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The difference of students self-directed learning outcomes between the implementation of creative problem solving model and problem-based learning model on history education subjects

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Abstract
This study aims to verify the difference between the Creative Problem Solving model and the Problem-Based Learning model on the self-directed learning of students in historical subjects. This study used a quantitative approach with an experimental research design. The research design used a quasi-experimental pretest-posttest, nonequivalent multiple-group design. The research sample consisted of 68 grade XI students from IPS 1 and IPS 2 classes at SMAN Balung. Data collection techniques used documentation and questionnaires. The data analysis used an independent sample t-test with SPSS 23 software for Windows. The results showed a significant difference in the self-directed learning of students who were taught using the Creative Problem Solving model and those who were taught using the Problem-Based Learning model. This can be seen from the results of the independent sample t-test on the self-directed learning variable, which obtained a significance level of 0.046 (0.046 < 0.05), indicating that there is a significant difference in the self-directed learning of students who were taught using the Creative Problem Solving model and those who were taught using the Problem-Based Learning model. The difference in the mean self-directed learning score was -0.89, a negative value indicating that the self-directed learning of students in the experimental class using the Creative Problem Solving model was better than that of the control class taught using the Problem-Based Learning model.

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Keywords: Creative Problem Solving, Problem-Based Learning, self-reliance

1. Introduction

The 21st century is characterized by information and communication technology use in education (Baroya, 2018) [7]. The use of information and communication technology has a significant impact on the world of education (Bottino, 2019; Kolikant, 2019) [12, 24]. Education in the 21st century demands that educators and students be able to utilize technology in the learning process (Bedir, 2019; Kandar & Qattan, 2020) [8, 19]. In the 21st century, students can choose their learning style due to the accessibility of digital technology (Moyle, 2010) [31]. Student learning outcomes focus on information technology skills, innovation, and adaptability (Makaramani, 2015; Cheng *et al*., 2004; Alismail & McGuire, 2015) [27, 14, 2]. Education in the 21st century demands that students adapt to the digital era.

In the 21st century, educators who used to be the centre of knowledge have shifted their role to become mentors, discussion directors, and assessors in the development of student learning (Hampson *et al*., 2011) [15]. Educators in the 21st century need to prepare themselves with digital technology to adjust to the needs of students in the digital education era. Educators' digital competence is closely related to their skills in using information and communication technology based on pedagogical principles, as well as being aware of its impact on educational methodology. According to Blyznyuk (2018) [9], educators' digital competence consists of information, communication, educational content creation, security, and educational problem-solving 21 has brought significant changes to the education system.

Students in the 21st century are part of Generation Z, also known as Digital Natives, born between 1995-2010 (Ozkan & Solmas, 2015) [33]. They are independent thinkers who utilize various sources of information through technology (Boholano, 2017) [11]. Generation Z students always crave change and have the power to make decisions. They assume that technology is crucial to their education (Umamah, 2017) [47]. Their attachment to technology has become an integral part of their lives.

The rapid development of science demands that students adapt to these changes. Integrating technology into education is one of the most important aspects of learning in the 21st century (Mirra & Garcia, 2020) [30]. The use of technology in education provides effective practical learning experiences (King *et al*., 2017) [22]. This brings a paradigm shift in education, as collaborative technology integration is necessary to face the challenges of 21st-century learning (Malik, 2018) [28]. Students are required to be skilled in learning and innovation, be able to operate information technology, and have life skills (Mardhiyah *et al*., 2021) [29]. The advancement of technology and information in the 21st century demands that educators and students adapt to the digital age.

The Ministry of Education and Culture has emphasized 21st-century learning on students' skills in exploring sources of information, deciphering problems, analytical thinking, and collaborating to solve problems (Research and Development of the Ministry of Education and Culture, 2013). Here are the 4C skills of 21st-century learning: Critical Thinking Skills, Creativity, Collaborative Skills, and Communication (Bedir, 2019; Rais *et al*., 2021; Sani *et al*., 2018; Rotterdam & Willingham, 2009; Umamah *et al*., 2020) [8, 36, 40, 37, 48]. The need for graduates who are critical, creative, communicative, and collaborative is a primary competency in the 2013 curriculum (Sumardi *et al*., 2018; Haniah *et al*., 2020) [43, 16]. The 4C skills have been implemented in Indonesia's competency-based 2013 curriculum, including in the history subject.

History learning plays a role in character formation by understanding and reaffirming the excellent values in a nation's journey. The spirit of struggle is expected to be continued by the next generation. Indonesia's national history has shown that perseverance, independence, mutual respect, and the spirit of unity are essential in forming a nation. Students are expected to take life values from the past to implement them in their present and future lives (Kocchar, 2008). In this context, history learning plays a role in shaping students' independence.

Character education is an innovation to address character issues and forms of educational modernization in Indonesia (Mustoip, 2018) [32]. Character values are the most important part of education based on character education and align with intellectual competencies (Bogan *et al*., 2015) [10]. Character education is essential to provide a quality generation useful to society (Lickona, 1991) [25]. Character education aims to cultivate students' character with character values as the main point, namely religiosity, cooperation, integrity, nationalism, and independence (Ministry of Education and Culture, 2017). Character education will be achieved if educators have flexible mindsets and innovations and integrate educational goals and character values (Umamah, 2015) [46]. According to the 2013 curriculum, independence is one of the core values in Indonesian education to produce students who never stop learning.

Education in the modern era demands that students actively engage in self-directed learning processes and encourages their independence in the learning process. According to in self-directed learning, educators always act as guides who ask questions and encourage students to find solutions to problems according to their abilities. Educators can create self-directed learning by encouraging student interests through proper motivation and planning (Nugroho in Wulandari, 2019) [49]. Learning independence means that students are enthusiastic about learning and consistent in learning (Pintrich & Groot, 1990; Zimmerman, 1990:4) [50]. Students are expected to be able to apply what they have learned in their daily lives.

The urgency of independence is a response to the reality that there still needs to be a relatively low level of independence among students. Previous research indicates that student independence is needed. Based on research conducted by Setiani (2018) [41], student independence is only at 68.07%, which is considered low. Furthermore, the value of Fhitung is smaller than Ftabel (Fhitung < Ftabel), indicating that the learning model applied has no effect on improving student independence. Similar research conducted by Asnita (2017) [5] also found that the learning model used had no significant effect on improving student independence. This is evidenced by the value of Fhitung, which is smaller than Ftabel, which is 2.099 < 3.168. Thus, the learning model used was not effective in increasing student independence. Based on previous research that has been presented, independence is one of the problems that need to be addressed in learning.

A low level of independence in students can be addressed by implementing innovative learning models. One of the learning models that can improve students' independence is the Creative Problem Solving model. The Creative Problem Solving model consists of four steps, namely: (1) problem clarification; (2) idea generation; (3) evaluation and selection; and (4) implementation (Pepkin, 2004:2). The steps in the Creative Problem Solving model are designed to facilitate students' thinking so that creative ideas emerge to solve problems (Afifa, 2017) [1]. Previous research has shown that the Creative Problem Solving model affects students' independence (Intan, 2017; Supardi, 2017) [18, 44]. The Creative Problem Solving model develops creativity in problem-solving, which in turn affects students' independence.

Another learning model that can improve students' independence is the Problem-Based Learning model. In line with this, the researcher observed that subject history educators apply the Problem-Based Learning model during learning activities. The Problem-Based Learning model involves students actively solving problems during learning activities. The Problem-Based Learning model aims to help students develop flexible knowledge, problem-solving skills, independent skills, collaborative skills, and intrinsic motivation (Hmelo, 2004) [17]. Previous research has shown that the Problem-Based Learning model improves students' learning outcomes (Rufaidah, 2020; Budi, 2020; Sabil *et al*., 2021) [38, 13, 39]. The Problem-Based Learning model encourages students to be actively involved and responsible in the learning process, thus affecting their independence.

Table 1: The characteristics of learning models (Smith, 2018; Chen, 2020; Abdullah, 2019; wang, 2016)

characteristics of Learning models	Creative Problem Solving (CPS)	Problem-Based Learning (PBL)
syntax	The CPS model has a structured and systematic process, which includes understanding the problem, generating ideas, evaluating solutions, and implementing the solution	The PBL model involves presenting students with a problem or real-world scenario that they need to solve collaboratively in a systematic way. This includes identifying the problem, formulating questions, conducting research, generating and evaluating hypotheses, and applying the knowledge gained to solve the problem
social system	CPS encourages collaboration in groups with diverse backgrounds to create diverse and innovative ideas and solutions. Additionally, the model strengthens interpersonal and communication skills among group members	PBL is a collaborative learning approach that requires students to work together in small groups to solve the problem. This promotes teamwork, communication, and interpersonal skills among students
reaction principles	CPS emphasizes flexibility and adaptability in responding to changes in the environment or situation, enabling students to develop the ability to adapt to changes	PBL emphasizes the importance of reflection and feedback in the learning process. Students are encouraged to reflect on their learning and receive feedback from their peers and instructors, which helps them develop critical thinking and self-assessment skills
support systems	The CPS model requires resources and an environment that supports creativity and innovation, such as relevant information and technology resources, open and flexible spaces, and skilled teachers or facilitators who can guide students in the learning process	The PBL model requires resources and an environment that support student learning, such as access to relevant information and technology, expert guidance from instructors or facilitators, and a supportive learning community
instructional impact	CPS helps students develop creative and innovative problem-solving skills, enabling them to apply these skills in real-life situations.	PBL helps students develop problem-solving, critical thinking, and self-directed learning skills, which are essential for success in academic and professional settings
accompanying impact	The CPS model can also increase student motivation to learn and improve their confidence in solving problems, thus helping students achieve their academic and professional goals.	The PBL model has been shown to increase student motivation, engagement, and satisfaction with learning, as well as promote long-term retention of knowledge.

Based on the background above, the researcher is interested in investigating whether there is a difference between the Creative Problem Solving and Problem-Based Learning models on the learning independence of students in historical subjects. This study aims to verify the difference between the Creative Problem Solving and Problem-Based Learning models on the learning independence of students in historical subjects.

2. Research Methods

This research uses a quantitative approach. The type of research is experimental research, which aims to determine the causality relationship between two or more variables (Ary *et al*., 2010) [4]. In this study, the researcher applies the Creative Problem Solving and Problem-Based Learning models as independent variables, controls other relevant variables, and observes the differences in the dependent variable, independence. The sample used in this study consisted of 68 students, specifically XI IPS 1 and XI IPS 2 classes at SMAN Balung. The determination of the sample in this study was not randomly selected. All classes underwent homogeneity tests, after which the average value of the history subject's daily test scores was calculated. The homogeneity test determines whether the population variance is the same. In contrast, the average value of the daily test scores is used to determine the class that becomes the research group by looking at the nearly identical average results.

This study uses a questionnaire as an instrument to measure autonomy, which refers to the autonomy indicators according to Steinberg (2017) [42], namely: (1) Emotional Autonomy; (2) Behavioral Autonomy; and (3) Cognitive Autonomy.

The data analysis in this study includes the following steps:

A. Instrument Test

1. Validity Test

A validity test measures the accuracy or precision of the instrument used. The validity test aims to measure the degree of validity of an instrument. The test items are validated first to ensure their credibility. Invalid items will be discarded and unused, while useful items will be used as research instruments. The validity of the items is tested using the Product Moment correlation supported by SPSS 23 for Windows. The correlation results are based on the r-table with a significance level of 0.05. If the correlation value of an item is greater than or equal to the r-table, the item is considered valid. On the other hand, if the correlation value of an item is smaller than the r-table, the item is considered invalid.

2. Reliability Test

A reliability test is conducted to measure an instrument's accuracy or precision. The purpose of a reliability test is to measure the level of accuracy and consistency of the test as a research instrument (Ary *et al*., 2010) [4]. This research uses the Cronbach Alpha reliability test supported by SPSS 23 for Windows software. If the test items have a high-reliability value, then those items can be used as research instruments.

B. Analysis of Data

1. Normality Test

The normality test is a prerequisite for parametric data analysis. The normality test aims to determine whether the data obtained is normally distributed. This normality test uses the results of the independence questionnaire of the experimental and control groups. The normality test uses the Kolmogorov-Smirnov test supported by SPSS 23 for Windows. The decision is based on a significance level of 0.05. The data is normally distributed if the sig value is greater than 0.05. Conversely, the data is considered not normally distributed if the sig value is less than 0.05.

2. Hypothesis Testing

Hypothesis testing in this study uses the independent sample t-test. The independent sample t-test is a test to compare the mean scores of the experimental group and control group before and after treatment. Hypothesis testing is conducted using SPSS 23 for Windows. The decision-making is based on a significance level of 0.05. If the sig. value is less than 0.05; there is a significant difference between the Creative Problem Solving and Problem-Based Learning models in improving students' autonomy. On the other hand, if the sig. value is greater than 0.05, it can be concluded that there is no significant difference between the Creative Problem Solving model and the Problem-Based Learning model in improving students' autonomy.

C. Hipotesis Test

The hypothesis testing in this study uses an independent sample t-test. An Independent sample t-test is a test to compare the mean values of experimental and control groups before and after the treatment. The hypothesis testing is conducted using SPSS 23 for Windows. The decision-making is based on a significance level of 0.05. If the p-value is less than 0.05, it can be concluded that there is a significant difference between Creative Problem Solving and Problem-Based Learning models regarding students' autonomy. Conversely, if the p-value is greater than 0.05, it can be concluded that there is no significant difference between Creative Problem Solving and Problem-Based Learning models regarding students' autonomy.

3. Results and Discussion

3.1 Results

A. Instrument Validity Test

1. Validity Test

A validity test was conducted before the instrument was used for the research. A valid instrument means the measuring tool 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 aided by SPSS 23 for Windows software. The data from the validity test of the independence questionnaire before and after the treatment consisted of 18 items that refer to the independence indicators, according to Steinberg (2017) [42]. The overall validity test results for the items showed that the r-value is greater than the r-table. The significance value for all items is smaller than the significance level of 0.05 or 5%, which means the values are significant. Therefore, the independence questionnaire before and after treatment in the validity test is valid and suitable for use in the research.

2. Reliability Test

The reliability test aims to determine the reliable test items. The reliability test used is the Cronbach Alpha technique with the help of SPSS 23 for Windows, which refers to the reliability coefficient categories according to Guilford (1956:145) as follows:

a) $0.80 < r11 \leq 1.00$ very high reliability
b) $0.60 < r11 \leq 0.80$ high reliability
c) $0.40 < r11 \leq 0.60$ moderate reliability
d) $0.20 < r11 \leq 0.40$ low reliability
e) $-1.00 < r11 \leq 0.20$ very low reliability (not reliable)

Table 2: Results of the Reliability Test

Variable	N	Cronbach Alpha	Description
Pre-treatment questionnaire	34	0,902	Very high reliability
Post-treatment questionnaire	34	0,841	Very high reliability

Based on the reliability test results table data, the questionnaire instrument before treatment has a value of 0.902, which is in the category of $0.80 < r11 \leq 1.00$ (very high reliability). Meanwhile, the questionnaire instrument after treatment has a value of 0.841. Overall, based on the data obtained, it can be concluded that the questionnaire instruments before and after treatment are considered reliable and have a good consistency for use in the study.

B. Analysis Prerequisite Test

1. Normality Test

Before conducting the analysis using the t-test or independent sample t-test, the data is tested for normality. The normality test uses Kolmogorov-Smirnov with the help of SPSS 23 for Windows. The decision-making criteria in this study use a significance level of 5%. The results of the normality test for the data on the independence questionnaire before and after treatment in the experimental and control groups can be seen in the following table.

Table 3: Normality Test Results

	Class	Kolmogorov-Smirnov		
		Statistic	df	Sig.
Questionnaire before treatment	Control	0,139	34	0,095
	Experiment	0,177	34	0,200
Questionnaire after treatment	Control	0,121	34	0,200
	Experiment	0,097	34	0,061

Based on the normality test results using the Kolmogorov-Smirnov test in Table 4, the significance value for the experimental class questionnaire data before treatment is 0.200 and after treatment is 0.061, while the significance value for the control class questionnaire data before treatment is 0.095 and after treatment is 0.200. These values are greater than 0.05 (> 0.05), which means that H0 is accepted and Ha is rejected, so it can be concluded that the questionnaire scores before and after treatment are normally distributed.

2. Homogeneity Test

After conducting the normality test, the next step is to perform the homogeneity test. The homogeneity test uses the Levene statistic with the help of SPSS 23 for Windows. The decision-making criteria in this study use a significance level of 5%. The homogeneity test aims to determine the sample in the study, namely the control and experimental classes.

The determination of sample in this study was not chosen randomly. All classes were tested for homogeneity, and then the average values of the daily history assignments were calculated. Homogeneity testing functions to determine whether the population variance is the same or not, while the average daily assignment values are used to determine the class that becomes the research group, namely by looking at the results of the almost similar average values. The following is the table of homogeneity test and the average value of the daily history assignments for the grade XI IPS class.

Table 4: Homogeneity Test Results of Daily History Assignments for Grade XI IPS Class

Test of Homogeneity of Variances			
UH XI IPS			
Levene Statistic	**df1**	**df2**	**Sig.**
1,479	2	101	,233

Based on the homogeneity test using SPSS 23 for Windows, a 0.233 (0.233 > 0.05) was obtained. This indicates that the daily test scores of class XI IPS have homogenous values. Furthermore, to determine the sample, it was selected based on the average score of daily test results, which were similar. The following is the table of average scores of daily tests for class XI IPS.

Table 5: Average Scores of Daily Tests for Class XI IPS

Class	Average
XI IPS 1	86,08
XI IPS 2	86,03
XI IPS 3	84,02

Based on the average daily test scores above, class XI IPS 2 was chosen as the experimental group taught using the Creative Problem Solving model and class XI IPS 1 as the control group taught using the Problem-Based Learning model.

C. Hypothesis Testing

Hypothesis testing is performed using a mean difference or independent sample t-test with the help of SPSS 23 for the Windows program. Before interpreting the results of the t-test using the SPSS 23 for Windows program, several things should be noted, including determining the variances of the two variables. Variance can be determined from the output of the t-test in SPSS 23 for Windows, which is in Levene's Test for Equality of Variance column, which functions to show whether the variances of the two variables are the same or different. The variances of the two variables are said to be the same if the significance value (p) > 0.05. Conversely, the variances of the two variables are said to be different if the significance value (p) < 0.05 in Levene's Test for Equality of Variance column. The output in Levene's Test for Equality of Variance column shows that the variances of the two variables are the same. Hence, the coefficient t value to be read is in the equal variances assumed row column. If the variances of the two variables are different, then in the t-test, the coefficient t value used is in the equal variances, not the assumed row column.

Based on the pretest scores, the data is used to examine whether the level of student independence in the control and experimental classes is the same. The pretest scores of independence and students were analyzed using an independent samples t-test. The results of the independent samples t-test analysis for the pretest scores of student independence in the control and experimental classes are as follows:

Table 6: Results of Pretest Data t-test

Research Variable	Class	N	Mean	Mean Difference
Independence Pretest	Control	34	53,85	.050
	Experiment	34	53,35	

The pretest scores on learner's independence in the control group obtained a mean score of 53.85, and the result of pretest scores on learner's independence in the experimental group obtained a mean score of 53.35. The difference between the means of the two groups is shown in the mean difference column, which is 0.050, indicating that before being given the treatment of learning models in each class, the level of learner's independence in the control group was better than in the experimental group.

The hypothesis testing in this study is

1) Significant difference in independence between students taught using the Creative Problem Solving model and those taught using the Problem-Based Learning model.

H0: There is no significant difference in independence between students taught using the Creative Problem Solving model and those taught using the Problem-Based Learning model.

Ha: There is a significant difference in independence between students taught using the Creative Problem Solving model and those taught using the Problem-Based Learning model.

The results of the independent sample t-test for the post-test independence of the students in the control and experimental groups are shown in the following table:

Table 7: Results of Independent Sample t-Test for Post-test Independence

	Levene's Test for Equality of Variances		t-test Equality of Means		
	F	**Sig.**	**T**	**Df**	**Sig. (2-tailed)**
Equal variances assumed	.839	.060	.731	66	.046
Equal variances not assumed			.731	56.466	.047

Based on the results of the independent sample t-test calculation for post-test independence of students in the control and experimental groups using SPSS 23 for Windows, as shown in Table 8, the Levene's Test for Equality of Variances yielded an F value of 839 with a significance level of 0.060 (0.060 > 0.05). As this value is greater than 0.05, H0 is accepted, indicating that the data on students' independence in the control and experimental groups have homogeneous variances. Hence, the t coefficient should be read in the equal variances assumed column.

The next step is to test t using the assumption that the two variances are equal (equal variances assumed). The t-test analysis for post-test independence yielded a t-table value of 1.996 with df = 66 at a significance level of 5%. The t-value shows that the calculated t-value is less than the t-table value (0.731 < 1.996), and the sig. (2-tailed) value is 0.00 (0.046 < 0.05), which is less than the significance level of 0.05, indicating that H0 is rejected and Ha is accepted, showing a significant difference in the independence of students who were taught using the Creative Problem Solving and Problem-Based Learning models.

The magnitude of the mean difference in autonomy between the experimental class taught using the Creative Problem Solving model and the control class taught using the

Problem-Based Learning model can be seen in the following table.

Table 8: Results of Posttest t-test Data

Research Variables	Class	N	Mean	Mean Difference
Posttest Self-Regulation	Control	34	53,17	-0.89
	Experiment	34	54,06	

The post-test result for student independence in the control group obtained a mean score of 53.17, while the mean score for the experimental group was 54.06, with a mean difference of -0.89, as shown in the mean difference column. This indicates that after being given the learning treatment in their respective classes, the level of student independence in the experimental group was better than that of the control group.

Frequency Query is one of the features in NVIVO that can display the frequency of informative words, and the size of the words represents the number of times they appear, with larger sizes indicating that the word appears most frequently. We obtained a set of the most frequently occurring words in the data based on a search using this feature. Figure 1 and Table 9 shows the results of the Word Frequency Query feature. The word "Learning" dominates teacher conversations with a percentage of occurrence of 3.95% of the total data, followed by the word "Problem" with a percentage of 3.78%, then the word "PBL" with a percentage of 3.11%, "CPS" with a percentage of 3.02%, and "Students" with a percentage of 2.27%.

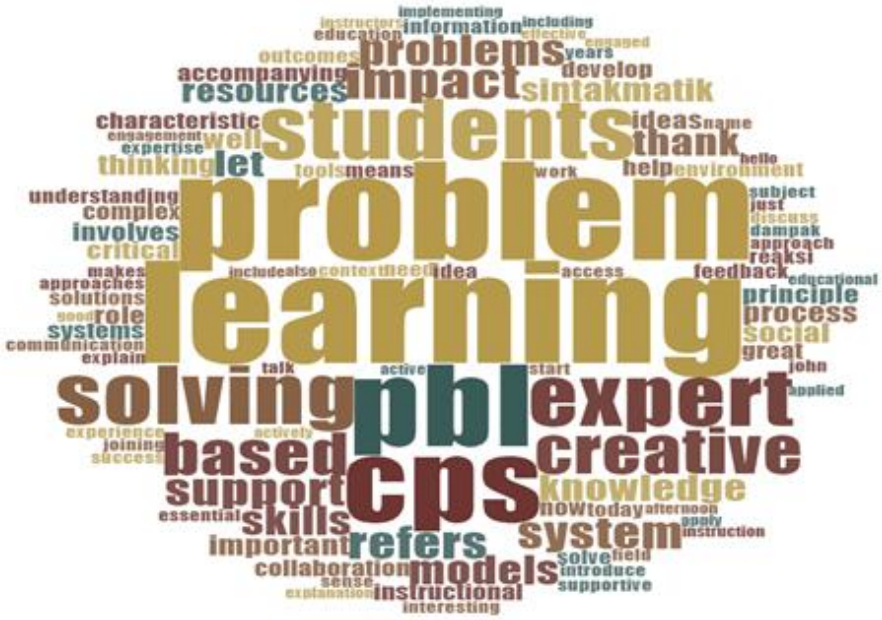

Fig 1: Words that frequently appear in the data

Table 9: The percentage words that appears in the data

Word	Length	Count	Weighted Percentage (%)
learning	8	47	3.95
problem	7	45	3.78
pbl	3	37	3.11
cps	3	36	3.02
students	8	27	2.27

The next feature is Text Search Query, which is used to understand the meaning of words in the word cloud. In this research, the researcher used the word "PBL" as one of the keywords for this research. The results of the Text Search Query feature can be seen in Figure 2. Based on Figure 2, it was found that there are two learning models namely PBL and CPS. In addition, other information related to PBL was obtained, namely that PBL and CPS have a positive impact and have characteristics of learning models including syntagmatic, social systems, reaction principles, support systems, instructional impact, accompanying impact, and many more pieces of information that can be seen in the word cloud.

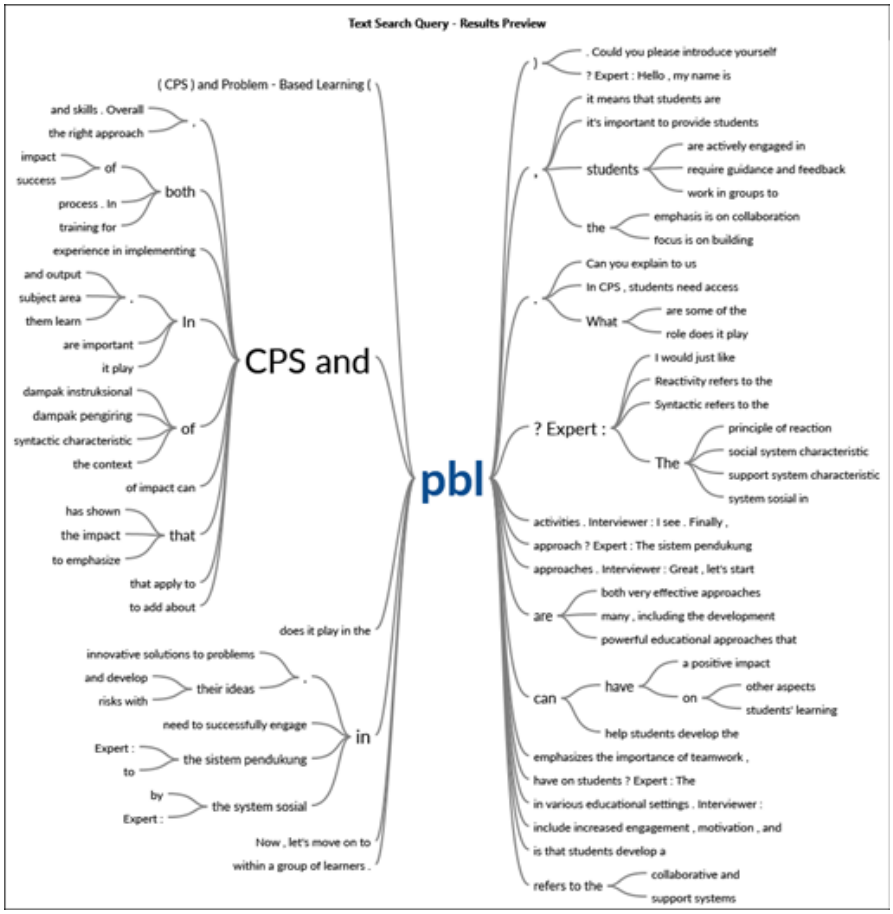

Fig 2: Word Tree of the Use of the Word "PBL"

Here are the results of the Project Map feature from four teachers who were interviewed about the differences in characteristics between the Problem-Based Learning (PBL) and Creative Problem Solving (CPS) models. The results of the Project Map can be seen in Figure 3.

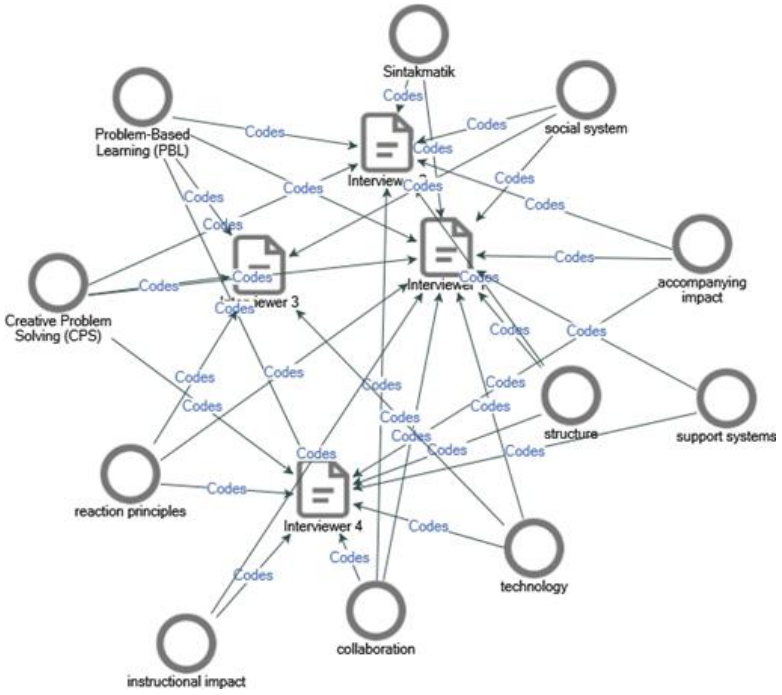

Fig 3: Project Map Result

Based on Figure 3, several pieces of information were obtained regarding the topics discussed by the four teachers, namely the Problem-Based Learning (PBL) and Creative Problem Solving (CPS) models, and the characteristics of learning models including syntagmatic, social systems, reaction principles, support systems, instructional impact,

and accompanying impact.

The final analysis compares the results of interviews from four teachers to check the level of similarity between the interviews. This analysis uses the Item Clustered by Word Similarity feature, which can be seen in Figure 4, and the Pearson Correlation Coefficient values can be seen in Table 3.

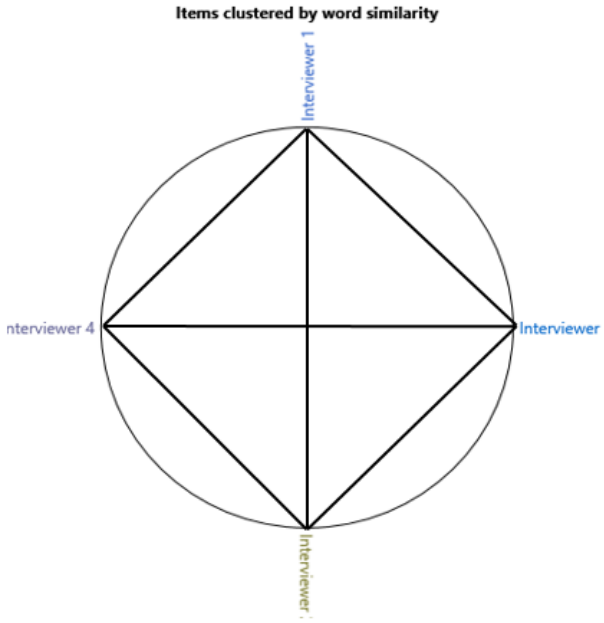

Fig 4: Item Clustered by Word Similarity

Table 10: The Value of Pearson Correlation Coefficient

Teacher A	Teacher B	Pearson Correlation Coefficient
Teacher 4	Teacher 1	0.663137
Teacher 3	Teacher 2	0.623623
Teacher 4	Teacher 3	0.569475
Teacher 4	Teacher 2	0.465922
Teacher 2	Teacher 1	0.282049
Teacher 3	Teacher 1	0.245214

According to Table 10 that there are two teachers who have relatively similar answers, namely Teacher 4 and Teacher 1, with a Pearson Correlation Coefficient value of 0.663137, Teacher 3 and Teacher 2 with a Pearson Correlation Coefficient value of 0.623623, Teacher 4 and Teacher 3 with a Pearson Correlation Coefficient value of 0.569475, Teacher 4 and Teacher 2 with a Pearson Correlation Coefficient value of 0.465922, Teacher 2 and Teacher 1 with a Pearson Correlation Coefficient value of 0.282049, and Teacher 3 and Teacher 1 with a Pearson Correlation Coefficient value of 0.245214."

3.2 Discussion

The Problem-Based Learning model aims to help students develop flexible knowledge, problem-solving skills, independent skills, collaborative skills, and intrinsic motivation (Hmelo, 2004) [17]. Previous research has shown that the Problem-Based Learning model improves students' learning outcomes (Rufaidah, 2020; Budi, 2020; Sabil *et al*., 2021) [38, 13, 39]. The researcher used the pretest data to examine whether students' independence level in the control and experimental groups was the same. The pretest data on students' independence was analyzed using an independent sample t-test. The results showed that the mean score for independence in the control group was 53.85, while the mean score for independence in the experimental group was 53.35, with a mean difference of 0.050. This indicates that before the implementation of the learning models in the control and experimental groups, the level of independence among students in the control group was better than that in the experimental group.

The researcher then applied the learning model treatment to each class. Namely, the control class was taught using the Creative Problem Solving model, and the experimental class was taught using the Problem-Based Learning model. The researcher examined whether there were significant differences in students' independence in the control class taught using the Creative Problem Solving model and the experimental class taught using the Problem-Based Learning model. The researcher analyzed the post-test scores of student independence using an independent samples t-test.

The result of the t-test analysis on independence post-test scores showed a significance value of 0.046 (0.046 < 0.05), which is smaller than the significance level of 0.05. Therefore, H0 was rejected, and Ha indicated that there was a significant difference in the independence of students taught using the Creative Problem Solving model and those taught using the Problem-Based Learning model in history subject. This is due to the differences in treatment in both classes during the learning process.

The difference in the mean of independence between the control class taught using the Creative Problem Solving model and the experimental class taught using the Problem-Based Learning model can be seen from the post-test values of student independence. The data on post-test values of student independence was analyzed using an independent sample t-test. The post-test values of student independence in the control class were obtained with an average score of 53.17. The result of the post-test values of student independence in the experimental class was obtained with an average score of 54.06, with a mean difference of -0.89, a negative value indicating that the independence level of the experimental class taught using the Creative Problem Solving model was better than the control class taught using the Problem-Based Learning model.

The Creative Problem Solving model can improve student autonomy. This is supported by research conducted by Intan (2017) [18] which stated that students taught using the Creative Problem Solving model had higher autonomy than those taught using conventional models. The research results showed that based on the hypothesis test, the obtained t-value > t-table was 4.456 > 1.997, so it can be concluded that the Creative Problem Solving model can improve student autonomy. In the Creative Problem-Solving model, students need to plan goals, regulate their learning, set time limits for completing tasks, and evaluate their learning, thus cultivating autonomy. Similar research was also conducted by Supardi (2017) [44], which stated that there was an increase in autonomy by implementing the Creative Problem Solving model. This can be seen from the percentage in cycle 1 of 60.20% and increasing to 75.85% in cycle 2. Thus, the Creative Problem Solving model impacts increasing student autonomy.

The Problem-Based Learning (PBL) model has been proven effective in improving students' independence. This can be evidenced by previous research conducted by Sabil *et al*. (2021) [39], which states that independence plays a crucial role in students' engagement in learning and motivates them to

develop problem-solving skills, self-efficacy, and creative thinking. The results of the study show that there is a significant difference in the application of the Problem-Based Learning model with scaffolding techniques towards the independence and learning outcomes of students. Another study by Aulia *et al*. (2019) also states that the Problem-Based Learning model can increase students' independence. This can be seen from the average score of student independence before treatment, which is 58.51. Meanwhile, the average score after treatment is 71.67. Therefore, the independence of students after treatment is better than before treatment.

The Creative Problem Solving model and the Problem-Based Learning model successfully improve students' independence, but the Creative Problem Solving model is better at enhancing student independence. The Creative Problem Solving model encourages students to solve problems creatively, increasing their motivation to learn the given material. The Creative Problem Solving model also motivates students to learn and improves their skills, knowledge, and thinking abilities (Lin, 2017; Kandemir & Gur, 2007). The Creative Problem Solving model emphasizes critical and creative thinking skills in problem-solving (Tseng *et al*., 2013). This requires students to participate in learning, which affects their independence actively. Therefore, the Creative Problem-Solving model taught in the experimental group is better at improving student independence than the Problem-Based Learning model taught in the control group.

4. CONCLUSION

The study's conclusion shows a significant difference in the independence of students taught using the Creative Problem Solving model and those taught using the Problem-Based Learning model. The difference in mean independence score of -0.89 negative value indicates that students' independence in the experimental class taught using the Creative Problem Solving model is better than in the control class taught using the Problem-Based Learning model. This is because the Creative Problem Solving model emphasizes critical and creative thinking skills in problem-solving, which requires students to actively engage in learning actively actively, thus influencing their independence.

This study recommends that educators are encouraged to utilize the Creative Problem Solving model in teaching to help students master the learning material according to their abilities and take initiative to achieve optimal independence.

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