Profile of Argumentation Skills using Toulmin's Argumentation Pattern (TAP) in Senior High School Students in Biology Learning: Preliminary Research

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Abstract. The skills needed in the 21st century, including critical thinking, communication, collaboration, and creativity, can be developed through argumentation skills. The method used is descriptive quantitative, with a sample size of 102 students. Student argument analysis refers to Toulmin's Argumentation Pattern (TAP), which contains aspects of claim, grounds, warrant, backing, and rebuttal. This study aims to describe the profile of the students' argumentation skills of class XII science at Senior High School 1 Sungai Pinyuh on the structure and function of cells in the reproductive system. The results showed that the students' argumentation skills had a percentage of 64.8% with enough category. The percentage of each aspect, namely the claim was in excellent category (95.25%), grounds was in enough category (59.25%), warrant was in good category (70.5%), backing was in enough category (56%), and rebuttal was in less category (42.75%). This study also showed the percentage level of student argumentation, namely the percentage of students categorized as level 1 at 1.96%, level 2 at 29.41%, level 3 at 68.63%, level 4 at 0%, and level 5 at 0%. The students' argumentation skills categorized as enough and were at levels 1, 2, and 3. Empowering through appropriate learning models and strategies.

1. Introduction
The 21st century is marked as the century of openness or globalization. The all-new demands call for various breakthroughs in thinking, conceptualization, and actions [1]. This causes the whole world to prepare high-quality human resources, who master several skills. One way to train high-quality human resources is through the education process [2]. The skills that students need to master in the 21st century, according to the Partnership for 21st Century Learning [3] are learning and innovation skills; information, media, and technology skills; and life and career skills, as shown in figure 1.
Figure 1. 21st century learning framework shows the skills that need to be mastered in the 21st century, including learning and innovation skills (4Cs); information, media, and technology skills; and life and career skills. It also included mastery of key subjects-3Rs and 21st century themes. Further, five support systems are essential to ensure all students receive a learning experience that builds 21st century competencies, including standards and assessments, curriculum and instruction, professional development, and learning environments [3].

Competition in the global community demands that students become critical thinkers, communicators, collaborators, and creators. In other words, skills that are important to develop for students and graduates, according to Redhana [2], are learning and innovation skills, which include critical thinking, communication, collaboration, and creativity.

The skills needed in the 21st century can be developed through argumentation skills. Not only critical thinking [4,5], but also communication [6,7], collaboration [8,9,10] and creativity [11,12]. Argumentation is the process of making a claim and obtaining justification from the claim accompanied by evidence. Finding out which view is better than others and further explaining the ideas and defending them [13]. Argumentation skills are considered necessary in the learning process of science, especially biology [4,13].

Toulmin's Argumentation Pattern (TAP) is the right choice to analyze the argument. Using TAP is very useful for measuring someone's argumentative ability. Erduran, Simon & Osborne [14] show that TAP is very suitable for researchers to identify arguments and measure the arguments' quality. Toulmin classifies six essential elements in an argument: claim, grounds, warrant, qualifiers, backing, and rebuttal, as shown in figure 2.

Figure 2. Toulmin's argument model shows the structure of argumentation consisting of six parts, namely claim, grounds, warrant, qualifiers, backing, and rebuttal [15].

In every act of expressing an opinion or arguing, there is always a claim. This claim is in the form of a conclusion or claim raised and believed to be accurate by the speaker or writer. This claim becomes central in the text. In an argumentation process, both oral and written claims will always be clarified and defended by the speaker or writer. Efforts to explain and defend this claim will be
successful if supported by grounds, namely a basis in the form of evidence to strengthen the claim. If
the available evidence is insufficient to support the claim, a warrant can be presented. The warrant is a
statement that connects a claim with grounds. The warrant also needs to be supported by backing. The
backing which corroborates this warrant is called support. Besides, when the claim is a condition that
contains distinct possibilities, qualifications may arise. Next comes a rebuttal, namely rejection or
exception [15].

Argumentation skills formed based on TAP can be assessed for its aspects using a rubric for
assessing aspects of argumentation skills by Noviyanti, Mukti, Yuliskurniawati, Mahanal & Zubaidah
in Mahanal [16]. Aspects that are assessed are claim, grounds, warrant, backing, and rebuttal.
According to assessing aspects of argumentation skills, the resulting argumentation skills can be
assessed for quality using a framework, according to Erduran et al. [14]. The framework developed is
used to identify the argument's quality based on TAP. Erduran et al. [14] classified students'
argumentation levels into five levels. Level 1 shows the argument in the form of a superficial claim
with the opposite claim. Level 2 shows the argument in the form of claim accompanied by grounds,
rebuttal, warrant, or backing but without rebuttal. Level 3 shows the argument contains a series of
claims accompanied by grounds, warrant, or backing and occasionally weak rebuttal. Level 4 shows
the argument contains a claim accompanied by a rebuttal that can be identified clearly and precisely
and contains several claims. Level 5 indicates the argument is broad but still related to the learning
material with more than one clear

Biology in schools discusses about the structure and function of cells in the reproductive system
and has a significant role in addressing adolescents' reproductive problems. Biology in Senior High
School examines the relationship between the reproductive system and reproductive health. This is a
solution to address the youth's lack of understanding of sexuality problems so that Senior High School
students know what to do and what is not to be imitated not to cause problems related to the
reproductive system [17]. This causes the material structure and functions of cells in the reproductive
system to be essential to be taught, especially issues related to reproduction, which contain pros and
cons so that students have a good view of the issue. Material that discusses these kinds of pros and
cons can stimulate argumentation skills.

The kind of research that has been done is research conducted by Faiqoh, Khasanah, Astuti,
Prayitno & Prayitno [18] at Senior High School Batik 1 Surakarta which shows that students'
argumentation skills into the good category with a percentage of every aspect of argumentation skills
namely claim is at a percentage of 68%, grounds are at a percentage of 52%, warrant is at a percentage
of 60%, backing is at a percentage of 44% and rebuttal is at a percentage of 0%. Furthermore, research
conducted by Devi, Susanti & Indriyanti [19] at Senior High School 3 Surakarta shows that the
students’ argumentation skills are at levels 1 and 2, with level 1 is at a percentage of 48.1%, and level
2 is at a percentage of 51.9%. That means students at that level can only include aspects of claim,
grounds, warrant, and backing in their answers. While in the rebuttal aspect, students have not been
able to provide answers by using rebuttal.

Based on that background, the problem in this research was how to profile the students’
argumentation skills of class XII science at Senior High School 1 Sungai Pinyuh on the structure and
function of cells in the reproductive system? This research was conducted to describe the profile of the
students’ argumentation skills of class XII science at Senior High School 1 Sungai Pinyuh on the
structure and function of cells in the reproductive system. This study's final results are expected to be
the basis for empowering argumentation skills through appropriate learning models and strategies.

2. Method
This study used a quantitative descriptive method to describe the profile of the students’
argumentation skills. It was grouped based on the TAP analysis or the Toulmin’s argumentation
model. The research was conducted on 102 students of class XII science for the 2019/2020 academic
year at Senior High School 1 Sungai Pinyuh.
The instrument used in this study was a description of the questions referring to Grooms [20], which consisted of 5 questions related to the structure and function of cells in the reproductive system with the theme of free condom distribution to prevent HIV/AIDS. The data collected were in the form of students’ arguments in written form. The results of student writing could be analyzed using the TAP or the Toulmin’s argumentation model with aspects of the argument, including a claim, grounds, warrant, backing, and rebuttal.

In this study, an assessment of each aspect of argumentation skills and an assessment of the argumentation level was carried out. The assessment of each aspect of argumentation skills referred to the rubric of assessment by Noviyanti et al. in Mahanal [16] presented in table 1, then calculated by calculating the average. Then the quantitative data obtained was converted to qualitative data referring to Widoyoko [21]. Meanwhile, the argumentation level assessment referred to Erduran et al. [14] presented in table 2.

| Table 1. Rubric for Assessment of Aspects of Argumentation Skills |
|------------------|------------------|------------------|------------------|------------------|
| Aspect           | 1                | 2                | 3                | 4                |
| Claim            | The claim is unclear or does not appear. | The claim is not valid and needs further development. | The claim is well written but uses no further explanation. | The claim is valid and well written. |
| Grounds          | Grounds are missing or irrelevant. | The grounds are less clear and require development. | Grounds are easy to identify but requires some clarification. | Grounds are presented correctly, concisely, and easy to identify. |
| Warrant          | The warrant used do not link/associate the claim with the grounds. Alternatively, the warrant is challenging to identify. | The warrant used is incorrect, but there is something that links the claim to the grounds. | The warrant presented are valid and easy to identify, but need some clarification. | The warrant is written correctly, are easy to identify, and connect grounds with arguments efficiently. |
| Backing          | Evidence supporting a warrant cannot be identified or does not support a warrant at all. | Sufficient evidence supports the warrant but needs further justification. | The evidence supports the warrant, but cannot clarify the emergence of a relationship as evidence. | The evidence strongly supports the warrant. |
| Rebuttal         | The rebuttal is not accompanied by warrant and supporting evidence. | The rebuttal is accompanied by a warrant and evidence that are less supportive. | Rebuttal with supporting warrant, but not accompanied by supporting evidence. | Rebuttal with warrant and supporting evidence. |

| Table 2. Analytical Frameworks for Assessing the Quality of Argument |
|------------------|------------------|------------------|------------------|------------------|
| Level            | Criteria                                    |
| 1                | The argument in the form of a superficial claim with the opposite claim |
| 2                | The argument in the form of claim accompanied by grounds, warrant, or backing but without rebuttal |
| 3                | The argument contains a series of claims accompanied by grounds, warrant, or backing and occasionally weak rebuttal |
| 4                | The argument contains a series of claims accompanied by grounds, warrant, or backing and one clear rebuttal |
| 5                | The arguments contain several arguments with more than one clear rebuttal |

3. Results and Discussion
The assessment of argumentation skills on the structure and function of cells in the reproductive system with the theme "Free Condom Distribution to Prevent HIV/AIDS" consisted of two
assessments, namely the aspect of argumentation skills and the level of argumentation. The assessment results of the aspect of argumentation skills are presented in figure 3, and the results of the assessment of the level of argumentation are presented in figure 4.

**Figure 3.** Results of the students’ argumentation skills of class XII science at Senior High School 1 Sungai Pinyuh as a whole are seen from the aspect of argumentation skills, which has a percentage of 64.8% with enough category shown in the claim is at a percentage of 95.25% with excellent category, grounds are at a percentage of 59.25% with enough category, warrant is at a percentage of 70.5% with good category, backing is at a percentage of 56% with enough category, and rebuttal is at a percentage of 42.75% with less category.

The claim aspect is the aspect that has the highest percentage, namely 95.25%, which means that students are very good at making claims in their arguments. The claims are well written and correct, but some require further development and explanation. The claim determines the direction of the arguments made, whether it supports or does not have to be following the grounds presented.

The grounds aspect, which has a percentage of 59.25%, indicates that students have enough ability to include and understand grounds to be included in their arguments. These grounds need further development and can be clarified as the grounds used in the arguments. Writing out relevant sources supports the grounds are valid or not.

The warrant aspect has a percentage of 70.5%, indicating that students have good ability to connect the claim with grounds. Students make claims based on the grounds presented by clarifying the supporting warrant. The warrant must be convincing by showing a strong relationship between the claim and the grounds.

The backing aspect, which has a percentage of 56%, indicates that students have enough ability to include supporting grounds as evidence to strengthen their arguments. The evidence provided needs further justification and can clarify the relationship as evidence in the arguments made.

The rebuttal aspect is the aspect that has the lowest percentage, namely 42.75%, indicating that students are still lacking in making arguments that are opposite to the previous argument. Some students misinterpret the questions. Students are also adamant about the previous arguments, and the arguments made are mostly accompanied by warrant and evidence that are less supportive.
Figure 4. Results of the students’ argumentation skills of class XII science at Senior High School 1 Sungai Pinyuh as a whole are seen from the level of argumentation. Level 1 is at a percentage of 1.96%, level 2 is at a percentage of 29.41%, level 3 is at a percentage of 68.63%, level 4 is at a percentage of 0%, and level 5 is at a percentage of 0%.

At level 1, the percentage result is 1.96%, meaning that 2 students have arguments in the form of a superficial claim with the opposite claim. At level 2, the percentage is 29.41%, meaning that 30 students have arguments containing claims with grounds, warrant, or backing but do not contain rebuttal. At level 3, with a percentage result of 68.63%, meaning that 70 students have arguments containing a series of claims with grounds, warrant, or backing and weak rebuttal. At level 4 with a percentage result of 0%, meaning that there are no students who have arguments containing a series of claims with grounds, warrant, or backing and one clear rebuttal. At level 5, with a percentage result of 0%, meaning that there are no students who have arguments containing several arguments with more than one clear rebuttal.

The argumentation level percentage results show that students of class XII science at Senior High School 1 Sungai Pinyuh have the quality of the arguments, which are categorized as level 1, 2, and 3. The data also shows that students have not been able to make clear rebuttal, whether it is one rebuttal, which is categorized as level 4 or more than one rebuttal, categorized as level 5.

4. Conclusion
Based on the results of the research on argumentation skills of class XII science students at Senior High School 1 Sungai Pinyuh, the students' argumentation skills based on the assessment of each aspect categorized as enough and based on students’ argumentation level were at levels 1, 2, and 3. Based on the results that have been obtained, the argumentation skills need to be developed in Senior High School 1 Sungai Pinyuh so that students have argumentation skills with a very good category and reach level 5. Therefore the role of the teacher is needed by choosing the right learning model and strategy.

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HIV stands for Human Immunodeficiency Virus. HIV attacks the immune system, which further weakens the body's ability to fight infection and disease. AIDS is the final stage of HIV infection when the body's ability to fight infection is no longer there. Early detection and treatment prevent people with HIV from moving to AIDS [22].

In 2017 36.9 million people were living with HIV worldwide. In Indonesia, from 2005 to March 2019, the number of reported HIV cases reached 338,363 people, while the number of AIDS conditions reported since it was first discovered in 1987 to March 2019 reached 115,601 people. The latest report from the Directorate General of P2P, Ministry of Health of the Republic of Indonesia, dated August 27, 2019, shows the cumulative number of HIV/AIDS cases approaching half a million or 500,000, namely 466,859 consisting of 349,882 HIV and 116,977 AIDS [23].

December 1 is celebrated as World AIDS Day. World AIDS Day commemoration calls for care for PLWHA (people living with HIV/AIDS). HIV is not transmitted by shaking hands or by chatting. HIV/AIDS can be transmitted through free sex, needles, and blood transfusions that have been contaminated with HIV/AIDS. Some things to avoid HIV/AIDS include not having free sex or having sex with safety [24].

The public protested the distribution of condoms to prevent HIV/AIDS. In 2014, the AIDS Prevention Commission (KPA) stated that condom distribution was only carried out in certain places such as prostitution, tourism spots, and massage parlors. This is in line with one of the doctors at the Teratai Clinic at Hasan Sadikin Hospital in Bandung, who stated that the distribution of free condoms is one of the reasonable efforts to prevent the spread of HIV/AIDS in the community. However, the distribution of condoms must be on target, namely in prostitution places and HIV/AIDS clinics [25].

Rusdi [26] has refused to distribute condoms to prevent HIV/AIDS in his paper entitled "Fenomena HIV sebagai Sebuah Masalah dari Pencegahan yang Bermasalah: Studi Kasus Kebijakan Kondomisasi di Indonesia Makalah untuk Mata Kuliah Current Issues in Religion, Health, and Ethic (Jakarta: ResearchGate) pp 1-19.

Appendices
Questions of Argumentation Skills Profile using Toulmin’s Argumentation Pattern (TAP): Free Condom Distribution to Prevent HIV/AIDS.

1. As a citizen, if you are allowed to support or not support free condom distribution to prevent HIV/AIDS, what are your options? (Select one).
   a. Support free condom distribution to prevent HIV/AIDS.
   b. Do not support free condom distribution to prevent HIV/AIDS.

2. Write down your arguments regarding free condom distribution to prevent HIV/AIDS.

3. Not everyone agrees with your opinion. Make arguments contrary to your previous arguments that may be used by others to oppose your arguments.

4. What was the most compelling evidence that influenced your decision? Why?

5. What additional information do you need to strengthen your argument?