

## INCREASING STUDENTS' INDEPENDENCE THROUGH A CULTURALLY RESPONSIVE TEACHING APPROACH BASED ON MADURA CULTURE

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### ABSTRACT

Student independence is a condition or ability of students to carry out learning activities that are driven by their own will, their own choices and their own responsibility for learning. Student independence can be encouraged through a culture-based approach known as the Culturally Responsive Teaching Approach. This research aims to increase students' independence through a culturally responsive teaching approach based on Madurese culture. This research is Classroom Action Research using a model developed by Kurt Lewin. The subjects in this research were 30 students in class VII B of SMP Negeri 1 Bangkalan for the 2023/2024 academic year. This research was divided into two cycles, namely cycle I (two meetings) and cycle II (three meetings) using observation sheets as a data collection technique. The results of the research showed that the average percentage of independence, which initially had an average percentage of 56% in cycle I in the sufficient category, increased to 69% in cycle II in the good category. So the average increase in the percentage of student independence in cycles I and II increased by 13%. Thus, it can be concluded that the application of a culturally responsive teaching approach based on Madurese culture can increase students' independence.

*Keywords: Culturally Responsive Teaching, Madurese Culture, Student Independence*

### INTRODUCTION

In improving the quality of learning in schools, there are many factors that must be considered, such as: educators (teachers), students, facilities and infrastructure, the environment and management (Al-Balushi, Ambusaidi, Al-Balushi, Al-Hajri, & Al-Sinani, 2020; Chen & Yu, 2019; Matsuyama et al., 2019). Teachers and students are the two main components, which play an active role in ongoing learning activities (Muganga & Ssenkusu, 2019). The role and responsibility of the teacher is to manage the class by empowering all the potential of students so that the learning process continues (BARA & XHOMARA, 2020; Benlahcene, Lashari,

Lashari, Shehzad, & Deli, 2020; Coleman & Money, 2020; Keiler, 2018). This means that when the learning process in class takes place, the teacher must manage the class professionally to create a conducive learning environment. Therefore, teachers must have good pedagogical competence. Pedagogical competency is the competency or skill that teachers need to have in managing a learning process or the ability to interact with students (Hartini, 2019; Irviana, 2016; Salim Nahdi, Yonanda, & Agustin, 2018; Sudarsana et al., 2019).

The independent learning curriculum is present with the aim of developing teacher pedagogical competence through 5 methods,

namely; Humanizing Relationships, Understanding Concepts, Building Sustainability, Choosing Challenges, and Empowering Contexts (Haris, 2019). The existence of an independent learning curriculum is expected to provide a reflection of the formation of character education that fully contributes to the future of the nation, known as the Pancasila Student Profile (PPP).

The Pancasila Student Profile (PPP), which is the vision of the Ministry of Education and Culture 2020-2024, is part of Indonesia's Vision 2045 in realizing an advanced Indonesia that is sovereign, independent, and has personality through the creation of Pancasila Students who reason critically, creatively, independently, have faith, and are devoted to God Almighty (Nurtanto, Fawaid, & Sofyan, 2020; Saputro, Atun, Wilujeng, Ariyanto, & Arifin, 2020) and have noble character, work together and have global diversity (Endrayana Putut Laksminto Emanuel, Meidiana, & Suhartono, 2021; Endrayana Putut Laksminto Emanuel & Meilantifa, 2022; Putut, Emanuel, & Anam, 2022; Putut, Emanuel, Nusantara, Rahman, & Rahardi, 2023). One of the key elements of PPP values is that Indonesian students are independent students, namely students who are responsible for the process and results of their learning. PPP in independent values has two key elements in the form of 1) awareness of oneself and the situation at hand, and 2) self-regulation. In this case the researcher will provide research limitations, namely focusing on the elements of self-regulation in the development of an independent profile in sub-dimensions 3) showing initiative and working independently and 5) becoming a confident, resilient and adaptive individual (Aini, Emanuel, & Chamidah, 2021; E. P.L. Emanuel, Kirana, & Chamidah, 2021; Putut Laksminto Emanuel & Zakiyah, 2021).

Based on initial observations in class VII-B SMPN 1 Bangkalan, it appears that students are not or less independent in participating in learning. When doing exercises or individual assignments, students ask a lot of questions and depend on their friends, and when asked questions, students

are still afraid to answer. So that during the teaching and learning process students tend to be passive when participating in learning. In addition, when working in groups, students with low abilities play less of a role in carrying out tasks and depend on other members (Hadinugrahaningsih, Rahmawati, & Ridwan, 2017; Jonsson, Norqvist, Liljekvist, & Lithner, 2014). As a result, they obtain low learning outcomes and are less independent in participating in learning.

Students' learning independence is needed so that they have responsibility in organizing and disciplining themselves (Sitorus & Masrayati, 2016). With a willingness to learn, students can create responsibility for independent learning and gain knowledge (Chikiwa & Schäfer, 2018; Fazriyah, Supriyati, & Rahayu, 2018; Kim et al., 2019; Permana, Hindun, Rofi'ah, & Azizah, 2019). Apart from that, the learning independence factor can be influenced by the teaching methods used by the teacher in delivering the material.

One-way learning makes the learning atmosphere boring, it is feared that it will affect students' motivation to learn the material (Aizikovitsh-Udi & Cheng, 2015). Students who have an interest in learning mathematics means they have the effort and willingness to study mathematics. Students need real problems that they encounter in everyday life (Ioannou, 2017; Jones, 2020; Stewart, Troup, & Plaxco, 2019; Tasara, 2017). In line with this, educators need to be aware of the close relationship between culture and students' way of thinking. Integration of students' cultural backgrounds is an effort to bring students closer to the learning context and students' awareness of their cultural identity. In addition, teachers must be aware of cultural and social issues that influence student behavior in order to create effective classroom management.

One learning approach that links learning with students' culture is the Culturally Responsive Teaching (CRT) approach, which is a learning approach that uses cultural knowledge, students' experiences and students' learning styles to

create more meaningful learning (Afriyani, Sa'dijah, Subanji, & Muksar, 2018; Netti, Nusantara, Subanji, Abadyo, & Anwar, 2016; Purnomo, Nusantara, Subanji, & Rahardjo, 2017). This approach allows students to see the relevance and meaning of the subject matter to their life experiences, thereby generating higher interest and involvement. Culturally Responsive Teaching (CRT) is carried out by applying the cultural knowledge possessed by students. CRT components include: 1) Self identification, 2) Cultural understanding, 3) Collaboration, 4) transformative construction and 5) transformative construction (Listiyowati, 2023). Then students will see problems related to their cultural environment and then solve them with mathematical concepts.

Cultural integration through the Culturally Responsive Teaching approach involves students in involving their cultural identity and nationalism, awareness of cultural differences, and development of a learning identity. So that students discover new learning experiences and have helped develop their mathematical knowledge from their cultural background (Maryono, Sutawidjaja, Subanji, & Irawati, 2017). Madura has a diverse culture ranging from kerapan sape, saronen music, Madurese sinden dance, macapat, sandhur, arokat culture, the ritual of pellets, and so on. Madurese culture that appears in learning through the culturally responsive teaching (CRT) approach is kerapan sapi (kerabhen sape), typical Madurese food such as sewel (siwil) and Madurese satay as well as typical Madurese souvenirs, namely tette chips, and also related to traditional Madurese clothing. (Sakera and Marlana),

In the context of students' independent learning, a culturally responsive teaching approach can involve using problems that are relevant to students' Madurese culture and providing different integer learning experiences through a cultural perspective, and empowering students to acquire knowledge of integer material independently. Through independent learning, students can explore their own potential because

independent learning will build on knowledge that is already known and form new knowledge responsibly (Irianti, Subanji, & Chandra, 2016; Purnomo et al., 2017; Subanji, 2015). This can provide a more enjoyable, interesting and meaningful learning experience for students. So this research aims to increase students' independence through a culturally responsive teaching approach based on Madurese culture.

## METHOD

This research is Classroom Action Research. The subjects in this research were 30 students in class VII B of SMP Negeri 1 Bangkalan for the 2023/2024 academic year. This research model consists of four components, namely: a) planning, b) action, c) observation and d) reflection. This research consists of two cycles, namely cycle I (two meetings) and cycle II (three meetings). The cycle is declared to have ended if the research results obtained have met the specified success indicators (Cresswel, 2013; Kelly, 2014).

Data collection techniques are carried out using observation with the aim of viewing, observing and recording activities teachers and students regarding students' learning independence during the learning process. The research instrument is an independence observation sheet which contains five indicators and eleven aspects of student independence. Using a Likert scale, observers will give a score of 1 (very poor), 2 (poor), 3 (fair), 4 (good), 5 (Very good). Data analysis in this research uses qualitative analysis techniques and quantitative analysis. The criteria used in this research use the following criteria:

**Table 1.** Criterias for student's independence

No	Percentage	Categories
1	$80 < X \leq 100$	Very Good
2	$60 < X \leq 80$	Good
3	$40 < X \leq 60$	Pair
4	$20 < X \leq 40$	Poor
5	$0 < X \leq 20$	Very Poor

## RESULT

In this research, researchers used a culturally responsive teaching approach based on Madurese culture to increase students' independence in Mathematics class VII-B at SMP Negeri 1 Bangkalan, with material on integers. This classroom action research includes two cycles. Cycle I consists of two meetings and Cycle II consists of three meetings each. The material used is the integer.

The first cycle consists of two meetings, namely the first meeting on 16 August with sub-material on the concept of multiplication of integers which is integrated with Karapan sapi culture (kerabhen sape) and the second meeting on 18 August with sub-material on exponents integrated with typical Madurese snacks, namely sewel (siwil). Learning is carried out based on the teaching modules that have been prepared. The learning process using the CRT approach has component stages, namely self identification, cultural understanding, collaboration, critical reflections, transformative construction. Based on the data analysis that has been carried out, the results of student independence in cycle I were obtained with the following details:

**Table 2.** Recapitulation of Student Independence Data in Cycle I

No	Indicators	Cycle I		Average (%)
		P1	P2	
1	Able to identify things that support and hinder	60%	61%	61%
2	in achieving goals.	51%	58%	56%
3	Able to effectively manage time	53%	58%	56%
4	Show good performance in every situation and condition (confident)	53%	58%	53%
5	Can work under pressure conditions (resilient).	46%	55%	51%
% Independence		53%	58%	56%

Based on table 2, analysis of data from observations in cycle I shows an increase in the average percentage of student independence from the first meeting, namely 53% in the sufficient category and at the

second meeting, namely 58% in the sufficient category. So the overall independence in cycle I (meetings 1 and 2) was 56%. This figure is in the range of 40 – 60% in the sufficient category. This shows that there are several percentages of indicators that have not met the success target. Only the first indicator has met, so further action is needed in cycle II

After taking action at the second meeting of cycle I, there were several reflections on action, namely that there were still many students who were not confident, reflected in not having the courage to express opinions, ask questions and not having the initiative to present work results without being appointed. When working in groups, on average only a few students or students who have high abilities work in groups and the others just watch. Apart from that, students also still lack respect for time and lack responsibility in solving the problems they are given.

The second cycle consisted of three meetings. The first meeting was held on 24 August with the sub-material of dividing integers integrated with Madurese satay and the second meeting on 25 August 25 with the sub-material of mixed integer operations integrated with a typical Madurese souvenir, namely Tette Chips. Meanwhile, for the third meeting, the learning was carried out based on the teaching module that had been prepared on 30 August with the sub-material of applying the concept of integers to daily life which was integrated with Madurese traditional clothing (Sakera and Marlina). The learning process using the CRT approach has five stages, namely self identification, cultural understanding, collaboration, critical reflections, transformative construction. Based on the data analysis that has been carried out, the results of student independence in cycle I were obtained with the following details.

**Table 3.** Recapitulation of Student Independence Data in Cycle II

No	Indicators	Cycle I
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		P1	P2	Average (%)
1	Able to identify things that support and hinder	67%	76%	81%
2	in achieving goals.	56%	60%	74%
3	Able to effectively manage time	62%	69%	78%
4	Show good performance in every situation and condition (confident)	58%	71%	78%
5	Can work under pressure conditions (resilient).	64%	68%	71%
<b>% Independence</b>		<b>53%</b>	<b>53%</b>	<b>61%</b>

Based on table 3 above, analysis of data from observations in cycle II shows an increase in the average percentage of student independence from the first meeting, namely 53% in the sufficient category, the second meeting, namely 61% in the good category, and the third meeting, namely 69% in the good category. So that the overall independence of students in cycle II (meetings 1, 2 and 3) is 76%. This figure is in the range of 61 – 80% in the good category.

This shows that all indicators have met the success target. Apart from that, there was an increase in student independence from each meeting from both cycle I and cycle II so that the research did not need to be continued because it had achieved the expected indicators of success.

## DISCUSSION

Based on the results of research conducted on class VII B of SMP Negeri 1 Bangkalan in mathematics subjects, it can be seen that cycle I and cycle II saw an increase in student independence through the application of a culturally responsive teaching approach based on Madurese culture. The following is a recapitulation table of the averages. percentage of student independence from each cycle.

**Table 3.** Recapitulation of Student Independence Data in Cycle II

No	Indicators	Cycle I		Average (%)
		P1	P2	

1	Able to identify things that support and hinder	67%	76%	81%
2	in achieving goals.	56%	60%	74%
3	Able to effectively manage time	62%	69%	78%
4	Show good performance in every situation and condition (confident)	58%	71%	78%
5	Can work under pressure conditions (resilient).	64%	68%	71%
<b>% Independence</b>		<b>53%</b>	<b>53%</b>	<b>61%</b>
<b>% Increasing</b>		<b>16 %</b>		

Based on the identification of student independence in table 4 above, it can be seen that each indicator has increased in cycle I and cycle II. Indicators 2,3,4 and 5 in cycle I are still not good, seen from the percentage obtained for indicator (2) Able to effectively manage time at 56%, indicator (3) Showing good performance in every situation and condition (confidence) at 56% , indicator (4) Being able to work under pressure conditions (resilient) is 53%, indicator (5) Being a teenager who is accepted in various social environments (adaptive) is 56%. Only indicator (1) Able to identify things that support and hinder achieving goals shows that cycle I is good at 61%. Therefore, cycle II still needs to be carried out. Based on the researcher's observations, the failure to achieve success indicators in the independent indicators is influenced by several aspects of the independent indicators, namely that students have not been able to respect time by trying to learn as much as possible, students have not had self-confidence and students have not seen difficulties as challenges. Meanwhile, the Culturally Responsive Teaching approach is designed to help empower students by using meaningful cultural relationships to convey social knowledge and attitudes (BARA & XHOMARA, 2020; Benlahcene et al., 2020; Coleman & Money, 2020; Keiler, 2018).

In cycle II, all indicators have obtained an average of reaching the good category. Indicator (1) Able to identify things that support and hinder achieving goals obtained a

percentage of 74%, indicator (2) Able to effectively manage time at 63%, indicator (3) Showing good performance in every situation and condition (confidence) at 70 %, indicator (4) Being able to work under pressure conditions (resilient) is 69%, indicator (5) Being a teenager who is accepted in various social environments (adaptive) is 68%. This shows that students have carried out learning activities that are driven by their own will, their own choices and their own responsibility for learning.

There was an increase in the results of student independence achieved by class VII-B, in cycle I there were four indicators that had not reached the success criteria. Only one indicator, namely indicator (1), is able to identify things that support and hinder the achievement of goals that achieve success criteria. Furthermore, in cycle II, all indicators of student independence have reached the success criteria. Based on table 4.8, it shows that the independent indicators experienced an increase in the average percentage, namely that initially had an average percentage of 56% in cycle I with the sufficient category, increasing to 69% in cycle II with the good category. So the average increase in the percentage of student independence in cycles I and II increased by 13%. Increased student independence can occur because the Culturally Responsive Teaching approach involves all students to actively participate in learning. Apart from that, it also makes students independent, meaning that students learn to be independent, responsible, have high tolerance, and respect the differences of other students. This is in line with the statement that learning with a Culturally Responsive Teaching approach has characteristics including triggering positive student interactions, student-centered learning and triggering attitude formation (Hossain, Tarmizi, & Ayub, 2012). Therefore, learning by combining material and culture in the learning process will create a meaningful learning atmosphere and encourage good character in students. This research focuses on increasing the independent character possessed by students in learning. The results

of classroom action research which was carried out using the independence observation sheet instrument, showed that there was an increase in students' independence through a culturally responsive teaching approach based on Madurese culture.

## **CONCLUSION**

Based on the results of the research and discussion, it can be concluded that the application of a culturally responsive teaching approach based on Madurese culture can increase students' independence. This is shown by the increase in the average percentage, namely that initially the average percentage was 56% in cycle I in the sufficient category, increasing to 69% in cycle II in the good category. So the average increase in the percentage of student independence in cycles I and II increased by 13%.

After the researcher carried out classroom action research at SMP Negeri 1 Bangkalan, the researcher proposed suggestions to other researchers to apply the culturally responsive teaching approach to other learning materials and to increase the profile of Pancasila students in other dimensions.

## **REFERENCES**

- Afriyani, D., Sa'dijah, C., Subanji, S., & Muksar, M. (2018). Characteristics of Students' Mathematical Understanding in Solving Multiple Representation Task based on Solo Taxonomy. *International Electronic Journal of Mathematics Education*.  
<https://doi.org/10.12973/iejme/3920>
- Aini, F. N., Emanuel, E. P. L., & Chamidah, A. (2021). Efektivitas Penerapan Model Blended Learning Berbasis Google Classroom Ditinjau Dari Motivasi Belajar Dan Hasil Belajar Siswa Pada Pokok Bahasan Trigonometri Kelas XI IPA-1 SMA Hang Tuah 4 Surabaya. *Briliant: Jurnal Riset Dan Konseptual*, 6(2), 303.  
<https://doi.org/10.28926/briliant.v6i2.629>
- Aizikovitsh-Udi, E., & Cheng, D. (2015).

- Developing Critical Thinking Skills from Dispositions to Abilities: Mathematics Education from Early Childhood to High School. *Creative Education*, 06(04), 455–462.  
<https://doi.org/10.4236/ce.2015.64045>
- Al-Balushi, S. M., Ambusaidi, A. K., Al-Balushi, K. A., Al-Hajri, F. H., & Al-Sinani, M. S. (2020). Student-centred and teacher-centred science classrooms as visualized by science teachers and their supervisors. *Teaching and Teacher Education*.  
<https://doi.org/10.1016/j.tate.2019.103014>
- BARA, G., & XHOMARA, N. (2020). The Effect of Student-Centered Teaching and Problem-Based Learning on Academic Achievement in Science. *Journal of Turkish Science Education*.  
<https://doi.org/10.36681/tused.2020.20>
- Benlahcene, A., Lashari, S. A., Lashari, T. A., Shehzad, M. W., & Deli, W. (2020). Exploring the perception of students using student-centered learning approach in a Malaysian public university. *International Journal of Higher Education*.  
<https://doi.org/10.5430/ijhe.v9n1p204>
- Chen, W., & Yu, S. (2019). Implementing collaborative writing in teacher-centered classroom contexts: student beliefs and perceptions. *Language Awareness*.  
<https://doi.org/10.1080/09658416.2019.1675680>
- Chikiwa, C., & Schäfer, M. (2018). Promoting critical thinking in multilingual mathematics classes through questioning. *Eurasia Journal of Mathematics, Science and Technology Education*.  
<https://doi.org/10.29333/ejmste/91832>
- Coleman, T. E., & Money, A. G. (2020). Student-centred digital game-based learning: a conceptual framework and survey of the state of the art. *Higher Education*.  
<https://doi.org/10.1007/s10734-019-00417-0>
- Cresswel, J. (2013). Qualitative, quantitative, and mixed methods approaches. In *Research design*.  
<https://doi.org/10.2307/3152153>
- Emanuel, E. P.L., Kirana, A., & Chamidah, A. (2021). Enhancing students' ability to solve word problems in Mathematics. *Journal of Physics: Conference Series*, 1832(1). <https://doi.org/10.1088/1742-6596/1832/1/012056>
- Emanuel, Endrayana Putut Laksminto, Meidiana, Y. G., & Suhartono. (2021). Studi Komparasi Penggunaan Google Meet Dan Whatsapp Group Terhadap Hasil Belajar Siswa SMA Hangtuh 4 Surabaya. *Briliant: Jurnal Riset Dan Konseptual*, 6(4), 849–853.
- Emanuel, Endrayana Putut Laksminto, & Meilantifa. (2022). Dimanakah Nilai Ekstrim Fungsi Kuadrat Ditinjau dari Lensa Commognitive ? *BRILIANT Jurnal Riset Dan Konseptual*, 7(54), 269–279.
- Fazriyah, N., Supriyati, Y., & Rahayu, W. (2018). Watson-Glaser ' s Critical Thinking Skills Watson- Glaser ' s Critical Thinking Skills. 2nd International Conference on Statistics, Mathematics, Teaching, and Research, 1–6. Retrieved from <https://iopscience.iop.org/article/10.1088/1742-6596/1028/1/012094/pdf>
- Hadinugrahaningsih, T., Rahmawati, Y., & Ridwan, A. (2017). Developing 21st century skills in chemistry classrooms: Opportunities and challenges of STEAM integration. *AIP Conference Proceedings*.  
<https://doi.org/10.1063/1.4995107>
- Haris, H. dan B. F. (2019). Penerapan Model Pembelajaran Kooperatif Tipe Student Teams Achievement Division (Stad) Pada Pelajaran Pkn Di Sma Negeri 1 Watansoppeng. *Journal of Chemical Information and Modeling*.
- Hartini, H. (2019). Peningkatan Kemandirian dan Prestasi Belajar IPA melalui Problem Based Learning berbantuan Lembar Kerja Siswa. *Paedagogie*.  
<https://doi.org/10.31603/paedagogie.v14i1.2678>

- Hossain, M. A., Tarmizi, R. A., & Ayub, A. F. M. (2012). Collaborative and cooperative learning in Malaysian mathematics education. *Journal on Mathematics Education*, 3(2).  
<https://doi.org/10.22342/jme.3.2.569.103-114>
- Ioannou, M. (2017). Investigating the discursive shift in the learning of Group Theory: Analysis of some interdiscursive commognitive conflicts. Retrieved from <https://hal.archives-ouvertes.fr/hal-01941352/document>
- Irianti, N. P., Subanji, S., & Chandra, T. D. (2016). Proses Berpikir Siswa Quitter dalam Menyelesaikan Masalah SPLDV Berdasarkan Langkah-langkah Polya. *JMPM: Jurnal Matematika Dan Pendidikan Matematika*.  
<https://doi.org/10.26594/jmpm.v1i2.582>
- Irviana, I. (2016). PENGARUH MODEL PEMBELAJARAN TEAM GAMES TOURNAMENT TERHADAP HASIL BELAJAR IPS SISWA SD. *Journal of Educational Science and Technology (EST)*.  
<https://doi.org/10.26858/est.v2i1.2041>
- Jones, K. (2020). Preservice teacher commognitive conflict around poetic discourse in digital spaces and implications for equitable teaching. *Contemporary Issues in Technology and Teacher Education*, 20(4), 592–617. Retrieved from <https://citejournal.org/volume-20/issue-4-20/english-language-arts/preservice-teacher-commognitive-conflict-around-poetic-discourse-in-digital-spaces-and-implications-for-equitable-teaching/>
- Jonsson, B., Norqvist, M., Liljekvist, Y., & Lithner, J. (2014). Learning mathematics through algorithmic and creative reasoning. *Journal of Mathematical Behavior*.  
<https://doi.org/10.1016/j.jmathb.2014.08.003>
- Keiler, L. S. (2018). Teachers' roles and identities in student-centered classrooms. *International Journal of STEM Education*.  
<https://doi.org/10.1186/s40594-018-0131-6>
- Kelly, A. E. (2014). Handbook of Design Research Methods in Education. In *Handbook of Design Research Methods in Education*.  
<https://doi.org/10.4324/9781315759593>
- Kim, D.-J., Choi, S., Lim, W., Thoma, A., Nardi, E., Viirman, O., ... Sfar, A. (2019). Discourses of Functions – University Mathematics Teaching Through a Commognitive Lens. *Educational Studies in Mathematics*, 8(2), 423–430.  
<https://doi.org/10.1007/s10649-015-9676-1>
- Maryono, M., Sutawidjaja, A., Subanji, S., & Irawati, S. (2017). Implementation of Pedagogical Content Knowledge (PCK) of Mathematics Teachers in Teaching Practice: A Case Study. *International Education Studies*.  
<https://doi.org/10.5539/ies.v10n3p11>
- Matsuyama, Y., Nakaya, M., Okazaki, H., Lebowitz, A. J., Leppink, J., & Van Der Vleuten, C. (2019). Does changing from a teacher-centered to a learner-centered context promote self-regulated learning: A qualitative study in a Japanese undergraduate setting. *BMC Medical Education*.  
<https://doi.org/10.1186/s12909-019-1550-x>
- Muganga, L., & Ssenkusu, P. (2019). Teacher-Centered vs. Student-Centered. *Cultural and Pedagogical Inquiry*.  
<https://doi.org/10.18733/cpi29481>
- Netti, S., Nusantara, T., Subanji, S., Abadyo, A., & Anwar, L. (2016). The Failure to Construct Proof Based on Assimilation and Accommodation Framework from Piaget. *International Education Studies*.  
<https://doi.org/10.5539/ies.v9n12p12>
- Nurtanto, M., Fawaid, M., & Sofyan, H. (2020). Problem Based Learning (PBL) in Industry 4.0: Improving Learning Quality through Character-Based Literacy Learning and Life Career Skill (LL-LCS). *Journal of Physics: Conference Series*, 1573(1), 0–10.



- <https://doi.org/10.1088/1742-6596/1573/1/012006>
- Permana, T. I., Hindun, I., Rofi'ah, N. L., & Azizah, A. S. N. (2019). Critical thinking skills: The academic ability, mastering concepts and analytical skill of undergraduate students. *Jurnal Pendidikan Biologi Indonesia*, 5(1), 1–8. <https://doi.org/10.22219/jpbi.v5i1.7626>
- Purnomo, D., Nusantara, T., Subanji, S., & Rahardjo, S. (2017). The Characteristic of the Process of Students' Metacognition in Solving Calculus Problems. *International Education Studies*. <https://doi.org/10.5539/ies.v10n5p13>
- Putut, E., Emanuel, L., & Anam, F. (2022). Sebuah Tinjauan Commognitive : Apakah Matriks Singular ? 7(54), 922–930.
- Putut, E., Emanuel, L., Nusantara, T., Rahman, A., & Rahardi, R. (2023). Why am I confused ? Commognitive Conflict in Non-ordinary Question About Number Division. 6, 891–901.
- Putut Laksminto Emanuel, E., & Zakiyah, A. M. (2021). Penggunaan Media ICT dalam Implementasi Problem Based Learning Pada Pelajaran IPA Materi Siklus Hidup. *Briliant: Jurnal Riset Dan Konseptual*, 6(2), 321. <https://doi.org/10.28926/briliant.v6i2.650>
- Salim Nahdi, D., Yonanda, D. A., & Agustin, N. F. (2018). UPAYA MENINGKATKAN PEMAHAMAN KONSEP SISWA MELALUI PENERAPAN METODE DEMONSTRASI PADA MATA PELAJARAN IPA. *Jurnal Cakrawala Pendas*. <https://doi.org/10.31949/jcp.v4i2.1050>
- Saputro, A. D., Atun, S., Wilujeng, I., Ariyanto, A., & Arifin, S. (2020). Enhancing pre-service elementary teachers' self-efficacy and critical thinking using problem-based learning. *European Journal of Educational Research*, 9(2), 765–773. <https://doi.org/10.12973/eu-jer.9.2.765>
- Sitorus, J., & Masrayati. (2016). Students' creative thinking process stages: Implementation of realistic mathematics education. *Thinking Skills and Creativity*. <https://doi.org/10.1016/j.tsc.2016.09.007>
- Stewart, S., Troup, J., & Plaxco, D. (2019). Reflection on teaching linear algebra: examining one instructor's movements between the three worlds of mathematical thinking. *ZDM - Mathematics Education*, 51(7), 1253–1266. <https://doi.org/10.1007/s11858-019-01086-0>
- Subanji, S. (2015). Peningkatan Pedagogical Content Knowledge Guru Matematika Dan Praktiknya Dalam Pembelajaran Melalui Model Pelatihan Teqip. *Jurnal Ilmu Pendidikan Universitas Negeri Malang*.
- Sudarsana, I. K., Nakayanti, A. R., Sapta, A., Haimah, Satria, E., Saddhono, K., ... Mursalin, M. (2019). Technology Application in Education and Learning Process. *Journal of Physics: Conference Series*. <https://doi.org/10.1088/1742-6596/1363/1/012061>
- Tasara, I. (2017). Commognitive analysis of a teacher's mathematical discourse on the derivative. *Proceedings of the British Society for Research into Learning Mathematics*.