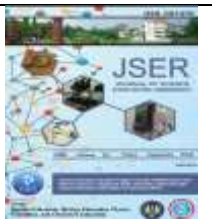
JSER

Journal of Science Education Research
Journal homepage: https://journal.uny.ac.id/index.php/jser/index

ISSN: 2597-9701



Profile of Critical Thinking Skills and Sustainability Awareness of Junior High School Students in Dumai City

M. Andriansyah[1], I. D. Pursitasari[2*]
[1,2]*Departement of Science Education, Postgraduate School, Pakuan University, Bogor, Indonesia*
[*]*Corresponding Author. Email: indarini.dp@unpak.ac.id*

Keywords
Critical thinking, sustainability awareness, sustainable education, explanatory sequential.

Phone*: +6282386100589

Abstract

Critical thinking skills and sustainability awareness are important competencies for students in facing 21st century education as well as supporting the achievement of Sustainable Development Goals (SDGs). This study aims to describe the profile of critical thinking skills and sustainability awareness of junior high school students in Dumai City, using an explanatory sequential design. Data collection involved critical thinking tests, sustainability awareness questionnaires, and interviews with teachers. The results of this study show that students critical thinking skills are in the low to very low category, while students' sustainability awareness shows a medium category in the practical aspect, but low in the behavioral and emotional aspects. This research provides important recommendations to support the development of education that integrates critical thinking exercises and sustainability education through an evidence-based approach. Sustainability awareness shows a mixed profile: moderate in the practical dimension—students can name everyday actions such as waste sorting and water conservation—yet low in behavioral and emotional dimensions, signaling limited persistence of pro-sustainability habits and weak affective commitment. These results suggest a gap between knowing and doing that schools can address through evidence-based curriculum and pedagogy.

History
Received:
March 23, 2025
Revised:
August 7, 2025
Accepted:
September 9, 2025

How to cite:
Andriansyah, M., Pursitasari, I, D., & Febrian, A. (2025). Profile of Critical Thinking Skills and Sustainability Awareness of Junior HighSchool Students in Dumai City. *Journal of Science Education Research*, 9(2), 170-176. doi: https://doi.org/10.21831/jser.v9.i1.84132.

INTRODUCTION

Critical thinking skills and Sustainability awareness are two key competencies needed by learners to face the challenges of the 21st century while supporting the achievement of the Sustainable Development Goals (SDGs). Critical thinking can be defined as a reflective and rational thinking process that focuses on making decisions about what to believe or do (Ennis, 2011). This competency is considered important to help learners critically analyze information and solve problems in various contexts (Facione et al., 2020). However, various studies show that the critical thinking skills of students in Indonesia still require special attention to develop optimally (Abrami et al., 2015; Lai, 2011). In fact, empirical evidence in Indonesia also confirms that students' critical thinking skills remain at a low level and need further practice to be improved (Nuryanti et al., 2016). This shows that other aspects related to sustainability also need to be considered in building learners' overall competence.

Sustainability awareness is also an important aspect of modern education. Sustainability awareness includes an understanding of the environmental, social and economic dimensions and commitment to behaviors that support sustainable development (Hassan et al., 2010). Education that promotes sustainability awareness can help learners understand the relationship between actions and their impact on the environment and society (UNESCO, 2022). However, the implementation of education that supports sustainability still faces various challenges, especially in putting these concepts into practice.

The Sustainable Development Goals (SDGs) have become a guide to promote education for sustainability. Education for Sustainable Development plays an important role in shaping a

society that is aware of sustainability through interdisciplinary learning (Baierl et al., 2021; Stanszus et al., 2019). However, the implementation of ESD often faces obstacles in the form of lack of understanding and implementation in the field (Giangrande et al., 2019). Similar challenges are also evident in Indonesia, where the integration of ESD into science learning remains low (only around 25%), and teachers still face limitations in knowledge, resources, and classroom practice (Purnamasari et al., 2022; Rohmawati & Roshayanti, 2021). It is important to understand how this global concept translates into local contexts, such as in Indonesian education.

The reality of education in Indonesia shows that critical thinking skills and sustainability awareness should begin to receive attention, especially in the Core Competency and Basic Competency-based curriculum (Nuryanti et al., 2016; Rohmawati & Roshayanti, 2021). However, challenges in implementation still remain, such as limited teacher training, lack of resources, and the absence of a truly integrated learning approach for these two competencies. For example, although the curriculum is already geared towards strengthening critical thinking skills, teaching methods in the field still tend to focus on memorization and do not encourage learners to analyze or evaluate information critically (Abrami et al., 2015; Lai, 2011). Similarly, the teaching of sustainability aspects is still limited to practical activities, such as hygiene programmers, without providing an in-depth understanding of the relationship between individual actions and their global impact (Hassan et al., 2010). This condition opens up opportunities to further explore the application of ESD at the local level, especially in urban areas that have unique characteristics.

Dumai City is one of the urban areas in Indonesia. Dumai City is considered relevant to explore the profile of critical thinking and sustainability awareness. The city has social and cultural diversity and a high level of urbanisation, which provides its own opportunities and challenges in developing learners' competencies. An in-depth understanding of the profile of learners in this region can be the basis for designing more effective educational interventions. Although many previous studies have discussed the importance of critical thinking skills (Abrami et al., 2015; Ennis, 2011; Facione et al., 2020) and sustainability awareness (Hassan et al., 2010; UNESCO, 2022), there are some limitations that need to be addressed. Giangrande et al., (2019) and Susanti et al., (2021) shows that the implementation of Education for Sustainable Development (ESD) in Indonesia still faces challenges, especially at the junior secondary school level. This study tends to be conceptual without providing empirical data that describes the real conditions of learners.

Most research on critical thinking skills and sustainability awareness is conducted separately (Abrami et al., 2015; Hassan et al., 2010; Lai, 2011). The combination of these two aspects is rarely explored in the Indonesian educational context, especially in urban areas such as Dumai City, which has socio-cultural diversity and the challenges of urbanization. Therefore, this study seeks to fill this gap by describing the profile of critical thinking skills and sustainability awareness of junior high school students in Dumai City. The data obtained is expected to provide evidence-based insights to support the development of more effective education in preparing students for the challenges of the 21st century.

RESEARCH METHOD

This research design uses a quantitative approach with the main data in the form of questionnaire results designed to measure students' critical thinking skills and sustainability awareness. The research respondents consisted of 116 junior high school students in Dumai City who were selected using purposive sampling technique, where the selected students met the criteria relevant to the research objectives. Supporting data in the form of interviews with teachers, who were also purposively selected based on their involvement in the respondents' learning, were used on limited basis to enrich the interpretation of the quantitative results.

Instruments

Critical Thinking Skill

Measurement used indicator-based tests from Ennis (2011). The questions were designed to measure focus on questions, analyze arguments, ask and answer clarifying questions, assess the credibility of sources, make decisions based on criteria. Then it is also assisted by supporting data from interviews about students' critical thinking skills. The following are the rubric guidelines for assessing critical thinking skills:

Table 1. Assessment Scores of Critical Thinking Indicators

Score	Descriptions
1	Answer is irrelevant or completely wrong
2	Answer shows partial understanding
3	Answers have some depth but are rudimentary
4	Answers are very in-depth and relevant

Sustainability awareness

Measuring sustainability awareness is done with a questionnaire and supporting data from teacher interviews. Through interviews with teachers, the aim is to get overview and data on learners‘ behavior in the classroom related to sustainability, such as learners’ participation in environmental activities or mindsets about sustainability issues. The questionnaire contains 15 statements based on the dimensions of Hassan et al., (2010), the questionnaire was developed according to the needs of the research subjects, namely behavioral and attitudinal awareness, emotional awareness, and practical awareness. The instrument grid can be seen in Table 2 and the questionnaire scoring guidelines can be seen in Table 3.

Table 2. Sustainability awareness questionnaire instrument

No	Statements	Positive	Negative
1	Behavioral and attitudinal awareness	1, 2, 4, 5	3
2	Emotional awareness	7, 8, 10	6, 9
3	Practical awareness	11, 12, 13	14

Table 3. Assessment Scores of Sustainability Awareness Indicators

Skor	Description
1	Strongly disagree
2	Disagree
3	Agree
4	Strongly agree

Based on Table 3 is the assessment score of positive statements of the sustainability awareness questionnaire and the reverse score applies to the assessment score of negative statements. Data from questionnaires and interviews were compared to ensure the validity of the results. For example, if learners show high awareness on the questionnaire but the teacher interview is not supportive, then further analysis is conducted to find the reason behind the discrepancy.

Data Processing Technique

Quantitative data were analyzed descriptively to describe students' critical thinking skills and sustainability awareness. The analysis was conducted by calculating the total score of the questionnaire results for each variable. The results of the total score calculation are then grouped into certain categories based on the score range, which is different for each variable according to the number of questions.

Critical Thinking Skills

The critical thinking skills questionnaire consisted of 5 questions, with a maximum score of 4 for each question. The total maximum score for this variable is 20 (5 × 4). The division of categories for critical thinking ability is as follows:

Table 5. Critical Thinking Ability categorization

Score Interval	Category
5 – 8	Very Low
9 – 12	Low
13 – 16	Medium
17 – 20	High

Sustainability Awareness

The sustainability awareness questionnaire consists of 15 questions; each indicator has 5 questions with a maximum score of 4 for each question. The total maximum score for this variable is 20 (5 × 4). The division of categories for sustainability awareness is as follows:

Tabel 6. Sustainability Awareness categorizations

Score Interval	Category
5 – 8	Very Low
9 – 12	Low
13 – 16	Medium
17 – 20	High

Interview data obtained from teachers was used to provide additional context to the quantitative results. These interviews help explain findings that may not be apparent from analysing the questionnaire scores, for example if there are discrepancies in the questionnaire results with the teachers' direct observations.

Data Integration

The quantitative analysis results were the main findings of the research, providing a measurable picture of learners' critical thinking skills and sustainability awareness. Qualitative data from teacher interviews was used to a limited extent to provide additional context to the quantitative results, particularly to explain findings that required more in-depth explanation.

This approach allows objective quantitative data to be reinforced with qualitative insights, resulting in more meaningful and relevant interpretations. Thus, this integration supports a more comprehensive understanding of learners' competency profiles.

RESULT AND DISCUSSION

The graphical results in Figure 2 show that the high scores on 'Focus on the Question' (16.4) and 'Make Decisions Based on Criteria' (16.2) reflect learners' ability to understand and answer questions descriptively. Similar findings were also reported by Nuryanti et al., 2016, who found that Indonesian students tend to perform better on descriptive tasks than on evaluative tasks. However, the low score on 'Assessing Source Credibility' (14.3) indicates a challenge in critically evaluating information, which is consistent with previous studies showing that students often struggle to assess the validity and reliability of information sources (Abrami et al., 2015; Lai, 2011). This is in line with previous research which confirms that source evaluation skills require explicit training (Ennis, 2011).

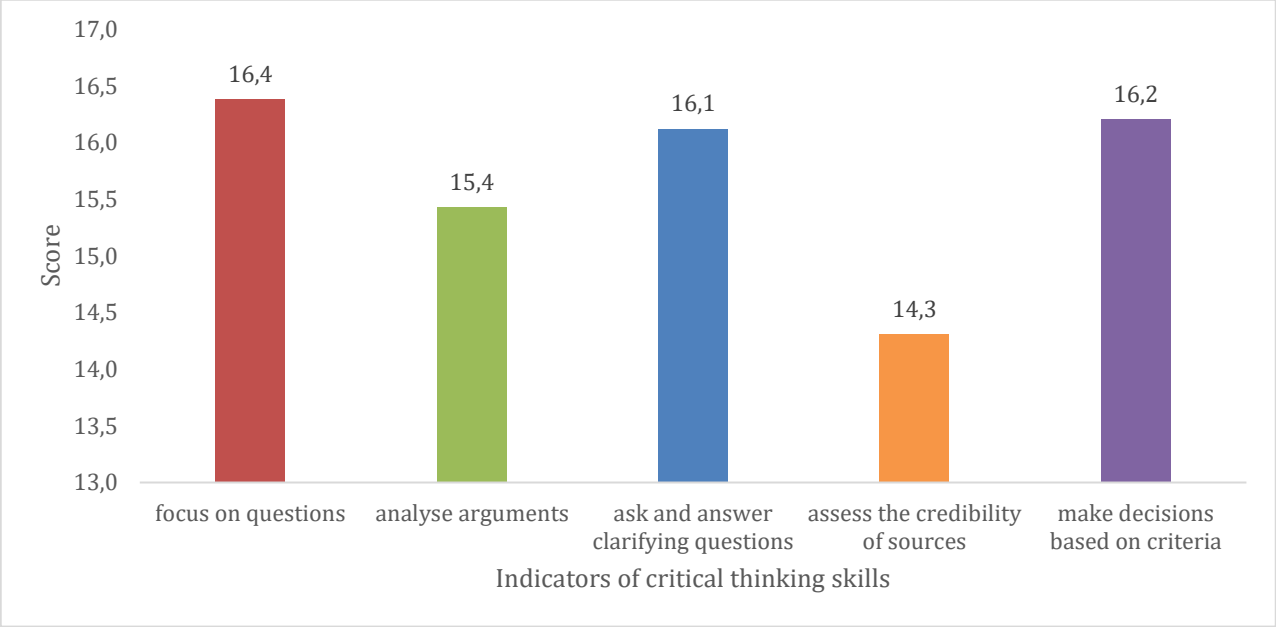


Figure 2. Critical Thinking Skills Graphic

To reinforce this finding, Guo et al. (2020) emphasises the importance of an evidence-based approach to improving critical thinking skills through project-based learning. De Wever et al. (2011) found that collaboration and teamwork helped learners to evaluate the credibility of information. Flipped classroom as suggested by Jdaitawi, (2019), proven to increase learners' active participation, allowing them more time for in-depth analysis. Hsu et al. (2015) showed that structured discussions improved learners' ability to understand and evaluate arguments.

Problem-Based Learning (PBL) by De Witte & Rogge, (2016) encourages learners to tackle real problems, thus honing their analytical and evaluative skills. Yazar Soyadı, (2015) added that problem-based approaches are effective in improving critical thinking skills in a variety of educational contexts. Khalid et al. (2023) stated that experiential learning through field activities and simulations can strengthen critical thinking skills. This is supported by Falloon, (2020) who found that experiential learning provides relevant real-world context for information evaluation.

Mohammed Alharbi et al. (2022) and Clark et al. (2020) showed that collaboration in study groups improved critical thinking skills, and teamwork facilitated the development of analytical skills through interaction between team members. Integration of sustainability values, as suggested by Chiong et al. (2017) helps learners understand the relationship between individual decisions and their impact on society. This is relevant for raising critical awareness of global issues. A Khan, (2024) highlights that an interdisciplinary approach, which incorporates science, social and economics, can

improve learners' critical evaluation. Carmichael et al. (2014) stated that interdisciplinary teaching helps learners build a more holistic perspective in assessing information.

Sustainability awareness

The results showed that students' sustainability awareness was assessed through three main indicators, namely behavioral and attitudinal awareness, emotional awareness, and practical awareness. behavioral and attitudinal awareness obtained the highest scores with high categories on negative statements and moderate categories on positive statements, while emotional and practical awareness were in moderate categories on negative statements and low categories on positive statements. This finding reflects the gap between the understanding of sustainability values and their application in daily actions. These results can be seen in Figure 3.

.

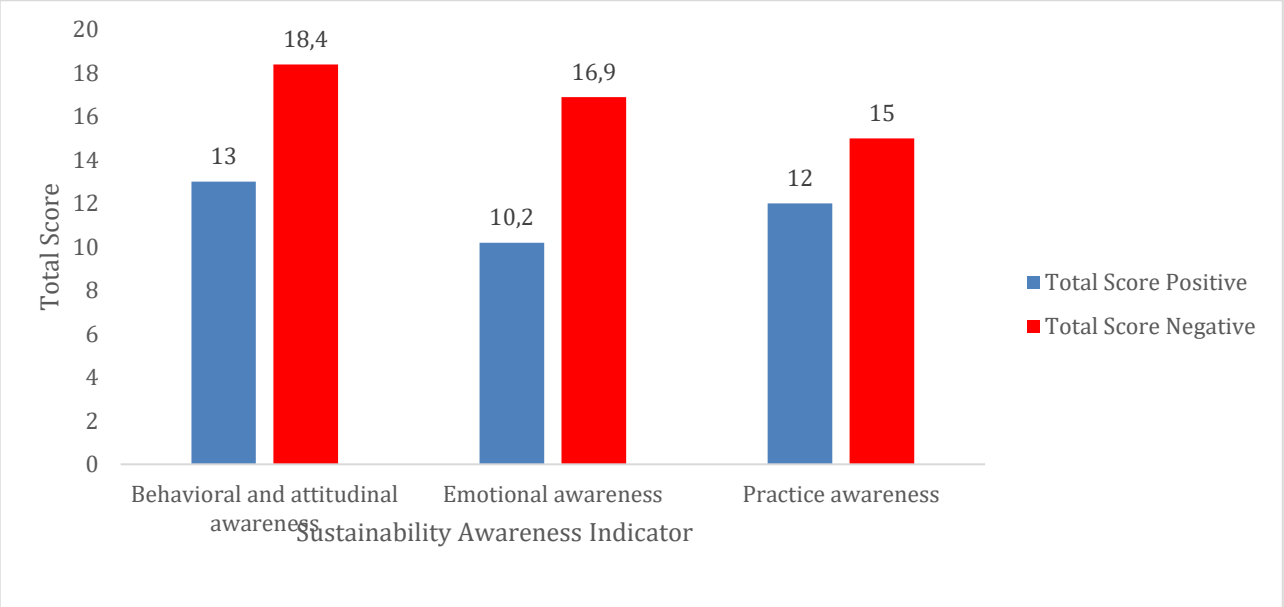


Figure 3. Sustainability awareness Graphic

These results show that learners tend to be more capable of implementing sustainability actions, such as keeping the environment clean and saving energy, than understanding sustainability values in depth. Interviews with science teachers support this finding, where teachers noted that learners have positive habits such as keeping the environment clean and saving electricity. However, some learners still show a lack of response to the sustainability values taught. School programs such as the obligation to bring five pieces of waste to the waste bank are considered effective enough to increase learners' practical awareness, although efforts are still needed to strengthen behavioural and emotional awareness.

This result is in line with research by Roczen et al. (2013) which emphasises the importance of a holistic approach to building sustainability awareness, encompassing cognitive, affective and behavioural dimensions. Jose et al. (2017) and Blankesteijn et al. (2024) emphasises that experiential learning, such as environmental activities, is highly effective in raising awareness of sustainability practices. Tilbury (2011) showed that the integration of sustainability values in the curriculum can improve learners' understanding of global issues. Leicht et al. (2018) found that project-based learning can help learners develop practical skills and sustainability awareness simultaneously. Cotic et al. (2020) highlighted the importance of experiential learning methods, such as outing class, which proved to be more effective than conventional methods in building students' sustainability awareness.

Research by Bergman (2016) and Zsóka et al. (2013) showed that direct experience with the environment, such as field activities, can strengthen learners' sustainability awareness. Hassan et al. (2010) found that interdisciplinary learning involving social, economic and environmental dimensions can improve understanding of sustainability. Baierl et al. (2021) also shows that long-term environmental awareness-based programmes have a significant impact on learners' awareness. Lastly, Stanszus et al. (2019) found that mindfulness can be an innovative approach to increase sustainability awareness, especially among adolescent learners.

CONCLUSION

This research shows that junior high school students in Dumai City have good critical thinking skills in understanding and responding to questions, but still face challenges in critically evaluating information. In terms of sustainability awareness, students tend to be better able to implement positive actions such as maintaining cleanliness, but in-depth understanding and application of sustainability values in daily behavior still need to be improved. To address these weaknesses, evidence-based education strategies that integrate critical thinking training and sustainability education are needed. Approaches such as project-based learning and hands-on experience are considered effective to holistically improve students' competencies in facing future challenges and supporting sustainable development goals.

ACKNOWLEDGMENTS

With gratitude, the authors would like to thank all those who have provided support and contributions in the completion of this research. A big thank you goes to the school where this research was conducted, including the students and teachers who have been willing to participate and provide assistance during the data collection process. Hopefully this research can provide benefits to the world of education and be a meaningful contribution to the development of science.

REFERENCES

Abrami, P. C., Bernard, R. M., Borokhovski, E., Waddington, D. I., Wade, C. A., & Persson, T. (2015). Strategies for Teaching Students to Think Critically: A Meta-Analysis. *Review of Educational Research*, *85*(2), 275–314. https://doi.org/10.3102/0034654314551063

Baierl, T. M., Johnson, B., & Bogner, F. X. (2021). Assessing environmental attitudes and cognitive achievement within 9 years of informal earth education. *Sustainability (Switzerland)*, *13*(7). https://doi.org/10.3390/su13073622

Bergman, B. G. (2016). Assessing impacts of locally designed environmental education projects on students' environmental attitudes, awareness, and intention to act. *Environmental Education Research*, *22*(4), 480–503. https://doi.org/10.1080/13504622.2014.999225

Blankesteijn, M. L. (M. L. ., Houtkamp, J. (J. ., & Bossink, B. (B. A. G. . (2024). Towards transformative experiential learning in science- and technology-based entrepreneurship education for sustainable technological innovation. *Journal of Innovation & Knowledge*, *9*(3), 100544. https://doi.org/https://doi.org/10.1016/j.jik.2024.100544

Carmichael, Tami; LaPierre, Y. (2014). *Interdisciplinary Learning Works: The Results of a Comprehensive Assessment of Students and Student Learning Outcomes in an Integrative Learning Community*. *32*, 53–78.

Chiong, K. S., Mohamad, Z. F., & Abdul Aziz, A. R. (2017). Factors encouraging sustainability integration into institutions of higher education. *International Journal of Environmental Science and Technology*, *14*(4), 911–922. https://doi.org/10.1007/s13762-016-1164-3

Cotič, N., Plazar, J., Starčič, A. I., & Zuljan, D. (2020). The effect of outdoor lessons in natural sciences on students' knowledge, through tablets and experiential learning. *Journal of Baltic Science Education*, *19*(5), 747–763. https://doi.org/10.33225/jbse/20.19.747

De Wever, B., Van Keer, H., Schellens, T., & Valcke, M. (2011). Assessing collaboration in a wiki: The reliability of university students' peer assessment. *The Internet and Higher Education*, *14*(4), 201–206. https://doi.org/https://doi.org/10.1016/j.iheduc.2011.07.003

De Witte, K., & Rogge, N. (2016). Problem-based learning in secondary education: evaluation by an experiment. *Education Economics*, *24*(1), 58–82. https://doi.org/10.1080/09645292.2014.966061

Ennis, R. (2011). Critical Thinking: Reflection and Perspective Part I. *Inquiry: Critical Thinking Across the Disciplines*, *26*(1), 4–18.

Facione, P., Facione, N., & Gittens, C. (2020). *What the Data Tell Us about Human Reasoning* (pp. 272–297). https://doi.org/10.1163/9789004444591_016

Falloon, G. (2020). From simulations to real: Investigating young students' learning and transfer from simulations to real tasks. *British Journal of Educational Technology*, *51*(3), 778–797. https://doi.org/10.1111/bjet.12885

Giangrande, N., White, R. M., East, M., Jackson, R., Clarke, T., Coste, M. S., & Penha-Lopes, G. (2019). A competency framework to assess and activate education for sustainable development: Addressing the UN sustainable development goals 4.7 challenge. *Sustainability (Switzerland)*, *11*(10), 1–16. https://doi.org/10.3390/su11102832

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational*

Research, *102*(November 2019), 101586. https://doi.org/10.1016/j.ijer.2020.101586

Hassan, A., Noordin, T. A., & Sulaiman, S. (2010). The status on the level of environmental awareness in the concept of sustainable development amongst secondary school students. *Procedia - Social and Behavioral Sciences*, *2*(2), 1276–1280. https://doi.org/10.1016/j.sbspro.2010.03.187

Hsu, C.-C., Chiu, C.-H., Lin, C.-H., & Wang, T.-I. (2015). Enhancing skill in constructing scientific explanations using a structured argumentation scaffold in scientific inquiry. *Computers & Education*, *91*, 46–59. https://doi.org/https://doi.org/10.1016/j.compedu.2015.09.009

Jdaitawi, M. (2019). The effect of flipped classroom strategy on students learning outcomes. *International Journal of Instruction*, *12*(3), 665–680. https://doi.org/10.29333/iji.2019.12340a

Jose, S., Patrick, P. G., & Moseley, C. (2017). Experiential learning theory: the importance of outdoor classrooms in environmental education. *International Journal of Science Education, Part B*, *7*(3), 269–284. https://doi.org/10.1080/21548455.2016.1272144

Khalid, A. F., George, M. A., Eggen, C., Sritharan, A., Wali, F., & Viens, A. M. (2023). Using Simulation-Based Experiential Learning to Increase Students' Ability to Analyze Increasingly Complex Global Health Challenges: A Mixed Methods Study. *MedRxiv*, 2023.12.19.23300262. https://doi.org/10.1101/2023.12.19.23300262

Khan, A. (2024). *Frontiers in Interdisciplinary Educational Methodology The Role of Interdisciplinary Methods in Promoting Critical Thinking Skills Frontiers in Interdisciplinary Educational Methodology*. *01*(01), 19–27.

Lai, E. (2011). Critical thinking: A literature review. *Pearson's Res Rep*, *6*, 40–41.

Leicht. (2018). Issues and trends in education for sustainable development. In *Issues and trends in education for sustainable development*. https://doi.org/10.54675/yelo2332

Mohammed Alharbi, S., Ibrahim Elfeky, A., & Sultan Ahmed, E. (2022). The Effect Of E-Collaborative Learning Environment On Development Of Critical Thinking And Higher Order Thinking Skills. *Journal of Positive School Psychology*, *2022*(6), 6848–6854. http://journalppw.com

Nuryanti, L., Zubaidah, S., & Diantoro, M. (2016). Analisis Kemampuan Berpikir Kritis Siswa SMP. *Jurnal Pendidikan*, *3*(2), 155–158.

Purnamasari, S., Suhendi, F. A. F., & Zulfah, N. L. N. (2022). Implementasi education for sustainable development (ESD) dalam pembelajaran IPA di Kabupaten Garut: Sebuah studi pendahuluan. *Jurnal Kajian Pendidikan IPA*, *2*(1), 105–110. https://doi.org/10.52434/jkpi.v2i1.1573

Roczen, N., Kaiser, F. G., Bogner, F. X., & Wilson, M. (2013). A Competence Model for Environmental Education. *Environment and Behavior*, *46*(8), 972–992. https://doi.org/10.1177/0013916513492416

Rohmawati, Q., & Roshayanti, F. (2021). Potensi Implementasi Education for Suistanable Development (ESD) Pada Konsep Dinamika Rotasi. *UPEJ Unnes Physics Education Journal*, *10*(3), 241–247.

Stanszus, L. S., Frank, P., & Geiger, S. M. (2019). Healthy eating and sustainable nutrition through mindfulness? Mixed method results of a controlled intervention study. *Appetite*, *141*, 104325. https://doi.org/https://doi.org/10.1016/j.appet.2019.104325

Strategy, M. (2022). *Medium-Term Strategy 2022-2029*.

Susanti, D., Volland, A., Tawari, N., Baxter, N., Gangaiah, D., Plata, G., Nagireddy, A., Hawkins, T., Mane, S. P., & Kumar, A. (2021). Multi-Omics Characterization of Host-Derived Bacillus spp. Probiotics for Improved Growth Performance in Poultry. *Frontiers in Microbiology*, *12*(October), 1–19. https://doi.org/10.3389/fmicb.2021.747845

Tilbury, D. (2011). *Tilbury, D (2011) 'Education for Sustainable Development: An Expert Review of Processes and Learning' Paris: UNESCO. Available in Spanish, French and English.ED-2010/WS/46*.

Yazar Soyadı, B. B. (2015). Creative and Critical Thinking Skills in Problem-based Learning Environments. *Journal of Gifted Education and Creativity*, *2*(2), 71–71. https://doi.org/10.18200/jgedc.2015214253

Zsóka, Á., Szerényi, Z. M., Széchy, A., & Kocsis, T. (2013). Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students. *Journal of Cleaner Production*, *48*, 126–138. https://doi.org/https://doi.org/10.1016/j.jclepro.2012.11.030