BIOEDUSCIENCE
ISSN: 2614-1558
http://journal.uhamka.ac.id/index.php/bioeduscience

Students' Ability to Argue Through a Scientific Approach at the High School Level with Different Accreditation Levels in North Lampung

Anitia Fadhila Bumay [1], Neni Hasnunidah [1*], and Dina Maulina [1]

[1] Biology University of Lampung, Jl. Prof. Dr. Ir. Soemantri Brojonegoro No. 1, Bandar Lampung City, Lampung, Indonesia, 35141
* Correspondence: neni.hasnunidah@fkip.unila.ac.id

Abstract

Background: Argumentation skill is a crucial ability to be possessed by students. Argumentation skills can be trained by applying a scientific approach during learning. The implementation of the scientific approach in schools can vary; it is suspected that one of the causes is the accreditation rating. The study aimed to determine the differences in the argumentation skill of high school students based on their accreditation rating. **Methods:** The research design used is the Ex-post Facto design. The sample in this study was sampled using the purposive sampling technique. **Results:** There are differences in students' argumentation abilities between accreditation ratings of A, B, and C. **Conclusions:** Students' argumentation skill differs between high school students with accreditation ratings of A, B, and C. The difference in students' argumentation skills is caused by differences in the application of the scientific approach applied by teachers in each school.

Keywords: Accreditation; Argumentation; Scientific Approach.

Article history
Received: 27 Apr 2022
Accepted: 16 Oct 2022
Published: 31 Dec 2022

Publisher's Note:
BIOEDUSCIENCE stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Citation: Bumay, A.F., Hasnunidah, N. and Maulina, D. (2022). Students' Ability to Argue Through a Scientific Approach at the High School Level with Different Accreditation Levels in North Lampung. *BIOEDUSCIENCE, 6*(3), 252-260. 10.22236/j.bes/639047

Introduction

Education The ability to argue is the ability to express ideas or ideas about scientific phenomena based on existing data/evidence and theories (Ginanjar et al., 2015). Argumentation skills are fundamental to being trained in learning science so that students have logical reasoning, clear views, and rational explanations of scientific phenomena that occur in everyday life based on relevant concepts/theories (Zahara et al., 2018).

One way that can be used to train students' argumentation skills in learning is through a scientific approach. Scientific approaches include observing, questioning, trying, processing data, and communicating results (Arini, 2020). Suppose the teacher has applied the appropriate scientific approach. In that case, it is expected that students will have the ability to ask questions, the ability to think critically, and the ability to communicate ideas and opinions. Students will be trained in their argumentation skills through activities to communicate ideas and opinions. Qomariah (2014) stated that scientific approaches are related to improving students' accuracy, critical attitude, communication, and scientific argumentation.

The scientific approach is very appropriate to be used in biology learning, as in the subject matter of Plantae, because it can provide a direct learning experience to students so that students can meet the essential competencies set because in the learning application, it requires students to observe plants directly (Aprilianti et al., 2019). Through the application of a scientific approach to the Plantae material, students can observe plants directly (Observing), ask (Questioning), conduct experiments (Experimenting), process information (Associating), communicate the results of the observations they have made

(Communicating) so that with the application of the steps of the scientific approach can support the achievement of essential competencies in the material Plantae (Yani et al., 2018).

Several high schools in North Lampung have applied a scientific approach to learning biology. This was shown based on the results of researchers' interviews with class X biology teachers from December 2020 to January 2021 at three high schools in North Lampung with different accreditation ratings, and the fact is that teachers in three schools with different accreditation ratings have used a scientific approach in learning biology with an inquiry learning model. This is supported by the RPP (Learning Implementation Plan) and LKPD (Student Worksheet). However, schools have never studied the effect of applying a scientific approach on students' argumentation ability. One of the reasons is that teachers have never given questions to measure the ability to argue because of the limitations of educators in that regard.

The importance of argumentation ability is possessed by students in learning biology because students who study biology must know scientific explanations of natural phenomena and use argumentation in solving problems. Students must fully understand that science and actively participate in scientific activities such as observation and argumentation. Students are required to think critically, be able to communicate and collaborate well, and have the creativity to create arguments that are acceptable to others (Probosari et al., 2016).

The implementation of a scientific approach in biology learning in schools can vary. It is suspected that one of the contributing factors is the school's accreditation rating, which can cause differences in the ability to argue with students. Based on Permendikbud (2020), the accreditation ranking of academic units is divided into 4, namely accredited A (superior), accredited B (good), accredited C (sufficient), and Not Accredited (TT). School accreditation rankings support the development of students' argumentation skills; schools with an A accreditation rating (excellent) are suspected of having the potential to produce students with good argumentation skills. Schools with A accreditation are quality schools to support students' learning process because they have met the SNP (National Education Standards) assessment criteria. Meanwhile, schools with B and C accreditation are not as good as schools with A accreditation because they still do not meet the completeness of the SNP, so in the learning process in their schools, there are still disturbances in the completeness of both the facilities and comfort provided by the school to support the maximum learning process so that students can learn effectively (Safahi et al., 2019).

Based on the problems described, researchers are interested in researching students' ability to argue through a scientific approach in high schools with different accreditation ratings. This study aims to determine the differences in the argumentation ability of high school students based on their accreditation rankings.

Method

This research was conducted at a North Lampung Regency, Province high school. Samples were taken from high schools (SMA) using a stratified sampling technique (A accreditation: 51 participants, B accreditation: 30 participants, and C accreditation: 23 participants).

This research is quantitative with a survey method using an ex post facto design. This design is intended to test what happened to the subject (ex post facto means after the fact) because the causation investigated already affects other variables (Hasnunidah, 2017). Data were collected from the results of the arguing ability test and teacher interviews.

The argumentation ability test consists of 10 description questions. The type of argumentation ability that will be given is competing theory, where students are given two theories about a phenomenon. Then students choose one of the theories considered correct, accompanied by data/facts, warrants, and backing (Osborne et al., 2004). Quality

assessment argues based on the rubric Toulmin (2003) adapted by Hazeltine (2011). The argument ability test data were analyzed with one-way ANOVA and advanced test (BNT) with a significance level of 5%.

Interviews were conducted with biology teachers of class X science in all three schools. The questions asked are related to implementing the learning process using a scientific approach to Plantae material and achieving national standards of education in schools. The question form is a semi-structured question. Data were analyzed descriptively and qualitatively with Miles and Huberman models.

Result

Based on data analysis, students' argumentation ability shows differences in the average between school accreditation rankings, namely schools with accreditation A, B, and C. Average scores of students' argumentation ability in schools with accreditation A, B, and C are presented in Table 1.

Table 1. Students' Argumentation Ability Based on Accreditation Rating

Argumentation Ability	N	Mean ± Standard Deviation	Highest Value	Lowest Value
Accreditation A	51	54 ± 10,2	74	31
Accreditation B	30	37,2 ±10,6	60	23
Accreditation C	23	29,8 ± 7,9	46	17

Table 1 shows the highest average value of argumentation ability achieved by the students in schools with accreditation A, while the group of students in schools with accreditation C obtains the lowest score. The proportion of the average value of student argumentation ability can be seen in Table 2.

Table 2. The proportion of Average Value of Students' Argumentation Ability

Category	Argumentation Ability		
	A	B	C
Enough (%)	29	0	0
Less (%)	45	17	0
Very Less (%)	26	83	100

Table 2 represents that students in A-accredited high schools already have argumentation skills in the "sufficient" category despite having the most significant percentage in the "less" category. Meanwhile, the argumentation ability of students in high schools with B and C accreditation shows similarities, namely that they both have the most significant percentage in the "very lacking" category. However, students in B-accredited high schools already have argumentation skills in the "less" category with a low percentage. Then, students' ability to argue on each indicator has a different percentage score among high schools with A, B, and C accreditation, as shown in Figure 1.

Table 3. ANOVA Test Results

Source	Sum f squares	df	Mean Square	F	Sig.
Between Groups	11206,222	2	5603,111		
Within Groups	9868,614	101	97,709	57,345	0,000
Total	21074,837	103			

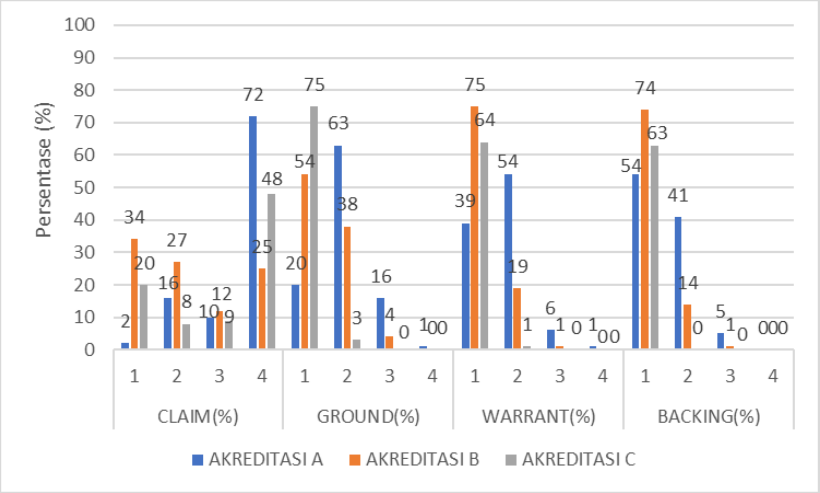

Figure 1. Percentage of Student Argumentation Ability Score Each Indicator

Figure 1 shows that students' ability to argue with each indicator in high school with A, B, and C accreditation has a different percentage score. The ability of students to declare claims, grounds, and warrants in high schools with an A accreditation rating has the most significant percentage at the maximum score of = 4. Then, the student's ability to declare ground in high school accreditation C occupies the most significant percentage on a score of 1. Then the student's ability to declare a warrant occupies the most significant percentage on a score of 1 for high school accreditation B. Furthermore, the student's ability to state backing occupies the most significant percentage on a score of 1 for high school accreditation B. Then, A-accredited high school students can already declare backing at a score of 3, even with a low percentage.

The ANOVA test is used to test whether or not there are differences in argumentation ability in high school students based on the accreditation level at a fundamental level of 5%. The results of the ANOVA test are presented in Table 3.

Table 3 shows that the value of F = 57.345 with a significant number is 0.000 (sig<0.05), so the null hypothesis is rejected. Thus, there are differences in the argumentation ability of students in high school with accreditation A, accreditation B, and accreditation C. Then the BNT (Smallest Real Difference) test is carried out, as for the BNT test results in Table 4.

Table 4. BNT Test Results (Smallest Real Difference)

Accreditation Rating		Average Value Difference	Sig.
A	B	16,898*	0,000
	C	24,272*	0,000
B	A	-16,898*	0,000
	C	7,474*	0,008
C	A	-24,272*	0,000
	B	-7,374*	0,008

*There is a noticeable difference

The BNT test was conducted to test the differences between each group. Table 5 shows marked differences in argumentation ability between students in high schools accredited A, B, and C.

Table 5. Results of Teacher Interviews on the Implementation of Scientific Approaches

Learning Activities	Inquiry Number	Answer	High School Accreditation (%)		
			A	B	C
Learning Planning	1, 2, 3, 4, 5, 6, 7	Yes	57%	42%	14%
		No	43%	58%	86%
Implementation of Learning	8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	Yes	83%	75%	50%
		No	17%	25%	50%
Learning Assessment	20, 21, 22, 23, 24	Yes	60%	40%	40%
		No	40%	60%	60%

Table 5. show the results of teacher interviews on the Implementation of Scientific Approaches. The percentage of teacher interview results on the implementation of a scientific approach to biology learning which includes learning planning, learning implementation, and learning assessment, can be seen in Table 5.

Discussion

The results showed differences in the argumentation ability of students in high school accreditation A, accreditation B, and accreditation C. Students in high school with accreditation A obtained the most significant percentage in the category of "less" in the ability to argue. In contrast, students in high school with accreditation B obtained the most significant percentage in the category of "very less." All students in high school with accreditation C obtained a percentage of the category "very lacking" in the ability to argue. Based on these results, it is known that the argumentation ability of students in each school is different. High school students with A accreditation have better argumentation skills than those with B and C accreditation. The achievement of national education standards in A-accredited high schools is more complete and suitable than in B and C-accredited high schools. This is in line with Safahi (2019) research, namely that schools with A accreditation are quality schools to support students' learning process because they have met the SNP (National Education Standards) assessment criteria. Meanwhile, schools with B and C accreditation are not as good as schools with A accreditation because they still do not meet the completeness of the SNP so that in the learning process. There are still obstacles to the learning process in school, so learning is not optimal, and students cannot learn effectively.

Students in A-accredited high schools have been able to state claims, grounds, warrants, and backings quite well. Meanwhile, students in high schools with B and C accreditation, on the indicators of writing claims, have written them well. However, writing answers in stating ground, warrant, and backing is still not good enough and needs to be developed again. B and C-accredited high school students tend to answer with brevity and lack of elaboration. This is in line with research conducted by Pritasari et al. (2016), which shows that students' answers are still limited to statements without including evidence and supporting reasons. Meanwhile, argumentation must be accompanied by truth, not only in the form of theory, so students cannot only express a statement but must be accompanied by reasons and evidence of its truth (Kuhn, 2010).

The low ability of students to argue is caused by the learning process that does not maximize students' arguing. In addition, Wahdan et al. (2017) stated that the factor affecting students' scientific arguing ability is students' understanding of the material and involvement in argumentation activities during the learning process. The learning process cannot be separated from the role of the teacher who teaches. Teachers who carry out learning with the suitable model will produce students with good argumentation skills. As Rahayu et al. (2020) stated in his research, students' written argumentation skills can be improved and trained by applying suitable methods, models, and approaches by teachers.

Based on the interview results, teachers at high schools accredited A, B, and C has so far trained students' argumentation skills even though they are only limited to stating a statement (claim). A claim is a statement submitted to another person for acceptance (Erduran et al., 2004). The process of implementing the scientific approach to "observing" and "questioning" activities has been carried out, the teacher provides material, and in the question and answer activity, the teacher gives questions to students related to the material taught. Students answer and express their opinions briefly so that the student's ability to express claims is trained.

The ground is data or facts that can support the claim that has been given. Meanwhile, warrants link ground and claim (Erduran et al., 2004). The ability of students to declare ground and warrant in high school accreditation A is better than students in high school accreditation B and C. Overall, the ability of students to declare ground and warrant can

be said to be still low, which is dominated by points 1 and 2. This is because the activities of "gathering information" and "associating" have not been carried out properly during the learning process. Supported by the results of the interview, teachers in high schools accredited B and C do not direct students to the data collection and data processing steps in the learning model, so this causes a low ability of students to declare ground and warrant. However, students in A-accredited high schools are better at declaring ground and warrants because there are students who are already able to declare ground and warrants on points 3 and 4. Then there are students in high school accreditation B who can declare ground and warrant on point 3, while students in high school accreditation C have not reached points 3 and 4.

The backing is a supporting theory of an argument to provide additional support to the warrant (Fatmawati & Ramli, 2018). The ability to state backing in students in a high school accredited A, B, and C is still relatively low, dominated by point 1. This can be because, during the learning process, the teacher skips the verification step, which is the step where students verify the results of their observations with theory in the books or sources they read. This is supported by the results of interviews, namely teachers in high schools accredited A, B, and C often skips the verification step due to time constraints when online.

The argumentation ability of students in high school accreditation A is better than students in high school accreditation B and C. Differences can occur due to differences in teachers in carrying out learning with a scientific approach. The results of the interview on the implementation of the scientific approach show that teachers in high schools accredited A and B in learning planning have formulated a learning model based on a scientific approach and designed learning media that supports the implementation of a scientific approach but has not designed learning that can develop students' argumentation ability because the teacher's knowledge is lacking in students' ability to argue. So far, teachers have never measured and paid less attention to how students' argumentation skills. Meanwhile, teachers in accreditation C only formulate learning models based on scientific approaches but do not design media and learning resources that can support the implementation of scientific approaches. Then teachers also do not design learning that can develop argumentation skills because of the teacher's lack of understanding of the ability to argue and how to develop it as well as limited facilities from the school.

Teachers in high schools accredited A in implementing learners have used a learning model based on a scientific approach and have implemented learning steps on a scientific approach-based model, namely the discovery learning model. Still, some steps, such as verification and generalization, cannot be carried out properly due to time constraints during online learning. The teacher has not trained the student's argumentation ability at the time of learning to the maximum, and the teacher only trains the student's argumentation ability to the extent of making a claim.

Teachers in high school accreditation B in the implementation of learning have used a learning model based on a scientific approach, namely discovery learning. Still, they cannot carry out the learning steps in the model correctly. Only part of the steps is carried out due to time constraints during online learning.

Teachers in high schools accredited C in the implementation of learning have used a model based on a scientific approach, namely discovery learning, but did not correctly carry out the steps in the model. Many were missed due to limited teacher time during online learning. Teachers also do not train students' argumentation skills during learning due to time constraints and the teacher's lack of knowledge on how to train students' argumentation skills. The teacher only asks the students questions about how the students think of the material that the teacher has conveyed. Then only a few students can answer with the word agree or not, without providing data or theories that support it. Teachers do not create an interactive and inspirational learning atmosphere because in online learning via Whatsapp, the teacher's space to interact is limited to providing

opportunities for students; if students want to ask questions, then the response from students is only tiny, and no one even asks questions.

Teachers in high schools accredited A on learning assessments do not carry out assessments of the ability to argue because teachers do not measure argumentation ability during learning. Teachers have conducted an assessment of the authentic assessment process, namely cognitive, affective, and psychomotor. Teachers have conducted assessments of the implementation of scientific approaches by fellow educators and principals but have not done assessments of the implementation of scientific approaches by students. Teachers in high schools accredited B and C on learning assessments do not carry out assessments of the ability to argue because of the teacher's lack of knowledge of measurement and how to train the ability to argue in the learning process. Teachers also do not carry out assessments of the implementation of scientific approaches by fellow educators and students.

The difference in students' argumentation ability is also due to differences in the achievement of national standards of education (SNP) in each school. Schools whose national standards of education have been achieved well will support the learning process based on the scientific approach to be carried out optimally so that when the scientific approach is applied optimally, it will produce students with better argumentation skills. The achievement of national education standards in high schools accredited A can be said to be better than high schools accredited B and C. Interviews with teachers support this. In the aspect of graduate quality, students in high school accreditation A are active in question-and-answer activities with teachers during learning compared to students in high school accreditation B and C. High school students in accreditation A are also able to make presentations and express opinions even though they are only limited to stating statements or claims, not accompanied by supporting evidence and theories. Students can discuss in a group actively.

The facilities and infrastructure at the A-accredited high school are good. This is supported by the teacher's statement that the high school has provided books, LCD, biology labs, comfortable and clean classrooms, benches, and tables that are sufficient to support the learning process in the classroom. Meanwhile, the facilities and infrastructure in SMA accreditation B and C are not as good as in SMA accreditation A. SMA accreditation B only provides books and biology labs. However, the lab is rarely used by teachers, so facilities and infrastructure are not optimal. Meanwhile, high school accreditation C does not provide facilities in the form of books and biology labs. There are limited LCD facilities in schools, and teachers never use them in biology learning due to the lack of teaching skills. The absence of book facilities in C-accredited high schools results in students being less in receiving material because they only rely on the material provided by the teacher.

Providing adequate facilities that can be utilized optimally affects the learning process and student learning outcomes. This follows Timba's opinion (2019) that the facilities and equipment provided by the school should be held according to needs. Adequate facilities will create a pleasant learning atmosphere for teachers and students to improve learning achievement and the quality of school learning processes.

Based on the results of interviews regarding the achievement of national education standards in each school, it can be said that achieving a high school A accreditation to educational standards in schools is good. Meanwhile, the achievement of national education standards in high schools accredited B and C is still lacking, especially in high schools accreditation C the achievement of educational standards in schools is very lacking. Differences in the completeness of national education standards for each school affect the quality of learning and students' ability. This follows Zulnika (2017), who states that the level of school accreditation affects the quality of student learning; the better the school accreditation ranking, the better the quality of student learning.

Teachers in high schools accredited A, B, and C has met the teacher's academic qualification standards, namely Strata 1. Academic qualifications are one of the things

that can improve teacher competence. As Susanti, S., Fitria, H., & Puspita (2020) argues, the higher and more standardized the teacher's academic qualifications will affect the implementation of learning carried out by teachers in the classroom. The teaching experience of teachers in A-accredited schools is longer than the teaching experience of teachers in high schools accredited B and C. Experienced teachers will affect the improvement of student achievement compared to less experienced teachers. This is in line with Lidia & Hasibuan (2018) research that the teacher's teaching experience influences learning outcomes and the achievements that students will achieve. Wiranti (2021) teacher teaching experience affects professionalism, especially in teacher competency indicators; the longer a teacher's teaching experience, the higher the professionalism and quality of the teacher in teaching.

Conclusions

The conclusion obtained from the results of this study is that there is a real difference in the ability to argue ($p<0.05$) in students in high school accreditation A, accreditation B, and accreditation C.

Declaration statement

The authors reported no potential conflict of interest.

References

Aprilianti, H., Rahayu, E. S., & Indriyanti, D. R. (2019). Development of Saintific-based Students' Worksheet (LKS) by Utilizing the Ferns Taxonomy Garden as a Supplementary of Plantae Teaching Material. *Journal of Innovative Science Education*, *8*(2), 221–227. https://doi.org/10.15294/jise.v0i0.28304

Arini, W. (2020). Implementation of Scientific Approach in Physics. *Journal of Natural Science Teaching*, *3*(2), 151–161.

Erduran, S., Simon, S., & Osborne, J. (2004). TAPping into Argumentation: Developments in the Application of Toulmin's Argument Pattern for Studying Science Discourse. *Science Education*, *88*, 915–933. https://doi.org/10.1002/sce.20012

Fatmawati, D., & Ramli, M. (2018). Meningkatkan Kemampuan Argumentasi Siswa melalui Action Research dengan Fokus Tindakan Think Pair Share. *Proceding Biology Education Conference*, *15*(1), 253–259.

Ginanjar, W., Utari, S., & Muslim. (2015). Penerapan Model Argument-Driven Inquiry dalam Pembelajaran IPA untuk Meningkatkan Kemampuan Argumentasi Ilmiah Siswa SMP. *Jurnal Pengajaran MIPA*, *20*(1), 32–37. https://doi.org/10.18269/jpmipa.v20i1.36195

Hasnunidah, N. (2017). *Metodologi Penelitian Pendidikan*. Media Akademi.

Hazeltine, C. (2011). *Toulmin Argument Rubric*.

Kuhn, D. (2010). Teaching and Learning Science as Argument. *Science Studies and Science Education*, *92*(5), 810–824. https://doi.org/10.1002/sce.20395

Lidia, & Hasibuan, A. (2018). Pengaruh Pengalaman Mengajar Guru terhadap Peningkatan Minat dan Prestasi Belajar Bahasa Indonesia Siswa Kelas X SMK Immanuel 2 Kabanjahe. *Jurnal Pendidikan Bahasa Indonesia Dan Sastra*, *1*(1), 45–51. https://doi.org/10.54367/pendistra.v1i2.480

Osborne, J., Erduran, S., & Simon, S. (2004). Enhancing The Quality Of Argumentation In School Science. *Journal of Research in Science Teaching*, *41*(10), 1–40. https://doi.org/10.1002/tea.20035

Permendikbud. (2020). *Permendikbud Nomor 1005 Tentang Kriteria dan Perangkat Akreditasi Pendidikan Dasar dan Menengah*. Kemendikbud.

Pritasari, A. C., Dwiastuti, S., & Probosari, R. M. (2016). Peningkatan Kemampuan Argumentasi melalui Penerapan Model Problem Based Learning pada Siswa Kelas X MIA 1 SMA Batik 2 Surakarta Tahun Pelajaran 2014/2015. *Jurnal Pendidikan Biologi*, *8*(1), 1–7.

Probosari, R. M., Ramli, M., Indrowati, M., & Sajidan, S. (2016). Profil Keterampilan Argumentasi Ilmiah Mahasiswa Pendidikan Biologi FKIP UNS pada Mata Kuliah Anatomi Tumbuhan. *Bioedukasi: Jurnal Pendidikan Biologi*, *9*(1), 29–33. https://doi.org/10.20961/bioedukasi-uns.v9i1.3880

Qomariah, L. (2014). Penerapan Pembelajaran Melalui Pendekatan Ilmiah untuk Meningkatkan Sikap, Pengetahuan, dan Keterampilan Proses Peserta Didik Kelas X MIA 4 SMAN 3 Malang pada Materi Kingdom Animalia. In *Skripsi*. Universitas Negeri Malang.

Rahayu, Y., Suhendar., & Ratnasari, J. (2020). Keterampilan Argumentasi Siswa pada Materi Sistem Gerak SMA Negeri Kabupaten

Sukabumi-Indonesia. *Jurnal Ilmiah Pendidkan Biologi*, *6*(3), 312–318. https://doi.org/10.22437/bio.v6i3.9802

Safahi, L., Akbar, B., Selvianah, A., Astuti, Y., & Anugrah, D. (2019). Perbedaan Keterampilan Proses Sains Biologi Siswa SMA Akreditasi A dengan Akreditasi B Kecamatan Cengkareng Jakarta Barat. *BIOEDUSCIENCE*, *3*(2), 106–111. https://doi.org/10.29405/j.bes/32106-1113651

Susanti, S., Fitria, H., & Puspita, Y. (2020). Pengaruh Kualifikasi Akademik dan Kinerja Guru Terhadap Nilai Siswa. *Journal of Education Research*, *1*(3), 139–145. https://doi.org/10.37985/joe.v1i2.13

Timba, F. (2019). Pemanfaatan Fasilitas Belajar terhadap Minat Belajar Peserta Didik Kelas V SD Katolik 008 NITA 1 Kecamatan Sikka Kabupaten Sikka Tahun 2019. *Jurnal Serambi PTK*, *6*(3), 151–161.

Toulmin, S. E. (2003). *The Uses of Argument*. Cambridge University Press.

Wahdan, W., Sulistina, O., & Sukarianingsih, D. (2017). Analisis Kemampuan Berargumentasi Ilmiah Materi Ikatan Kimia Peserta Didik SMA, MAN, dan Perguruan Tinggi Tingkat 1. *Jurnal Pembelajaran Kimia*, *2*(2), 30–40.

Wiranti, R. (2021). Pengaruh Pengalaman Mengajar dan Motivasi Mengajar terhadap Profesionalisme Guru Taman Kanak-Kanak Se-Kecamatan Way Jepara. *Jurnal Humaniora Dan Ilmu Pendidikan*, *1*(1), 27–37. https://doi.org/10.35912/jahidik.v1i1.297

Yani, A., Muhsyanur., Sahriah., Haerunnisa., & Samawati, S. (2018). Efektivitas Pendekatan Saintifik dengan Media Boklet Higher Order Thinking Terhadap Hasil Belajar Biologi Siswa SMA di Kabupaten Wajo. *Jurnal Biology Science & Education*, *7*(1), 1–12. https://doi.org/10.33477/bs.v7i1.387

Zahara, I. K., Rosidin, U., & Hasnunidah, N. (2018). Pengaruh Penerapan Model Argument Driven Inquiry (ADI) pada Pembelajaran IPA Terhadap Keterampilan Argumentasi Siswa SMP Berdasarkan Perbedaan Kemampuan Akademik. *Jurnal Ilmu Fisika Dan Pembelajarannya (JIFP)*, *2*(2), 53–61. https://doi.org/10.19109/jifp.v2i2.2630

Zulnika. (2017). Pengaruh Akreditasi Sekolah dan Kinerja Guru Terhadap Mutu Pembelajaran Siswa SMP Negeri di Kecamatan Kopang. *Jurnal Ilmiah Profesi Pendidikan*, *2*(2), 222–227. https://doi.org/10.29303/jipp.v2i2.66