

Relating Experiencing Applying Cooperating Transferring (REACT), Discovery Learning Model and History Learning Outcomes of Learners: An Experimental Study

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Abstract: *The merdeka curriculum has been designed as a way to improve students' capabilities in learning history. The ability to analyze and evaluate is an important part of the assessment of learning. Based on previous research, it shows that there are low student learning outcomes in history subjects. Theoretical studies show the application of innovative learning models can improve learning outcomes. In theory, one of the learning models that can improve student learning outcomes is the Relating Experiencing Applying Cooperating Transferring (REACT) learning model. The purpose of this study was to examine the effect of the REACT model on student learning outcomes in history subjects. This research uses a quantitative approach with a quasi experimental; pretest-post-test; nonequivalent group design. The data analysis technique used ANCOVA test and LSD further test. The ANCOVA test results show the sig value. $0.003 < 0.05$, which means it shows a significant effect of the application of the REACT model on learning outcomes and the partial eta squared value of 0.125 is classified as a small effect of the application of the REACT model on student learning outcomes. LSD (Least Significant Different) Further Test of the experimental class shows a mean difference of -9.972 with a significance value of $0.000 < 0.05$, while in the control class pretest shows a mean difference of -3.917 with a significance value of $0.002 < 0.05$. In conclusion, there is a significant effect on learning outcomes taught by applying the REACT model in history subjects. The recommendation of the results of this study, to teach conceptual material, with the learning outcome of analyzing, the REACT model is recommended to be used, because it is proven to have a significant effect.*

Keywords: Relating Experiencing Applying Cooperating Transferring (REACT), Discovery Learning, Learning Outcomes

1. INTRODUCTION

Education is currently experiencing a paradigm shift due to technological developments in the digital era. Technological transformation has an impact on the urgency of skills known as 21st century skills [36, 20], which emphasizes 4C skills including Critical Thinking Skills, Creativity, Collaborative Skills, and Communication [34, 37] Along with these changes, there is a shift in the role of educators, through creativity and technological innovation, they can optimize the learning potential of students [38] so that learning activities facilitate students to practice 4C skills.

Learning is designed in such a way as to prepare young people for the industrial revolution 4.0 [32, 26] which has the aim of increasing the competence and digital skills of learners at all levels [22]. The Ministry of Education and Culture made changes from the 2013 curriculum to the independent curriculum. The independent curriculum is present as an answer to the need for technology-based learning, creating freedom of learning for educators and students, and is present as an answer to the tight competition for human resources in the global era [29, 38, 18]. The implementation of the independent learning curriculum has adjusted the conditions and needs of 21st century learning by prioritizing 4C skills that prepare critical thinking skills in students.

The critical thinking skills of these learners have a positive impact on learning outcomes [27]. Learning outcomes are the process of collecting information, both formally and informally about learners' understanding and skills [4]. Learning outcomes are expected to show learners what they need to achieve in order to graduate [15]. Learning assessments are designed to serve accountability functions, determine class rank and decide who should graduate [4] Student learning outcomes can be achieved after receiving learning and student achievement of assessment competencies that have been determined by educators. Assessment of learning outcomes will be obtained at the evaluation stage.

Regarding history learning outcomes, based on previous research studies, it shows that the value is not optimal. Research conducted by Aisyah et al (2022) showed an average score of 47.17 including in the criteria less high[1]. Fitrientyas's research (2015) the percentage of completeness of the cognitive aspect was 75.00% [16]. Safitri et al's research (2014) showed the results of cognitive aspects obtained a percentage of classical completeness of 70.96% [28]. The results of previous studies that have been described above, show the level of learning outcomes obtained by students is relatively low so that it becomes a problem that must be solved in learning history. The solution to solve the problem is through an innovative learning model.

Innovative learning models are very important to apply today because of the increasingly complex demands of the times [36]. One of the innovative learning models that is suitable for implementation is the Relating, Experiencing, Applying, Cooperating, Transferring (REACT) learning model. The Relating, Experiencing, Applying, Cooperating, Transferring (REACT) learning model is a learning model that uses a contextual approach [11]. The REACT learning model consists of several syntaxes, namely relating, experiencing, applying, cooperating and transferring [12]. REACT it self is an acronym for the syntax stages contained in the model.

The advantages of the REACT model include increasing students' affective responses, building cooperation among students, developing critical thinking skills and developing cognitive learning outcomes [7, 24, 12, 40]. Previous studies show that the REACT model can be improve students' understanding [13]. Previous research results state that the REACT model can improve student learning outcomes [6, 17].

Another learning model that is classified as innovative is the discovery learning model. Discovery learning model is learning that forms students' own knowledge and generates ideas based on observation, discovery, experimentation, and draws conclusions about concept rules from the results of some of these activities [33, 2, 30]. The syntax of the discovery learning model is: simulus; problem identification; data collection; data processing; proof; generalization [19]. The advantages of the discovery learning model include: building active and independent learning, fostering learning motivation; being able to solve problems obtained; and improving communication [40,14]. Previous research revealed that the Discovery Learning model affects history learning outcomes [14, 23].

Based on the background description above, researchers are interested in investigating whether there is an effect of the REACT model on student learning outcomes in history subjects. This study aims to verify the effect of the REACT model on student learning outcomes in history subjects.

2. RESEARCH METHODS

This research used a quantitative approach with a quasi experimental design; pretest-post-test non equivalent group design [10]. The population of this research were students of grade 12 MIPA SMA Negeri 4 Sidoarjo academic year 2022/2023. The sample used in this study was 70 students. The technique used in sampling is not randomized but uses a homogeneity test to see whether or not the population variants are the same, while the determination of the research group uses the average results of the nearest daily test scores in history subjects.

Table 1: Homogeneity test results

Data	Levene Statistic	df1	df2	Sig.
History's Daily Test Result	2.306	4	175	.060

Source : primary data processed

Based on the results of the homogeneity test on the research population, it shows a significance value of 0.060 ($0.060 > 0.05$) which means that it is very significantly different so that it shows that the data is homogeneously distributed. This means that the requirement of homogeneity of variance is met. Furthermore, sample selection is carried out on the calculation of the average between classes.

Table 2: Average daily test score of class 12 MIPA

Class	Average	Std. Deviation
12 MIPA 1	83,17	5,016
12 MIPA 2	85,61	3,499
12 MIPA 3	87,97	3,066
12 MIPA 4	86,50	4,632
12 MIPA 5	86,52	4,849

Source : primary data processed

Based on the results of the average daily test scores above, class 12 MIPA 4 was selected as the experimental class taught with the REACT model and class 12 MIPA 3 as the control class taught with the discovery learning model. The selection of two classes with a high average aims to provide treatment for critical thinking skills need to have a high understanding, the assumption is that if the average value of the daily test results is higher it is easy to be invited to think critically so that it can affect the learning outcomes obtained by students.

The instrument used to measure learning outcomes is using a multiple choice test with reference to the C4 (analyze) cognitive domain learning outcome indicator. The learning outcomes instrument have been tested validity and reliability. The validity test uses Product Moment correlation assisted by SPSS 25 for windows software in calculating the analysis of the relationship between the items and the total score. While the reliability test is calculated using the Cronbach Alpha technique assisted by SPSS 25 for windows software.

The data analysis technique used in this study used the ANCOVA test assisted by SPSS 25 for windows software and continued by using the LSD further test. Before conducting hypothesis testing, first conduct a prerequisite test of analysis, namely by carrying out the normality test, regression homogeneity test and linearity test.

3. RESULTS AND DISCUSSION

3.1 Result

A. Instrument Testing

1. Validity Test

The validity test was carried out before used for research. A valid instrument means that the measuring instrument used to obtain the data is valid. The data collected from the instrument trial was then calculated for its validity level. The validity of the items was tested using the Product Moment correlation formula assisted by SPSS 25 for windows software in calculating the analysis of the relationship between the items and the total score. The data from the validity test results of the two instruments, namely the pretest and posttest, consisted of 30 items each which were arranged with different questions but were still at the same cognitive level, namely C4 (Analysis). The results of the validity test on the overall item of pretest and posttest questions show a rcount value greater than r_{table} . The overall significance value on the item is less than the significance level of 0.05 or 5% which means that the value is significant. So it can be decided that all items of pretest and posttest questions in the validity test are declared valid and suitable for research.

2. Reability Test

The reliability test in this study was calculated using the Cronbach Alpha technique assisted by SPSS 25 for windows software by measuring the accuracy of the instrument using Guilford's (1956) opinion which is presented below as follows $0.80 < r_{11} \leq 1.00$ very highly reliable

- a. $0.60 < r_{11} \leq 0.80$ high reliable
- b. $0.40 < r_{11} \leq 0.60$ reliable
- c. $0.20 < r_{11} \leq 0.40$ less reliable
- d. $-1.00 < r_{11} \leq 0.20$ not reliable

Table 3: Reliability test results

Research Variables	N	Koefisien Alpha Cronbha	Description
Learning outcomes (Pre-test)	35	0,934	Very high reliability
Learning outcomes (Post-test)	35	0,965	Very high reliability

Source : primary data processed

Based on the results of the reliability test on the learning outcomes instrument, the pretest question obtained a value of 0.934 in the category $0.80 < r_{11} \leq 1.00$ (very high reliability). So, the learning outcomes instrument pretest and posttest questions are declared reliable and have good consistency used in research.

B. Prerequisite Test Analysis

1. Normality Test

The normality test is used to show that the research data is normally distributed. The normality test formula used is Kolmogorov-Smirnov assisted by SPSS for Windows version 25.

Table 4: Normality test result

Sample	Data	N	Sig.	Description
Experiment	Pre-test value	32	0,200*	Normal distribution
	Post-test value	32	0,064	Normal distribution
Control	Pre-test value	32	0,200*	Normal distribution
	Post-test value	32	0,200*	Normal distribution

Source : primary data processed

Based on the results of the normality test, the experimental class showed a pretest significance value of 0.200 ($0.200 > 0.05$) and a posttest of 0.064 ($0.064 > 0.05$). While the control class showed a pretest significance value of 0.200 ($0.200 > 0.05$) and a posttest of 0.200 ($0.200 > 0.05$). So overall the data obtained by the experimental class and control class are normally distributed.

2. Regression Homogeneity Test

The regression homogeneity test was conducted using SPSS 25 for windows with the F-test. The test was conducted with a significance level of 0.05. The slope of the regression line can be said to be homogeneous if the interaction between covariates and independent variables has a significant value of more than 0.05.

Table 5: Regression homogeneity test results

Data	Type III Sum of Squares	Df	Mean Square	F	Sig.
Class*Pretest	2.559	1	2.559	.163	0.687

Source : primary data processed

The regression homogeneity test results above show a significance value of 0.687 ($0.687 > 0.05$). This value shows greater than the significance level of 0.05, so the homogeneity assumption is met.

3. Linierity Test

The linearity test aims to determine whether there is a linear relationship between covariates and the dependent variable by using the F-test. The linearity assumption is as follows:

1. Sig. > 0.05 , there is no significant linear relationship between the covariates and the dependent variable
2. Sig. value < 0.05 there is a significant linear relationship between the covariates and the dependent variable

Table 6: Linearity test results

Data	Type III Sum of Squares	Df	Mean Square	F	Sig.
Pretest	68.234	1	68.234	3.873	.040

Source: primary data processed

The linearity test results above show a significance value of 0.040 ($0.04 < 0.05$). The conclusion is that the value is smaller than 0.05, so the linearity assumption of the regression is met. Thus, the linearity assumption of the regression has a strong enough reason for the pretest variable as a covariate.

C. Hypothesis Test

Hypothesis testing was carried out to answer the problem formulation in the study. In this study, pretest and posttest data from experimental and control classes will be tested using ANCOVA and LSD (Least Significant Different) tests assisted by the SPSS 25 for windows software program.

Table 7: ANCOVA test result

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	410.096 ^a	2	205.048	13.263	.000	.278
Intercept	1648.591	1	1648.591	106.632	.000	.607
Pretest	67.749	1	67.749	4.382	.040	.060
Learning Model	151.711	1	151.711	9.813	.003	.125
Error	1066.779	69	15.461			
Total	493013.000	72				
Corrected Total	1476.875	71				

a. R Squared = .278 (Adjusted R Squared = .257)

Source: primary data processed

Based on the results presented in table 7, namely to determine the effect of the learning model on the ability of learning outcomes obtained by students. The results of the corrected model column show a result of 0.000 ($0.000 < 0.05$), so simultaneously the pretest and the REACT learning model affect the learning outcomes of students. The results of the learning model column show a significance result of 0.003 ($0.003 < 0.05$) so that H_0 is rejected and H_a is accepted, the conclusion is that there is a significant effect of the application of the REACT model on the learning outcomes of students in history subjects. The magnitude of the effect of the learning model on learning outcomes can be seen in the partial eta squared value in the learning model column which shows a value of 0.125, including in the small category. So it can be concluded, that the REACT model has a small influence on the learning outcomes of students in history subjects. The criteria for the magnitude of the influence can be seen with the Effect Size Criteria table presented below.

Table 8: Effect size criteria

Effect Size	Criteria
0,1	Small Effect
0,3	Medium Effect
0,5	Large effect

Source : Cohen, 1998

After conducting the ANCOVA test, the LSD (Least Significant Different) further test was used to determine which treatment was significantly different if the null hypothesis was rejected.

Table 9: LSD (*Least Significant Different*) test result

Multiple Comparisons						
Dependent Variable: Posttest						
LSD						
(I) Class Name	(J) Class Name	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Pretest Experiment	Posttest Experiment	-9.972*	1.264	.000	-12.47	-7.47
	Pretest Control	2.083	1.264	.101	-.41	4.58
	Posttest Control	-1.833	1.264	.149	-4.33	.66
Pretest Control	Pretest Experiment	-2.083	1.264	.101	-4.58	.41
	Posttest Experiment	-12.056*	1.264	.000	-14.55	-9.56
	Posttest Control	-3.917*	1.264	.002	-6.41	-1.42

*. The mean difference is significant at the 0.05 level.

Source: primary data processed

Based on the output of the LSD (Least Significant Different) Advanced Test results, the learning outcomes data in the experimental class pretest value in column I with posttest in column J shows mean difference of -9.972 with a significance value of $0.000 < 0.05$. While the data on learning outcomes in the control class pretest value in column I with posttest in column J shows mean difference of -3.917 with a significance value of $0.002 < 0.05$. The conclusion is that there is an average difference from the LSD test that the mean difference value of the experimental group is superior to the control group. So that the REACT model has more effect on learning outcomes compared to the discovery learning model.

3.2 Discussion

This study aims to examine the effect of the REACT model on student learning outcomes in history subjects. This study consists of two groups, namely the experimental group taught using the REACT model and the control group taught using the discovery learning model. Researchers verified whether there was a significant effect in the learning outcomes of students who were taught using the REACT model. Data analysis used ANCOVA test with pretest as covariate.

The ANCOVA test results in table 8 with the results of the corrected model column show the results of 0.000 (sig. < 0.05), so simultaneously the pretest and learning model affect student learning outcomes. While the learning model column shows a significance value of 0.003 (sig. < 0.05), then H_0 is rejected and H_a is accepted. The conclusion that can be drawn is that there is a significant effect of the application of the REACT model on the learning outcomes of students in history subjects, with a partial eta squared value of 0.125 included in the category of a small effect.

After conducting the ANCOVA test, further tests were carried out using LSD (Least Significant Different) to determine which treatment had a significant effect if the null hypothesis was rejected. The results of the LSD test on pretest and posttest data for the experimental class showed a sig value. $0.000 < 0.05$ means there is an effect, with a mean difference of -3.606. While the pretest and posttest of the control class showed a sig value. $0.000 < 0.05$ means there is an effect, with a mean difference of -9.972. So it can be concluded that the experimental class taught using the REACT model has more effect on student learning outcomes than the control class taught using the discovery learning model.

The REACT learning model is teaching that can contribute to improving learner achievement. Learners are facilitated to solve a problem through several syntaxes contained in the REACT learning model, it can encourage collaborative work skills and cause adequate cognitive readiness.

REACT learning model can improve students' learning outcomes. The REACT model is able to increase active involvement, critical thinking, problem solving skills, creative thinking and build cooperation between individuals in students. This has an impact on the learning outcomes obtained by students. Through directed practice on applying syntax facilitates learners to learn to apply concepts when doing problem solving activities, both through worksheets, practice assignments to ultimately make their understanding increase so as to make learning outcomes better. This has an impact on the learning outcomes obtained by students.

This study is in line with previous research which shows that the REACT model has an influence on student learning outcomes. Previous research studies belonging to Bilgín et al (2017) show that the results of applying the REACT strategy are more efficient in improving academic achievement [6]. This is also presented from previous research by Gökalp & Aden (2020) showing the results of the t-test, that the 5E method enriched with the REACT strategy was found to be more efficient in improving student achievement [17]. Previous research by Akay and Kanadli (2021) showed that the results of teaching based on the REACT strategy were found to contribute greatly to the learning process and learning outcomes [3]. Another study by Taraufu et al (2020) also said the same thing, showing the results of his research that 41.82% of the application of the REACT strategy had an influence on student learning outcomes on acid-base concept material [31]

The discovery learning model applied to the control class also has a good effect on learning outcomes. The Discovery Learning model emphasizes activeness, self-confidence, critical thinking, and fosters motivation, so it is related to learning outcomes indicators. The discovery learning model applied to the control class in solving learning problems can be realized with critical thinking skills in order to get better quality learning outcomes.

This is evident from the difference in the average score obtained between the pretest of 76 and the posttest of 80. However, the REACT model is better than the discovery learning model. This is evident from the average obtained in the experimental class, namely the pretest value of 78 and the posttest value of 83. The average value of the experimental class is higher than the control class. Based on the average value of the learning outcomes of the two classes, the experimental class has a value that is superior to the value of the control class. Thus, the experimental class has higher learning outcomes by being taught the REACT model than the control class which is taught using the discovery learning model.

Therefore, the REACT Model and the Discovery Learning Model both have an influence, but the REACT model is superior in influencing student learning outcomes in history subjects.

4. CONCLUSION

The conclusion of the research that has been done is that there is an effect of the REACT model on student learning outcomes in history subjects. The results of the ANCOVA test analysis on the learning outcomes variable obtained a significance value (sig) of $0.003 < 0.05$. This shows that the H_0 hypothesis is rejected and H_a is accepted, which means that there is a significant effect. The magnitude of the effect of the learning model on learning outcomes can be seen from the partial eta squared value in the learning model column of 0.125, which is classified as a small effect of applying the REACT model on student learning outcomes in history subjects. The LSD test results obtained a mean difference value in the experimental class of -9.972 and the control class of -3.917, so it can be concluded that the experimental class taught with the REACT model has more effect on learning outcomes compared to the control class taught using the discovery learning model.

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6. REFERENCES

- [1] Asiyah, A. S., Sumardi, S., & Umamah, N. (2022). Pengembangan Media Pembelajaran Sejarah Berbasis Prezi untuk Meningkatkan Hasil Belajar Menggunakan Model ASSURE. *Jurnal Pendidikan Sejarah Indonesia*, 5(1), 77-86.
- [2] Akanmu, M. A., & Fajemidagba, M. O. (2013). Guided-discovery learning strategy and senior school students performance in mathematics in Ejigbo, Nigeria. *Journal of Education and Practice*, 4(12), 82-89.
- [3] Akay, C., & Kanadli, S. (2021). The Effect of React Strategy on Achievement in Science Education: A Mixed Research Synthesis. *Journal of Baltic Science Education*, 20(6), 868-880
- [4] Arends, R.I. 2014. Learning to Teach. Tenth Edition. New York: McGraw-Hill Education. Ary, D. et al. (2010). Introduction to Research in Education. 8th ed. USA: Wadsworth.

- [5] Ary, Donald., Lucy Cheser J., Christine K. S., David A. W., (2010). *Introduction to Research in Education. 8th ed.* USA: Wadsworth
- [6] Bilgin, A. K., YÜRÜKEL, F. N. D., & YİĞİT, N. (2017). The effect of a developed react strategy on the conceptual understanding of students: " Particulate nature of matter". *Journal of Turkish Science Education, 14*(2), 65-81.
- [7] Broman, K., Bernholt, S., & Christensson, C. (2020). Relevant or interesting according to upper secondary students? Affective aspects of context-based chemistry problems. *Research in Science & Technological Education, 1*-21
- [8] Cahyani, N. P. I., Suarsana, I. M., & Mahayukti, G. A. (2021). Improving Student's Mathematical Problem-Solving Skills Through Relating-Experiencing-Appling-Cooperating-Transferring Learning Strategy and Graphic Organizer. In *First International Conference on Science, Technology, Engineering and Industrial Revolution (ICSTEIR 2020)* (pp. 337-344).
- [9] Cohen, J. 1988. *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale N.J.: L. Erlbaum Associate.
- [10] Cohen, Louis., Lawewncw Manion dan Keith Morrison. (2018). *Research Methods in Education* (8th Edition). London : Routledge.
- [11] CORD. (1999). *Teaching Mathematics Contextually: The Cornerstone of Tech Prep.* Texas USA: CORD Comm, Inc.
- [12] Crawford, M.L. (2001). *Teaching Contextually: Research, rationale, and techniques for improving students motivations and achievement in mathematics and science.* Texas: CCI Publishing Online.
- [13] Demircioğlu, H., S. Vural, & G. Demircioğlu. (2012). "The Effect of A Teaching Material Developed Based On 'REACT' Strategy On Gifted Students' Achievement." On Dokuz Mayıs University Journal of Education Faculty 31 (2): 101-144.
- [14] Dwijayanti, L. M., Na'Im, M., & Soepeno, B. (2020). The Effect of Discovery Learning under Mind Mapping on Students' Results of History Learning at SMAN 1 Tenggara. *IOP Conference Series: Earth and Environmental Science, 485*(1).C
- [15] Erikson, M. G., & Erikson, M. (2019). Learning outcomes and critical thinking-good intentions in conflict. *Studies in Higher Education, 44*(12), 2293-2303.
- [16] Fitrianiingsih, R., Umamah, N., & Naim, M. (2015). Penerapan Model Pembelajaran Berbasis Proyek Untuk Meningkatkan Kemampuan Berpikir Kritis dan Hasil Belajar Sejarah Peserta Didik Kelas X SOS 2 di SMAN 4 Jember Tahun Ajaran 2014/2015. *Jurnal Edukasi, 2*(1), 32-36.
- [17] Gökalp, F., & Adem, S. (2020). The effect of REACT and computer-assisted instruction model in 5E on student achievement of the subject of acids, bases and salts. *Journal of Science Education and Technology, 29*(5), 658-665.
- [18] Indarta, Y., Jalinus, N., Waskito, W., Samala, A. D., Riyanda, A. R., & Adi, N. H. (2022). Relevansi Kurikulum Merdeka Belajar dengan Model Pembelajaran Abad 21 dalam Perkembangan Era Society 5.0. *Edukatif: Jurnal Ilmu Pendidikan, 4*(2), 3011-3024.
- [19] Kementerian Pendidikan dan Kebudayaan, Badan Pengembangan Sumber Daya Manusia Pendidikan dan Kebudayaan dan Penjaminan Mutu. (2013). *Pendidikan tentang Model Pembelajaran Penemuan (Discovery Learning).* Jakarta: Kementerian Pendidikan Nasional.
- [20] Lavi, R., Tal, M., & Dori, Y. J. (2021). Perceptions of STEM alumni and students on developing 21st century skills through methods of teaching and learning. *Studies in Educational Evaluation, 70*, 101002.
- [21] Pahrudin, A., Misbah, Alisia, G., Saregar, A., Asyhari, A., Anugrah, A., & Susilowati, N. E. (2021). The effectiveness of science, technology, engineering, and mathematics-inquiry learning for 15-16 years old students based on K-13 Indonesian curriculum: The impact on the critical thinking skills. *European Journal of Educational Research, 10*(2), 681-692.
- [22] Peredrienko, T., Belkina, O., & Yaroslavova, E. (2020). New language learning environment: Employers'-learners' expectations and the role of teacher 4.0. *International Journal of Instruction, 13*(3), 105-118.
- [23] Prasetya, T. A., & Harjanto, C. T. (2020). Improving learning activities and learning outcomes using the discovery learning method. *VANOS Journal of Mechanical Engineering Education, 5*(1).
- [24] Putu, N., Cahyani, I., Suarsana, I. M., & Mahayukti, G. A. (2021). *Improving Student 's Mathematical Problem -Solving Skills Through Relating-Experiencing-Appling- Cooperating-Transferring Learning Strategy and Graphic Organizer.* 536(Icsteir 2020), 337-344.
- [25] Peredrienko, T., Belkina, O., & Yaroslavova, E. (2020). New language learning environment: Employers'-learners' expectations and the role of teacher 4.0. *International Journal of Instruction, 13*(3), 105-118.
- [26] Rekh, S., & Chandy, A. (2020). ScienceDirect Implementation of academia 4 . 0 for engineering college education. *Procedia Computer Science, 172*(2019), 673-678.
- [27] Roohr, K. C., & Burkander, K. (2020). Exploring critical thinking as an outcome for students enrolled in community colleges. *Community College Review, 48*(3), 330-351.
- [28] Safitri, D., Handayani, S., & Umamah, N. (2014). Penerapan Model Connecting, Organizing, Reflecting, dan Extending (CORE) Untuk Meningkatkan Kreativitas dan Hasil Belajar Sejarah Peserta Didik Kelas X3 SMAN 1 Bangorejo Tahun Ajaran 2013/2014. *Jurnal Edukasi, 10*-14.
- [29] Sihombing, A. A., Anugrah Sari, S., Parlina, N., & Kusumastuti, Y. S. (2021). Merdeka Belajar in an Online Learning during The Covid-19 Outbreak: Concept and Implementation. *Asian Journal of University Education, 17*(4), 35-48
- [30] Sulistiani, E., Waluya, S.B., & Masrukan. (2018). The analysis of student' s critical thinking ability on discovery learning by using hand on activity based on the curiosity. In *International Conference on Mathematics, Science and Education 2017*

(ICMSE2017) (1-7)

- [31] TarauFu, A. F., Gumolung, D., & Caroles, J. (2020). Pengaruh Penerapan Strategi Pembelajaran REACT (Relating, Experiencing, Applying, Cooperating, dan Transferring) Terhadap Hasil Belajar Siswa Pada Materi Konsep Asam Basa. *Oxygenius Journal Of Chemistry Education*, 2(2), 52.
- [32] Teo, T., Unwin, S., Scherer, R., & Gardiner, V. (2021). Initial teacher training for twenty-first century skills in the Fourth Industrial Revolution (IR 4.0): A scoping review. *Computers and Education*, 170(May), 104223.
- [33] Tran T, Nguyen N G, Bui M D and Phan A H. (2014). Discovery Learning with the Help of the GeoGebra Dynamic Geometry Software International Journal of Learning, Teaching and Educational Research 7 1 44-57.
- [34] Umamah, N., Marjono, Sumardi, & Ma'Rifatullah, R. (2020). Need Assessment and Performance Analysis on Innovative, Adaptive, and Responsive Curriculum Development Geared to Life Skills. *IOP Conference Series: Earth and Environmental Science*, 485(1).
- [35] Umamah, N., Surya, R. A., & Muffida, E. (2021). Teachers' ability analysis of developing innovative instructional design. In *IOP Conference Series: Earth and Environmental Science* (Vol. 747, No. 1, p. 012070). IOP Publishing.
- [36] Umamah, N., & Sholehah, H. (2022). *The Pogil Learning Model and Students ' Critical Thinking Improvement in History Subject*. 11(3), 11–22.
- [37] Umamah, N., & Surya, R. A. (2022). *The Implementation Of Self-Organized Learning Environment Model And Self-Directed Learning Model To Improve Students ' Critical Thinking Skills : An Experimental Study*. 6(11), 26–33.
- [38] Umami, R., Umamah, N., Sumardi, S., & Surya, R. A. (2022). Model Pembelajaran Value Clarification Technique (VCT) dalam Meningkatkan Kesadaran Sejarah Peserta Didik. *Diakronika*, 22(1), 58–75.
- [39] van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, 72, 577–588.
- [40] White, J., Paslawski, T., & Kearney, R. (2013). 'Discovery learning': An account of rapid curriculum change in response to accreditation. *Medical Teacher*, 35(7), 1319–1326.
- [41] Yıldırım, G., & Gültekin, M. (2017). Applications of context-based learning in primary 4th class science and technology course. *Journal of Ahi Evran University Kırşehir Faculty of Education*, 18(Özel Sayı), 81-101.