Universitas Muhammadiyah Malang, East Java, Indonesia

JPBI (Jurnal Pendidikan Biologi Indonesia)

p-ISSN 2442-3750, e-ISSN 2537-6204 // Vol. 7 No. 3 November 2021, pp. 231-239

Research Article

Integration of local wisdom through Enculturation-Assimilation-Acculturation (EAA): A solution to enhance problem-solving skills

Ika Nurani Dewi [a,1,], Baiq Muli Harisanti [a,2,*], S. Sumarjan [b,3]

[a] Biology Education Department, Faculty of Mathematics and Natural Sciences Education, Universitas Pendidikan Mandalika, JL. Pemuda No 59A Mataram, West Nusa Tenggara, 83126, Indonesia

[b] Faculty of Agriculture, Universitas Mataram, JL. Majapahit No 62, Mataram, West Nusa Tenggara, 83126, Indonesia

[1] ikanuranidewi@ikipmataram.ac.id; [2] muli_lombok@yahoo.com *, [3] sumarjanfaperta@unram.ac.id

[*] Coresponding author

ARTICLE INFO

Article history
Received: 25 August 2020
Revised: 13 September 2021
Accepted: 09 November 2021
Published: 09 November 2021

Keywords
EAA
Learning model
Learning science
Local wisdom
Problem-solving skills

ABSTRACT

The 21st-Century learning has been widely associated with problem-solving skills in a global perspective but not much related to local wisdom, even though local perspectives are also needed in adapting people's daily social lives. The purpose of this research was to analyze the effectiveness of Enculturation-Assimilation-Acculturation (EAA) model in enhancing problem-solving skills in learning science. This is pre-experimental research by using one group pretest and post-test design. The samples used were 140 students from two junior high schools in West Nusa Tenggara: (1) SMPN 2 Gunung Sari and (2) SMPN 3 Lingsar. Data collection using a problem-solving test refers to Curtis & Denton. Local wisdom integrated into EAA is the culture of the Sasak Tribe, including *Bau Nyale*, *GORA* rice, and *awiq-awiq*. The analysis data was done using Paired t-test/Wilcoxon test, N-gain, Tukey, ANOVA, and Kruskal-Wallis. The results showed that the integrated EAA model effectively enhances problem-solving skills (sig 0.001). The level of increase is medium, the average level of increase in the six groups is significantly different, and there are differences in learning outcomes of problem-solving skills. Therefore, it can be concluded that the integrated EAA teaching model effectively enhances students' problem-solving skills. The results of this study imply that the EAA integration model can be used as an alternative to overcome the low scientific creativity and responsibility of students in West Nusa Tenggara.

How to cite: Dewi, I. N., Harisanti, B. M., & Sumarjan, S. (2021). Integration of local wisdom through Enculturation-Assimilation-Acculturation (EAA): A solution to enhance problem solving skills. *JPBI (Jurnal Pendidikan Biologi Indonesia), 7*(3), 231-239. https://doi.org/10.22219/jpbi.v7i3.13385

INTRODUCTION

The 21st-Century learning is marked by the integration of technology and information in various educational activities (Hussin, 2018; Scott, 2015; Thompson, 2017). In addition, learning in the global era is how complex communication skills are multidisciplinary (Bray & Tangney, 2016; English, 2016; Genlott & Grönlund, 2013). On the other hand, learning is also faced with preserving local cultural wisdom as a characteristic in interacting with the world globally (Fadli & Irwanto, 2020; Parmin et al., 2016). Several studies also report that strengthening local wisdom reinforces the superior quality of human resource development (Parmin et al., 2016; Suastra et al., 2017; Syaparuddin, 2018). These factors then need to be developed as a framework for Indonesian students' 21st-Century skills.

The 21st-century skills framework is a foothold in developing the 2013 curriculum (Mastur, 2017). Implementation of the 2013 Curriculum is intended to meet global competency needs. These skills include problem-solving skills. Problem-solving skills need to be possessed in order to be able to compete globally, help students consider the problems encountered in everyday life (Karatas & Baki, 2013), and make logical, accurate, and systematic decisions (Aka et al., 2010; Veysel, 2015). However, (Rannikmäe, 2016) explains that it is not enough for students to only be equipped with conducting experiments but must also be involved in the decision-making process and problem-solving in real life. Several research in junior high schools in West Lombok Regency shows that students' problem-solving abilities are still relatively low in general (Dewi et al., 2017). The individual completeness scores obtained by most students are below 40, much lower than the expected completeness criteria. The data illustrates that the majority of junior high school students still have difficulties in learning.

Factors that influence the low problem-solving ability are the science learning process in Indonesia, in general, lack of experimental activities. Science learning tends to be more emphasized on mastery of concepts and mathematical problem-solving. One alternative solution to improve problem-solving skills in science learning is applying integrated local wisdom learning through enculturation, assimilation, and acculturation. This model is an innovation from PBL and Inquiry (Overton & Randles, 2015). The results showed that students were able to think critically, recognize and solve complex problems by identifying and evaluating sources of information, and work effectively in small groups. The PBL model is widely used to improve students' attitudes towards science and facilitate the development of a sense of community in the classroom (Ferreira & Trudel, 2012). However, the application of investigative skills is still low, the interaction is limited, and they need much time to solve problems (Celik, 2011). Tosun & Taskesenligil (2013) concluded that there are difficulties in assessing skills, challenges to familiarize students, difficulties in preparing heterogeneous groups and overcoming problems during group collaboration, and facing competition between students. Weaknesses in applying the PBL model in learning include the lack of feedback so that it does not involve the role of student responsibility in controlling their learning process (Gorghiu et al., 2015).

The inquiry model is also strongly indicated to develop students' problem-solving and science process skills (Duran, 2014; Pedaste et al., 2015). Students can collaborate to build new cognitive creatively and independently and analyze opinions through the process of investigation and discovery (Opara & Oguzor, 2011). Based on several research results, an inquiry is a model that is widely applied in schools. Several studies state that inquiry requires much time for observing, drawing, and writing activities (Duran, 2014; Oğuz-Ünver & Arabacioğlu, 2011).

Integrating local culture in learning can improve students' thinking skills (Abidinsyah et al., 2019; Fadli & Irwanto, 2020; Syahrial et al., 2019). However, learning the integration of local wisdom still has several weaknesses. For example, the problem-solving process emphasizes building knowledge and is less related to the scientific knowledge possessed by local communities (Hunaepi et al., 2019). In addition, exploration activities are not in-depth, so they are not optimal in training students to find alternative problem solving (Fadli & Irwanto, 2020) and are not sustainable (Abidinsyah et al., 2019; Syahrial et al., 2019).

This study develops a science learning model by integrating problem-solving activities in PBL and inquiry with local wisdom. Integration through Enculturation-Assimilation-Acculturation (EAA) in the learning model is an innovation that provides students the broadest opportunity to solve problems critically while adhering to regional cultural values. Furthermore, the learning model for integrating local wisdom through adaptation of environmental conservation values contained in the social life of the community is expected to be able to develop problem-solving skills to maintain environmental balance (Abidinsyah et al., 2019). This study aimed to analyze the effectiveness of the EAA model in improving problem-solving skills in science learning. The contribution of this research is to develop alternatives in teaching students higher-order thinking skills.

METHOD

This pre-experiment uses a one group pre-test and post-test design (Fraenkel et al., 2012). Purposive sampling was used as a sampling technique in this study. The sample in this study included 140 seventh grade junior high school students with the distribution as shown in Table 1. The location of this research is Junior High School (JHS) 3 of Lingsar and Junior High School (JHS) 2 of Gunung Sari in West Lombok Regency (Indonesia) in March - May 2019. The research locations are divided into 2, namely: schools in urban and suburban areas. The consideration of choosing the location of the student's social environment is the influence of emerging modernization and the heterogeneity of society.

Table 1. The research sample

No	School	Groups	Total
1	JHS 3 of Lingsar	1	26
		2	27
		3	28
2	JHS 2 of Gunung Sari	4	20
		5	19
		6	20

This research emphasizes testing the application of the effectiveness of the integrated EAA learning model by analyzing the improvement in learning outcomes of junior high school students' problem-solving skills before and after the implementation of science learning activities. The learning process begins by giving a pre-test. The problem-solving skills test consists of five essay questions referring to Curtis and Denton (2003) including defining the problem, planning an approach, carrying out a plan, monitoring progress, reflecting on the result. The effectiveness of the integrated EAA learning model was determined based on the significant increase in scores between pre-test and post-test and the N-gain score in learning outcomes of problem-solving skills (Table 2). N-gain score criteria refer to (Hake, 1999).

Table 2. N-gain score criteria

No	N-Gain	Category
1	> 0.7	High
2	0.3 - 0 .7	Moderate
3	< 0.3	Low

Learning instructional is designed to integrate the local culture of the Sasak Tribe, including; local tradition *bau nyale*, the local farming system *padi gora*, local rules in the form of *awiq-awiq*, as well as animals and plants endemic to the Mount Rinjani area. The learning process ended with the provision of a post-test of problem-solving skills and cognitive science. Data analysis was performed using paired t-test (parametric) and Wilcoxon test (non-parametric), while the magnitude of the increase was calculated based on the N-gain. Finally, the magnitude of the interaction between the six groups was tested using ANOVA and continued with the Tukey test to determine differences between groups. This test was carried out with the help of IBM SPSS 17.0 software.

RESULTS AND DISCUSSION

The learning outcomes of problem solving skills at SMPN 3 Lingsar and SMPN 2 Gunung Sari in the six groups are presented in Table 3. The results showed that there was an increase in problem solving skills in each indicator in all groups. Indicators of problem solving ability achieved are in the low to moderate category The lowest N-gain value on progress monitoring indicators and results reflection in group 1 is 0.03 (low), while the highest N-gain is in group 3 planning implementation indicators of 0.62 (medium).

Table 3. Average n-gain of problem-solving skill for all groups.

School	Group	Indicator of Problem-solving Skill				
		DP	PA	COP	MP	RR
JHS 3 of Lingsar	Group 1	.22	.33	.36	.03	.03
	Group 2	.19	.22	.39	.25	.22
	Group 3	.22	.29	.62	.25	.15
JHS 2 of Gunung Sari	Group 4	.23	.31	.24	.19	.21
	Group 5	.34	.33	.28	.30	.20
	Group 6	.45	.33	.38	.58	.34

Note: DP = defining the problem, PA = planning an approach, COP = carrying out a plan, MP = monitoring progress, RR = reflecting on the result

Based on Table 4, the data on student learning completeness in groups 1 to 3 is below 50, which shows that most students still have low learning outcomes. Some indications that can be identified are that students are still accustomed to the previous learning pattern, students' learning abilities are different, and the evaluation questions given are the same as the practice questions on the worksheets and the concentration of students' learning. Students who do not complete their learning outcomes are due to their low ability to understand the material, so they have difficulty mastering concepts. The low activity observed also affects students' cognitive learning outcomes (Demoin & Jurisson, 2013), which explains that a concept is built through social interaction.

Table 4. The normalized pre-test and post-test of problem-solving skill

Group	N	Test	Problem-solving Skill			
			Mean	**Std. Dev**	**Asymp. Sig .(2-tailed)**	**Normal Distrib.**
Group 1	26	pre-test	23.94	1.00	.20	Yes
		post-test	41.63	1.69	.10	Yes
Group 2	27	pre-test	28.37	1.08	.10	Yes
		post-test	43.74	1.58	.04	No
Group 3	28	pre-test	37.54	9.74	.20	Yes
		post-test	53.36	1.31	.20	Yes
Group 4	19	pre-test	37.79	1.20	.20	Yes
		post-test	62.63	1.69	.10	Yes
Group 5	20	pre-test	36.20	1.47	.18	Yes
		post-test	64.13	2.06	.20	Yes
Group 6	20	pre-test	37.85	9.76	.20	Yes
		post-test	72.13	1.07	.20	Yes

Table 4 shows that the pre-test and post-test scores of problem-solving skills were normally distributed in all groups, except for group 2, which were not normally distributed in the post-test scores. Therefore, to determine the effect of learning with the integrated EAA learning model in improving learning outcomes of problem-solving skills, paired t-test was used, except for problem-solving skills in group 2, which were not normally distributed, analyzed using the Wilcoxon test. The results of paired t-test and Wilcoxon test are presented in Table 5.

Table 5. Paired t-test and Wilcoxon test results of problem-solving skill.

Group	N	Paired t-test					Wilcoxon test	
		Std. Dev	**Std. Error mean**	**t**	**df**	**Sig. (2-tailed)**	**Z**	**p**
Group 1	26	10.48	2.05	-8.60	25	.00		
Group 2	27						-4.54	.001
Group 3	28	4.71	.89	-17.75	27	.00		
Group 4	19	9.06	2.07	-11.94	18	.00		
Group 5	20	9.62	2.15	-12.97	19	.00		
Group 6	20	8.89	1.98	-17.24	19	.00		

Table 5 shows that the paired test results are significant (sig <.05), as well as the Wilcoxon test results, and show a Z score of 4.54 with a significance level of p <.05. These results indicate an increase in learning outcomes of problem-solving skills in all groups after the integrated EAA learning model is applied. The effectiveness of the integrated EAA learning model is known based on the achievement of students' problem-solving skills in science learning seen from the increase in the pre-test and post-test scores, the N-gain score of problem-solving skills in each group is in the low and medium categories, and the interaction between groups is consistent.

Table 6. ANOVA test of problem-solving skill and science cognitive problem in all groups.

N-gain of all group		Sum of square	df	Mean square	F	Asymp. sig (2-tailed)
Problem-solving skill	Between groups	2.19	5	.43	16.78	.001
	Within groups	3.49	134	.02		
	Total	5.68	139			

The results of the different tests (Table 6) show the significance of the students' problem-solving skills aspect of 0.001 (sig <.05). These results indicate differences in improving student problem-solving skills learning outcomes after applying science learning using the integrated EAA learning model for all groups. Furthermore, the results of the Tukey test shows that there are differences in problem-solving between groups (Table 7).

The Tukey test results showed that the problem-solving abilities of students in group 4 and group 6 were in the high category, while the others were at moderate (group 5) and low levels (group 1, 2, and 3). The integration of local wisdom values in an integrated manner through enculturation, assimilation, and acculturation (EAA) is indicated to connect students' cognitive knowledge with the traditions of local communities in everyday life (Abidinsyah et al., 2019; Parmin et al., 2016). The nature of meaningful learning that is strengthened through the expression of community ideas encourages students to be wise in solving problems (Belecina & Ocampo, 2018; Ferreira & Trudel, 2012). Problem elaboration activities in the learning process familiarize students with digging up the information needed to describe the problem. Furthermore, it can increase students' creativity (Birgili, 2015; Im et al., 2015), generate ideas (Parmin et al., 2015), and solve problems (Binkley et al., 2012). The integrated EAA model can help students find solutions to problems given through group work.

Table 7. Tukey test of problem-solving skill learning

Group	N	Subset for alpha 5 %		
		1	2	3
Group 1	26	.26		
Group 3	28	.27		
Group 2	27	.29		
Group 5	20		.51	
Group 6	20			.66
Group 4	19			.76
Sig.		.96	1.00	.20

At the beginning of the lesson, students are trained to understand the phenomena of growing rice in dryland (*padi gora*), endemic fauna conservation (*Nyale*), and environmental conservation (*Awiq-Awiq*) through pictures and videos. Identification of scientific principles through observation enables us to identify and then classify problems based on concepts. Based on these observations, it is hoped that questions will arise in the minds of students. These questions will help focus and build students' thinking (Opara & Oguzor, 2011). Information processing theory explains that a person needs to pay attention to information so that important information can always be remembered and stored in short-term memory (Im et al., 2015).

The second step is to make a problem-solving plan. Planning skills emerge when students identify problems (Oğuz-Ünver & Arabacioğlu, 2011). In general, students develop problem-solving plans that only meet one or two criteria, meaning that students' problem-solving abilities are still in the low category. It is because almost all students have difficulty starting to formulate problems, formulate hypotheses to identify variables. In other words, students cannot yet think systematically. In addition, most students lack attention to the material given, and some depend on more competent students. However, overall there was an increase in the n-gain score of the planning indicators for each group. These results indicate that students who can understand the problem well can make a problem-solving plan. The data relating to the causes of low planning skills above follows the functional fixation theory (Solso et al., 2014) that students tend to see things based on their everyday uses and have difficulty accepting new perspectives needed in problem-solving. It is supported by (Mueller et al., 2012) that a person is born as a problem-solver, but creativity barriers often interfere with the ability to recognize ideas.

Students' skills in problem-solving planning are related to the ability to understand the problem to be solved and their initial cognitive (Duran et al., 2011; Oğuz-Ünver & Arabacioğlu, 2011). Gagne stated that students' initial cognitive contributions contributed to forming cognitive understanding (Choy & Cheah, 2009; Wilson, 2016). Guidance can slowly be stopped when students can complete the task without the help of others. It shows that monitoring can be achieved through assimilated reconstruction of problem-solving results. In this process, students juxtapose their understanding of tradition as a science. Likewise, according to Dewi et al (2017), the ability to monitor will continue to develop well if students are given the proper learning. Students who have been able to monitor means that they can understand, analyze, interpret, and define the problem and connect the signals from the problem statement to determine goals (Gorghiu et al., 2015; Tosun & Taskesenligil, 2013). La'biran (2017) explains that monitoring through discussion can help fulfill three primary learning objectives, including increasing student involvement in the learning process, developing understanding by providing opportunities to think about and then communicating it, and helping students acquire communication skills. Students who carry out monitoring activities have used their thinking skills in terms of translating. In addition, in integrated learning with EAA, the teacher facilitates students to explain problems and problem-solving plans that students have prepared for other groups (Abidinsyah et al., 2019; Hunaepi et al., 2019).

The assessment of students' reflection skills showed an increase even though it had not reached the expected value. Measurement of reflection ability is carried out to show students' understanding, including before, during, and after learning (McCrum, 2017; Rahmatih et al., 2020). Reflection through acculturation is not limited to cognitive aspects but allows reflection on students' thoughts and learning experiences (Persico et al., 2010). The results showed that many students still had difficulty in reflecting on problem-solving activities. It is closely related to how students' prior knowledge is the basis for thinking in problem-solving. In practicing problem-solving, students need to gradually observe and imitate what has been done to solve the given problem (Listiyani, 2018). The implementation of the EAA model provides enough space for students to do this. It can be seen from how students actively seek solutions to the problems given at the beginning of learning through group work. When the teacher presents problems based on local wisdom, most students pay attention to the displayed phenomena, formulate problems from the phenomena displayed, and then discuss solutions to the problem formulations prepared with guidance by the teacher (Shaaruddin & Mohamad, 2017). Reflection activities in learning aim to assess how students respond in a lesson or delivery of a material; so that teachers can understand what are the weaknesses and shortcomings of a lesson that has been delivered in class (Rahmatih et al., 2020).

The increase in problem-solving abilities is also due to the development of integrated worksheets of local wisdom that facilitate students to practice thinking skills. Together with groups, students analyze problems in discussion activities to find out the solutions that will be carried out. Discussion activities are carried out by expressing opinions and sharing ideas between friends. De Cock (2012) stated that students get cognitive concepts and essential subject matter through problem-based learning. With a worksheet that presents problems based on local wisdom on the island of Lombok, students carry out investigative activities to solve problems by the ethno science of the local community. Students who have acquired problem-solving thinking can discuss information in achieving the desired goals effectively (Argaw et al., 2017; Binkley et al., 2014).

CONCLUSION

The results of this research indicate that the integrated EAA teaching model is effective in improving problem-solving skills. This research results imply that the integrated EAA teaching model can be used as an alternative innovation to overcome the low problem-solving skill, which at the same time students have good natural science cognitive mastery. However, they can also maintain the noble values of national culture by cultivating local wisdom. Further research is needed on other material and at various levels of education. The contribution of the results of this study is that the EAA integration model can be used as an alternative to overcome the low scientific creativity and responsibility of students in NTB - Indonesia.

ACKNOWLEDGEMENT

The researchers thank the Ministry of Research, Technology, and Higher Education, who have funded the research [Contract number 03 / K8.0570 / L1 / SK / IKIP-Mtr / 2018]. Likewise, the researchers expressed their gratitude to IKIP Mataram, Junior High School 3 of Lingsar, Junior High School 2 of Gunung Sari, and Surabaya State University, which allowed them to carry out research activities.

REFERENCES

Abidinsyah, A., Ramdiah, S., & Royani, M. (2019). The implementation of local wisdom-based learning and HOTS-based assessment: Teacher survey in Banjarmasin. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *5*(3), 407–414. https://doi.org/10.22219/jpbi.v5i3.9910

Aka, E. I., Güven, E., & Aydoğdu, M. (2010). Effect of problem solving method on science process skills and academic achievement. *Journal of Turkish Science Education*, *7*(4), 13–25. http://tused.org/index.php/tused/article/view/533

Argaw, A. S., Haile, B. B., Ayalew, B. T., & Kuma, S. G. (2017). The effect of problem based learning (PBL) instruction on students' motivation and problem solving skills of physics. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(3), 857–871. https://doi.org/10.12973/eurasia.2017.00647a

Belecina, R. R., & Ocampo, J. M. (2018). Effecting change on students' critical thinking in problem solving. *EDUCARE: International Journal for Educational Studies International Journal for Educational Studies Article Timeline: Accepted*, *10*(102), 109–118. https://doi.org/10.2121/edu-ijes.v10i2.949

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining twenty-first century skills. In P. Griffin, B. McGaw, & E. Care (Eds.), *Assessment and teaching of 21st* *century skills* (pp. 17–66). Springer. https://doi.org/10.1007/978-94-007-2324-5

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2014). Defining twenty-first century skills. In *Assessment and teaching of 21st century skills*. https://doi.org/10.1007/978-94-007-2324-5_2

Birgili, B. (2015). Creative and critical thinking skills in problem-based learning environments. *Journal of Gifted Education and Creativity*, *2*(2), 71–80. https://doi.org/10.18200/JGEDC.2015214253

Bray, A., & Tangney, B. (2016). Enhancing student engagement through the affordances of mobile technology: a 21st century learning perspective on Realistic Mathematics Education. *Mathematics Education Research Journal*, *28*(1), 173–197. https://doi.org/10.1007/s13394-015-0158-7

Celik, S. (2011). Characteristics and competencies for teacher educators: Addressing the need for improved professional standards in Turkey. *Australian Journal of Teacher Education*, *36*(4). https://doi.org/10.14221/ajte.2011v36n5.6

Choy, S. C., & Cheah, P. K. (2009). Teacher perceptions of critical thinking among students and its influence on higher education. *International Journal of Teaching and Learning in Higher Education*, *20*(2), 198–206. https://files.eric.ed.gov/fulltext/EJ864337.pdf

Curtis, D., & Denton, R. (2003). The authentic performance-based assessment of problem-solving generic skills. In *NCVER*. https://ncver.edu.au/__data/assets/file/0011/5015/nr2007.pdf

De Cock, M. (2012). Representation use and strategy choice in physics problem solving. *Physical Review Special Topics - Physics Education Research*, *8*(2), 1–15. https://doi.org/10.1103/PhysRevSTPER.8.020117

Demoin, D. W., & Jurisson, S. S. (2013). Chemical kinetics laboratory discussion worksheet. *Journal of Chemical Education*, *90*(9), 1200–1202. https://doi.org/10.1021/ed400059f

Dewi, I. N., Ibrahim, M., & Poedtjiastoeti, S. (2017). Validitas model pembelajaran integrasi kearifan lokal (IKL) untuk mengembangkan keterampilan penyelesaian masalah dan komunikasi ilmiah. *Seminar Nasional Pendidikan Biologi Dan Biologi*, *2011*, 7–14. http://seminar.uny.ac.id/sembiouny2017/sites/seminar.uny.ac.id.sembiouny2017/files/PB 2_0.pdf

Duran, M. (2014). A Study on 7 th Grade Students' Inquiry and Communication Competencies. *Procedia - Social and Behavioral Sciences*, *116*, 4511–4516. https://doi.org/10.1016/j.sbspro.2014.01.976

Duran, M., Işik, H., Mihladiz, G., & Özdemir, O. (2011). The relationship between the pre-service science teachers' scientific process skills and learning styles. *Western Anatolia Journal of Educational Science*, 467–476. http://webb.deu.edu.tr/baed/giris/baed/ozel_sayi/467-476.pdf

English, L. D. (2016). STEM education K-12: Perspectives on integration. *International Journal of STEM Education*, *3*(1), 1–8. https://doi.org/10.1186/s40594-016-0036-1

Fadli, A., & Irwanto. (2020). The effect of local wisdom-based ELSII learning model on the problem solving and communication skills of pre-service islamic teachers. *International Journal of Instruction*, *13*(1), 731–746. https://doi.org/10.29333/iji.2020.13147a

Ferreira, M. M., & Trudel, A. R. (2012). The impact of problem based learning (PBL) on student attitudes toward science, problem-solving skills, and sense of community in the classroom. *Journal of Classroom Interaction*, *47*(1), 23–30. https://www.jstor.org/stable/43858871

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (Eighth Edi). https://saochhengpheng.files.wordpress.com/2017/03/jack_fraenkel_norman_wallen_helen_hyun-how_to_design_and_evaluate_research_in_education_8th_edition_-mcgraw-hill_humanities_social_sciences_languages2011.pdf

Genlott, A. A., & Grönlund, Å. (2013). Improving literacy skills through learning reading by writing: The iWTR method presented and tested. *Computers and Education*, *67*(2013), 98–104. https://doi.org/10.1016/j.compedu.2013.03.007

Gorghiu, G., Drăghicescu, L. M., Cristea, S., Petrescu, A.-M., & Gorghiu, L. M. (2015). Problem-based learning - An efficient learning strategy in the science lessons context. *Procedia - Social and Behavioral Sciences*, *191*, 1865–1870. https://doi.org/10.1016/j.sbspro.2015.04.570

Hake, R. R. (1999). *Analyzing change/gain scores*.

Hunaepi, H., Dewi, I. N., & Sumarjan, S. (2019). Profiling students' environmental care attitudes taught using Sasak Tribe local wisdom-integrated model. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *5*(3), 549–558. https://doi.org/10.22219/jpbi.v5i3.10009

Hussin, A. A. (2018). Education 4.0 made simple: Ideas for teaching. *International Journal of Education and Literacy Studies*, *6*(3), 92–98. https://doi.org/10.7575/aiac.ijels.v.6n.3p.92

Im, H., Hokanson, B., & Johnson, K. K. P. (2015). Teaching creative thinking skills: A longitudinal study. *Clothing and Textiles Research Journal*, *33*(2), 129–142. https://doi.org/10.1177/0887302X15569010

Karatas, I., & Baki, A. (2013). The effect of learning environments based on problem solving on students' achievements of problem solving. *International Electronic Journal of Elementary Education*, *5*(3), 249–267. https://www.iejee.com/index.php/IEJEE/article/view/25

La'biran, R. (2017). Improving speaking ability through small groups discussion for the eighth year students of SMPN 2 Saluputti in Tana Toraja. *Elite: English and Literature Journal*, *4*(1), 51–62. https://doi.org/10.24252/elite.v4i1a5

Listiyani, L. R. (2018). Implementasi model pembelajaran inkuiri berbasis refleksi kelompok pada materi reaksi redoks. *Jipva*, *2*, 58. https://doi.org/10.31331/jipva.v2i1.576

Mastur, M. (2017). Implementasi Kurikulum 2013 dalam pelaksanaan pembelajaran di SMP. *Jurnal Inovasi Teknologi Pendidikan*, *4*(1), 50. https://doi.org/10.21831/jitp.v4i1.10131

McCrum, D. P. (2017). Evaluation of creative problem-solving abilities in undergraduate structural engineers through interdisciplinary problem-based learning. *European Journal of Engineering Education*, *42*(6), 684–700. https://doi.org/10.1080/03043797.2016.1216089

Mueller, J. S., Melwani, S., & Goncalo, J. A. (2012). The bias against creativity: Why people desire but reject creative ideas. *Psychological Science*, *23*(1), 13–17. https://doi.org/10.1177/0956797611421018

Oğuz-Ünver, A., & Arabacioğlu, S. (2011). Overviews on inquiry based and problem based learning methods. *Western Anatolia Journal of Educational Sciences (WAJES)*, *Selected papers presented at WCNTSE*, 303–310. http://webb.deu.edu.tr/baed/giris/baed/ozel_sayi/303-310.pdf

Opara, J. A., & Oguzor, N. S. (2011). Inquiry instructional method and the school science currículum. *Current Research Journal of Social Sciences*, *3*(3), 188–198. https://maxwellsci.com/print/crjss/v3-188-198.pdf

Overton, T. L., & Randles, C. A. (2015). Beyond problem-based learning: Using dynamic PBL in chemistry. *Chemistry Education Research and Practice*, *16*(2), 251–259. https://doi.org/10.1039/c4rp00248b

Parmin, P., Sajidan, S., Ashadi, A., & Sutikno, S. (2015). Skill of prospective teacher in integrating the concept of science with local wisdom model. *Jurnal Pendidikan IPA Indonesia*, *4*(2), 120–126. https://doi.org/10.15294/jpii.v4i2.4179

Parmin, Sajidan, Ashadi, Sutikno, & maretta, Y. (2016). Preparing prospective teachers in integrating science and local wisdom through practicing open inquiry. *Journal of Turkish Science Education*, *13*(2), 3–14. https://doi.org/10.12973/tused.10163a

Pedaste, M., Mäeots, M., Siiman, L. A., Jong, T. De, Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, *14*, 47–61. https://doi.org/10.1016/j.edurev.2015.02.003

Persico, D., Pozzi, F., & Sarti, L. (2010). Monitoring collaborative activities in computer supported collaborative learning. *Distance Education*, *31*(1), 5–22. https://doi.org/10.1080/01587911003724603

Rahmatih, A. N., Maulyda, M. A., & Syazali, M. (2020). Reflection of local wisdom value on sains learning in elementary school: Literature review. *Jurnal Pijar Mipa*, *15*(2), 151. https://doi.org/10.29303/jpm.v15i2.1663

Rannikmäe, M. (2016). Some crucial areas in science education research corresponding to the needs of the contemporary society. *Journal of Baltic Science Education*, *15*(1), 1–6. https://doi.org/10.33225/jbse/16.15.04

Scott, C. L. (2015). *The futures of learning 2: What kind of learning for the 21st Century?* https://unesco.org/ark:/48223/pf0000242996

Shaaruddin, J., & Mohamad, M. (2017). Identifying the effectiveness of active learning strategies and benefits in curriculum and pedagogy course for undergraduate TESL students. *Creative Education*, *8*(14), 2312–2324. https://doi.org/10.4236/ce.2017.814158

Solso, R. L., Maclin, O. H., & Maclin, M. K. (2014). Cognitive Psychology. In *British Library Cataloguing-in-Publication Data* (Eighth Edi). Pearson Education Limited. https://toaz.info/docdownloadv2-solso-robert-l-cognitive-psychology-pearson-2013-kognitifpdf-pr_308a56c5e3f3f8ebec65c75fc4e140bf?data_code=fbf9f1d92ee1c3a1ccc9b249c6fa4427

Suastra, I. W., Jatmiko, B., Ristiati, N. P., & Yasmini, L. P. B. (2017). Developing characters based on local wisdom of bali in teaching physics in senior high school. *Jurnal Pendidikan IPA Indonesia*, *6*(2), 306–312. https://doi.org/10.15294/jpii.v6i2.10681

Syahrial, S., Asrial, A., Kurniawan, D. A., & Pratama, R. A. (2019). Towards improving the critical thinking skills of pre-service teachers in Indonesia. *Journal of Education and Learning (EduLearn)*, *13*(4), 575–582.

https://doi.org/10.11591/edulearn.v13i4.13613

Syaparuddin. (2018). Revitalizing Buginese local wisdom in the development of local economy: Constructing paradigm and models. *IOP Conference Series: Earth and Environmental Science*, *175*(1). https://doi.org/10.1088/1755-1315/175/1/012142

Thompson, T. (2017). Teaching creativity through inquiry science. *Gifted Child Today*, *40*(1), 29–42. https://doi.org/10.1177/1076217516675863

Tosun, C., & Taskesenligil, Y. (2013). The effect of problem-based learning on undergraduate students' learning about solutions and their physical properties and scientific processing skills. *Chemistry Education Research and Practice*, *14*(1), 36–50. https://doi.org/10.1039/c2rp20060k

Veysel, T. (2015). The problem-solving skills of the teachers ın various branches. *Educational Research and Reviews*, *10*(5), 641–647. https://doi.org/10.5897/err2014.2059

Wilson, L. O. (2016). Anderson and Krathwohl bloom's taxonomy revised understanding the new version of bloom's taxonomy. *The Second Principle*. https://intranet.ecu.edu.au/__data/assets/pdf_file/0010/772867/Understanding-the-New-Blooms-Taxonomy-Wilson-2016.pdf