Sekolah Pascasarjana Universitas Pendidikan Indonesia Bandung.
- Kirana, D., Budiyanto, M., & Purnomo, A. (2022). meningkatkan kemampuan literasi sains siswa melalui pembelajaran IPA berbasis socio-scientific issues pada materi pencemaran lingkungan. *PENSA: E-JURNAL PENDIDIKAN SAINS*, 10(2), 260-265. Retrieved from <https://ejournal.unesa.ac.id/index.php/pensa/article/view/45095>
- Lestari, H. (2020). Literasi sains siswa melalui penerapan model pembelajaran blended learning dengan blog. *NATURALISTIC : Jurnal Kajian Penelitian Pendidikan dan Pembelajaran*, 4(2): 597-604. <https://journal.umtas.ac.id/index.php/naturalistic/article/view/769>
- Lubis, M. M., Mahzum, E., & Halim, A. (2021). Analisis Kemampuan literasi sains mahasiswa jurusan pendidikan fisika Universitas Syiah Kuala berdasarkan instrumen scientific literacy assessment. *Serambi Akademika*, 9(8), 1479-1488. <https://ojs.serambimekkah.ac.id/serambi-akademika/article/view/3412>
- Maluly, Hellen D. B.; Ariseto-Bragotto, Adriana P.; Reyes, & Felix G. R. (2017). Monosodium glutamate as a tool to reduce sodium in foodstuffs: Technological and safety aspects. *Food Science & Nutrition*, 5(6), 1039-1048. doi:10.1002/fsn3.499
- Mundzir, M., Sujana, A., & Julia, J. (2017). Problem-based learning untuk meningkatkan kemampuan literasi sains siswa SD. *Jurnal Pena Ilmiah*, 2(1), 421-430. doi:<https://doi.org/10.17509/jpi.v2i1.10677>
- Nofiana, M & Julianto, T. (2018). Upaya peningkatan literasi sains siswa melalui pembelajaran berbasis keunggulan lokal. *Biosfer Jurnal Tadris Biologi*, 9(1): 24-25. <http://ejournal.radenintan.ac.id/index.php/biosfer/article/view/2876>
- Nusi, K., Laliyo, L.A.R., Suleman, N., & Abdullah, R. (2021). Deskripsi pemahaman konseptual siswa pada materi hidrolisis garam. *Quantum Jurnal Inovasi Pendidikan Sains*, 12(1): 118-127. <https://ppjp.ulm.ac.id/journal/index.php/quantum/article/view/9228/0>
- Pikoli, M. (2017). Pola-pola kesalahan siswa dalam memahami konsep hidrolisis garam ditinjau dari aspek gambaran makroskopik-submikroskopik. *Jambura Journal of Educational Chemistry*, 12(2): 231-235.
- Prabowo, C. A., & Fidiastuti, H. R. (2017). Mengukur Keterampilan Literasi Ilmiah Mahasiswa Tahun Pertama menggunakan Test of Scientific Literacy Skills ( TOSLS ) Measuring First Year Student Scientific Literacy Skills using Test of Scientific Literacy Skills ( TOSLS). *Bioeducation Journal*. 2, 78-86.

doi:10.24036/bioedu.v1i2.45.

- Purnawan, I dan Ramadhani, R.B. (2017). Pengaruh konsentrasi koh pada pembuatan tawas dari kaleng alumunium bekas. *Jurnal Teknologi*, 6(2): <https://jurnal.umj.ac.id/index.php/jurtek/article/view/221>
- Setiawan, A.R. (2019). Peningkatan Literasi Sainifik melalui Pembelajaran Biologi Menggunakan Pendekatan Sainifik. *Journal of Biology Education*, 2(1): 1-13. [https://journal.iainkudus.ac.id/index.php/jbe/article/view/5278/pdf\\_1](https://journal.iainkudus.ac.id/index.php/jbe/article/view/5278/pdf_1)
- Utami, A. U. (2021). Pengembangan instrumen Test Of Scientific Literacy Skills (Tosls) berbasis daring pada pembelajaran IPA untuk mengukur literasi sains. *Lensa (Lentera Sains): Jurnal Pendidikan IPA*, 11, 83–89. <https://jurnallensa.web.id/index.php/lensa/article/view/157/93>
- Wiyanto. (2017). Pendekatan saintifik pada perkuliahan dengan sistem e-learning. *Integralistik*, 18(2): 217-229. <https://journal.unnes.ac.id/nju/index.php/integralistik/article/view/13738>
- Wulandari, N. H. S. (2016). Analisis kemampuan literasi sains pada aspek pengetahuan dan kompetensi sains siswa SMP pada materi kalor. *Edusains*, 8(1), 66–73. <https://journal.uinjkt.ac.id/index.php/edusains/article/view/1762/0>