



Analysis of High School Students' Learning Discipline in Physics Learning

Ria Ambarwati¹, Elwells B. Ulla², Mehdi Tajaddini³

¹Department of Physics Education, Universitas Jambi, Jambi, Indonesia

²Physics Education Graduate, University of the Philippines Open University, Phipippines

³School of Physics, University Sains Malaysia, Malaysia

Article Info

Article history:

Received Oct 6, 2023

Revised Oct 26, 2023

Accepted Dec 18, 2023

OnlineFirst Dec 21, 2023

Keywords:

Discipline
Education
Physics
Student Learning

ABSTRACT

Purpose of the study: This research was conducted with the aim of finding out students' disciplinary attitudes towards physics subjects in high school.

Methodology: This research uses a mixed methods explanatory design. The sampling technique uses simple random sampling. The number of samples in this study was 120 high school students. Data collection techniques used questionnaires and interviews. Data analysis uses descriptive statistics and miles and miles model. Data analysis in this research uses a quantitative approach using the SPSS program.

Main Findings: It was found that student discipline was categorized as good and quite good. So, stimulus treatment from the teacher is needed to increase student learning discipline. The implication of this research is that it can help teachers and educational stakeholders to understand the factors that influence student learning discipline in Physics subjects. With better understanding, they can develop more effective learning strategies to increase student motivation and engagement.

Novelty/Originality of this study: The novelty of the research may provide a better understanding of the dynamics of student learning in physics, enabling the development of more effective learning strategies.

This is an open access article under the [CC BY-NC](https://creativecommons.org/licenses/by-nc/4.0/) license



Corresponding Author:

Ria Ambarwati,

Department of Physics Education, Universitas Jambi,

Jl. Jambi – Muara Bulian No.KM. 15, Mendalo Darat, Kec. Jambi Luar Kota, Kabupaten Muaro Jambi,

Jambi, 36361, Indonesia

Email: riaambarwati457@gmail.com

1. INTRODUCTION

Education is the basic thing that can change an individual's cognitive and affective abilities for the better [1]–[3]. Education is a structured effort to realize the development of students' potential so that they have religious strength, self-control, personality, intelligence, noble morals and skills. Education is an inevitable necessity for human life as long as humans are still alive. It is impossible for humans to develop and be in line with educational ideals at all [4], [5]. This shows the importance of education for human life.

It can be seen that education is an effort to improve dignity, and prepare individuals intellectually, spiritually and morally so that a breakthrough is needed to realize the individual's dreams [6], [7]. Education is tasked with preparing competencies and forming individual attitudes and spirituality so that students can achieve their goals [8], [9]. School is a place where a child develops his potential and is a means for students to gain formal knowledge [10], [11]. One of the main tasks of schools is to prepare students so they can achieve optimal development.

Schools are a place for children to understand the way of life in the society around them [12], [13]. And schools are expected to be able to create successful generations in the future [14]. Good facilities and

infrastructure in schools are one of the supporting factors for producing a teaching and learning process in schools [15]. Every school has rules or regulations that are applied at that school. A student can be said to be disciplined if he has done or done a job with great patience and perseverance without coercion from anyone [16]. Every school applies these regulations so that students can know the obligations they must carry out. If these rules are violated [17]. Then the student will be punished. By implementing discipline, in the end, children as students are expected to truly be able to become capable and highly disciplined human beings [18].

At high school level there are natural science subjects which include physics, chemistry, biology. Physics discussion topics expect students to be curious, think critically, be sensitive to the environment, think openly and cooperatively, be creative and have science process skills [19], [20]. Because the purpose of education is to shape national character [21]. That the attitudes reviewed by teachers in learning are honesty, discipline, responsibility, tolerance, mutual cooperation, courtesy and self-confidence. This shows that in every teaching and learning activity there is always an educational character [22], [23]. That the attitudes reviewed by teachers in learning are honesty, discipline, responsibility, tolerance, mutual cooperation, courtesy and self-confidence [24]. This shows that in every teaching and learning activity there is always an educational character.

Character education is an educational concept to shape and develop human personality [25]. Character education in Indonesia applies Pancasila values in character education, including religious values, honesty, tolerance, discipline, hard work, creative, independent, democratic, curiosity, national spirit, love of the country, respect for achievement, communicative, love, peace, likes to read, cares about the environment, cares socially, and is responsible [26], [27]. In facing the current era of globalization, the development of science and technology has had quite a large negative impact, one of which is the impact on adolescent behavior [28]. One of the problems encountered is not paying attention during teaching and learning activities, coming late to school [29]. The next problem is like a student cheating given by the teacher and this is even supported by the community [30]. This shows the need, even the urgency, of character education to create students who are intellectual, emotional, superior individuals and have noble morals.

The purpose of forming a disciplined character is to shape behavior so that individuals can adapt to the roles that have been implemented by society and ultimately benefit themselves. Meanwhile, the factors that influence discipline are physical condition (12.662%), psychological condition (23.782%), family habits (16.540%), application of rules (38.498%), community environmental conditions (8.558%). Coming late to school is a form of lack of discipline. Discipline means orderly and obedient, meaning people who are obedient and orderly about something, people who have a disciplined attitude means people who are orderly, carry out their duties well and also regularly and on time [31]. Discipline is a mental attitude to obey the rules and act in accordance with existing rules voluntarily [32]. In the school environment, discipline is very necessary because it helps learning activities, creates a sense of joy and improves social relations by living in a concrete community, so that there is a balance between oneself and others.

Based on the results of previous research, it is known that student attitudes are correlated with student discipline in learning physics. Student discipline towards science is a habitual behavior that is carried out consistently towards science [33], [34]. However, previous research was conducted in junior high schools, so as a generalization of previous research, this research was conducted in senior high schools. In this research, students' learning discipline in physics learning will be described [35]. Students who have a high level of discipline will receive a stimulus to achieve achievement because in the learning process a disciplined attitude is used to develop strong motivation.

This research is in line with research conducted by Sin [36] the results showed that there were several factors that made students less disciplined. The factors that occurred included those that occurred to themselves and the students' parents [37]. Factors that cause this include students who are actually capable of academics or subjects but are hampered by obstacles that occur, students who are truly lazy and are hampered by something. In the research there is a striking gap between expectations and reality in terms of students' level of learning discipline [38]. Although it is expected that high school students will show a high level of discipline in studying the subject of Physics, the research results show a significant gap between expectations and reality. Factors such as intrinsic motivation, family support, and learning environment can be the main determinants in determining a student's level of learning discipline [39]. Therefore, a deeper understanding of the factors that influence students' learning discipline in the field of Physics is important to formulate more effective learning strategies.

The novelty of this research is in the targeted subjects and school level. Through this research, innovative solutions may be found to improve student learning discipline in Physics [40]. For example, the use of technology in teaching, a more open and interactive learning approach, or the integration of material that is more relevant to students' daily lives [41]. The urgency of conducting this research is that by understanding the factors that influence students' learning discipline in Physics, we can find ways to increase students' interest in science and technology, which in turn can influence their career choices in the future.

Therefore, a disciplined attitude is very necessary, especially in the field of education. Every activity really requires discipline because discipline is the key to the success or failure of an activity. Discipline is a form of self-awareness to control oneself. In relation to learning, learning discipline functions as a person's self-

control so that learning is full of awareness and without coercion [42]. Discipline is the awareness to carry out work in an orderly and orderly manner according to applicable regulations with full responsibility without coercion from anyone. The principles of learning discipline are needed for successful learning, so all parties must pay attention to and understand the principles of learning. Discipline is one aspect of life that must be realized in society [43]. Therefore, students should receive attention from all parties at school and outside school. The attention given to students is expected to foster students' disciplined attitudes, especially in learning because students feel supervised. So this research is important to do. This research aims to describe the character of student discipline on the subject of physics learning in XI high schools in Jambi City and Pampanga National High School.

2. RESEARCH METHOD

2.1 Research Type

This research uses mix method research with an explanatory design. Mix method research is a combination method between quantitative research methods and qualitative research methods [44]. Explanatory design is carried out in several research stages, starting with data collection, analyzing data and formulating quantitative analysis results, then continuing with data collection, analyzing and formulating qualitative data, and ending with interpreting the research results.

2.2 Population and Sample

The population of this research is XI high schools in the city of Jambi and Pampanga National High School. The sampling technique in this research used simple random sampling. The number of research samples obtained was 60 high school students in each school with a total of 120 students.

2.3 Data Collection Techniques

Data collection tools in the form of questions or statements that are confirmed by respondents are also called questionnaires, then interviews are used for qualitative data. The questionnaire used by the author was adopted from the thesis. Students are given a questionnaire and asked to fill out the questionnaire to determine the student's response to disciplinary attitudes. The rating scale in the questionnaire is never, rarely, sometimes, often, always. This research was conducted at XI high schools in the city of Jambi and Pampanga National High School. The sampling technique in this research used purposive sampling. With the criteria of students who have studied temperature and heat material in physics subjects.

2.4 Data Analysis Techniques

The questionnaire consists of 20 questionnaires with ratings on a scale of always, often, sometimes, rarely, never. Each option has a value, namely, always 5 points, often 4 points, sometimes 4 points, rarely 2 points and never 1 point. The sampling for population members was carried out randomly, that is, without paying attention to achievement, age and gender. Data analysis in this research uses a quantitative approach using the SPSS program to look for descriptive statistical data. Descriptive research is research that is intended to collect information regarding the status of a symptom according to what it was at the time the research was conducted [45].

One example of a questionnaire statement in the research conducted was "I don't like cheating on my friends". Because this statement is a negative statement, if the student answers "always" then the student gets full points (5). To further determine the category of students' good learning discipline attitudes, a Likert Scale was used by calculating the range. The description of student learning discipline categories is as follows:

Category	Indicator intervals
Very good	71.5 – 85.0
Good	57.9 – 71.4
Enough	44.3 – 57.8
Not good	30.7 – 44.2
Very not good	17 – 30.0

3. RESULTS AND DISCUSSION

Character education is considered very important in this era, due to the impact of globalization which is growing very rapidly, especially discipline. Learning discipline is very important for each school to improve. The purpose of this research is to describe the learning discipline of students at XI high schools in Jambi City

and Pampang National High School. The following are the results of descriptive statistical tests on student learning discipline in high school:

Table 2. Descriptive statistical results of students' physics learning discipline in XI high schools in Jambi City and Pampang National High School

Student Response	Interval	F	%	Category	Mean	Med	Min	Max
XI High Schools in Jambi City	71.5 – 85.0	13	21.7%	Very good	61.7167	61.0	41.0	85.0
	57.9 – 71.4	27	45%	Good				
	44.3 – 57.8	20	33.35	Enough				
	30.7 – 44.2	0	0%	Not good				
	17 – 30.0	0	0%	Very not good				
Pampang National High School	71.5 – 85.0	16	26.7%	Very good	60.9833	60.0	45.0	84.0
	57.9 – 71.4	21	35.0%	Good				
	44.3 – 57.8	23	38.3%	Enough				
	30.7 – 44.2	0	0%	Not good				
	17 – 30.0	0	0%	Very not good				

Based on table 2 above, it is known that students at Senior High School XI in Jambi City have discipline in studying physics which is dominant in the good category with a percentage of 45%. Then, students at Pampang National High School have discipline in studying physics which is dominant in the sufficient category with a percentage of 38.3%.

Q: Do you think discipline in studying physics is important?

S1: In my opinion, it is important because physics is quite a difficult lesson

S2: Quite important

S3: It is very important to remember the difficulty of the lesson so you need to be disciplined in studying

S4: It's not that important because I'm not interested in studying physics

S5: In my opinion, it is very important that with discipline in studying we can be consistent in studying physics so that it is easy to understand the material

Q: In your opinion, when is the discipline applied by teachers in physics subjects?

S1: When assigning assignments and submitting assignments

S2: assignment collection

S3: Collecting assignments, group work and projects

S4: discussion session and assignment collection

S5: assignments and exams are collected

Q: How disciplined are you when studying physics at school?

S1: Quite disciplined

S2: I am quite disciplined in completing the assignments given by the teacher and I like learning physics because the teacher presents material that makes it easy for me to understand it

S3: Lack of discipline because I find it difficult to divide my time in working on assignments

S4: I think I am quite disciplined in following physics lessons at school, I listen to the material presented by the teacher in a friendly manner, I go to class on time and I do the assignments given on time.

S5: Quite disciplined

In the data processing process there is something that is very worthy of emulation, namely the statement "I attended lessons from the beginning to the end of the class hour". With this statement, 99,429% of the total respondents agreed. Very few students miss school during learning activities. The thing that needs to be improved is the statement "I don't like cheating when doing assignments". Only 66,857% of the total respondents agreed with this statement. This means that students still predominantly like to cheat when given assignments. This is what needs to be improved by both the school and the family so that students increasingly have a good disciplinary attitude.

The character of discipline is important for every human being to have. This character is formed and trained through formal education at school and in the environment around students [46]. Student discipline when studying physics will make it easier for students to receive the knowledge distributed by educators [47]. For example, when giving an assignment to understand a concept and apply a physics concept, students are asked to submit it on time [48]. So students are required to be disciplined in managing their time, making maximum use

of the time they have. With the disciplined character of students, students will have a planned schedule for doing work.

This research is in line with research conducted by Melati et al, where the research states that the factors that hinder the cultivation of students' discipline and responsibility character are external factors, namely cellphones and television. Internal factors that influence responsibility are feelings of laziness within students which cause students to delay completing school assignments. Apart from that, this research is also in line with research conducted by Toli & Kallery [49], where the research states that undisciplined and irresponsible behavior can affect student achievement, make students miss the lesson material delivered by the teacher, the class atmosphere becomes noisy, and the environment becomes noisy. schools become not conducive to the implementation of the teaching and learning process. The novelty of this research is that it integrates an interdisciplinary approach between educational psychology and educational physics to more deeply analyze student learning behavior patterns [50]. New methods such as qualitative and quantitative data analysis are used to identify patterns of learning discipline that may influence students' academic achievement in physics subjects [51]. It is hoped that the new findings from this research will provide more comprehensive insight for educators and researchers in developing effective learning strategies to improve student learning discipline in the context of physics learning at the high school level.

The implication of this research is that it can be a basis for designing special programs or interventions aimed at improving student learning discipline in Physics [52]. This may include the development of more engaging materials, technology-based learning, or additional support programs. Apart from that, information from this research can also help in improving the quality of teaching [53]. Teachers can adapt their approach to teaching Physics to better suit students' learning styles as well as consider more effective motivation strategies [54].

This research can also be used as consideration for further research to carry out further research. In line with the results of previous research, it is advisable to implement the cultivation of students' disciplined character as best as possible in every subject, especially sians, because students who have a disciplined character will make students diligent and consistent in doing a job. This research is limited to measuring students' affective behavior only, it is hoped that in future research it can also measure students' cognitive and psychomotor aspects [55]. Learning disciplines can have varying definitions and measurements. This can make comparisons between different studies difficult or produce inconsistent results.

4. CONCLUSION

A disciplined attitude needs to be applied in the educational environment to support students in achieving the goals they desire. The type of research carried out is quantitative research with data analysis using descriptive statistics. Based on the data collection and processing that has been carried out, students at Jambi City XI High Schools and Pampanga National High School have a disciplined learning attitude in the good category with a percentage of 40% and the very good category with a percentage of 57.1%. The thing that really needs to be improved is the issue of cheating when students do their assignments. With the hope that students' disciplined learning attitudes at XI High Schools in Jambi City and Pampanga National High School will improve. The recommendation from this research for further research is further exploration of how the learning environment, both at school and at home, influences students' learning discipline in Physics. Factors such as classroom atmosphere, support from teachers and families, and learning facilities can be the focus of research.

ACKNOWLEDGEMENTS

The author would like to thank the entire research team who helped this research so that it could be completed well.

REFERENCES

- [1] R. M. D. Guido, "Attitude and Motivation towards Learning Physics," *Int. J. Eng. Res. Technol.*, vol. 2, no. 11, pp. 2087–2094, 2018.
- [2] J. Hyun, R. Ediger, and D. Lee, "Students' Satisfaction on Their Learning Process in Active Learning and Traditional Classrooms," *Int. J. Teach.*, vol. 29, no. 1, pp. 108–118, 2017.
- [3] Yusnidar, "The Impact of Unidentified Elementary School Students' Character Values in the Independent Curriculum Class IV Science Science Teacher's Book," *Res. J. Basic Educ.*, vol. 4, no. 3, pp. 112–117, 2023, doi: 10.37251/jber.v4i3.727.
- [4] A. A. Aldahdouh, A. J. Osório, and S. C. Portugal, "Understanding Knowledge Network, Learning, and Connectivism," *Int. J. Instr. Technol. Distance Learn. Oct.*, vol. 12, no. 10, pp. 3–21, 2015.
- [5] E. Nusantari, R. Utina, A. S. Katili, Y. Tamu, and I. Damopolii, "Effectiveness of environmentally-based science learning towards environmentally-friendly character of students in coastal area," *Int. J. Instr.*, vol. 13, no. 3, pp. 233–246, 2020, doi: 10.29333/iji.2020.13316a.
- [6] Yusnidar, M. D. W. Ernawati, D. A. Kurniawan, M. Z. Azzahra, F. I. Putri, and N. Prameswari, "Effect Of Learning

- Using The Problem-Based Learning (PBL) Model With Scaffolding On Creative Thinking And Learning Independence,” *J. Southwest Jiaotong Univ.*, vol. 58, no. 5, pp. 681–692, 2023, doi: 10.35741/issn.0258-2724.58.5.52.
- [7] O. A. Sogunro, “Motivating Factors for Adult Learners in Higher Education,” *Int. J. High. Educ.*, vol. 4, no. 1, pp. 22–37, 2014, doi: 10.5430/ijhe.v4n1p22.
- [8] J. Tondeur, R. Scherer, E. Baran, F. Siddiq, T. Valtonen, and E. Sointu, “Teacher educators as gatekeepers: Preparing the next generation of teachers for technology integration in education,” *Br. J. Educ. Technol.*, vol. 50, no. 3, pp. 1189–1209, 2019, doi: 10.1111/bjet.12748.
- [9] J. C. Corbo, D. L. Reinholz, M. H. Dancy, S. Deetz, and N. Finkelstein, “Framework for transforming departmental culture to support educational innovation,” *Phys. Rev. Phys. Educ. Res.*, vol. 12, no. 1, pp. 1–15, 2016, doi: 10.1103/PhysRevPhysEducRes.12.010113.
- [10] T. Tran *et al.*, “How digital natives learn and thrive in the digital age: Evidence from an emerging economy,” *Sustain.*, vol. 12, no. 9, pp. 1–24, 2020, doi: 10.3390/su12093819.
- [11] D. Serhan, “Transitioning from Face-to-Face to Remote Learning: Students’ Attitudes and Perceptions of using Zoom during COVID-19 Pandemic,” *Int. J. Technol. Educ. Sci.*, vol. 4, no. 4, pp. 335–342, 2020, doi: 10.46328/ijtes.v4i4.148.
- [12] D. Apriana, M. Kristiawan, and D. Wardiah, “Headmaster’s competency in preparing vocational school students for entrepreneurship,” *Int. J. Sci. Technol. Res.*, vol. 8, no. 8, pp. 1316–1330, 2019.
- [13] Z. Y. Kalender, E. Marshman, C. D. Schunn, T. J. Nokes-Malach, and C. Singh, “Gendered patterns in the construction of physics identity from motivational factors,” *Phys. Rev. Phys. Educ. Res.*, vol. 15, no. 2, p. 20119, 2019, doi: 10.1103/PhysRevPhysEducRes.15.020119.
- [14] G. Zhou, J. Xu, and D. Martinovic, “Developing pre-service teachers’ capacity in teaching science with technology through microteaching lesson study approach,” *Eurasia J. Math. Sci. Technol. Educ.*, vol. 13, no. 1, pp. 85–103, 2017, doi: 10.12973/eurasia.2017.00605a.
- [15] K. A. Anderson, M. Crespi, and E. C. Sayre, “Linking behavior in the physics education research coauthorship network,” *Phys. Rev. Phys. Educ. Res.*, vol. 13, no. 1, pp. 1–10, 2017, doi: 10.1103/PhysRevPhysEducRes.13.010121.
- [16] I. Eilks, “Science education and education for sustainable development - justifications, models, practices and perspectives,” *Eurasia J. Math. Sci. Technol. Educ.*, vol. 11, no. 1, pp. 149–158, 2015, doi: 10.12973/eurasia.2015.1313a.
- [17] T. Jagušt, I. Botički, and H. -J. So, “A review of research on bridging the gap between formal and informal learning with technology in primary school contexts,” *J Comput Assist Learn*, vol. 15, no. 12, pp. 1–12, 2018, doi: 10.1111/jcal.12252.
- [18] K. D. Hambala, E. C. G. Lopez, D. C. Cobrado, G. B. Naparan, G. L. Dela, and A. J. D. Tantog, “Exploring the Parents’ Disciplinary Strategies to Promote Children’s Learning Interest,” *Edukasiana J. Inov. Pendidik.*, vol. 2, no. 4, pp. 237–250, 2023, doi: 10.56916/ejip.v2i4.437.
- [19] Y. Supriani, H. Basri, and A. Suhartini, “Leadership Role in the Formation of Students’ Morals,” *Munaddhomah J. Manaj. Pendidik. Islam*, vol. 4, no. 3, pp. 528–538, 2023.
- [20] R. Hidayat, Z. Moosavi, Hermandra, Zulhafizh, and P. Hadisaputra, “Achievement goals, well-being and lifelong learning: A mediational analysis,” *Int. J. Instr.*, vol. 15, no. 1, pp. 89–112, 2022, doi: 10.29333/iji.2022.1516a.
- [21] A. L. Traxler, X. C. Cid, J. Blue, and R. Barthelemy, “Enriching gender in physics education research: A binary past and a complex future,” *Phys. Rev. Phys. Educ. Res.*, vol. 12, no. 2, pp. 1–15, 2016, doi: 10.1103/PhysRevPhysEducRes.12.020114.
- [22] H. Mulang, A. Halim, and P. Kusuma, “Exploring the Implementation of Ethical and Spiritual Values in High School Education : A Case Study in Makassar , Indonesia,” *Soc. Sci. Educ.*, vol. 3, no. 1, pp. 1–13, 2023.
- [23] Asrial, Syahrial, Maison, Muhaimin, and D. A. Kurniawan, “E-assessment for characters independence,” *Int. J. Interact. Mob. Technol.*, vol. 14, no. 15, pp. 125–141, 2020, doi: 10.3991/IJIM.V14I15.12995.
- [24] Y. Ariyana, A. Pudjiastuti, R. Bestary, and Zamroni, *Learning Oriented Handbook on Higher Order Thinking Skills*. Jakarta: Ministry of Education and Culture, 2018.
- [25] D. L. Naryatmojo, “Internalization of the Concept of Local Wisdom for Students in the Listening Class,” *SSRN Electron. J.*, vol. 10, no. 1, pp. 382–394, 2019, doi: 10.2139/ssrn.3367656.
- [26] S. M. Shaharudin, N. A. Rajak, N. W. M. Junus, and N. A. Samat, “Development and validation of early childhood care and education pre-service lecturer instrument,” *Int. J. Eval. Res. Educ.*, vol. 9, no. 1, pp. 188–194, 2020, doi: 10.11591/ijere.v9i1.20415.
- [27] B. Nor, E. T. Djatmika, S. U. M. Widjaja, and H. Wahyono, “Development of Economic Learning Model Based on Pancasila Values,” *Int. J. Instr.*, vol. 15, no. 1, pp. 259–276, 2022, doi: 10.29333/iji.2022.15115a.
- [28] A. Madsen, S. B. McKagan, and E. C. Sayre, “How physics instruction impacts students’ beliefs about learning physics: A meta-analysis of 24 studies,” *Phys. Rev. Spec. Top. - Phys. Educ. Res.*, vol. 11, no. 1, pp. 1–19, 2015, doi: 10.1103/PhysRevSTPER.11.010115.
- [29] Harun, A. Jaedun, Sudaryanti, and A. Manaf, “Dimensions of early childhood character education based on multicultural and community local wisdom,” *Int. J. Instr.*, vol. 13, no. 2, pp. 365–380, 2020, doi: 10.29333/iji.2020.13225a.
- [30] R. S. Barthelemy, B. Van Dusen, and C. Henderson, “Physics education research: A research subfield of physics with gender parity,” *Phys. Rev. Spec. Top. - Phys. Educ. Res.*, vol. 11, no. 2, pp. 1–10, 2015, doi: 10.1103/PhysRevSTPER.11.020107.
- [31] J. Musengimana, E. Kampire, and P. Ntawiha, “Factors Affecting Secondary Schools Students’ Attitudes toward Learning Chemistry : A Review of Literature,” *Eurasia J. Math. Sci. Technol. Educ.*, vol. 17, no. 1, pp. 1–12, 2021, doi: 10.29333/ejmste/9379.
- [32] S. Levent, “Analysis of 5 th Grade Science Learning Outcomes and Exam Questions According to Revised Bloom

- Taxonomy,” *J. Educ.*, vol. 6, no. 1, pp. 58–69, 2020, doi: 10.5296/jei.v6i1.16197.
- [33] B. R. Wilcox and H. J. Lewandowski, “Students’ views about the nature of experimental physics,” *Phys. Rev. Phys. Educ. Res.*, vol. 13, no. 2, pp. 1–10, 2017, doi: 10.1103/PhysRevPhysEducRes.13.020110.
- [34] T. Tamrongkunan and T. Tanitteerapan, “Development of required knowledge and skills among students through applied learning modules,” *Int. J. Instr.*, vol. 13, no. 4, pp. 695–714, 2020, doi: 10.29333/iji.2020.13443a.
- [35] M. J. Camasso and R. Jagannathan, “Nurture thru Nature: Creating natural science identities in populations of disadvantaged children through community education partnership,” *J. Environ. Educ.*, vol. 49, no. 1, pp. 30–42, 2018, doi: 10.1080/00958964.2017.1357524.
- [36] C. Sin, “Student-centred learning and disciplinary enculturation: an exploration through physics,” *Educ. Stud.*, vol. 41, no. 4, pp. 351–368, 2015, doi: 10.1080/03055698.2015.1007925.
- [37] A. R. Samadov, “Problems of forming and developing person’s aesthetic ideal,” *Int. J. Integr. Educ.*, vol. 2, no. 6, pp. 132–137, 2019, doi: 10.31149/ijie.v2i6.222.
- [38] R. Bellová, D. Melicherčíková, and P. Tomčík, “Possible reasons for low scientific literacy of Slovak students in some natural science subjects,” *Res. Sci. Technol. Educ.*, pp. 1–18, 2017, doi: 10.1080/02635143.2017.1367656.
- [39] J. Wang, Z. Hazari, C. Cass, and R. Lock, “Episodic memories and the longitudinal impact of high school physics on female students’ physics identity,” *Int. J. Sci. Educ.*, vol. 40, no. 13, pp. 1543–1566, 2018, doi: 10.1080/09500693.2018.1486522.
- [40] D. H. Halek, S. Budijanto, and D. H. Utomo, “Examination Improving Character towards Environment Care Through Their Creativity and Innovation at School (A Case Study at the Senior High School 3 Ternate City),” *Eurasian J. Educ. Res.*, vol. 21, no. 96, pp. 82–101, 2021, doi: 10.14689/ejer.2021.96.6.
- [41] A. Sun and X. Chen, “Online education and its effective practice: A research review,” *J. Inf. Technol. Educ. Res.*, vol. 15, no. 2016, pp. 157–190, 2016, doi: 10.28945/3502.
- [42] E. Istiyono, B. Kartowagiran, H. Retnawati, H. Cahyo Adi Kistoro, and H. Putranta, “Effective Teachers’ Personality in Strengthening Character Education,” *Int. J. Eval. Res. Educ.*, vol. 10, no. 2, pp. 512–521, 2021.
- [43] N. D. S. Chetty *et al.*, “Learning styles and teaching styles determine students’ academic performances,” *Int. J. Eval. Res. Educ.*, vol. 8, no. 4, pp. 610–615, 2019, doi: 10.11591/ijere.v8i3.20345.
- [44] I. Hermawan, *Metodologi Penelitian Pendidikan (Kualitatif, Kuantitatif dan Mixed Method)*. Kuningan: Hidayatul Qur’an Kuningan, 2019.
- [45] J. W. Creswell, *Research Design Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage, 2014.
- [46] T. R. Tretter, Y. Ardasheva, J. A. Morrison, and A. Karin Roo, “Strengthening science attitudes for newcomer middle school english learners: visually enriched integrated science and language instruction,” *Int. J. Sci. Educ.*, vol. 41, no. 8, pp. 1015–1037, 2019, doi: 10.1080/09500693.2019.1585993.
- [47] L. Huang, F. Huang, and P. T. Oon, “Constructs Evaluation of Student Attitudes towards Science,” *EURASIA J. Math. Sci. Technol. Educ.*, vol. 15, no. 12, 2019, doi: https://doi.org/10.29333/ejmste/109168.
- [48] O. Kosenchuk, O. Shumakova, A. Zinich, S. Shelkovnikov, and A. Poltarykhin, “The development of agriculture in agricultural areas of Siberia: Multifunctional character, environmental aspects,” *J. Environ. Manag. Tour.*, vol. 10, no. 5, pp. 991–1001, 2019, doi: 10.14505/jemt.v10.5(37).06.
- [49] G. Toli and M. Kallery, “Enhancing Student Interest to Promote Learning in Science: The Case of the Concept of Energy,” *Educ. Sci.*, vol. 11, no. 220, 2021, doi: https://doi.org/10.3390/educsci11050220.
- [50] Z. B. Takaoğlu, “Energy concept understanding of high school students: A cross-grade study,” *Univers. J. Educ. Res.*, vol. 6, no. 4, pp. 653–660, 2018, doi: 10.13189/ujer.2018.060409.
- [51] K. C. Margot and T. Kettler, “Teachers’ perception of STEM integration and education: a systematic literature review,” *Int. J. STEM Educ.*, vol. 6, no. 1, 2019, doi: 10.1186/s40594-018-0151-2.
- [52] M. B. Weissman, “Policy recommendations from causal inference in physics education research,” *Phys. Rev. Phys. Educ. Res.*, vol. 17, no. 2, p. 20118, 2021, doi: 10.1103/PhysRevPhysEducRes.17.020118.
- [53] A. J. Gonsalves, A. Danielsson, and H. Pettersson, “Masculinities and experimental practices in physics: The view from three case studies,” *Phys. Rev. Phys. Educ. Res.*, vol. 12, no. 2, pp. 1–15, 2016, doi: 10.1103/PhysRevPhysEducRes.12.020120.
- [54] L. S. Keiler, “Teachers’ roles and identities in student-centered classrooms,” *Int. J. STEM Educ.*, vol. 5, no. 1, 2018, doi: 10.1186/s40594-018-0131-6.
- [55] G. Ocak, “A Model for Determining Students’ and Teachers’ Perspectives on the Turkish 11 th Grade English Language Curriculum in Terms of Achieved Learning Outcomes,” *J. Educ.*, vol. 7, no. 1, pp. 184–200, 2021, doi: 10.5296/jei.v7i1.18313.