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The Influence of Online Project Collaborative Learning and Achievement Motivation on Problem-Solving Ability

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Abstract: The aim of this study is to find out the influence of online project collaborative learning and achievement motivation on problem-solving ability in the area of citizenship. This study uses a quasi-experimental design. The total of study subjects is 71 students of higher education; consist of 36 students as the experimental group and 35 students as the control group. Data of problem-solving ability is obtained by using an essay test, while data of achievement motivation is obtained by using a questionnaire. Data analysis is done with ANOVA (Analysis of Variance). The study results show that online based-project collaborative learning strategy has a positive influence on civic problem-solving ability. There is a difference in civic problem-solving ability between students with high achievement motivation and students with low achievement motivation. Online project collaborative learning strategy and achievement motivation interact in influencing the civic problem-solving ability of students. It is recommended that further study corroborate this finding by testing again the effectiveness of using online-based project collaborative strategy in the aspect of problem-solving in a similar field of study.

Keywords: *Online project collaborative learning, achievement motivation, civics problem-solving.*

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Introduction

The effort to renew learning activity is continuously done along with the development of learning science related to the application of information technology (Suartama, et al., 2021). Development and renewal are in accord with the demand of learners need in the 21st century, namely the ability to collaborate, communicate, and problem-solving (Levy & Murnane, 2003). Online learning is learning that must be pursued along with the development of information technology in order to achieve learning objectives. Today, online learning is a very good choice in education, particularly when there is an obstacle for traditional learning situation (Moore et al., 2011).

The learning strategy which is suitable with the demand of the 21st century is a project and collaborative learning in which this learning can use an innovative approach (Bell, 2010; Lee et al., 2015). Project-based learning has often been done, but in the 21st century, it requires project collaborative learning (Helle et al., 2006). In project-based learning, students are encouraged to cooperate, discuss and share an idea (Krajcik & Czerniak, 2014). Project-based learning affects positively students' dimension development related to information literacy and skill in information technology (Chu et al., 2011). The use of information technology tools in learning also has generated many study results about online-based collaborative learning.

Online project-based collaborative learning is expected to improve student performance, learning experience, and problem-solving. All these factors contribute to the fact that collaborative online learning is considered a pleasant and beneficial experience (Farrah, 2015). The online learning system can enrich students' collaborative learning activity and their knowledge construction through group interaction (Zhu, 2012). Meanwhile, the results of online-based project collaborative learning studies in other fields have not yet obtained findings related to problem-solving.

Online project-based collaborative learning benefits college students, because it can help each other in working on virtual projects. the collaborative characteristics of online-based projects consist of five indicators; Communicate,

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Cooperate, Compromise, Commitment, and Compliment. The learning process is carried out in an e-learning system developed by the University with a learning environment that is not tied to classical. The conventional learning strategy used as a control class is carried out by face-to-face lectures starting with a lecture, then group discussions from the results of assignments that have been carried out previously, and ending with drawing conclusions together.

Literature Review

The study of project-based online collaborative learning strategies already has the results of research. Project-based collaborative learning is considered a useful method to enhance active, meaningful, and directed communication among students in which its learning can enhance English language skills, particularly writing skills provided students try to collaborate (Al Rawahi & Al-Mekhlafi, 2015). Another study concluded that project-based online collaborative learning uses ADDIE Model to get positive feedback (Nadiyah & Faaizah, 2015). Project learning in the web-based community succeeds to promote learning through group reflection (Kim et al., 2011).

By giving attention to those study results above in which some focused-on project collaborative learning it had not tried to find its influence on problem-solving particularly in civic problem-solving. Therefore, this study tries to use online-based project collaborative learning to find its influence on civic problem-solving. It is expected that the application of online-based project learning can become the solution to enhance the civic problem-solving ability of students.

Research results that are used as a basis for supporting research on online-based project collaborative learning strategies related to problem-solving are the results of research on project-based learning, project collaborative learning, and online-based learning. Among the research results, it is clear that project-based learning is very good for encouraging student independent learning (Chiang & Lee, 2016). Project-based learning can place students in real projects to solve problems they face in reality (Hartescu, 2014; Salehudin, Sarimin et al., 2020). The development of project-based learning strategies contributes to students' problem-solving abilities (Pinho-Lopes & Macedo, 2014). Project-based learning is learning strategy which participates in the project, it is interesting for students because they learn by solving problem, collecting data, discussing, and presenting the result as a report (Chu et al., 2011; Koh et al., 2010). Students who learn collaboratively in a blended environment are able to solve a homework problem, learn for the exam, and enhance their conceptual understanding in the course (Kandakatla et al., 2020).

The results of related research reveal that increasing learning outcomes, motivation, and problem-solving abilities can be pursued through digital projects (Hung et al., 2012). Online learning based on blended learning also can enhance student's attitudes and problem-solving skills (Tsai & Tang, 2017). Meanwhile, another study on citizenship related to the application of project collaborative learning focuses on the effort to create active citizenship through the management of the project-based learning (Shadiev et al., 2015). Meanwhile, the research examines the effect of adaptive-based collaborative learning strategies on student learning outcomes in civic education in secondary schools (Adeyemi, 2017). Based on this study, it is expected that this study becomes a new finding in the civic education field by testing the influence of online-based collaborative learning strategy on civic problem-solving of students.

Another variable that also influences the problem-solving ability of students related to civic education is the achievement motivation variable. In this study, the achievement motivation variable is placed as a moderator variable which also influences problem-solving ability. The study result revealed that achievement motivation affects learning outcomes and learning quality (Soltanzadeh et al., 2013). Achievement motivation is something that causes people to choose a certain activity, how long they can persist in that activity (Dorney & Otto, 1998). Achievement motivation is an intrinsic motive that proclaim students' experience and interaction with elements and environment surround it (Bandura, 1986).

Some study results had revealed that achievement motivation has a relationship with learning outcomes. The result of the research explains that achievement motivation has a positive correlation with academic achievement (Bakar et al., 2010). Achievement motivation affects the product quality of their work (Capa et al., 2008). Some study results also had investigated the correlation of learning motivation and problem-solving ability. The problem-solving ability of students with low achievement motivation differs from students with high achievement motivation (Vollmer & Kaufmann, 1975). Students with high achievement motivation have strength in problem-solving compared with students with low achievement motivation.

Participants with high achievement motivation have a high score of problem-solving style and tend to persist in training compared to participants with low achievement motivation (Cassidy, 2002). Another result study revealed that there is a correlation between problem-solving strategy and achievement motivation (Preckel et al., 2006). By noticing some results of studies about project collaborative learning and online learning, the correlation between achievement motivation and problem-solving which has been done in another field, then this study is deserved to study online-based project collaborative learning strategy as another influencing variable and student's achievement motivation. Therefore the problems for this research can be formulated as follows:

1. Is there an influence of online project collaborative learning on student's problem-solving ability?
2. Is there an influence of achievement motivation on student's problem-solving ability?

3. Is there an interaction between learning strategy and achievement motivation on problem-solving ability?

Method

Design of Study

This study is an experimental study, with quasi-experimental design. Quasi-experiment is used as consideration that student characteristic is varied, so it is impossible for the researcher to manipulate all related variables (Budiyono, 2015). This experiment study design uses factorial research design, in which research structure has two independent variables and faced each other to study its effects independently and interactively on the dependent variable (Kerlinger, 1986). This design is a 2 x 2 factorial design, in which two variations of one factor (A1 and A2) and two variations of another factor (B1 and B2) are manipulated at the same time. This factorial design needs the formation of four treatment groups, with each group needs a different combination of two factors: A1B1, A1B2, A2B1, and A2B2 (Gall et al., 2003). The factorial design can be explained in the table as follows.

Table 1. Factorial research design 2 x 2 two ways

Independent Variable		Learning Strategies (A)	
		Online project collaborative learning (A ₁)	Conventional (Assignment and Group Discussion) (A ₂)
Achievement	High (B ₁)	(A ₁ , B ₁)	(A ₂ , B ₁)
Motivation (B)	Low (B ₂)	(A ₁ , B ₂)	(A ₂ , B ₂)

Research subject

The subject of study is students of the State University of Malang who programmed Civic Education course in the even semester of 2019/2020 academic year. Research subjects who learn with online project-based collaborative learning strategies are used for experimental groups conducted virtually where students are free to have a place wherever they are. Students also present assignments online, including online discussions using university e-learning. While the research subjects are learning conventional strategies, students learn face-to-face in class including presenting assignments. The subject of study will be explained in accord with the difference of treatment group and individual character based on achievement motivation as follows.

Table 2. Subject of study

Achievement Motivation	Experiment Group	Control Group	Total
High	17	18	35
Low	18	18	36
Total	35	36	71

Instrument of study and procedure

The instrument used to collect data are a questionnaire and test. The questionnaire is used to obtain data of achievement motivation as a moderator variable with an aim to group students who have high achievement motivation and low achievement motivation. The questionnaire used was the achievement motivation questionnaire developed by (McClelland, 1961). Then, it was adjusted to the learning aspects. The essay test was used to measure the problem-solving ability of students. The essay test was developed in the form of an indefinite essay test so that students can solve citizenship problems in detail. The use of those two instruments had fulfilled the requirement of validity and reliability test. The collection of achievement motivation data was done at the beginning of lectures concurrent with the initial test to measure problem-solving ability before treatment is given. While the final data for the effect of learning strategies in the experimental group and the control group on problem-solving abilities was carried out in the midterm exam.

Analysis of data

Data analysis is series of activities to examine, group, systematize, interpret, and verify data in order that a phenomenon has value. This study uses statistical analysis by using Analysis of variance (ANOVA) factorial 2x2 of two ways. Before doing analysis by using ANOVA, two conditions should be fulfilled first, namely: 1) data is normally distributed; 2) data must be homogenous. To ease the data analysis process whether normality test, homogeneity, and ANOVA in this study, the researcher used the computer program *Statistical Package for the Social Sciences (SPSS)* version 23.0.

Result

The influence of online project collaborative learning strategy on problem-solving ability

To prove that there is an influence of online project collaborative learning strategy on problem-solving ability is done by comparing the difference of problem-solving ability between groups who are taught by online project collaborative learning strategy and conventional learning strategy. That difference is displayed in Table 3 as follows.

Table 3. The difference of problem-solving ability between experiment group (online project collaborative strategy) and control group (conventional learning strategy)

Descriptive Statistics			
Dependent Variable: Problem-solving ability			
Learning Strategy	Mean	Std. Deviation	N
Online project collaborative strategy	77,78	10,173	36
Conventional learning strategy	73,86	8,321	35
Total	75,85	9,449	71

Table 3 above shows that the mean score and deviation standard for problem-solving ability between the experimental group who apply online project collaborative strategy is higher than the mean score and deviation standard of the control group who uses conventional learning strategy. To prove whether or not there is a significant difference, the ANOVA result can be explained in table 4 as follows.

Table 4. The significance level of difference of problem-solving ability between experiment group and control group

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Learning strategy	258,228	1	258,228	5,205	,026
Error	3323,938	67	49,611		
Total	414675,000	71			
Corrected Total	6249,296	70			

Dependent Variable: Problem-solving ability

Table 4 above proves that the difference in problem-solving ability between students who are taught by online project collaborative learning strategy and students who are taught by conventional learning strategy is significantly different. It is proved by the result of data in *Tests of Between-Subjects Effects*, in which significance value of 0.026 is smaller than 0.05. Therefore, it can be concluded that online project collaborative strategy has a significant influence on problem-solving ability. The effect size provided by the online learning strategy model is also greater based on the gain score which reaches 0.444 in the medium category, compared to conventional learning strategies with a gain score of 0.291 which is still in the low category.

The influence of achievement motivation on problem-solving ability

The influence of achievement motivation on student's problem-solving ability can be proved by descriptive statistic table as seen in table 5 as follows.

Table 5. Descriptive statistic of student's problem-solving ability based on achievement motivation

Achievement motivation	Mean	Std. Deviation	N
Low	70,14	7,120	36
High	81,71	7,854	35
Total	75,85	9,449	71

Table 5 shows that students who have low achievement motivation and high achievement motivation differ in their problem-solving ability in which group of low achievement motivation has a mean score of 70.14 and group of high achievement motivation achieve 81.71. The ANOVA test is done to ensure that there is a significant difference as in Table 6 as follows.

Table 6. Significance level of problem-solving ability difference between group of students with low achievement motivation and group of students with low achievement motivation

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Achievement motivation	2330,692	1	2330,692	46,979	,000
Error	3323,938	67	49,611		
Total	414675,000	71			
Corrected Total	6249,296	70			

Dependent Variable: Problem-solving ability

The result of the ANOVA test in Table 6 above shows that the group of students with low achievement motivation and the group with high achievement motivation have significant difference because significance value of 0.000 is lower than 0.05. Therefore, it can be concluded that achievement motivation influences problem-solving ability. The effect size of the high achievement motivation group was greater based on the gain score which reached 0.477 in the medium category, compared to the low motivation group with a gain score of 0.267 in the low category.

Interaction of learning strategy and achievement motivation on problem-solving ability

The result of interaction between learning strategy and achievement motivation and its influence on problem-solving ability can be showed in table of *Tests of Between-Subjects Effects* as follows.

Table 7. Significance level of influence in interaction between learning strategy and achievement motivation on problem-solving ability

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Learning strategy *	297,197	1	297,197	5,991	,017
Achievement motivation					
Error	3323,938	67	49,611		
Total	414675,000	71			
Corrected Total	6249,296	70			

R Squared = ,468 (Adjusted R Squared = ,444)

Dependent Variable: Problem-solving ability

The table above shows that there is an interaction between learning strategy and achievement motivation that influences problem-solving ability. Evidence of interaction is seen from the significance value of 0.017 which is lower than 0.05. The interaction of students with high achievement motivation in the group who learn with conventional learning strategy also gives a real contribution. In that table, it is seen that score of R Squared = .468 which means that contribution of those two variables is 46.8%. Another evidence that shows that there is an interaction can be seen in the figure as follows.

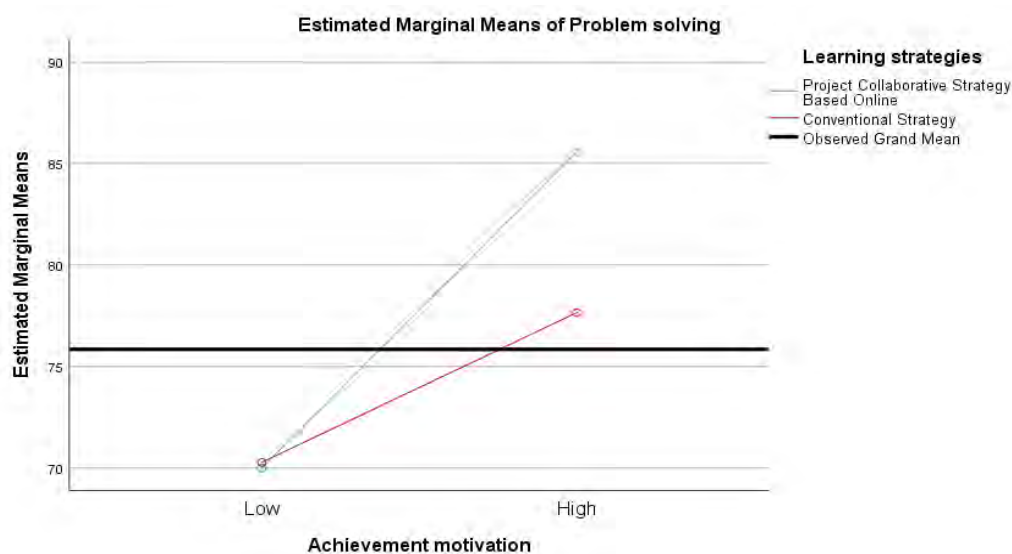


Figure 1. The interaction of learning strategies, achievement motivation affects problem-solving abilities

The picture above shows that evidence of an interaction between the learning model and achievement motivation is seen on the grand mean line. The cutting of two lines, namely the collaborative online project strategy and conventional

learning strategies with high and low achievement motivation variable lines. The existence of this deduction proves that there is an interaction in the context of the influence that is given together on problem solving. This means that the learning model and achievement motivation are two variables that affect the problem-solving ability of citizenship.

Discussion

Discussion of study result is done in accord with aim and finding of study namely: 1) influence of online project collaborative strategy on problem-solving ability, 2) influence of achievement motivation on problem-solving ability, and 3) interaction of online project collaborative learning strategy and achievement motivation and its influence on problem-solving ability. Discussion of three finding results can be explained as follows. The first finding of this study is that online project collaborative strategy is influential on the problem-solving ability. It is because the problem-solving ability of students who learn with online project collaborative learning strategy is significantly different from students who learn with conventional learning strategy.

This result is supported by an earlier study that said that situated learning strategy had an influence on problem-solving ability (Utari et al., 2019). Problem-solving is the effort to apply a complex new solution to a dilemma through a collaborative approach (Manassis, 2012). Collaborative learning is very effective when students are confronted with problem-solving (Retnowati et al., 2017). Conventional teaching is effective to acquire factual knowledge but to enhance problem-solving ability, it is more effective to use collaborative group learning (Mandusic & Blaskovic, 2015). Problem-solving ability of students who learn with collaborative learning is better than students who learn with conventional learning (Adolphus et al., 2013).

Another study also asserted that a project-based learning strategy can grow and develop the student to the thinking process and problem-solving (Sukmawati et al., 2019). Project-based learning not only can enhance student motivation to learn but also can facilitate students to enhance problem-solving ability (Chiang & Lee, 2016). Project-based learning can make problem-solving ability become better compared with conventional learning (Kamil et al., 2020; Tamba et al., 2017). Project collaborative learning has an influence on concept understanding and concept application (Safiah et al., 2020). Learning with the performance of a collaborative team with democratic control is better than the collaborative group with autocratic control (Acharya & Sinha, 2018).

The results of this study were also supported by the results of research which stated that collaborative learning with computer media had a positive effect on students' positive attitudes in collaborating and problem-solving skills (Uribe et al., (2003). Online collaborative learning can increase participation in exploring problem-solving tasks (Rosen, 2014). Project-based learning through collaboration among online groups is a good strategy felt by students and has a good impact on collaborative skill and project performance (Lou & MacGregor, 2004). Online project learning with collaborative strategy influences student's problem-solving process and performance (Thomas & MacGregor, 2005). Collaborative learning is very beneficial for team members in doing project tasks (Ellis & Hafner, 2008). Students who learn in international classes with online collaboration perform better significantly in project work compared with students who are not involved in this study (Appiah-Kubi & Annan, 2020).

Based on support from some references above, the finding result can be accepted that online project collaborative learning is effective to enhance civic problem-solving ability. This effectiveness is seen from a learning process done online, in which students can do the learning process anytime and anywhere without limited by space and time. Another positive side is when a student or team member who is responsible for a task face obstacle, they can directly discuss online with other group members and also with the lecturer who are in one group together with them. Meanwhile, in the control group who learn with conventional learning strategy the presence of an instructor to help and guide them in doing the task is limited by time and space caused learning is limited when face to face in class.

The second finding is there is an influence of achievement motivation on civic problem-solving ability, in which students with high achievement motivation have better ability in problem-solving compared with students with low achievement motivation. This study result is supported by some earlier studies in various fields. Achievement motivation has a positive correlation with the ability in solving a mathematical problem (Awan et al., 2011; DeCaro et al., 2015; Sings et al., 2002; Stanly, 2014). Problem-solving ability in students is significantly influenced by achievement motivation variables (Surur & Tartilla, 2019; Yunus et al., 2021). In the psychological aspect related to problem-solving, reality therapy also has a positive correlation with achievement motivation (Masoudi et al., 2016).

The ability to solve problems is better owned by groups of students with high achievement motivation (Vollmer & Kaufmann, 1975). Teacher, parent, peer support will increase student involvement and motivation to achieve success together (Bempechat & Shernoff, 2012). The study conducted by McClelland (1961) generates achievement motivation theory which identifies cognition and behavior of people with high achievement. Individuals with high achievement consistently use series of thinking and strategy to do a task assigned to him or her.

Students with high achievement motivation also have a good problem-solving ability because it is related to student attitude aspect to learning. A student who has a positive attitude to learning has a learning outcome which is better compared to a student who has less positive attitude to learning (Bakar et al., 2010). Another study also concluded a

positive and significant relationship between learning attitudes and academic motivation, and there was a high and positive correlation between intrinsic, extrinsic motivation and academic motivation (Tasgin & Coskun, 2018). Students with high achievement motivation also have more positive attitude to the exam they will face (Adegboyega, 2018).

Online learning has been recommended by many researchers, particularly for higher education. E-learning can enhance effectiveness, motivation and academic achievement, and involvement in the learning process (Lin et al., 2014). Online learning has a positive correlation with student attitude, in which they like it, but it does not influence assessment results (Wong & Fong, 2014). The online discussion gives students essential time to create a response that stimulates thinking, encourages students to consider information to support each other in posting their discussion (Bosman et al., 2019; Salehudin, Hamid et al., 2020). E-learning is more efficient when all teaching and learning approaches are applied. Thus, it is recommended that e-learning should be included as one tool which is integrated in enhancing learning quality (Castillo-Merino & Serradell-López, 2014).

Achievement motivation is the main contributor to the achievement of student's learning outcomes, so it is important for teachers to consider it (Suswanto et al., 2017). Achievement motivation contributes to problem-solving about conflict (Yunus et al., 2020). Related to this achievement motivation, another aspect such as family will be influential. Verkuyten et al. (2001), writes that achievement motivation in Turkey, adolescents and youths who learn in Netherland relates directly to their individual motivation, and individual motivation is an independent predictor to performance, but in the case of academic performance, family motivation is positively related goal orientation, mediated by family motivation. With support from another study result as explained, it is reasonable for study to conclude that achievement motivation influences the civic problem-solving ability of students. Civic problem-solving ability in this study is national identity problem, national integration and national defense. The aspect which causes students with high achievement motivation to possess better problem-solving ability namely high hard work, the high expectation for success, high anxiety for failure, and have the willingness to compete.

The third finding shows that there is an interaction between learning strategies and achievement motivation in influencing students' citizenship problem-solving abilities. Interaction between learning strategy and achievement motivation is possible because those two variables have an influence on learning outcome problem-solving. This is in line with the results of research which reveal that achievement motivation that interacts with problem-based learning strategies can have a positive effect on problem-solving abilities (Surur & Tartilla, 2019). Collaborative learning projects interact with social skills in influencing concept understanding and concept application abilities (Sukmawati et al., 2019). This conclusion does not contradict research which states that online project collaborative learning strategies that interact with achievement motivation can affect problem-solving abilities.

The results of this study are also supported by research results that reveal that collaborative projects have been used in arts, social sciences, science, and technology courses in higher education with the assumption that the strategy used is a more active student-centered approach and motivated to learn (Donnelly & Fitzmaurice, 2005). Social science such as civic education will become one subject that can be studied with online project collaborative learning. Online-based project learning by using group discussion is really preferred by students in which its acceptance level is very high (Tiantong & Siksen, 2013). Project-based online learning can be used to enhance student achievement. The success in applying online collaborative learning is a learning outcome, and that success is influenced by teacher guidance in an online system in which teachers communicate with students continuously (Sato & Kageto, 2015).

With good cooperation in collaboration among students and students with lecturers consistently, motivation to finish project tasks will be generated. Then, achievement motivation also will be generated and function by itself, so the interaction of learning strategy and achievement motivation influence student ability in problem-solving. Students prefer and motivated by learning that demand them to explore with internet media to do a social project. Thus, online project learning in the social field today is one alternative that deserve attention in higher education.

Conclusion

The conclusion of this study is: First, online project collaborative learning strategy has an influence on civic problem-solving ability in students. Online project collaboration is more effective in enhancing problem-solving ability. Effectiveness is caused by the online learning process, in which students can do it anytime and anywhere without limited by space and time. Second, achievement motivation also influences civic problem-solving ability in students. It asserts that student with high achievement motivation has a better civic problem-solving ability. The cause that makes a group of students with high achievement motivation is better in problem-solving are maximal effort and hard work, have an expectation to succeed, always feel anxious about failure, and ready to compete. Third, online project collaborative learning strategy and achievement motivation interact in influencing civic problem-solving ability in students. Indirectly, achievement motivation will be formed in students who like online project learning. It means that students who had learned with a strategy which is suitable with his or her need will always try to achieve the maximal result, including in civic problem-solving.

Recommendations

This study result has a practical contribution that application of online project collaborative learning to enhance civic problem-solving ability can be used by the civic lecturer as one alternative in implementing learning. It is recommended that lecturer and teacher who teach course or subject which is similar with civic education course also can conduct further study to prove the effectiveness of online project collaborative strategy. It aims to prove the appropriateness of use and application of online project collaborative strategy can be accepted as a concept or theory of learning in the technology and information era. It can also continue by testing the collaborative learning model of the project with other moderating variables which are student characteristics such as self-efficacy and self-regulated.

Limitations

This research is limited to solving problems of citizenship that focus on aspects of the problem of national identity, national integration, and national resilience. Another drawback is the test that is done to measure the problem solving is the test description.

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