THE QUALITY OF STUDENT ARGUMENTATION IS DETERMINED BY AN ANALYSIS OF STUDENT STATEMENTS VIEWED FROM SCIENCE LITERATURE

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Abstract: *This study aims to evaluate junior high school students argumentative skills related to environmental contamination. This study employs a quantitative research methodology. The study was carried out at SMPN 14 Bengkulu City, in Padang Nangka, Singgaran Pati District, and the sample consisted of 26 class VII students who were chosen at random. The research tool was a descriptive (essay-style) test with five questions based on markers of argumentation skill (claims, data, warrants, backing, rebuttal, and qualifiers). An analysis was done based on the argumentative element in the student responses. According to the findings, 100% of students wrote claims, 19% wrote down data, 12% wrote warrants, 4% were able to write backings, and 0% wrote rebuttals and qualifiers. Overall, it can be said that most students can write claims, but they are starting to have trouble presenting data, warrants, backups, rebuttals, and qualifiers. Teachers can use the proportion of a student's initial reasoning skills as a benchmark to decide on designs or learning activities in the future that will not only focus on helping students understand topics but will also help them build or train their thinking skills.*
Keywords: Scientific literacy, Toulmin's Argumentation Model, the environmental pollution

1. INTRODUCTION

The method of imparting knowledge (transfer of knowledge) from teacher to student has been the only focus of science learning up until this point (Evrilyan Rozanda & Wahyuningsih, 2017). Even though effective science instruction should involve direct instruction for the pupils (Rahmadhon & Amirul Mukminin, 2021). Enhancing education standards is one action taken to raise the standard of human resources. The learning process cannot be completed by merely imparting knowledge; information must also be provided (Hardini et al., 2022). The mastery of science and technology is emphasized in 21st-century skills as a prerequisite

for national prosperity. A major goal of science education is to build the capacity to think critically, logically, artistically, innovatively, and internationally competitively (Syahputra, 2018).

Toulmin defines an argument as a statement accompanied by reasons that comprise components of claims, data, justification, requirements, support, and rebuttal. One indication that can be used to measure argumentation skills is Toulmin's definition of an argument as a statement accompanied by reasons (Toulmin, 2003). The Toulmin argumentation model is used in this study to describe argumentation skills. The Toulmin argumentation model is used in this study to describe argumentation skills. This study provides a more detailed explanation of each element of Toulmin's reasoning; as a result, students are better able to create claims or respond to queries regarding the claim component. The data component requires that students record all relevant facts about the issue in writing. Students completed the justification component by making connections between the facts they know and the assertions they make. These connections are made by writing equations, examples, or mathematical relationships. Support has a requirement that all queries be answered by the students. The objection part, however, examines students' capacity to disprove or dispute claims they believe to be false (Sandhy, 2018).

The ability to create an argument effectively and accurately is a necessary talent for anyone who wants to influence others by being able to defend their beliefs (Nurrahman et al., 2018). Science education requires argumentation abilities so that students can think logically and be able to offer accurate explanations for the facts being examined (Amirul et al., 2022). In such a brain, emphasis must be placed on how students' arguments grow using various educational resources. In reality, there has been extensive research on reasoning in a variety of contexts, including how to evaluate students' argumentation abilities in science by taking into account their scientific literacy across a range of sources (Fadlika et al., 2022).

Scientific literacy refers to a person's capacity to use their knowledge to identify questions, produce new information, offer scientific explanations, draw

conclusions based on scientific evidence, and cultivate reflective thinking to take part in the solution of issues and concepts in the field of science (Fuadi et al., 2020). Because students' lack of willingness to read and write is one of the factors contributing to their lack of reading and writing abilities, scientific literacy is a crucial skill for students to have to appropriately apply science (Lentika et al., 2022).

Students with low levels of scientific literacy are less receptive to environmental changes and issues, particularly those linked to natural occurrences and the environment, as well as issues in the surrounding area (Sutrisna, 2021). Consequently, it's important to come up with a plan to boost scientific literacy, and one of those ideas is to use student discussions regarding a topic (Nofiana & Julian, 2018).

Research on students' scientific literacy and argumentation abilities is crucial for this reason. Teachers and schools can utilize this research as inspiration and guidance to enhance the teaching-learning process and help students develop their critical thinking and scientific literacy abilities.

2. METHOD

This study used quantitative descriptive research methodology to gauge students' argumentation and scientific literacy. A quantitative descriptive study seeks to collect data on the status of symptoms that are already present, specifically the state of the symptoms in light of the circumstances that existed at the moment the research was carried out. Consequently, it is possible to demonstrate or describe the format of student arguments using established percentages (Hasasiyah et al., 2019). The study population was made up of SMPN 14 Bengkulu City class VIII pupils for the academic year 2022–2023. The population is made up of 1 (one) class, class A, which has 26 members. The variables in this study that were looked at were argumentation and scientific literacy (Kusumastuti et al., 2019). The researcher's complement activation of a five-question essay and a scientific literacy aptitude test that the author had created using indications of scientific literacy. Based on the achievement of the

level of argumentation evaluated using five essay questions, this study's profile of the quality of student argumentation was created. The method of data analysis performed is quantitative and takes the form of data on student aptitudes (Fitriani., 2022). The description exam is employed because it makes identifying the argumentation skills accomplishment indicators simpler. Claims, Data, Warrants, Backing, Qualifiers, and Rebuttals are among the markers used to evaluate pupils' reasoning abilities.

For each claim, data, guarantee, support, qualifier, and rebuttal that the student writes accurately, a score of 1 is assigned; if not, a score of 0 is assigned. When determining the percentage of students who correctly write claims, data, warranties, backing, qualifiers, and rebuttals, the total score for each component is first determined for the entire class of each student.

Table 1. Argumentation Indicator

No	Indicator	Explanation
1.	*Claim*	Where students argue depending on the facts they get or the arguments of others in answering the questions presented
2.	*Grounds*	Where students can share what they know
3.	*Warrant*	Where students can connect data and claims by writing examples
4.	*Backing*	where students respond to all of the questions posed by the questions
5.	*Qualifier*	Where student responses fit the category and are accurate
6.	*Rebuttal*	when students must reject a question they believe to be incorrect

3. RESULTS AND DISCUSSION

The Toulmin argumentation analysis model states that data analysis is a data processing procedure in the form of students' inadequate responses. Written arguments were used by students as their responses. 26 students took an argumentation test, and the results were used as study material. From question 1 to question 5, each response to each research question is described during the data analysis process. Students are required to reply to all of the research questions. The outcomes of the descriptions of each student's responses were also compiled using Toulmin's argumentation model. All students' responses from the study of

each unit's argumentative component are then tallied up to get the percentages depicted in figure 1.
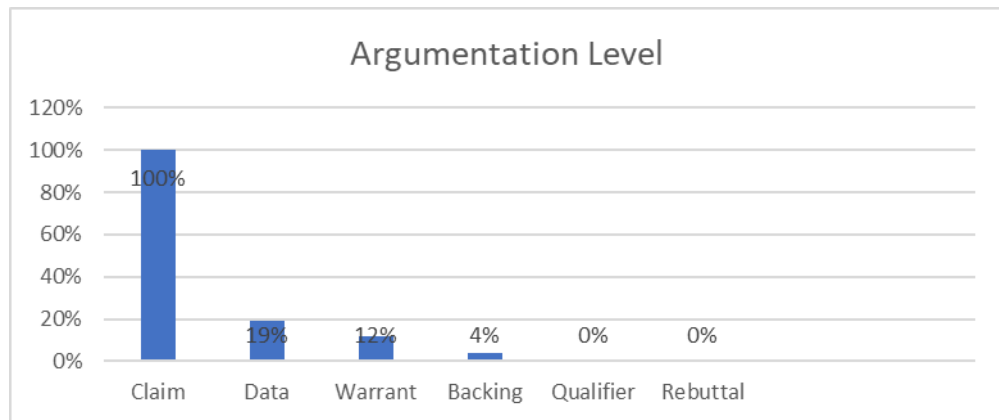

Figure 1 depicts the proportion of student arguments

According to an examination of the findings from the student argumentation exams, which are shown in Figure 1, 100% of students write claims correctly, for instance, "fish in the river will die," which is one of the statements they write. Students can generally articulate claims clearly and correctly, but when coming to the supporting details-such as evidence, warrants and backup, and qualifiers-things are different.

Student writing statistics make up about 19% of the total. This demonstrates how some pupils are just capable of writing assertions and not able to enter the information necessary to back them up. The term "data" refers to justifications for statements made in the form of facts or evidence, such as "if we toss the trash in the river, fish could die since the river is polluted by detergent waste''.

Only 12% of students can accurately write the warrant, which includes the justification of the statement and the relationship between the statement and the claim, in the third place. Students, for example, produce warrants that state that "overuse use of chemicals will harm ecosystems for humans and animals and cause creatures in rivers to perish from excessive chemicals."

Furthermore, in fourth place is backing, where just 4% of students can write down basic assumptions in the form of support or theory that can reinforce a claim. An example f a student writing a backing, example, "people littering the river will have an impact on flooding and the river water is not clean because there is no self-awareness in the surrounding community, not only that household waste disposed of in the river will pollute the water ecosystem." Furthermore, the components with the lowest rate, qualifiers, and rebuttals, are placed last with a proportion of 0%.

As illustrated in Figure 1, the proportion of individuals' reasoning abilities in gethe me, in general,ral demonstrates that even though the fact that students can already construct arguments, they still struggle with presenting data, warrants, support, qualifiers, and rebuttals. This means that students are already reasonably skilled at expressing their statements or opinions about the phenomena presented in the problem, but they are still limited in terms of writing down reasons such as evidence, and facts, linking data with claims and including assumptions or theories that justify warrants and support claims.

The acquired results are consistent with the findings of multiple prior studies, namely that the most commonly seen student arguments are claims-only (Devi Susanti& Indriyanti, 2019). Students can only offer replies in the form of claims that are not followed by arguments that tie their remarks to scientific evidence (Ambarawati et al., 2021).

There are various reasons why students' scientific argumentation abilities remain so low. Students find it challenging to construct coherent arguments based on scientific notions (theories, principles, and laws). They also don't understand the components of a true scientific argument. Other explanations include employing limited facts to support claims, as well as using reasoning or objections that they do not understand (Riwayani et al., 2019)

Most dominating students were able to construct sound arguments, but few of them were able to back up their assertions with reliable data, produce convincing proof, and secure consensus. Although they have studied the topic, students may not have fully grasped it, as evidenced by their inability to put down

their arguments clearly, indicating that they are still untrained in the art of reasoning.

4. CONCLUSION

According to the findings of an argumentation analysis at SMP 14 Bengkulu City on environmental pollution material, students' argumentation skills are more dominant in expressing claims with a percentage of 100%, data components with a percentage of 19%, warrants with a percentage of 12%, backing with a percentage of 4%, and qualifiers and rebuttals with a percentage of 0%.

The percentage of this argumentation component shows that while most students articulate claims, they are having difficulty giving data, warrants, backing, qualifiers, and rebuttals. This percentage represents students' initial argumentation abilities, which can be used by teachers to plan for future learning activities, with the hope that learning activities designed by teachers will not only focus on conceptual understanding but will also train and develop students' argumentation abilities.

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REFERENCES

Ambarawati, D. S. H. E., Muslim, M., & Hernani, H. (2021). Analisis Kemampuan Argumentasi Siswa SMP pada Materi Pencemaran Lingkungan [Analysis of Middle School Students' Argumentative Ability on Environmental Pollution Material]. *INKUIRI: Jurnal Pendidikan IPA*, *10*(1), 13–17. https://doi.org/10.20961/inkuiri.v10i1.29780

Amirul, M., Sulianto, J., & Cintang ,N. (2022). *Jurnal Tadris IPA Indonesia*. *2*(2), 195–204.

Devi, N. D. C., Susanti VH, E., & Indriyanti, N. Y. (2019). Analysis of High School Students' Argumentation Ability in the topic of Buffer Solution. JKPK (Jurnal Kimia Dan Pendidikan Kimia), 3(3).

Evrilyan Rozanda, N., & Wahyuningsih, R. (2017). Penerapan Knowledge Transfer Pada E-learning [Application of Knowledge Transfer in E-learning]. *Seminar Nasional Teknologi Informasi*, *February 2018*, 2579–5406.

Fadlika, R., Hernawati, D., & Meylani, V. (2022). Kemampuan Argumentasi Dan Kemampuan Literasi Sains Peserta Didik Kelas Xi Mipa Pada Materi Sel [Argumentation Ability and Science Literacy Ability of Xi Mipa Class Students on Cell Material]. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, *12*(1), 9–18. https://doi.org/10.24929/lensa.v12i1.156

Fitriani M. (2022). *Profile of Students ' Quantitative Literacy Ability and*. *3*(1), 38–49.

Fuadi, H., Robbia, A. Z., Jamaluddin, J., & Jufri, A. W. (2020). Analisis Faktor Penyebab Rendahnya Kemampuan Literasi Sains Peserta Didik [Analysis of the Factors Causing the Low Ability of Students' Scientific Literacy]. *Jurnal Ilmiah Profesi Pendidikan*, *5*(2), 108–116. https://doi.org/10.29303/jipp.v5i2.122

Hardini, S. D., Alberida, H., & Padang, U. N. (2022). *Analisis kemampuan argumentasi peserta didik [Analysis of students' argumentation abilities]*. *17*(1), 93–99.

Hasasiyah, S. H., Hutomo, B. A., Subali, B., & Marwoto, P. (2019). Analisis Kemampuan Literasi Sains Siswa SMP pada Materi Sirkulasi Darah [Analysis of Science Literacy Ability of Junior High School Students on Blood Circulation Material]. *Jurnal Penelitian Pendidikan IPA*, *6*(1), 5. https://doi.org/10.29303/jppipa.v6i1.193

Lentika, D. L., Maghfiroh, D. R., & Admoko, S. (2022). *Pengembangan Lkpd Model Pembelajaran Argument Driven [Development of Lkpd Argument Driven Learning Model]*. *8*, 84–90.

Kusumastuti, R.P., Rusilowati, A., & Nugroho, S.E. (2019). Pengaruh Kerampilan Berpikir Kritis Terhadap Literasi Sains Siswa [The Effect of Critical Thinking Skills on Students' Science Literacy]. *UPEJ Unnes Physics Education Journal,* 8(3), 254-261.

Nofiana, M., & Julianto, T. (2018). Upaya Peningkatan Literasi Sains Siswa Melalui Pembelajaran Berbasis Keunggulan Lokal [Efforts to Improve Students' Scientific Literacy Through Local Excellence-Based Learning]. *Biosfer : Jurnal Tadris Biologi*, *9*(1), 24. https://doi.org/10.24042/biosf.v9i1.2876

Nurrahman, A., Kadaritna, N., & Tania, L. (2018). Efektivitas Model Pembelajaran ADI dalam Meningkatkan Penguasaan Konsep Siswa berdasarkan Kemampuan Akademik [The Effectiveness of the ADI Learning

Model in Improving Students' Mastery of Concepts based on Academic Ability]. *FKIP Universitas Lampung*, *20*(1), 1–14.

Rahmadhon, R., & Amirul Mukminin, M. M. (2021). Kompetensi Guru Dalam Menggunakan Media Pembelajaran Berbasis Teknologi, Informasi dan Komunikasi pada Masa Pandemi Covid-19 di MIS Darussalam Kec. Jelutung Kota Jambi [Teacher Competence in Using Technology-Based Learning Media, Information and Communication during the Covid-19 Pandemic at MIS Darussalam Kec. Jelutung City of Jambi]. *Jurnal Manajemen Pendidikan Dan Ilmu Sosial*, *2*(1), 381.

Riwayani, R., Perdana, R., Sari, R., Jumadi, J., & Kuswanto, H. (2019). Analisis kemampuan argumentasi ilmiah siswa pada materi optik: Problem-based learning berbantuan edu-media simulation [Analysis of students' scientific argumentation abilities in optical material: Problem-based learning assisted by edu-media simulation]. *Jurnal Inovasi Pendidikan IPA*, *5*(1), 45–53. https://doi.org/10.21831/jipi.v5i1.22548

Sandhy, A. K. (2018). Pengaruh Model Inkuiri Untuk Meningkatkan Keterampilan Argumentasi Peserta Didik Terhadap Materi Getaran Dan Gelombang [The Influence of Inquiry Models To Improve Students' Argumentation Skills Against Vibration And Wave Material]. *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa*, *7*(10), 1–9.

Sutrisna, N. (2021). Analisis Kemampuan Literasi Sains Peserta Didik SMA di Kota Sungai Penuh [Analysis of Scientific Literacy Capability of High School Students in Sungaipuh City]. *Jurnal Inovasi Penelitian*, *1*(12), 2683.

Syahputra, E. (2018). *Pembelajaran Abad 21 Dan Penerapannya Di Indonesia [21st Century Learning And Its Application In Indonesia] Education Research View project Development of Learning Devices Oriented Problem Based Learning to Increase Student's Combinatorial Thinking in Mathematical Problem Solving Ability View project*. https://www.researchgate.net/publication/331638425

Toulmin, S. E. (2003). *The uses of argument*. Cambridge university press.