

Argumentation Writing Skills of Preservice Teacher in Higher Education: Mapping for Development

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Abstract. Argumentation skills are an important domain to be provided to students in higher education. This study aims to identify the level and category of scientific argumentation skills among students. The method used in this research is content analysis. Twenty-three students' written scientific arguments about environmental issues were analyzed to be mapped. The mapping analysis of students' written arguments is divided into two parts. Mapping analysis of students' written arguments is grouped into two parts. First, the analysis focuses on the completeness of the argumentation components without considering their scientificity. Second, the analysis is more emphasized on the argumentation component and the scientific level of the argument. The research findings illustrate that the argumentation component without a scientific level is dominated by grade 2 (ie Data, Claims and/or Warrants). Meanwhile, the research results on the argumentation component and the scientific level of argumentation are dominated by the Unacceptable-Incorrect Scientific Knowledge (SU-2) category. Thus, written argumentation skills must be taught to students comprehensively. This study is important for lecturers because it provides an overview of the ability of scientific argumentation among students, which then helps lecturers in determining the next step in the learning process by adopting appropriate teaching strategies.

1 Introduction

Numerous issues will arise as a result of the quickening pace of modern life, for which we must find solutions and take action. An effective educational system that equips students with critical thinking abilities including reasoning, inference, and the interpretation of scientific phenomena is one strategy to address this issue [1].

The use of scientific argumentation in the learning process is crucial because it engages students actively, aids in the development of their ideas, and allows them to better understand who they are as individuals as opposed to having them presented in a pre-made template [2]. In particular, when students are presented with contentious problems, teaching them how to participate in conversations and use scientific evidence in these discussions is

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crucial for future decision-making [2]. Therefore, science ought to play a significant role in creating future citizens who possess these abilities [3]. Students can collaborate in discussions and steer their understanding of natural phenomena toward more cogent scientific explanations when arguments are uncertain [4].

Ideally, science learning should practice argumentation skills [5, 6, 7]. Argumentation is acknowledged as a fundamental aspect of science practice, and contemporary reform initiatives promote it as a key objective of science education (e.g, NGSS Lead States, 2013). Additionally, teaching pupils how to make arguments is a crucial task. This is due to the crucial role that reasoning skills play in developing an explanation, model, and theory for a notion that is being investigated [8]. Practicing argumentation skills in the learning process means directly training students to master concepts as a whole at a high level of thinking.

The research results show that practicing argumentation skills in learning makes it easier for students to develop and master concepts as a whole [9, 10, 11, 12, 13, 14]. Additionally, argumentation is regarded as crucial for 21st century success and responsible citizenship [15, 16]. In inquiry-based science learning, argumentation is the main practice that needs to be practiced at all levels of education [17]. One of the most essential aspects of scientific literacy and a crucial practice for citizenship as well as a major learning objective in science instruction is the development of argumentation abilities. [10,17].

There are so many advantages that come from scientific arguments, but the use of scientific arguments has not received attention in learning [18]. Even some studies also show a decrease in the ability of scientific argumentation in general [19]. Therefore, in this study it will be mapped in which position the scientific argumentation abilities of prospective science teacher students are currently being carried out for further research.

The Toulmin Argumentation Pattern [19] is used to carry out the argumentation activity. This pattern has four components: (1) Claims, namely sentences addressed to other people to accept their truth; (2) Data, namely the truth of the underlying claim in the form of reasons so that the claim cannot be debated anymore; (3) Warrant, which is a type of sentence that explains the relationship between the claim and its supporting evidence; and (4) Backing, namely additions to the claim.

2 Methods

The research method used is content analysis. The analysis was carried out on written tests conducted by students on global environmental issues. The students who took the test were 22 students who had received environmental education teaching. Document analysis in revealing scientific argumentation skills is carried out in two types. The first type is mapping students' argumentation abilities by looking at the completeness of the components that make up argumentation, such as claims, data, warrants and backing. This type only looks at completeness without paying attention to the scientificity of the arguments that are compiled. While the second type is to look at the completeness and scientific and level of students' argumentation abilities. The grouping of data into two types refers to Table 1 and Table 2.

Table 1. Category Completeness of Argument Composing components.

completeness grade	Descriptions
Grade 1	Claim
Grade 2	Claim, data and/or warrant
Grade 3	Claim, data/warrant, backing or qualifier
Grade 4	Claim, data/warrant, backing, and qualifier

Table 2. Argument scientific category.

Scientific Grade	Descriptions
SA1	fully correct answer
SA2	partially correct answer
SU1	irrelevant answer
SU2	incorrect scientific knowledge
NE	without explanation

SA = Scientifically acceptable
SU = Scientifically unacceptable
NE = Not explanation

3 Results And Discussion

Data on students' written argumentation skills were obtained through analysis of global social issues test documents. The data obtained was analyzed into two groups, namely the category of completeness of argumentation (organs of argumentation) and the category of scientificity of the argumentation being prepared. The results of the analysis of the completeness of argumentation are shown in Figure 1.

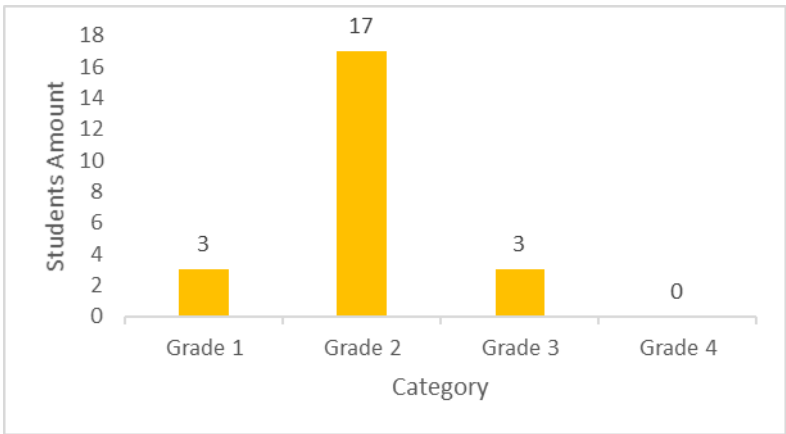


Fig. 1. Student’s arguments result.

From Figure 1, it can be seen that the grade of completeness of students in compiling arguments varies. The arrangement of arguments varies from grade 1 to grade 3. The level of completeness in the preparation of arguments is mostly found at grade 2, namely 17 respondents, mentioning the existence of claims and explanations of the reasons that accompany them. The highest score obtained by students is grade 3, namely the existence of a claim, explanation of the reasons for the claim, and support for the arguments put forward.

From Figure 1, it can be seen that most of the students gave an argument against an information without accompanying supporting data. This is most likely due to students not understanding the concept being asked. This is in line with the results of Cetin's research [21], that students have difficulty in compiling complete and systematic arguments. Therefore, Kuhn [7] suggests that the learning process should facilitate students to practice filing claims, data, warrants, and support/qualifications. In line with Kuhn, integration in the learning process is needed to practice the skills of compiling a complete argumentation organ [6, 22].

In addition to the completeness of the organ, another important thing that needs to be identified from the argument is the scientific grade of the argument presented. The scientific argumentation category data compiled by students is shown in Figure 2.

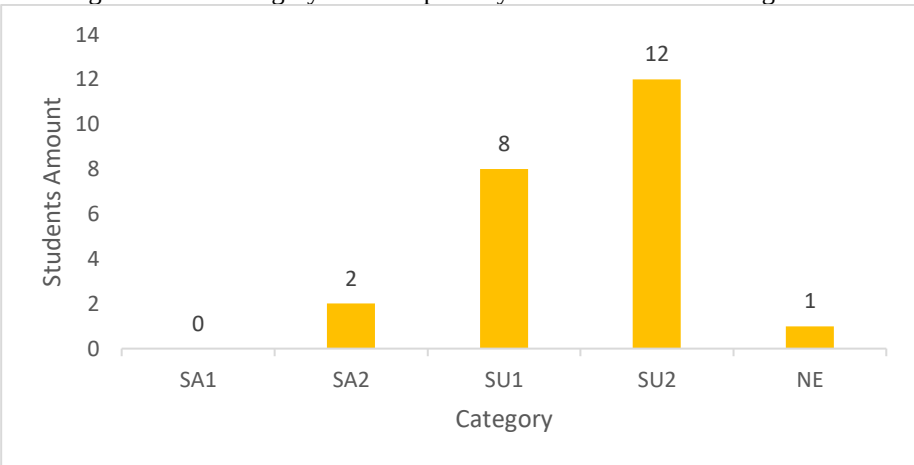


Fig. 2. students' written argumentation skills based on scientific level.

Based on Figure 2, none of the students were able to develop an argument at a level of science that was totally acceptable (SA1). Only two students were able to build arguments using scientific categories with some appropriate concepts (SA2). It is possible that students may not fully understand the subject matter being tested, resulting in their inability to appropriately describe the relationship between concepts when presented with a scenario that calls for analysis.

From Figure 2 it can also be seen that the ability of most students (52%) is in the SU2 category, namely in the category of conceptually incorrect answers so that they are not accepted scientifically. Based on data analysis, some of them did not master the concept and some had misconceptions. Based on the SA2 and SU2 data, it can be said that students already have the ability to compose arguments even though their scientific level is not perfect.

In addition, there are eight students whose argumentation skills cannot be accepted scientifically and it is irrelevant between the arguments made and the claims put forward. Meanwhile, two students only gave claims without any explanation. In other words, these two students are not able to make scientific arguments.

Argumentation is closely related to the concept [12, 13]. Therefore, it is essential to educate students' level of scientific understanding when assembling arguments in addition to teaching them to construct arguments according to their basic parts. This is crucial because argumentation aids students in solidifying their understanding of concepts. The practice of teaching students how to make arguments in favor of scientific theories can help students develop their scientific ideas and logic [13, 21]. Students receive direct instruction on how to master the topic as a whole at the level of higher-order thinking along with the development of their argumentation abilities during the learning process.

4 Conclusion

According to the study's findings, students' ability to organize arguments in a full manner as well as to produce arguments that are based on scientific principles needs to be strengthened and trained during the learning process. These results lead to the conclusion that the pupils' capacity for argumentation is still weak. Consequently, it is essential to receive training through the appropriate learning technique.

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