Senior High School Students' Argumentation Skills: Implementation of the Scientific Approach at Different Levels of Accreditation

Dina Maulina(✉), Neni Hasnunidah, and Ismi Rakhmawati

Biology Education, Lampung University, Lampung, Indonesia
{dina.maulina,neni.hasnunidah,ismi.rakhmawati}@fkip.unila.ac.id

Abstract. This study was aims to analyze the argumentation ability of students at the high school level in Lampung Province at different levels of accreditation. Methods of this research was used ex post facto. This research will be conducted in all high schools in Lampung Province. Determination of sampling using a purposive technique based on: (1) the determined area is an existing district/city expansion area which indicates that the area is in a phase of demographic development with education becoming urgent sectors in the fulfillment of human resources and demographics, (2) the same socio-economic and geographical conditions as considering the homogeneous evaluation of learning achievement in the Regency/City of Lampung Province in 2021. Therefore, the sample was 533 students with the distribution of schools in the Regency area North Lampung, Pesawaran and Way Kanan. Data obtained through: (i) quantitative data (test), and (ii) qualitative data, questionnaires, and interviews by teachers. The results of the research were found that all the schools studied had implemented a scientific approach as mandated by the 2013 Curriculum. This descriptive showed that there were differences in data implementation between schools accredited A, B, and C in Lampung Province. The argumentative aspects of Claim, Grounds, Warrants, backing in schools with different accreditation levels have a difference.

Keywords: accreditation · argumentation skills · scientific approach

1 Introduction

Achievements in 21st century education are characterized by the creation of educated humans who have the competence *of accompaniment soft skills* at each level of their graduates. The ability to argue is one of the realms of *soft skills* in education that needs to be trained to all students as capital in developing self-competence to build an educated human civilization. Efforts to train students' scientific argumentation skills require an approach that directs students to have behavior like *scientists* when carrying out learning activities. In line with the mandate of the 2013 Curriculum that the implementation of learning is carried out through a scientific approach. In addition, the implementation of a scientific approach at the high school level is strongly influenced by school accreditation rankings supported by eight national education standards which are contained in four

school quality assurances, namely: the quality of graduates, teachers, school facilities, and infrastructure and the quality of school administration regulations. Therefore, the research that will be submitted aims to analyze the ability of argumentation in the implementation of students at the high school level in Lampung Province at the high school level with different levels of accreditation.

The demand for 21st century education is to form educated humans by having the competence *of accompaniment soft skills* in their graduates. The ability to argue is one of the *soft skills* needed in this 21st Century Education [1] (AACTE, 2010: 9). Building arguments students are directed to understand concepts and reason against the phenomena that occur and look for evidence of claim reinforcement independently. Students will learn to solve problems sequentially and gradually through argumentation and dare to express ideas based on supporting evidence [2]. Therefore, habituation and training in arguments in science learning is very necessary so that students also have logical thinking, clear views, and can explain rational reasons for scientific phenomena or facts that occur in everyday life based on relevant theories or concepts of science.

The ability to argue can be developed in learning through a *scientific approach* integrated in the curriculum. Another research revealed that to build students' scientific argumentation skills, an approach is needed that directs students to have behavior like *scientists* when learning, namely a scientific or scientific approach [3]. The scientific approach has been mandated by the 2013 curriculum as an approach that adopts the steps of the scientific method in solving a problem [4]. This scientific approach directs educators to guide students in terms of activeness or more responsiveness in learning so that students can build concepts in their knowledge independently, get used to formulating, facing, and solving problems found both in the classroom and in the educational unit environment. Learning activities that can be carried out in the implementation of a scientific approach are observing, questioning, collecting information, associating, and communicating. Through these activities, students construct or build information that will become knowledge for students and the knowledge develops from simple to complex, from narrow to broad scope, and concrete to abstract [5].

Several studies on the use of scientific approaches in relation to the ability to argue have been carried out, concluded that scientific approaches have a strong influence on students' scientific argumentation ability [6]. Scientific methods can significantly improve students' argumentation skills [7]. Students can develop their argumentation skills through a scientific approach, because through questioning and reasoning students will be trained in speaking, then the activity of asking questions, giving answers logically-systematically, and using good and correct language will encourage students to discuss or argue, think critically and creatively.

The scientific approach is very suitable to be applied in learning science, especially biology. This is supported by the opinion that biology learning materials are closely related to contextual phenomena or real problems that are often encountered [8]. The application of a scientific approach to biology learning can facilitate students to be actively involved in finding their own knowledge in the learning process. Biology learning on Animalia material has a very large scope of discussion so that it will be more effective and efficient if students can learn it directly. Furthermore, Biology is effective

if it is carried out by direct observation which can be done through practicum activities in the laboratory [9].

The application of the scientific approach has been integrated in the 2013 Curriculum Lampung Province has been surveyed by researchers at the high school level in 2021. The results of interviews with high school biology teachers in Lampung Province at schools with different accreditation ratings in Pringsewu City/ Regency, Bandar Lampung, North Lampung, South Lampung, Way Kanan and Metro City have shown that a scientific approach to learning has been applied in recent years. The results of the analysis of learning documents, such as the Learning Implementation Plan (RPP), and the Student Worksheet also showed that the three schools have used a scientific approach in their learning process. However, the use of the scientific approach that has been applied has never been studied in relation to the ability to argue with students. One of the reasons is that teachers have never given questions to measure the ability to argue because of the limited knowledge of educators about it. In the learning process, students have not been facilitated to develop their argumentation skills orally or in writing [10]. Then, 40% of teachers did not know how to make a worksheet that could empower students' argumentation ability [11].

The implementation of the scientific approach in high schools is different in each school. This depends on one of them by the level of school accreditation. Accreditation is expressed in several groups, namely: A, B, C and Non-Accredited levels. The school accreditation rating is the result of an assessment in the form of formal certification of the condition of a school that has met the National Education Standards [12]. Accredited schools A (excellent) obtained a final accreditation score of 91–100, accredited schools B (good) obtained a final accreditation score of 81–90, accredited schools C (sufficient) obtained a final accreditation score of 71–80 and non-accredited schools obtained a final score of accreditations below 71. The acquisition of these values is based on the quality of graduates, the learning process, the quality of teachers and school management [13]. Assessment of the learning process on the written accreditation tool that learning must actively involve students in learning that can be explored from providing opportunities for students to communicate results or ideas [13]. Therefore, the quality of students' ability to communicate or argue in schools is related to the assessment of school accreditation. Accreditation can be viewed as an instrument of *self-regulation*, with the intention that schools can understand their strengths and weaknesses. Based on the understanding of their strengths and weaknesses, schools can make *quality continuous improvement* [14].

Several high schools in the district can be distinguished based on their accreditation levels. The application of the scientific approach in high schools throughout Pesawaran Regency will differ according to the accreditation rating. This will result in one of them being a difference in students' argumentation ability. Several studies have been conducted to test the quality of schools that differ in accreditation rank through measuring the ability of their students. Students in schools with an accreditation rating of A have different science process skills than students in accredited schools B and C [15]. Likewise with research that schools with an accreditation rating of A have differences with schools accredited B and C in terms of students' ability to solve problems [16]. However, there has never been a study on students' argumentation skills related to the implementation of curriculum policies regarding the implementation of the scientific approach.

The description of the problem above became the basis for the research team to further conduct research with the title "Study of Analysis of Student Argumentation Skills in the Implementation of *Scientific Approach* at the High School Level throughout Lampung Province in Schools with Different Accreditation". Based on the background and research problems above, the purpose of this study is to determine the difference in the ability to argue for students in high school with different accreditation rankings.

2 Methods

2.1 Population Dan Sample

This research will be carried out in 2022 at school levels with different accreditation rankings in Lampung Province. The Lampung Province area consists of 15 regencies/cities, namely: North Lampung Regency, South Lampung, Central Lampung, West Lampung, East Lampung, Pesawaran, onion bone, West Onion Bone, West Coast, Pringsewu, Tanggamus, Way Kanan, Metro city and Bandar Lampung City. From each region, mapping of schools will be carried out according to their accreditation rankings.

The population in this study was all students majoring in science class XI high school in Lampung Province. Samples were extracted from the population with *purposive sampling* techniques provided that: 1) have studied biological material on the subject matter of KD 3.1 to 3.5; 2) provide *a smartphone* for the implementation of the test; 3) be willing to be involved in the research. The *Purposive sampling* technique is the selection of samples based on certain characteristics and is considered to have a very close relationship with previously known populations [17]. Thus, the sample used was students majoring in science in class XI at three schools with three different levels of accreditation that met the above conditions. The research design used *ex post facto.*

The results of sampling that have been carried out based on purposive techniques obtained that the determination of regional mapping in Lampung Province (Fig. 1) as a sampling school are: North Lampung, Pesawaran and Way Kanan Regencies. The basis for mapping the areas used as a research sample is (1) the designated area is a pre-existing

Fig. 1. Research sample area in Lampung Province (Source: retrieved from https://bit.ly/peta_Lampung)

Table 1. Research Sample

Regency/City	Sample		Total (Student)
	Accreditation	*School*	
North Lampung	A	SMA N 4 Kotabumi	208
	B	MAN 2 Lampung Utara	49
	C	SMA N 1 Hulu Sungkai	24
Pesawaran	A	SMA N 1 Gedong Tataan	40
	B	SMAN 1 Kedondong	35
	C	SMA N 1 Way Khilau	31
Way Kanan	A	SMA N 1 Baradatu	62
	B	SMA N 2 Buay Bahuga	73
	C	MA Miftahul Ulum	31
Total			**533**

regency / city expansion area which indicates that the area in the phase of demographic development with education is an urgent sector in fulfilling human resources and demographics, (2) the same socioeconomic and geographical conditions with consideration of the evaluation of high school learning achievement in the Regency/City of Lampung Province in 2021 which is homogeneous. Thus, the determination of the sample determined to be 533 students with the distribution of partner schools presented in Table 1.

2.2 Research Instrument

Instruments used to collect data on the ability to argue. The student argument ability test is given to students to measure students' ability to provide data/grounds, warrants, and backing to strengthen or reject a statement (claim) [18]. The test form is in the form of essay questions totaling 20 questions. The argumentation indicators used include the technique of scoring test scores using formulas as follows [19]:

$$\text{Skor} = \frac{a}{b} \times 100$$

Information:

a = number of correctly answered earned scores
b = maximum number of scores from the test

The ability to argue students from the three schools with different accreditation rankings will be grouped based on the category of achievement of arguing ability [20].

2.3   Data Analysis

This research is qualitative research with data on the argumentation ability of students of different levels. Data on the value of students' argumentation ability were tested statistically using Variance Analysis (Anova). Variance Analysis is used to test differences between an average number of populations by comparing their variances. Before the Anova test is carried out, prerequisite tests are first carried out, namely the Normality test and the Homogeneity Test.

3   Result and Discussion

The results of the study found that high school level students in Lampung Province have argumentation skills in the low category (Fig. 1). The specification of the range of argumentation ability in accredited schools A in the category is sufficient, accredited B is lacking and accreditation C is severely lacking (Fig. 1). The average argumentation skills of students in A-accredited schools of 60.47 (enough) represent the meaning that the school level with accreditation level A has carried out learning with a *Scientific Approach* with sufficient argumentation skills (Fig. 2).

The results of class observations in learning showed that students' ability to collect evidence or information as a basis for making a statement (**Grounds**) in the sufficient category. Indicators of "Claim" argumentation ability, namely students' skills in formulating conclusions or statements that are believed to be true by students based on data observed in Lampung Province are still in sufficient and low condition. During the learning process with a scientific approach, students have not carried out Ground and
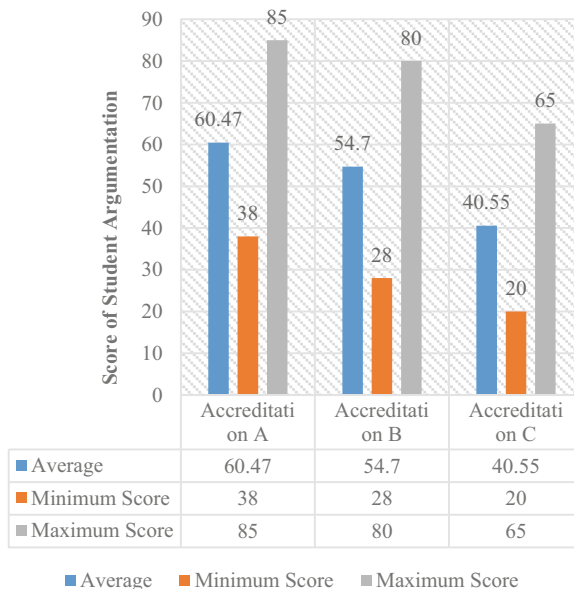

	Accreditation A	Accreditation B	Accreditation C
■ Average	60.47	54.7	40.55
■ Minimum Score	38	28	20
■ Maximum Score	85	80	65

■ Average   ■ Minimum Score   ■ Maximum Score

Fig. 2. Ability to Argue for High School Students in Lampung Province

Table 2. Differences in Argumentation Ability at Different Argumentation levels

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18070.889	2	9035.445	70.929	.000
Within Groups	32611.049	256	127.387		
Total	50681.938	258			

Table 3. The Ability of Argumentation of Students Between High Schools at Different Levels of Accreditation in Lampung Province

Accre-ditation Group	Accreditation Group	Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	*Upper Bound*
A	Accreditation B	5.768[*]	1.711	.002	1.73	9.80
	Accreditation C	19.913[*]	1.716	.000	15.87	23.96
B	Accreditation A	-5.768[*]	1.711	.002	-9.80	-1.73
	Accreditation C	14.145[*]	1.726	.000	10.08	18.21
C	Accreditation A	-19.913[*]	1.716	.000	-23.96	-15.87
	Accreditation B	-14.145[*]	1.726	.000	-18.21	-10.08

* The mean difference is significant at the 0.05 level

Claim activities. The role, process, and evaluation of high school learning activities in Lampung Province before being integrated in carrying out the strengthening of argumentation skills. This makes consideration in providing input to policy determinants for the implementation of learning activities.

Students' skills in connecting claims with data (**warrants)** in Lampung province are in the category of sufficient and lacking. Claim becomes the center of the text in an argumentation process and will always be clarified and maintained by students throughout the learning process. Students' habituation in linking data acquisition and drawing conclusions based on references and truths that are believed in learning has not been well honed. Backing skills, namely the acquisition of evidence and theories produced by students in relation to strengthening the achievement of scientific competencies supporting warrants also found low scores.

The difference in argumentation skills in the category range is sufficient, lacking and very lacking in Lampung Province, shown in Table 2 shows that there are differences (p < 0.05) in the average argumentation skills in the three different school accreditation groups. The differences between different schools of accreditation level are seen in Table 3. The results showed that the argumentation skills of students who came from A-accreditation schools were significantly different from the argumentation skills of students from accredited schools B and C (p < 0.05).

The implementation of student argumentation skills has not been fully implemented in the implementation of a scientific approach in carrying out data collecting student activities to collect information already using various valid sources and references such as student books, YouTube videos and the internet. This activity is in line with the process of questioning and collecting information on the scientific approach listed in Permendikbud that questioning is carried out by making and asking questions. The activity of collecting information is carried out by reading various literature [21]. In questioning activities, the questions asked by students should start from questions that are factual to lead to questions that are hypothetical) [22].

At the data processing stage, A-accreditation schools design the presentation of the information that students have collected. Students are asked to present data or information through the presentation of images to guide the analysis of the problems that are raised. Students are guided in connecting one information with another to find concepts. B and C-accreditation schools have not designed the optimal presentation of information. There is a data processing stage, students are only asked to write down the answers to the student worksheets in the notebook. At the verification stage, teachers from accredited high school B design a re-examination of the information collected and relate it to hypotheses.

The results of field observations show that accredited high schools A and C do not ask students to re-examine the suitability of the answers to the formulation of the problem through other reliable sources. Scientific approach accommodates activities, students from the three high schools are asked to make **conclusions (generalization)**. Data processing, proof and conclusion drawing activities are in line with reasoning activities / associating on a scientific approach. Permendikbud states that reasoning/associating activities are carried out by processing the information that has been collected, analyzing data, linking related phenomena/information to find a pattern and conclude [21]. This activity develops the ability to interpret and argue about the assemblage of various facts/concepts/theories/opinions. Data collection activities and drawing conclusions can develop students' argumentation skills to collect various data/facts (grounds), connecting grounds with claims (warrants) and supporting theories (backing). Thus, the results of this study provide answers to the argumentation skills of students at the high school level in Lampung Province, the difference in school accreditation levels.

4   Conclusion

This research implies that there are differences in the ability to argue significantly between students in high school with accreditation ratings of A, B and C (sig. < 0.05). The average argument ability of students from accredited high schools A is higher than that of accredited high schools B and C. Argumentation ability of students from all three schools falls into the category of severely lacking. Students from accredited high schools A, B and C can give claims well, but have not been able to provide grounds, warrants and backings that are relevant to the selected claim.

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