



Informal Reasoning Profile of State Senior High School Students in Brebes Regency

Fenny Roshayanti ¹, Ipah Budi Minarti ², Ariyat Afriadi ³

¹ Universitas Persatuan Guru Republik Indonesia Semarang, Indonesia

² Universitas Persatuan Guru Republik Indonesia Semarang, Indonesia

³ Universitas Persatuan Guru Republik Indonesia Semarang, Indonesia

Corresponding Author: Ipah Budi Minarti, E-mail: ipeh_mi2n@yahoo.co.id

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ABSTRACT This study aims to look at the Informal Reasoning profiles of public high school students in the Brebes Regency. Informal Reasoning is a type of thinking used by students in considering socio-scientific issues, which involves considering causation, pros and cons, and alternatives. The research was conducted at 11 public high schools in Brebes Regency using the Proportionate Stratified Random Sampling method. The research data was obtained through tests in the form of multiple-choice questions and essays that tested students' mastery of Informal Reasoning regarding issues such as HIV-AIDS, GMOs, and cloning. The results showed that 79.64% of students had good Informal Reasoning skills, 18.26% of students had very good abilities, and 2.10% of students had moderate abilities. These results indicate that most high school students in Brebes District have good Informal Reasoning skills in addressing socio-scientific issues. Comparing some of the results of students' Informal Reasoning between schools forms a pattern of possible causal factors, such as teachers' habits in teaching and giving questions, environment, region (rural and urban areas), as well as the availability of facilities and infrastructure. Keywords: <i>Brebes Regency, High School, Informal Reasoning</i>			

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INTRODUCTION

Education is the right way to improve the quality of human resources. A country can be said to be a developed country if its people have high and quality education, otherwise a country will be said to be a country left behind from other countries if the education of its people is low and not of good quality. All countries in the world including Indonesia must strive to improve the quality of education as stipulated in Law no. 20/2003 concerning the National Education System (Chen dkk., 2019; Juhandha dkk., 2019; Li dkk., 2020). The law states that 'National development in the field of education is an effort to educate the nation's life and improve the quality of Indonesian people in realizing an advanced, just and prosperous society and enabling its citizens to develop themselves (Qureshi dkk., 2022), both with regard to physical and spiritual aspects based on Pancasila

and the 1945 Constitution. ”. Quality Indonesian education is expected to have an impact on improving the quality of Indonesian people who have the ability to think and skills to access good technology so that they are able to keep up with technological advances such as the era of globalization

Education is expected to act as a connecting bridge that will connect individuals with their environment in an increasingly developing globalization era (Livingston dkk., 2020; Nicola dkk., 2020), so that individuals are able to act as independent and qualified persons. There is a need to improve the quality of education in Indonesia through the learning process (Teig, 2020; Varghese & A, 2021). One of them is learning science or Natural Education (IPA). Science learning is considered one of the efforts in realizing educational goals, namely improving the quality of human resources. Learning science is an intentional or systematic effort or process about living things, how to work, how to think, and how to solve a problem. Learning science in schools is expected to help students gain a deeper understanding of the natural surroundings by finding out and doing things independently and applying them in everyday life.

The reality on the ground shows that the quality of education (Hindricks dkk., 2021), especially science in Indonesia, is still far from what was expected. Based on the results of the PISA (the Program for International Student Assessment) study, a study under the auspices of the Organization for Economic Cooperation and Development (OECD) which is conducted every three years shows that Indonesia has scientific abilities ranked 64 out of 72 countries (OECD, 2015). This indicates that students' thinking skills in Indonesia (Alatab dkk., 2020; Powers dkk., 2019), especially reasoning in science, are still relatively low, students do not yet have the ability to think in responding to science problems in learning. According to Sinaga (2015) explains that students in Indonesia are less trained in solving PISA questions because PISA questions are designed questions that require reasoning abilities in answering them.

This problem can also be seen in Brebes Regency (Gabriela dkk., 2022; Kartel dkk., 2022; Keshav dkk., 2022). According to data on the results of the National Examination from the Ministry of Education and Culture in the 2016/2017 school year, Brebes Regency is in the last rank, namely ranking 35 Regencies or Cities in Central Java (Kemendikbud, 2017). While the results of the National Examination in Brebes Regency in the Biology subject experienced a decrease from the previous year. This can be proven that the results of the National Examination of 15 Public High Schools in Brebes Regency have decreased (Dewi S dkk., 2022; Hikmah dkk., 2022). The results of the Brebes 1 Public Senior High School National Examination, in 2016 reached 61.32% while in 2017 it decreased to 54.98%. This also happened at SMA Negeri 1 Banjarharjo, in 2016 it reached 55.51% while in 2017 it decreased to 47.05% (Kemdikbud, 2017). The problem of low National Examination results in Brebes Regency does not rule out the possibility that students' thinking abilities, especially reasoning, are still low.

Reasoning is a thinking process that includes the ability to think logically and systematically to draw conclusions based on relevant facts. According to Shadiq in Kariadinata (2012) the ability to reason is needed in life, this is so that every student can

show and analyze every problem, can solve problems appropriately (Bai dkk., 2020; Zhou dkk., 2020), can assess something critically. Students with good reasoning will be able to think logically in solving problems encountered in everyday life and be able to make the right decisions.

According to educational experts such as Venville & Dawson (2010) argue that the type of thinking that occurs when students consider socio-scientific issues is called informal reasoning or Informal Reasoning (Anoum dkk., 2022; Demina dkk., 2022). As explained by Tweney in Sadler (2004), although the results of science can be expressed in the language of formal reasoning and logic, the results of thinking themselves come from reasoning.

Sadler (2004) argues that informal reasoning is very good in addressing socio-scientific issues because by definition socio-scientific issues are complex, open, debatable or controversial, and do not have definite answers (Firman dkk., 2022; Ilham dkk., 2022). Socio-scientific issues or Socio Scientific Issues (SSI) represent issues or problems in social life that are conceptually closely related to science. Socio-scientific issues that develop, for example, in a global context, such as issues of genetic engineering (gene therapy, cloning or stem cells) and environmental problems such as global warming and climate change.

Socio-scientific issues can be included in learning, especially science learning. Herlanti (2014) argues that learning with socio-scientific issues can train critical thinking skills in solving problems and formulating decisions. Learning with socio-scientific issues is very important because students in addressing socio-scientific issues will use informal reasoning skills in responding to them so that they will be able to provide solutions in solving socio-scientific issues in society (Bilal dkk., 2019; Thushari & Senevirathna, 2020; Trambly dkk., 2020). If from the level of children to adults, an individual's informal reasoning does not develop, then an individual will find it difficult to answer and make decisions about various kinds of socio-scientific issues (Hartini dkk., 2022; Safitri dkk., 2022), because socio-scientific issues can be answered using informal reasoning.

According to Sadler & Zeidler (2005) informal reasoning is individual, meaning that each individual in thinking about something must use the reasons that underlie these thoughts differently. Therefore, an initial study is needed to explore this and see the pattern of students' informal reasoning (Najeed dkk., 2022; Nopiana dkk., 2022). Thus, it is necessary to conduct research in high schools because informal reasoning research in high schools has not yet been widely developed and the reason for the research to take place in Brebes Regency is because public high schools in Brebes Regency have problems related to low National Examination results (Nite dkk., 2020; Watkins & Marsick, 2021). Based on the background above, a study is needed to see the ability of informal reasoning patterns in an area. The research entitled Profile of Informal Reasoning (IR) of State Senior High School Students in Brebes Regency.

RESEARCH METHODOLOGY

The place or location of this research was carried out in public high schools throughout Brebes Regency because they have different student characteristics. The target of the research was in class XI because the researcher wanted to know the Informal Reasoning Profile of High School Students in Brebes Regency. The number of schools used in this study were 11 public high schools in Brebes Regency which were selected using the Proportionate Stratified Random Sampling principle. When the research was carried out in the odd semester of 2019/2020 with data collection carried out on July 24 2019 - August 8 2019.

The assessment instrument in the form of a test is used to obtain data on the mastery of Informal Reasoning by State Senior High School students throughout Brebes Regency. The test questions are in the form of multiple choice questions and descriptions. The questions contain cases regarding HIV-AIDS, GMOs, and cloning. The answer options for the multiple choice questions each point contain one of the Informal Reasoning patterns. According to Sadler & Zeidler (2005) there are three patterns of Informal Reasoning, namely: intuitive, emotive, and rational.

Table 1. Informal Reasoning Pattern Assessment Categories

category	Description
Rational	If the answers are logical, use scientific understanding and language, consider the risks and benefits, as well as the disadvantages and advantages. (various considerations).
(Category 3)	If the answer considers the emotional response to people related to the issue, concern, empathy, sympathy and concern for the fate of those affected. (judgment based on concern).
emotive	If the answers are based on hunch, direct responses, often respond negatively, are personal, often precede rational or emotional, and always leave the results to God. (respond directly without considering anything)

The data collected was then carried out a qualitative descriptive analysis by calculating the mean data. As additional data, observation and interview methods were used to obtain more in-depth information from respondents regarding issues related to research.

RESULT AND DISCUSSION

From the research results, it can be seen that the average level of Informal Reasoning ability of high school students in Brebes Regency. The results of the research on the percentage level of Informal Reasoning ability of high school students in Brebes Regency can be seen in Table 2 below.

Table 2. Level of Informal Reasoning ability of high school students in Brebes Regency

Criteria	Interval	Frecuency	Percentage (%)
Very good	81-100	61	18,26
Good	61-80	266	79,64
Enough	41-60	7	2,10
Not enough	21-40	0	0,00
Very less	<21	0	0,00
Total		334	100,00

Based on the percentage of Informal Reasoning criteria that had been determined from 334 samples tested from 11 public high schools in Brebes Regency, the results were 79.64% on the 'Good' criteria with a total of 266 students, then 18.26% on the 'Very Good' criteria with a total of 61 students , and in the 'Enough' category with a percentage of 2.10% which is 7 students. For more details on each school, see table 3.

Table 3. Informal Reasoning ability level for each school

Code School	Number of Samples	Average Value	Criteria
A	41	76,49	Good
B	39	76,5	Good
C	26	76,82	Good
D	29	75,67	Good
E	29	73,85	Good
F	30	73,33	Good
G	33	73,74	Good
H	16	73,96	Good
I	41	73,71	Good
J	16	72,57	Good
K	34	74,92	Good
Rata-Rata		74.52	Good

The 'Good' criterion shows the pattern that state high school students in Brebes Regency have not fully capable of reasoning in answering questions logically/rationally but are still answering by involving other patterns of reasoning. This is because emotive and intuitive patterns are under rational patterns. This is supported by the results of student interviews conducted.

Researcher: What do you think, if the cigarette factory in Indonesia is closed? Give the reason!

Student: It depends, yes, there are factors that agree or not, sir. Agree because cigarettes contain harmful substances that can cause cancer, so that it can reduce the number of patients suffering from cancer, so that Indonesian people are healthier, and disagree because many people depend on cigarette factories for their lives, so it would be a pity if the cigarette factory was closed it would be unemployment so that Indonesian people will increase their unemployment.

Data from student interviews conducted revealed that students in answering questions did not only use rational reasoning patterns, but students still involved other reasoning patterns. These patterns vary, namely emotional patterns and intuition. According to Venville & Dawson (2010) that the grouping of several forms of Informal Reasoning is based on the opinion that rational patterns are valued more in science and science education than emotive and intuitive patterns. This is because rational patterns are based on reason and logic, so that any decision will be accepted in society with open arms.

Students who have rational reasoning abilities if students are already faced with problems based on controversial issues that occur in the surrounding life conceptually then students will recognize problems better and be able to identify and analyze a problem and be able to solve these problems well.

Looking at the three patterns of Informal Reasoning ability, the rational pattern has the highest percentage value of 47.47%. In the second place there is an emotive pattern with a value of 29.47% and the lowest pattern is an intuitive pattern with an average value of 23.06%. These findings are supported by teacher interviews, student interviews and school observations. The following is a picture of the flow of findings.

Table 4. Percentage of each pattern of Informal Reasoning in Public High Schools throughout Brebes Regency

No.	Pola <i>Informal Reasoning</i>	Frekuensi	Percentage (%)
1	Intuitive	924	23,06
2	emotive	1181	29,47
3	Rational	1902	47,47
	Amount	4007	100

Table 5. Percentage of each school to the pattern of Informal Reasoning

Code School	Frekuensi			Percentage (%)		
	Intuitive	emotive	Rational	Intuitive	emotive	Rational
A	100	147	245	20,33	29,88	49,80
B	94	142	232	20,09	30,34	49,57
C	73	80	159	23,40	25,64	50,96
D	79	92	176	22,77	26,51	50,72
E	83	107	158	23,85	30,75	45,40
F	88	112	160	24,44	31,11	44,44
G	98	116	182	24,75	29,29	45,96
H	43	64	85	22,40	33,33	44,27
I	124	140	228	25,20	28,46	46,34
J	50	58	84	26,04	30,21	43,75
K	92	123	193	22,55	30,15	47,30
Amount	924	1181	1902	255,82	325,67	518,51

Based on the results of research on the Informal Reasoning abilities of State High School students in Brebes Regency, they have the same pattern of Informal Reasoning abilities, namely rational, emotive, and intuitive, but each school has a different percentage score. Table 5 shows that the school with the highest rational pattern is SMA C with a percentage of 50.96%. Meanwhile, the school with the lowest rational pattern was SMA J with a percentage of 43.75%. When viewed from the percentage of Informal Reasoning ability, it can be concluded that SMA C students are already able to use logic/rationality in answering reasoning questions related to issues in society. In contrast to SMA J, which has not been fully able to answer reasoning questions based on its logic/rationality.

Based on the results of teacher interviews, it is known that SMA C teachers often give students reasoning questions related to issues in society. This of course can have an impact on the students' reasoning abilities. Students who often get reasoning questions will certainly have good Informal Reasoning skills and will increase their good problem solving abilities and vice versa. According to Nurhayati (2016) that the higher the students' reasoning, the higher the students' problem-solving abilities. This of course can train students in reasoning students so that the reasoning abilities possessed by students and also students will be accustomed and honed in solving problems, providing solutions and drawing conclusions. Also agreed with Rizta (2013) who revealed that to improve students' reasoning, it is necessary to develop questions that can train students' reasoning abilities.



Figure 1. Informal Reasoning research sample map in 11 public high schools in Brebes Regency

Judging from the demographics of the region, SMA C which has a high rational pattern percentage value is in urban areas. Meanwhile, SMA J, which has a low percentage of rational patterns, lives in a rural area. Schools located in urban areas have

complete facilities and infrastructure. Facilities and infrastructure in schools will affect the teaching and learning process. According to Wenno (2010) through the unavailability of complete facilities and infrastructure, for example science laboratories greatly affect teaching and learning activities (Dianovi dkk., 2022; Rohmalimna dkk., 2022). Of course this can have an impact on good student learning outcomes. Schools must be able to improve existing facilities and infrastructure in schools so that they can support the process of teaching and learning activities and can improve maximum learning outcomes. If learning outcomes are good, it can be ascertained that the reasoning abilities possessed by students are also good (Nadya dkk., 2022; Rahmah dkk., 2022). This will certainly improve students' problem-solving abilities.

CONCLUSION

Based on the results of research on the Informal Reasoning ability of students of public high schools in Brebes Regency, it can be concluded that the level of Informal Reasoning ability of students in State Senior High Schools of the entire Brebes Regency is included in the 'Good' category. The average frequency of scores obtained for the 'Good' category is 74.52. The 'Good' category means that students in answering questions related to issues in society have not been fully able to answer rationally because they are vulnerable to a 'Very Good' score of 81-100. The highest average score was in SMA C with a score of 76.82 and the lowest average score was 72.57 in SMA J. The highest students' Informal Reasoning Ability was in the rational pattern with a percentage of 47.47%, while the highest low, namely the intuitive pattern with a percentage of 23.06%. Meanwhile, the emotive pattern has a percentage of 29.47%.

Based on the results of research on the Informal Reasoning skills of State Senior High School students in Brebes Regency, the suggestion that the researcher can convey is that in improving Informal Reasoning abilities, it is necessary to have Teacher guidance and direction. Science teachers should train students by providing reasoning questions related to issues that develop in society so that students' reasoning increases and students will get used to solving existing problems. 2. In improving the ability of Informal Reasoning teachers, students, and schools need to evaluate scientific reasoning which is still low. Teachers must be able to use the facilities.

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