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Correlational Study: Teacher Perceptions and The Implementation of Education for Sustainable Development Competency for Junior High School Teachers

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ABSTRAK

Kompetensi ESD menjadi kunci bagi guru untuk mengimplementasikan ESD di sekolah agar pendidikan dapat memberikan kontribusi nyata untuk mencapai tujuan pembangunan berkelanjutan. Penelitian ini menganalisis hubungan persepsi guru terhadap kompetensi ESD dengan implementasi ESD di Sekolah Menengah Pertama (SMP). Penelitian ini menggunakan penelitian korelasional. Populasi dalam penelitian ini adalah guru SMP. Sampel penelitian terdiri dari 384 guru yang diambil menggunakan teknik multistage sampling dengan mengambil guru dari 3 kecamatan di 6 kabupaten kota. Metode pengumpulan data yang digunakan adalah dengan menyebarkan kuesioner kepada responden. Analisis data menggunakan teknik analisis persentase dan teknik analisis korelasi Pearson. Hasil penelitian ini menunjukkan bahwa guru membutuhkan kompetensi ESD karena guru merasa penerapan ESD di sekolah masih dalam kategori rata-rata. Sehingga guru berharap dapat memperoleh kompetensi terkait ESD secara lebih mendalam. Berdasarkan hal tersebut, diharapkan para pengambil kebijakan di tingkat nasional, pemerintah daerah, bahkan sekolah sendiri menyelenggarakan kegiatan peningkatan kompetensi ESD bagi guru dalam berbagai bentuk pelatihan, seminar, dan lain-lain. Hal ini dilakukan agar penerapan ESD di sekolah dapat dimaksimalkan sehingga guru sebagai ujung tombak pendidikan dapat memberikan kontribusi nyata untuk pencapaian agenda tahun 2030.

ABSTRACT

ESD competence is key for teachers to implement ESD in schools so that education can make a real contribution to achieving sustainable development goals. This study analyzes the relationship between perceptions of teacher ESD competence and ESD implementation in Junior High Schools (JHS). This study uses a correlational study. The population in this study included JHS teachers. The research sample consisted of 384 teachers who were taken using a multistage sampling technique by taking teachers from 3 sub-districts in 6 urban districts. The data collection method used is by distributing questionnaires to respondents. Data analysis is using percentage analysis technique amd Pearson correlation analysis technique. The results of this study indicate that teachers need ESD competencies because teachers feel that the implementation of ESD in schools is still in the average category. So teachers hope to acquire competencies related to ESD in more depth. Based on this, it is hoped that policymakers at the national level, local governments, and even the schools themselves will organize activities to improve ESD competence for teachers in various forms of training, seminars, and others. This is done so that the implementation of ESD in schools can be maximized so that teachers, as the spearhead of education, can make a real contribution to achieving the 2030 agenda.

1. INTRODUCTION

Future education is directed at responding various sustainability related issues. Various challenges are faced due to the exploitation of natural resources on a large scale. Over-exploitation of natural resources negatively impacts the food supply, increases health hazards and risks of natural disasters, and many other risks to humans (Jeong, 2017; Rayuwati, 2020). This condition must be corrected as soon as possible to create a safe world for humankind, both for people living now and for future generations. Various world initiatives have discussed this condition a lot; in 2015, the United Nations launched the Agenda for Sustainable Development Goals and adopted it by world leaders covering 17 sustainable development goals along with 169 targets known as Sustainable Development Goals (SDGs) (Bravo et al., 2021; S.-Y. Chen, 2022; Vergara et al., 2020).

Sustainable development is an approach to balancing human needs with an awareness of the environmental, social, and economic limitations that will be faced. The concept of sustainable development

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emerged as a response to various challenges facing the world. Previous study argues that sustainable development is about protecting and preserving the planet's natural environment and promoting social and economic equity within and between countries (Y. Chen, 2022). Sustainable development focuses on improving the living conditions of people worldwide and enhancing the natural environment, creating sustainable communities over the long term. Furthermore, previous study explained that sustainable development is a concept of a country's national development in meeting the needs and improving the welfare of its people at this time while considering the needs of future generations (Hermelingmeier & von Wirth, 2021). Today sustainable development is seen as a plan of action for every human being to find a way to have a better life without a negative impact on life or future generations. Everyone must realize and acknowledge that his survival and the survival of future generations depend on responsible behavior regarding consumption and production, the environment, and progressive social values (Fatimah & Santiana, 2017; Fırat & Laramee, 2018).

Education has an important place in a society's transition strategy toward sustainable development (Karpan et al., 2020; Waltner et al., 2020). Education is the key to achieving sustainable development by providing the right knowledge, skills, and values to individuals; education can play an important role in changing behavior, developing capacities, and preparing future generations committed to sustainable development. The important statement of education in promoting sustainable development and increasing individual capacity to deal with issues around the environment and sustainable development was stated at the United Nations Conference on Environment and Development (UNCED) in 1992 by introducing the concept of education for Sustainable Development or Education for Sustainable Development (ESD) (Bravo et al., 2021; Carayannis & Morawska-Jancelewicz, 2022; Zhang & Wang, 2021).

ESD is generally understood as education that encourages changes in knowledge, skills, values , and attitudes, enabling society to live more sustainably and fairly for all. It was further explained that ESD aims to empower and equip present and future generations to meet their needs by using a balanced and integrated approach to the pillars of sustainable development namely economic, social and environmental. ESD is expected to support the transformation of society towards a more sustainable way of thinking, working and living (Müller et al., 2021; Nurtanto et al., 2019). The practice of ESD in Indonesia is still not optimally implemented properly. Problems. Learning indicators that are not oriented towards sustainable development goals, learning materials, and approaches used are not effective in developing ESD competencies; students are still not able to relate what is learned in subjects with ESD concepts, and most teachers, although some already know the ESD concepts, competencies that are there are in every dimension of ESD it is still a problem how teachers design integrated educational learning for sustainable development (Lestari, H., Ali, M., Sopandi, W., & Wulan, 2021; Nikmah et al., 2019; Perkasa et al., 2020).

Teachers are important agents in delivering sustainable development content and facilitating the competence of skills and actions to achieve the goals of sustainable development (Ferguson et al., 2021; Yuniarti et al., 2019). Teachers are powerful agents of change with the ability to provide the educational responses needed in the context of sustainable development. Teacher knowledge and competencies are essential for restructuring educational processes and institutions toward sustainability (Peedikayil et al., 2023; Rieckmann, 2018). Teachers are the torchbearers of sustainable development, promoting social change and balancing the two important concepts of development and sustainability. The achievement of inclusive, equitable, quality education and lifelong learning opportunities for all students, which ultimately achieves sustainable development goals, depends on the supply of quality teachers who meet competence standards (Nardo et al., 2022; Óskarsdóttir et al., 2020).

Competence is a combination of knowledge, skills, and social competencies needed to do a job, including conceptual competence (cognitive, knowledge, and understanding, as well as meta competence, including learning to learn) and operational (functional, psychomotor, and applied skills as well as social competence, including behavior and attitude) (Islam et al., 2022; Kalogiannakis & Papadakis, 2019). Competence includes visible and invisible performance and behavioral characteristics of an individual, where these two aspects jointly determine a person's performance/output in doing a job. Teacher ESD competence is the teacher's capacity to assist students in developing sustainability competencies through various innovative teaching and learning practices (Emilzoli et al., 2021; Rieckmann, 2018).

Various institutions have developed competence models, such as the United Nations Economic Commission for Europe (UNECE), which has developed a competence framework called "Learning for the Future: Competences in Education for Sustainable Development." The UNECE competence model is rated as abstract, complex, and repetitive, and a total of 39 is unmanageable (Segara, 2015; Vare et al., 2019). As a country in the Asia Pacific region, Indonesia has initiatives focusing on developing a competence framework, namely the Asia-Pacipic ESD Teacher Competency Framework, developed in 2019. This competence framework consists of three competence domains.

Meanwhile, previous study conducted research that produced an ESD competence framework for teachers by combining the most common ESD competencies in the literature that has been reviewed from 2011-2019 in three aspects of competencies, namely the first relates to knowledge, whether content knowledge or knowledge of

pedagogical content, the second relates to core life skills, and the third aspect concerns values and behavior (Imara, K., & Altinay, 2021). These competencies aspects form a unified whole, where ESD knowledge forms the context and basis of learning, while core life skills is a means to enable transforming ESD knowledge into desired behaviors and practices. Therefore this study is analyzes the relationship between perceptions of teacher ESD competence and ESD implementation in Junior High Schools (JHS).

2. METHOD

This study uses a correlation study to see the relationship between competence variables and perceptions of ESD implementation (Dewi et al., 2020; Dorouka et al., 2020). The population of this study was junior high school teachers in West Java Province, totaling 90.763 teachers. The sample in this study was selected using a multistage sampling technique by selecting three schools in sub-districts in the cities/districts of Bandung, Cianjur, Pangandaran, Bekasi, Sukabumi, and Cirebon. The number of samples used Krejcie and Morgan's tables, so that 384 teachers were selected.

Data collection used a Likert scale type questionnaire with four alternative answers, namely, Strongly Agree (SA), Agree (A), Disagree (DA), and Strongly Disagree (SD), and distributed them to teachers via the Google form link, which is shared online. Experts first assessed this instrument before being used in actual research, namely by Curriculum and Learning experts and Information Technology experts. After expert judgment, improvements are made according to their input. The research instrument grids are presented in Table 1 and Table 2.

Table 1. ESD Competence Classification

Competence Classification	Competence Category	Competence
Hard Competence	Knowledge-Related Competence	Able to understand the concept of sustainable development
		Able to understand 17 goals of sustainable development
		Able to understand 8 sustainability competencies
		Able to understand the concept of ESD
		Able to understand the objectives of ESD learning
		Able to know various policies related to sustainable development
		Able to know the problem-solving approach
	Competencies Related to Pedagogical Skills	Able to integrate sustainable development issues into the curriculum
		Able to develop student-centered learning
		Being able to apply learning strategies requires active students.
		Able to develop collaborative learning
		Able to develop sustainable development content content
		Able to use various evaluation methods
		Proficient in using multiple technology platforms to deliver digital learning
Soft Competence	Behavior-Related Competence	Teaching ESD topics within the subject
		Integrating ESD in subjects
		Integrating ESD as a separate subject
		Using active learning strategies regarding ESD
		Assess ESD attitudes toward students.
		Using digital technology platforms for learning
	Competence Related to Self-Actualization	Take ESD training
		Practicing ESD
		Looking for information or self-study about ESD
		Collaborate with colleagues on ESD.
		Collaborate with the community to discuss ESD.
		Guiding students to behave ESD

Table 2. Perceptions of ESD

Perception Aspect	Competence
ESD Policy	Participate in socialization about ESD
	Review policies related to ESD
	Developing an ESD lesson plan
Changes in the implementation of learning	Composing ESD behaving gestures
	Teaching ESD topics within the subject
	Integrating ESD in subjects
	Integrating ESD as a separate subject
	Using active learning strategies regarding ESD
	Assess ESD attitudes toward students.
	Using digital technology platforms
Capacity development	Take ESD training
	Practicing ESD
	Looking for information or self-study about ESD
	Collaborate with colleagues on ESD.
	Collaborate with the community to discuss ESD.
	Guiding students to behave like ESD

The instrument's reliability was tested using Cronbach Alfa because the instrument used was a questionnaire or questionnaire with more than one alternative correct answer. The instrument's validity was tested for content validity by experts and criterion validity using the Pearson product moment. The data analysis technique used to describe each indicator for the variable teacher competence and perceived implementation is a percentage analysis technique with an interpretation of the percentage value, which adapts from the interpretation of the percentage value. Meanwhile, to find out the relationship between variables in this study using the Pearson correlation analysis technique with the interpretation of the product-moment correlation coefficient value.

3. RESULT AND DISCUSSION

Result

The results of the instrument trial were applied to junior high school teachers from 4 (four) regions, namely Bandung, Bekasi, Cianjur, and Pangandaran. For the trial, this instrument was filled by 15 teachers from each region, bringing a total of 60 teachers. Test results to measure the validity, reliability, and differentiability of the instrument. Calculating the validity test in this study was performed using the help of IBM SPSS Statistics 25 with the Pearson product-moment validity test, and the r-table value obtained was 0.254. Based on the results of the validity test, it was found that the r count of all items on the teacher's ESD Competence variable and the Perception of ESD Implementation in Junior High School variables were above the r table. All items in this study are valid and used in research.

While the results of the reliability test on the 41 statement items in this study obtained a reliability level of $\alpha = 0.9$ which refers to two variables, namely competence and teacher perceptions regarding ESD. The results of the instrument's reliability stated that it was very reliable. Four categories are measured through instruments based on hard competence and soft competence: competence related to knowledge, competence related to pedagogic skills, competence related to behavior, and competence related to self-actualization.

This follows ESD practices in schools that require a transformation of teaching and learning processes; ESD must include and prioritize climate change, poverty, and sustainable consumption content in the curriculum and create interactive and learner-centered teaching and learning arrangements. Teachers are seen as the key to the successful implementation of ESD and as strong agents of change who can provide educational responses needed for sustainable development. Teacher knowledge and competencies are essential for restructuring educational processes and institutions toward sustainability. Perceptions of ESD competence is show in Table 3 and Figure 1.

Table 3. ESD Competence Indicator Scores for Teachers

Code	ESD Competence for Teachers	Number of Items	Score	Ideal Score	Percentage
X_1	Knowledge	7	8673	10752	80.66%
X_2	Skills	7	8916	10752	82.92%
X_3	Attitude	5	6338	7680	82.53%
X_4	Self-actualization	6	7463	9216	80.98%

Base on Table 3, the perception of ESD competence indicator score required by the teacher has four indicators. The highest indicator is Skills, and the second highest indicator is attitude, a very important result showing that these two competencies are considered important for teachers. Other skills are related to Self-actualization followed by knowledge showing necessary results. This result shows a lower value than the previous indicator. However, the results of this indicator also have a high average, so it is necessary for teachers to have this ESD competence. The percentage data is show in Figure 1.

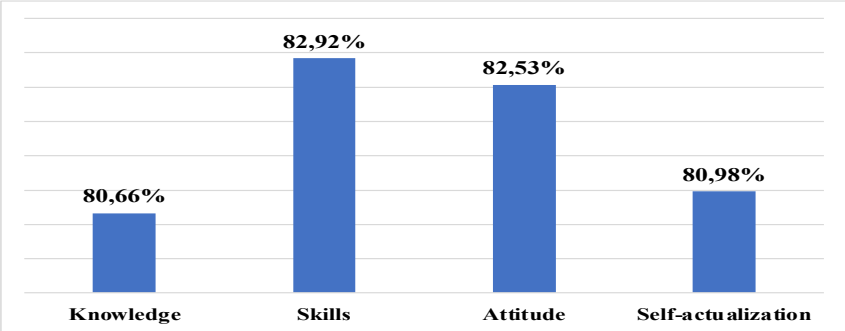

Figure 1. ESD Competence Indicator Results for Teachers

Based on the Figure 1, percentage data for each research indicator, it is stated that overall the teacher's ESD competence (hard competence) is higher. In contrast, the perceived indicator of ESD implementation in schools (soft competence) is lower. Following the competence classification categorize, competencies related to knowledge and skills are superior to behavioral and self-actualization competencies. Perceptions of ESD implementation is show in Table 4.

Table 4. Perception Indicator Scores of ESD Implementation in Schools

Code	Perceptions of ESD Implementation in Schools	Number of Items	Score	Ideal Score	Percentage
Y_1	ESD policies that have been implemented	4	2963	6144	48.23%
Y_2	Implementation of learning regarding ESD	6	4725	9216	51.27%
Y_3	ESD capacity development	6	4476	9216	48.57%

Base on Table 4 in general, this ESD competence needs to be possessed by teachers. This is reinforced by other data that describe this phenomenon regarding ESD competence. The teacher's perception of the implementation of ESD in schools is in the sufficient category. Teachers feel that the ESD policies implemented in schools are in the sufficient category. Another perception with the highest percentage relates to the implementation of learning regarding ESD, which is also in the sufficient category. The last indicator also illustrates that teachers feel sufficient about ESD capacity development. This sufficient category means that the implementation of ESD in schools has yet to be carried out optimally. The result of Pearson correlation test is show in Table 6.

Table 5. Pearson Correlation Test

		ESD Competence for Teachers	ESD Implementation in Schools
ESD Competence for Teachers	Pearson Correlation	1	0.304**
	Sig. (2-tailed)		0.000
	N	384	384
ESD Implementation in Schools	Pearson Correlation	0.304**	1
	Sig. (2-tailed)	0.000	
	N	384	384

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation test results in Table 5 shows that the coefficient between correlations has a relationship direction based on Pearson Correlation = 0.304. Based on the results of the correlation coefficient figures in the table, it also means that the relationship between perceptions of ESD competence and ESD implementation has a positive contribution, with 0.304. The results of the significance in the table are 0.000, which means <0.05, so it

can be interpreted that there is a significant relationship between perceptions of ESD competence and ESD implementation. Based on the correlation test results, the correlation coefficient interpretation shows that 0.304 is included in the low relationship. In line with the study's results, perceptions of ESD competence and ESD implementation have a positive but low level of relationship.

Discussion

ESD Teacher Competence

The competence classification described categorize, competencies related to knowledge and skills are superior to behavioral and self-actualization competencies. This is in line with the aim of ESD to empower and equip present and future generations to meet their needs by using a balanced and integrated approach to the pillars of sustainable development with the hope of supporting the transformation of society towards a more sustainable way of thinking, working and living (Müller et al., 2021). Achieving inclusive, equitable, quality education and lifelong learning opportunities for all students to achieve sustainable development goals will depend on the supply of quality teachers who meet competence standards (Baran et al., 2011; Schneider & Bodensohn, 2017; Sulaiman & Ismail, 2020). Teachers are important agents in delivering sustainable development content and facilitating competence skills and actions to promote social change and maintain a balance between the two important concepts of development and sustainability (Ferguson et al., 2021; Peedikayil et al., 2023).

Competence is an ability possessed by each party; in this case, the teacher fully owns and understands ESD competencies related to knowledge about sustainable development. This knowledge is certainly the basis for teachers to assist students in providing learning to students. Because in learning about sustainable development is not only related to the concept that is owned, but teachers are required to understand goals, competencies, and policies to solve problems that are relevant to sustainable development. This is because education is a means of implementing certain goals related to sustainable development (Rieckmann, 2018; Sutiman et al., 2022).

Furthermore, teachers are also required to have competencies related to skills in learning about sustainable development. In this study, the highest skill possessed by the teacher is being able to apply learning strategies that can certainly require active students. This certainly requires support from learning models that can encourage students to be active in their implementation (Hill, 2021; Siti et al., 2021). Another skill that scores highly is collaborative and student-centered learning. As we know, these two things are one unit. Previous study states that collaborative learning itself is a learning activity that can provide the widest possible space in providing opportunities for students to be active during the learning process (Winata, 2020). To achieve the maximum goals related to development, teachers can collaborate on the skills they have with each other.

Competence related to self-actualization is also an important indicator of the abilities possessed by the teacher. Self-actualization itself is a form of awareness in utilizing the capabilities possessed and visible in the form of activities carried out (Amrulloh & Galushasti, 2022; Burhan, 2019). One of the studies related to ESD is that ESD also includes attitudes, values , and perspectives that can guide humans in living a sustainable way of life for future generations. As is known, practicing sustainable survival is one of the ESD competencies that teachers can have in terms of self-actualization. Teachers need to be aware to improve abilities and skills related to ESD competencies (Nurlailah & Hamdu, 2021; Tristananda, 2018). Teachers need the ability to understand goals, competencies, and policies related to sustainable development. This is necessary so that teachers can build students' awareness and understanding in line with the concept of sustainable development. ESD implementation can be carried out more optimally if various parties are aware of sustainable development. Competence is the responsibility of each individual, so in this case, teacher competence regarding ESD is an important component in efforts to increase awareness about sustainable development.

Perceptions of ESD Implementation in Schools

Education is important in preparing the next generation to achieve sustainable development programs. Education for Sustainable Development (ESD) or education for sustainable development is an educational vision that instills an understanding of sustainable development from a social, economic, and environmental perspective to create a sustainable future (Bravo et al., 2021; Carayannis & Morawska-Jancelewicz, 2022). As educational institutions, schools certainly have their own role as a vehicle for implementing ESD. However, based on the results of the research, it can be seen that the implementation of ESD policies in the school environment has not been carried out optimally due to the lack of socialization and review of ESD-related policies in schools as well as the preparation of lessons plans and ESD behavior movements that have not been maximized. It is aligned with previous study which states that the implementation of ESD in Indonesia has not been implemented optimally because there is no policy for implementing ESD explicitly from the center, limited learning resources related to ESD, and minimal outreach to school principals and teachers so that they experience difficulties in integrating ESD in schools (Suprastowo, 2010).

Not only can ESD policies be implemented in schools, but ESD as part of education can also have an impact on the implementation of learning in schools. One of them is a change in the implementation of learning

by integrating ESD into subjects, using learning strategies related to ESD, using digital platforms, and assessing ESD attitudes toward students (Pornpimon et al., 2014; Tejedor et al., 2019). This change in the implementation of learning related to ESD occurs because ESD does not only teach sustainable development by adding new content to learning materials but with an overall transformation so that it can bring the concept of ESD into the classroom so that students can acquire knowledge, skills, attitudes, and values. These values are necessary to shape a sustainable future (Nikmah et al., 2019; Perkasa et al., 2020). However, teaching and integrating ESD topics into subjects is still challenging for teachers. This happens because the teacher is still unfamiliar with the concept of ESD and is not ready to integrate the concept of ESD into the subject.

Implementing ESD in schools, especially in junior high schools, is an important foundation for creating awareness for teachers and students about ESD. To create this awareness, it is necessary to have support from various parties so that the knowledge and abilities of teachers and students regarding ESD are constantly developing. Other policies must also be formulated to support schools integrating ESD for a sustainable future. This research shows that teachers have an understanding that they need ESD competencies because teachers feel that the implementation of ESD in schools is still in the sufficient category. Hence, teachers hope to acquire competencies related to ESD in more depth. Based on this, it is hoped that policymakers at the national and local ministry levels, local governments, and even the schools themselves will organize activities to improve ESD competence for teachers in various forms of training, seminars, and others. This is done so that the implementation of ESD in schools can be maximized so that teachers, as the spearhead of education, can make a real contribution to achieving the 2030 education agenda.

4. CONCLUSION

Based on the data and analysis that has been carried out, it is concluded that, in general, the teacher considers ESD competence necessary for teachers. This is supported by data and analysis, which illustrates that teachers still feel sufficiently related to perceptions of ESD implementation in schools. Meanwhile, the correlation obtained in this study included a positive but low level of relationship. This can be illustrated from the findings in the field where teachers feel competent, but it is sufficient to cause low correlation results at the time of implementation. This also causes the teacher to feel that competence which consists of knowledge, skills, attitudes.

5. REFERENCES

Amrulloh, M. S., & Galushasti, A. (2022). Professional development teacher to improve skills of science process and creativity of learners. *Journal of Education and Learning (EduLearn)*, *16*(3), 299–307. https://doi.org/10.11591/edulearn.v16i3.20404.

Baran, E., Correia, A. P., & Thompson, A. (2011). Transforming online teaching practice: Critical analysis of the literature on the roles and competencies of online teachers. *Distance Education*, *32*(3), 421–439. https://doi.org/10.1080/01587919.2011.610293.

Bravo, M. C. M., Chalezquer, C. S., & Serrano-Puche, J. (2021). Meta-framework of digital literacy: Comparative analysis of 21st century skills frameworks. *Revista Latina de Comunicacion Social*, *2021*(79), 76–110. https://doi.org/10.4185/RLCS-2021-1508.

Burhan, U. (2019). Self Efficacy, Self Actualization, Job Satisfaction, Organization Citizenship Behavior (Ocb), Effect on Employee Performance. *Ekuilibrium : Jurnal Ilmiah Bidang Ilmu Ekonomi*, *14*(1), 44. https://doi.org/10.24269/ekuilibrium.v14i1.1555.

Carayannis, E. G., & Morawska-Jancelewicz, J. (2022). The Futures of Europe: Society 5.0 and Industry 5.0 as Driving Forces of Future Universities. *Journal of the Knowledge Economy*, *0123456789*. https://doi.org/10.1007/s13132-021-00854-2.

Chen, S.-Y. (2022). To explore the impact of augmented reality digital picture books in environmental education courses on environmental attitudes and environmental behaviors of children from different cultures. In *Frontiers in Psychology* (Vol. 13). https://doi.org/10.3389/fpsyg.2022.1063659.

Chen, Y. (2022). How to improve the quality of youth education in developing countries. *Proceedings of the 2021 International Conference on Education, Language and Art (ICELA 2021)*, *637*(Icela 2021), 266–270. https://doi.org/10.2991/assehr.k.220131.048.

Dewi, R. S., Fahrurrozi, Hasanah, U., & Wahyudi, A. (2020). Reading Interest And Reading Comprehension A Correlational Study in Syarif Hidayatullah State Islamic University, Jakarta. *Talent Development & Excellence*, *12*(1), 241–250. http://repository.uinjkt.ac.id/dspace/handle/123456789/50885.

Dorouka, P., Papadakis, S., & Kalogiannakis, M. (2020). Tablets and apps for promoting robotics, mathematics, STEM education and literacy in early childhood education. *International Journal of Mobile Learning and Organization*, *14*(2), 255–274,. https://doi.org/10.1504/ijmlo.2020.10026334.

Emilzoli, M., Ali, M., & Rusman. (2021). Perceptions, attitudes and lifestyles of students of Madrasah Ibtidaiyah

Teacher Education Study Program about education for sustainable development. *IOP Conference Series: Earth and Environmental Science*, *739*(1). https://doi.org/10.1088/1755-1315/739/1/012058.

Fatimah, A. S., & Santiana, S. (2017). Teaching in 21St Century: Students-Teachers' Perceptions of Technology Use in the Classroom. *Script Journal: Journal of Linguistic and English Teaching*, *2*(2), 125. https://doi.org/10.24903/sj.v2i2.132.

Ferguson, T., Roofe, C., & Cook, L. D. (2021). Teachers' Perspectives on Sustainable Development: The Implications for Education for Sustainable Development. *Environmental Education Research*, 1–17. https://doi.org/10.1080/13504622.2021.1921113.

Fırat, E. E., & Laramee, R. S. (2018). Towards a survey of interactive visualization for education. *Computer Graphics and Visual Computing, CGVC 2018*, 91–101. https://doi.org/10.2312/cgvc.20181211.

Hermelingmeier, V., & von Wirth, T. (2021). The nexus of business sustainability and organizational learning: A systematic literature review to identify key learning principles for business transformation. *Business Strategy and the Environment*. https://doi.org/10.1002/bse.2719.

Hill, J. B. (2021). Pre-Service Teacher Experiences during COVID 19: Exploring the Uncertainties between Clinical Practice and Distance Learning. *Journal of Practical Studies in Education*, *2*(2), 1–13. https://doi.org/10.46809/jpse.v2i2.18.

Imara, K., & Altinay, F. (2021). Integrating education for sustainable development competencies in teacher education. *Sustainability*, *13*(22), 12555. https://doi.org/10.3390/su132212555.

Islam, M. K., Sarker, M. F. H., & Islam, M. S. (2022). Promoting student-centred blended learning in higher education: A model. *E-Learning and Digital Media*, *19*(1), 36–54. https://doi.org/10.1177/20427530211027721.

Jeong, K. O. (2017). The use of moodle to enrich flipped learning for english as a foreign language education. *Journal of Theoretical and Applied Information Technology*, *95*(18), 4845–4852. https://www.researchgate.net/profile/Kyeong-Ouk-Jeong/publication/325241776_The_use_of_moodle_to_enrich_flipped_learning_for_english_as_a_foreign_language_education/links/5bfd2ce0a6fdcc76e722f4f6/The-use-of-moodle-to-enrich-flipped-learning-for-english-as.

Kalogiannakis, M., & Papadakis, S. (2019). Evaluating pre-service kindergarten teachers' intention to adopt and use tablets into teaching practice for natural sciences. *International Journal of Mobile Learning and Organization*, *13*(1), 113–127,. https://doi.org/10.1504/ijmlo.2019.096479.

Karpan, I., Chernikova, N., Motuz, T., Bratanich, B., & Lysokolenko, T. (2020). Conceptual Principles of Education for Sustainable Development. *European Journal of Sustainable Development*, *9*(2), 99–114. https://doi.org/10.14207/ejsd.2020.v9n2p99.

Lestari, H., Ali, M., Sopandi, W., & Wulan, A. R. (2021). Infusion of environment dimension of ESD into science learning through the RADEC learning model in Elementary Schools. *Jurnal Penelitian Pendidikan IPA*, *7*, 205–212. https://doi.org/10.29303/jppipa.v7iSpecialIssue.817.

Müller, U., Hancock, D. R., Stricker, T., & Wang, C. (2021). Implementing ESD in Schools: Perspectives of Principals inGermany, Macau, and the USA. *Sustainability*, *13*(17), 1–16. https://doi.org/Müller.

Nardo, J. E., Chapman, N. C., Shi, E. Y., Wieman, C., & Salehi, S. (2022). Perspectives on Active Learning: Challenges for Equitable Active Learning Implementation. *Journal of Chemical Education*, *99*(4), 1691–1699. https://doi.org/10.1021/acs.jchemed.1c01233.

Nikmah, I. L., Juandi, D., & Prabawanto, S. (2019). Students' difficulties on solving mathematical problem based on ESD objectives. *In Journal of Physics: Conference Series*, *1157*(3), 032116. https://doi.org/10.1088/1742-6596/1157/3/032116.

Nurlailah, S., & Hamdu, G. (2021). Implementasi Assessment Sikap Berpikir Kritis Berbasis Education for Sustainable Development (ESD) di Sekolah Dasar. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *7*(3), 309. https://doi.org/10.32884/ideas.v7i3.390.

Nurtanto, M., Sofyan, H., Fawaid, M., & Rabiman, R. (2019). Problem-based learning (PBL) in industry 4.0: Improving learning quality through character-based literacy learning and life career skill (LL-LCS). *Universal Journal of Educational Research*, *7*(11), 2487–2494. https://doi.org/10.13189/ujer.2019.071128.

Óskarsdóttir, E., Donnelly, V., Turner-Cmuchal, M., & Florian, L. (2020). Inclusive school leaders – their role in raising the achievement of all learners. *Journal of Educational Administration*, *58*(5), 521–537. https://doi.org/10.1108/JEA-10-2019-0190.

Peedikayil, J. V., Vijayan, V., & Kaliappan, T. (2023). Teachers' Attitude Towards Education for Sustainable Development: A Descriptive Research. *International Journal of Evaluation and Research in Education*, 86–95. http://ejournal.iainmadura.ac.id/index.php/nuansa/article/view/8687.

Perkasa, M., Irwansyah, M., & Annafi, N. (2020). Teacher's perception on the implementation of education for sustainable development-based learning in senior high school. *In Journal of Physics: Conference Series*,

1521(4), 042110. https://doi.org/10.1088/1742-6596/1521/4/042110.

Pornpimon, C., Wallapha, A., & Prayuth, C. (2014). Strategy Challenges the Local Wisdom Applications Sustainability in Schools. *Procedia - Social and Behavioral Sciences*, *112*, 626–634. https://doi.org/10.1016/j.sbspro.2014.01.1210.

Rayuwati, R. (2020). How educational technology innovates distance learning during pandemic crisis in remote areas in Indonesia? *International Research Journal of Management, IT and Social Sciences*, *7*(6), 161–166. https://doi.org/10.21744/irjmis.v7n6.1032.

Rieckmann, M. (2018). Learning to transform the world: key competencies in Education for Sustainable Development. *Issues and Trends in Education for Sustainable Development*, 39–59.

Schneider, C., & Bodensohn, R. (2017). Student Teachers' Appraisal of the Importance of Assessment in Teacher Education and Self-Reports on the Development of Assessment Competence. *Assessment in Education: Principles, Policy and Practice*, *24*(2), 127–146. https://doi.org/http://dx.doi.org/10.1080/0969594X.2017.1293002.

Segara, N. B. (2015). Education for Sustainable Development (ESD) Sebuah Upaya Mewujudkan Kelestarian Lingkungan. *Social Science Education Journal*, *2*(1), 22–30. http://download.garuda.kemdikbud.go.id/article.php?article=2593748&val=24446&title=education for sustainable development esd sebuah upaya mewujudkan kelestarian lingkungan.

Siti, C., Md, L., Nur, L., Binti, D., Mohd, I., Afiq, D., & Tazilah, K. (2021). Application of technology acceptance model (TAM) toward online learning during covid-19 pandemic: Accounting students perspective. *International Journal of Business, Economics and Law*, *24*(1), 13–20. https://www.researchgate.net/profile/application_of_technology_acceptance_model_tam_towards_online_learning_during_covid-.19_pandemic_accounting_students_perspective/links/602547eaa6fdcc37a81d2da3/application-of-te.

Sulaiman, J., & Ismail, S. N. (2020). Teacher competence and 21st century skills in transformation schools 2025 (TS25). *Universal Journal of Educational Research*, *8*(8), 3536–3544. https://doi.org/10.13189/ujer.2020.080829.

Suprastowo, P. (2010). Kebijakan dan Implementasi Pendidikan untuk Pembangunan Berkelanjutan (Education for Sustainable Development/ESD). *Jurnal Penelitian Kebijakan Pendidikan*, *9*. https://core.ac.uk/download/pdf/143971307.pdf.

Sutiman, S., Sofyan, H., Arifin, Z., Nurtanto, M., & Mutohhari, F. (2022). Industry and Education Practitioners' Perceptions Regarding the Implementation of Work-Based Learning through Industrial Internship (WBL-II). *International Journal of Information and Education Technology*, *12*(10), 1090–1097. https://doi.org/10.18178/ijiet.2022.12.10.1725.

Tejedor, G., Segalàs, J., Barrón, Á., Fernández-Morilla, M., Fuertes, M. T., Ruiz-Morales, J., Gutiérrez, I., García-González, E., Aramburuzabala, P., & Hernández, À. (2019). Didactic strategies to promote competencies in sustainability. *Sustainability (Switzerland)*, *11*(7), 1–24. https://doi.org/10.3390/su11072086.

Tristananda, P. W. (2018). Membumikan education for sustainable development (ESD) di Indonesia dalam menghadapi isu-isu global. *Purwadita : Jurnal Agama Dan Budaya*, *2*(2), 42–49. https://stahnmpukuturan.ac.id/jurnal/index.php/Purwadita/article/download/86/79.

Vare, P., Arro, G., Hamer, A., Gobbo, G., Vries, G., Farioli, F., & Zachariou, A. (2019). Devising a Competence-Based Training Program for Educators of Sustainable Development: Lessons Learned. *Sustainability*, *11*(7), 1–21. https://doi.org/10.3390/su11071890.

Vergara, D., Paredes-Velasco, M., Chivite, C., & Fernández-Arias, P. (2020). The challenge of increasing the effectiveness of learning by using active methodologies. *Sustainability (Switzerland)*, *12*(20), 1–16. https://doi.org/10.3390/su12208702.

Waltner, E.-M., Scharenberg, K., Hörsch, C., & Rieß, W. (2020). What Teachers Think and Know about Education for Sustainable Development and How They Implement it in Class. *Sustainability*, *12*(4), 1–15. https://doi.org/10.3390/su12041690.

Winata, K. A. (2020). Model Pembelajaran Kolaboratif Dan Kreatif Untuk Menghadapi Tuntutan Era Revolusi Industri 4.0. *SCAFFOLDING: Jurnal Pendidikan Islam Dan Multikulturalisme*, *2*(1), 12–24. http://journal.unla.ac.id/index.php/pej/article/view/1077.

Yuniarti, Y. S., Hasan, R., & Ali, M. (2019). Competencies of education for sustainable development related to mathematics education in senior high school. *In Journal of Physics: Conference Series*, *1179*(1), 012075. https://doi.org/10.1088/1742-6596/1179/1/012075.

Zhang, Y., & Wang, P. (2021). Detecting the Historical Roots of Education for Sustainable Development (ESD): A Bibliometric Analysis. *International Journal of Sustainability in Higher Education*, 478–502. https://doi.org/10.1108/IJSHE-11-2020-0462.