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# The Implementation of Joyful Learning Strategies Using Experimental and Project Methods in terms of Students' Creativity and Self-Discipline

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**Abstract**

*This study aims to analyze the difference of students' study result between the joyful learning strategics using the experimental and project method seen from the creativity and self-discipline. The research method used in this study was the experimental method. The research design used in the study was a quasi-experimental research design. The sample was obtained by using the Cluster Sampling technique which consisted of two classes through scientific-based learning observations using project and experimental methods in different classes. The data collection on the learning outcomes of the knowledge aspect used to test techniques, the attitude aspect used the questionnaire technique, and the skill aspect used the observation sheet. The results of this study shows that project method influencing students' study and skill result better than the experimental method. The learning outcomes of students' knowledge and skills with creativity were better than those of students with low creativity. The learning outcomes of students with high self-discipline were better than those of students with low self-discipline.*

***Keywords:*** *Creativity, Self-Discipline, Learning Outcomes*

## 1. Introduction

Education is a very important part of a country. Education is the process of transmitting and receiving (Naziev, 2017; Tetep & Suparman, 2019) which is not similar to manufacturing production-line since students are highly concerned about the quality of education they receive (Kromydas, 2017). Equal access to education is a critical need, one that is particularly important for those in our undeserved communities (Dziuban et al., 2018). It is like the situation of countries being split into developed countries and developing countries in which Indonesia is under the developing countries list (Vasconcellos et al., 2018). Developing countries are measured by the progress of their education. To develop is to grow not only the economic growth but also interdisciplinary on education as well. Hence, education can be a key dimension of well-being and a crucial indicator of development (Friedman et al., 2020). Different countries adopt different education systems by considering the tradition and culture and adopt different stages during their life cycle ata school and college education levels to make it effective (Aithal & Aithal, 2020). It is the curriculum frameworks as the exercise power which curricula in the region have been produced (Durrani & Nawani, 2020). National education standards are as a simultaneous instrument of fair school control and performance increase (Hartong, 2015). As we know, national education functions to develop and build the character and civilization of a nation with dignity to educate the life of the nation. This is in accordance with the Law of Republic of Indonesia number 20 of 2003 concerning the National Education System. The development of education is also influenced by technological developments because technological developments will change the mindset and lifestyle of the community, including students and teachers, so that it will indirectly affect the current teaching system and educational process

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(Budiman, 2017). Hence, development education addresses the sustainability issues (O'Flaherty & Liddy, 2018).

Physics learning in senior high schools based on observations in the State Senior High School 2 Surakarta showed that it still used conventional methods in which the teacher presented teaching materials via LCD and explained it with lectures. Then, the students were given practice questions to find out students' abilities based on what the teacher has provided. The atmosphere of learning Physics in which the students only listen to lectures and exercise will make the students feel bored. In this case, it is similar to the traditional classroom teaching with only the chalk and board as the method of choicefor teaching (Vadakedath et al., 2018). Therefore, based on preliminary observations at school, in which 9 out of 27 students answered that Physics learning was boring, 6 of them answered that it was fun, 5 answered that it was fine, and 7 answered that it depended on the teacher who taught it. The assumption that Physics is difficult and boring is due to the innovative delivery of Physics learning concepts and practices has not been broadly applied by teachers. In teacher education, innovation is invoked as a proxy for change when new technological products (or solutions) are advanced (Ellis et al., 2019). Raising the quality and scale of innovations in education will positively affect education itself and benefit the whole society (Serdyukov, 2017). Teacher has to adapt curriculum and lesson plans while bringing innovations in his teaching methods (Naz & Murad, 2017). This is because basically students are able to do Physics questions correctly based on their understanding of the Physics concept because the Physics subject consists of concepts that are developed in everyday life. If students begin to understand Physics concepts well, it will improve their Physics learning outcomes. Based on a previous study, it stated that concept learning can significantly improve learning outcomes (Hanna et al., 2016). Concept learning as the ability to extract commonalities and highlights distinctions across a set of related experinces to build organized knowledge is a critical aspect of cognition (Zeithamova et al., 2019). The capacity to learn abstract concepts is considered higher-order cognitive function (Cope et al., 2018). The notion of critical thinking is used as a case for an epistemological critique of the model of intended learning outcomes (Erikson & Erikson, 2019). Learning outcomes are defined as statements of what a learner knows, understands, and is able to do after completion of learning (Harris et al., 2019). The learning objectives or outcomes communicate the knowledge and skills that has been taught by teachers for students to acquire in school (Osueke et al., 2018).

Comfortable learning conditions are required so that the learning atmosphere is no longer boring. Environment and the interaction of it with individuals' personal characteristics affect and shape human behavior (Mutlu & Yıldırım, 2019). Learning environment or atmosphere is considered as an essential factor in determining the success of an effective curriculum and the students' academic achievements (Shrestha et al., 2019). There is a need for an effective teaching and learning concept, while the implementation of effective teaching and learning process can occur if students are actively involved in the learning process previously provided by the teacher (Silaban, 2014). The development of an effective learning experience requires the modification of conventional learning (Prameswari & Budiyanto, 2017). Therefore, to make students more active in class, teacher should do explanation and facilitation strategy (Tharayil et al., 2018), for instance, giving experimental projects. Active learning can be considered as a superior method (Deslauriers et al., 2019). That is why building a comfortable teaching and learning process will give a positive impact on students so that they feel they need the learning. In this sense, learning spaces are not understood as as simple activites, but the concept goes beyond a mere architectural object (González-Zamar et al., 2020). In addition, an opinion suggested that the factors that influence learning are classified into two, consisting of internal factors including intelligence, interests, talents, and readiness, while external factors include family and school environment factors, also the atmosphere of the learning environment (Slameto, 2010). It is challenging to combine everyday life with learning activites (Henderikx et al., 2019). Points from the principles of learning in the 2013 curriculum include a joyful and challenging learning environment or atmosphere that will be very suitable for students so that Physics

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learning is greatly enjoyed by students. The learning environment and learning readiness play a very positive role in improving students' Physics learning achievement (Widyaningtyas et al., 2013). It is in line with the idea of how children's development and learning are shaped by interactions among the environmental factors, relationships, and learning opportunities they experience, both in and out of school (Darling-Hammond et al., 2020). The teacher as an intermediary for knowledge has a very significant role in the teaching process (Daryanto & Rahardjo, 2012). Thus, teachers must have the ability to think about and plan to learn carefully and thoroughly in increasing learning opportunities for students. Teachers must also improve the quality of their teaching. It is as learning style can be seen as unique ways an individual processes and retains new information and skills (İlçin et al., 2018). That is why, the ways to support teachers as they transition into non-traditional teaching must be developed (Keiler, 2018). This requires changes in class organization, use of teaching methods, teaching and learning strategies used, and teacher attitudes and characteristics in managing the teaching and learning process. These are for teacher professional development and school reform for the role of teacher agency (Imants & Van der Wal, 2020).

During the observation process at the State Senior High School 2 Surakarta, the principles mentioned in the 2013 Curriculum had indeed not been fully implemented by the teacher. In schools, the lecture method and question exercises are still broadly used by teachers. On the other hand, learning in the 2013 curriculum requires a change in the pattern from teacher-centered learning (TCL) to student-centered learning (SCL). SCL learning has many advantages compared to TCL learning (Muqarramah, 2016). In the journal article, it is affirmed that SCL learning causes students to be more active in class and teachers are only facilitators, so that the lecture method in the learning process is no longer in accordance with the 2013 curriculum. Learning using practicum at the State Senior High School 2 Surakarta is also still limited, in which the results of observations showed that 9 out of 16 students said that the teacher did not often do learning by conducting an experiment at school and 12 out of 16 students said that the teacher had never implemented project learning in school. The learning process in schools is still dominated by learning in the classroom and has not optimally utilized learning in the school environment or in the laboratory. The student learning activities in the teaching and learning process are very crucial so that John Dewey, as an educational figure, remarked the importance of this principle through the project method with the motto of learning by doing (Daryanto & Rahardjo, 2012). The quality of knowledge lies not in the final result or final product, but in the methodological process or how to find it (Mastuhu, 2003). In other words, the essence of new learning is conducting research, not accepting finished goods anymore.

The problems that arise in the Physics learning process can be overcome with a lesson that creates an attraction for students to study Physics and provides students with a real learning object. Joyful learning strategies are one of the appropriate learning strategies in overcoming Physics learning problems. The researcher directed a joyful learning strategy for experimental and project methods that refer to the 2013 Curriculum. Besides, another goal to be achieved through joyful learning strategies with experimental and project methods is to direct students to learn Physics by understanding Physics concepts and showing a real object of learning Physics. Then, students are more trained in their creativity to solve Physics problems and comprehend that Physics concepts can be found in everyday life in their environment. A study indicated that there is a positive and significant effect of learning using project methods in improving creativity and learning outcomes (Rati et al., 2017). Based on the elaboration above, it can be seen that teachers in Senior High School 2 Surakarta are still using the conventional method, meanwhile nowadays teachers need more than just explaining and talking in front of the class to make students be more active and to be more joyful in joining and participating in the class. Thus, this research will offer a joyful learning strategy emphasizing the student approach in real learning activity settings using experimental and project methods.

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## 2. Method

The research method used in this study was the experimental method. The research design used in the study was a quasi-experimental research design. In this study, there were two experimental groups, consisting of group I which was the group treated with the experimental learning method and group II which was the group treated with the project learning method. The two groups were provided with different learning treatments. Once being given the learning treatment, both groups were provided a learning outcome test. The results of the learning outcomes test of the two groups were compared to determine the appropriate learning method for learning Physics materials on elasticity and Hooke's law based on student characteristics. This study was conducted at the State Senior High School 2 Surakarta of class XI in the odd semester of the 2019/2020 academic year which is located at Jl. Monginsidi No. 40, Gilingan, Banjarsari District, Surakarta City, Central Java. This study was conducted from February 2019 to December 2019. The time to collect the research data was adjusted to the presentation of material on Elasticity and Hooke's Law. The population in this study were all students of class XI MIPA in the odd semester at the State Senior High School 2 Surakarta in the 2019/2020 academic year. The sampling technique of the study used was cluster sampling. In this study, the sample was collected randomly from 2 classes and tested using a two-tailed t-test to determine the similarity of the initial state of the two samples used.

The independent variables in this study were the strategies, approaches, and methods of learning Physics that were implemented. The moderator variables in this study consisted of creativity and self-discipline. The dependent variable in this study was the learning outcome. In this study, the data on learning outcomes were collected using a test, questionnaire, and observation techniques, while the data on creativity and self-discipline were collected using a questionnaire. Before the test instrument is used for research, it is necessary to test the validity and reliability of the questions. The validity of the questions is used to find out which questions are valid and can be used to test the ability of students' knowledge of Physics. Reliability is the level of consistency or stability of the measurement results. A good instrument is an instrument that can consistently provide data in accordance with reality (Arikunto, 2010). In this study, the test instrument used had met the validity and reliability values of the questions.

There were two prerequisite analysis tests used in this study, consisting of the normality test and the homogeneity test. The prerequisite test aimed to determine that the sample was normally distributed and homogeneous. The hypothesis testing in this study used the three-way Anava test and the Anava follow-up test when there were significant effects between the learning methods, creativity, and self-discipline. If in hypothesis testing, the null hypothesis ($H_0$) is rejected, which means that the alternative hypothesis ($H_1$) is not rejected, it is necessary to carry out further tests to determine the level of effectiveness of the independent variables on the dependent variable of the study. The Anava follow-up test was carried out using the estimated marginal means method in the SPSS program

## 3. Result and Discussion

### Results

### Anava Test

The results of the prerequisite analysis test above indicated that all data were normal and were from a homogeneous sample so that the three-way analysis of variance test was 2 x 3 x 3 with a significance level of 0.05. In this variance analysis, there was one variable as the dependent variable, which was learning outcomes, including aspects of knowledge, attitudes, and skills and two variables as factor variables, including scientific character and science process skills which were categorized into three categories, consisting of 1 if is high, 2 if is moderate, and 3 if it is low. The criteria for acceptance of the hypothesis is if the sig P-value < 0.05, then $H_0$ is rejected and $H_1$ is accepted, and vice versa, if the sig P-value is 0.05, then $H_0$ is accepted and $H_1$ is rejected.

**Learning Outcomes Data in the Knowledge Domain**

The results of the Anava test of learning outcomes in the knowledge domain can be seen in Table 2. Based on Table 2, it can be seen that of the seven hypotheses, there were four hypotheses in which the $H_o$ was accepted and three hypotheses in which the $H_o$ was rejected. Based on the data above, it can be concluded that the hypothesis of learning outcomes data of student's knowledge is as: (1) hypothesis 1: the statistical test value of the analysis of variance showed that the P-value < the significance level (0.05) so that $H_{0A}$ was rejected and $H_{1A}$ was accepted so that it can be concluded that the learning outcomes of students' knowledge who were given joyful learning through the scientific approach with the project method were better than that of students who were given joyful learning with the experimental method; (2) hypothesis 2: the statistical test value of the analysis of variance showed that the P-value < the significance level (0.05) so that $H_{0B}$ was rejected and $H_{1B}$ was accepted so that it can be concluded that the learning outcomes of student's knowledge who had high creativity were better than the learning outcomes of student's knowledge who a had low creativity. (3) hypothesis 3: the statistical test value of the analysis of variance showed that the P-value ≥ the significance level (0.05) so that $H_{0C}$ was accepted and $H_{1C}$ was rejected so it can be concluded that the learning outcomes of student's knowledge who had high self-discipline were not better than the learning outcomes of student's knowledge who had low self-discipline.

**Table 2.** Results of 2x3x3 Variant Analysis in the Knowledge Domain

| No | Variable | P-value | Decision | Conclusion |
|---|---|---|---|---|
| 1 | Learning Methods | 0.000 | Ho is ejected | There is a difference |
| 2 | Creativity | 0.000 | Ho is ejected | There is a difference |
| 3 | Self-Discipline | 0.806 | Ho is accepted | The is no interaction |
| 4 | Learning Methods and Creativity | 0.010 | Ho is ejected | There is interaction |

**Learning Outcomes Data in the Attitude Domain**

The results of the Anava test of learning outcomes in the attitude domain can be seen in Table 3. Based on Table 3, it can be seen that of the seven hypotheses, there were three hypotheses in which the $H_o$ was accepted and four hypotheses in which the $H_o$ was rejected. Based on the data above, it can be concluded that the hypothesis of learning outcomes data of student's attitude is as: (1) hypothesis 1: the statistical test value of the analysis of variance showed that the P-value < the significance level (0.05) so that $H_{0A}$ was rejected and $H_{1A}$ was accepted so that it can be concluded that the learning outcomes of student's attitudes who were given joyful learning through the scientific approach with the project method were better than those of students who were given joyful learning with the experimental method; (2) hypothesis 2: the statistical test value of the analysis of variance showed that the P-value ≥ the significance level (0.05) so that $H_{0B}$ was accepted and $H_{1B}$ was rejected so it can be concluded that the learning outcomes of student's attitudes who had high creativity were not better than the learning outcomes of student's attitudes who had low creativity; (3) hypothesis 3: t the statistical test value of the analysis of variance showed that the P-value < the significance level (0.05) so that $H_{0C}$ was rejected and $H_{1C}$ was accepted so that it can be concluded that the learning outcomes of student's attitudes who had high self-discipline were better than the learning outcomes of student's attitudes who had low self-discipline.

**Table 3.** Results of 2x3x3 Variant Analysis in the Attitude Domain

| No | Variable | P-value | Decision | Conclusion |
|---|---|---|---|---|
| 1 | Learning Methods | 0.005 | Ho is ejected | There is a difference |
| 2 | Creativity | 0.669 | Ho is accepted | There is no interaction |
| 3 | Self-Discipline | 0.000 | Ho is ejected | There is a difference |
| 4 | Learning Methods and Creativity | 0.640 | Ho is accepted | There is no interaction |

**Learning Outcomes Data in the Skill Domain**

The results of the Anava test of learning outcomes in the skill domain can be seen in Table 4. Based on Table 4, it can be seen that of the seven hypotheses, there were two hypotheses in which the $H_o$ was accepted and five hypotheses in which the $H_o$ was rejected. Based on the data above, it can be concluded that the hypothesis of learning outcomes data of student's skills is as; (1) hypothesis 1: the statistical test value of the analysis of variance showed that the P-value < the significance level (0.05) so that $H_{0A}$ was rejected and $H_{1A}$ was accepted so that it can be concluded that the learning outcomes of student's skills who were given joyful learning through the scientific approach with the project method were better than those of students who were given joyful learning with the experimental method; (2) hypothesis 2: the statistical test value of the analysis of variance showed that the P-value < the significance level (0.05) so that $H_{0B}$ was rejected and $H_{1B}$ was accepted so that it can be concluded that the learning outcomes of student's skills who had high creativity were better than the learning outcomes of student's skills who had low creativity; (3) hypothesis 3: the statistical test value of the analysis of variance showed that the P-value ≥ the significance level (0.05) so that $H_{0C}$ was accepted and $H_{1C}$ was rejected so it can be concluded that the learning outcomes of student's skills who had high self-discipline were not better than the learning outcomes of student's skills who had low self-discipline.

**Table 4.** Results of 2x3x3 Variant Analysis in the Skill Domain

| No | Variable | P-value | Decision | Conclusion |
|---|---|---|---|---|
| 1 | Learning Methods | 0.001 | Ho is ejected | There is a difference |
| 2 | Creativity | 0.000 | Ho is ejected | There is a difference |
| 3 | Self-Discipline | 0.588 | Ho is accepted | There is no interaction |
| 4 | Learning Methods and Creativity | 0.632 | Ho is accepted | There is no interaction |

**Anava Follow-Up Test**

**Learning methods and student learning outcomes**

In the first hypothesis, which is in learning methods and student learning outcomes, the Anava test was carried out. This was carried out to clarify the decisions on $H_{1A}$ on every aspect of learning outcomes. The $H_{1A}$ showed that the learning outcomes of students who were given joyful learning through the scientific approach with the project method were better than those of students who were given joyful learning with the experimental method. The results of the hypothesis test showed that all aspects of the learning outcomes of knowledge, attitudes, and skills were influenced by the learning methods used. Therefore, an Anava follow-up test was carried out using the estimated marginal means and the results were shown in Table 5.

**Table 5.** Results of the estimated marginal means in the first hypothesis

| Learning outcomes | Methods | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| Knowledge | Experimenal | 63.179 | 1.488 | 60.183 | 66.175 |
| | Project | 69.574 | 1.268 | 67.021 | 72.127 |
| Attitudes | Experimenal | 74.148 | 1.117 | 71.897 | 76.398 |
| | Project | 78.493 | 0.952 | 76.575 | 80.411 |
| Skills | Experimenal | 71.615 | 1.323 | 68.950 | 74.280 |
| | Project | 77.193 | 1.128 | 74.922 | 79.464 |

Based on Table 5, it can be seen that the average learning outcomes of students' knowledge, attitudes, and skills between the groups given the experimental and the project methods showed a difference. The students who were given joyful learning through a scientific approach with the project method had an average learning outcome better than

those of students who were given joyful learning with the experimental method.

**Creativity and student learning outcomes**

The Anava follow-up test was carried out in the second hypothesis, which is in creativity and learning outcomes in the aspects of student's knowledge and skills. This was carried out to clarify the decisions on $H_{1B}$ on every aspect of learning outcome. The $H_{1B}$ showed that the learning outcomes of students who had high creativity were better than those of students who had low creativity. The results of the hypothesis test showed that only aspects of learning outcomes of knowledge and skills were influenced by the category of student's creativity. Therefore, an Anava follow-up test was carried out using the estimated marginal means on the data on learning outcomes of knowledge and skills and the results were obtained as shown in Table 6.

**Table 6.** Results of the estimated marginal means in the second hypothesis

| Learning Outcomes | Creativity | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| Knowledge | High | 73.150 | 2.180 | 68.760 | 77.540 |
| | Moderate | 66.033 | 1.263 | 63.489 | 68.578 |
| | Low | 57.625 | 1.660 | 54.281 | 60.969 |
| Skills | High | 79.767 | 1.939 | 75.862 | 83.672 |
| | Moderate | 74.420 | 1.124 | 72.157 | 76.684 |
| | Low | 66.979 | 1.477 | 64.004 | 69.954 |

Based on Table 6, it can be seen that the average learning outcomes of students' knowledge and skills between categories with high, moderate, and low creativity varied. The students who had high creativity had the highest average learning outcomes of knowledge and skills, while students who had low creativity had the lowest average learning outcomes of knowledge and skills. The average difference in learning outcomes of knowledge between students with high creativity and students with low creativity was 15.525, while the average difference in learning outcomes between students with high creativity and students with low creativity was 12.788.

**Self-discipline and student learning outcomes**

The Anava follow-up test was carried out in the third hypothesis, which is in scientific process skills and student learning outcomes. This is carried out to the decisions on $H_{1C}$ on every aspect of learning outcome. The $H_{1C}$ showed that the learning outcomes of students who had high self-discipline were better than the learning outcomes of students who had low self-discipline. The results of the hypothesis test showed that only aspects of the learning outcomes of attitudes were influenced by the category of student's self-discipline, while the learning outcomes of the aspects of knowledge and skills were not proven to have a relationship with student's self-discipline. Therefore, an Anava follow-up test was carried out using the estimated marginal means on the learning outcomes of attitudes and the results were obtained as shown in Table 7 below.

**Table 7.** Results of the estimated marginal means in the third hypothesis

| Self-Discipline | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| High | 84.962 | 1.600 | 81.739 | 88.186 |
| Modertate | 74.728 | 0.938 | 72.839 | 76.616 |
| Low | 70.883 | 1.438 | 67.987 | 73.780 |

In Table 7, it can be seen that the average learning outcomes of students' attitudes

between categories with high, moderate, low self-discipline varied. The students who had high self-discipline had the highest average learning outcomes of attitudes, while students who had low self-discipline had the lowest average learning outcomes of attitudes. The average difference in learning outcomes of attitudes between students with high self-discipline and students with low self-discipline was 14.079.

## Discussion

### Learning methods and student learning outcomes

The results of the study on hypothesis one showed that there was an effect of joyful learning strategies through a scientific approach with the project and experimental methods on learning outcomes of knowledge, attitudes, and skills, which is in line with a study in which there is an effect of scientific model learning with the project and experimental methods on learning outcomes in aspects of knowledge, attitudes, and skills (Sugiyarti et al., 2015). In this study, the learning outcomes of students who were given a scientific approach through the project method were higher than those of the experimental method. There is a significant difference with the increase in learning achievement during and after the learning process using the project method (Akinoglu, 2008). Based on the four Unesco educational pillars about the meaning of education, one of which is learning to do, which means learning to do something. In the project and experimental learning methods, the learning process has been implemented by doing an experiment to find real things in Physics, but the project learning method emphasizes the activeness of students to gain knowledge independently. The advantages of the project method, students are given the freedom to determine, design, and find learning resources (Wena, 2013). The project method can provide opportunities for students to be creative in carrying out the tasks provided by the teacher in achieving learning indicators.

Therefore, combining a joyful learning strategy through a scientific approach with the project and experimental methods will provide a learning process with concepts that are directly discovered by the students themselves. This will provide students interest in learning Physics besides lectures and discussing problems in class. Based on Bruner's learning theory, it is stated that the learning process emphasizes the active participation of each student, so that students will interact with their environment in finding a concept. Student learning outcomes using the project method were higher than student learning outcomes using the experimental method because the project method requires students to take an active role in learning, including discovering the concept of learning, while the experimental method still uses a guide in the process of finding the learning concept.

### Creativity and student learning outcomes

The second hypothesis was to analyze the differences in learning outcomes between students who had high creativity and low creativity. Besides the combination of the model and the method, there were other factors that can affect learning outcomes, which was students' creativity. The results of the analysis of the three-way Anava data on the results of learning knowledge and skills showed a p-value < 0.05, so the null hypothesis was rejected and the alternative hypothesis was accepted. This means that the learning outcomes of students who had high creativity were better than those of students who had low creativity. However, the learning outcomes of students in the aspect of attitudes that had high creativity had a difference in the average score that was not so significant with those of students who had low creativity. This is evident in the results of the Anava test for the attitude aspect, in which the three-way Anava analysis results were 0.669 which means $\geqslant$ 0.05.

A previous study stated that creativity in learning Physics had a significant positive relationship to learning outcomes of Physics, in which creativity had an effect of 45.66% on learning outcomes of Physics (Syam et al., 2011). Teaching and learning activities in schools are oriented towards achieving high learning outcomes for all students. Students' creativity has the opportunity to develop in a conducive teaching and learning atmosphere, therefore high learning outcomes can be achieved because creativity encourages the actualization of student potential. Thus, it is clear that creativity has a positive relationship with learning

outcomes. Other study resulted in a positive influence between students' creativity and Physics learning achievement (Sugiyarti et al., 2015). The students are considered to have high creativity if they are able to find and combine new ideas or notions that are not influenced by other people's thoughts. To develop students' creativity in learning, a teacher provides many opportunities for students to solve problems, carry out some experiments, develop ideas or concepts from students themselves. Thus, students who were given the project learning method which was learning to free students in conducting experiments had higher learning outcomes based on students' creativity. Student learning outcomes in the aspects of knowledge and skills that had high creativity were better than student learning outcomes in the aspects of knowledge and skills that had low creativity. The learning outcomes of attitudes are not influenced by creativity because the benchmarks of a good attitude are not only seen from their creativity.

**Self-discipline and student learning outcomes**

This third hypothesis was to analyze the differences in learning outcomes between students who had high and low self-discipline. Besides the combination of the model and the method, there were other factors that can affect learning outcomes besides creativity, which was students' self-discipline. The results of the analysis of the three-way Anava data on the learning outcomes of attitudes showed a p-value < 0.05, so the null hypothesis was rejected and the alternative hypothesis was accepted. Meanwhile, the learning outcomes of knowledge and skills showed a p-value $\geqslant$ 0.05, so the null hypothesis was accepted or the alternative hypothesis was rejected. This means that the learning outcomes of the attitude aspect of students who had high self-discipline were better than those of students who had low self-discipline. However, the learning outcomes of students in the aspects of knowledge and skills who had high self-discipline had a difference in the average value that was not so significant with those of students who had low self-discipline. This is evident in the results of the Anava test in the aspects of knowledge and skills, in which the three-way Anava analysis results were obtained with a p-value $\geqslant$ 0.05.

Discipline is an order that can regulate human life (Susianah & Hidayat, 2015). Discipline can arise with self-awareness and the urge to obey the applicable order. Students who have a discipline will have a high responsibility for their future, including responsibility for learning. A child who is accustomed to being disciplined will be able to make good use of their study time, so that the regular student learning has a positive impact on student achievement. However, the results of this study proved that students' self-discipline did not significantly affect the learning outcomes of knowledge and skills. Discipline did not have a significant effect on learning outcomes which only had an effect of 8% on knowledge learning outcomes (Winarsih et al., 2013). The factors that affect the learning process can be divided into two, consisting of: (1) factors that exist in the individual themselves or are often referred to as individual factors, and (2) factors that exist outside the individual, which are referred to as social factors (Purwanto, 2017). In this case, individual factors include maturity or growth, intelligence, training, motivation, and personal factors. Meanwhile, the social factors include family/household conditions, teachers and their teaching methods, the tools used in teaching and learning, the environment and opportunities available, and social motivation. Many factors can affect students to gain knowledge, thus affecting student Physics learning outcomes. The factors that affect student learning outcomes are not only trait factors within the individual student, but also internal factors regarding student intelligence and external factors that have been mentioned above. The learning outcomes of the attitude aspect of students that had high self-discipline were better than those of the attitude aspect that had low self-discipline. The attitude of students' self-discipline did not significantly affect the learning outcomes of knowledge and skills.

## 4. Conclusions and Suggestions

Student learning outcomes with the project method were higher than student learning outcomes with the experimental method. Student learning outcomes in the aspects of

knowledge and skills that had high creativity were better than those of students that had low creativity. The learning outcomes of attitudes were not affected by creativity because the benchmarks of a good attitude were not only seen from their creativity. Student learning outcomes in the attitude aspect that had high self-discipline were better than those of students who had low self-discipline. The students' self-discipline did not significantly affect the learning outcomes of knowledge and skills. The suggestion from the researcher is that the application of joyful learning strategies through a scientific approach with experimental and project methods can be used to improve students' creativity and can be associated with other complementary impacts. The learning process using experimental and project methods can be implemented by using longer lesson hours so that Physics learning with both methods can run effectively in accordance with the learning objectives to be achieved.

## References

Aithal, P. S., & Aithal, S. (2020). Analysis of the Indian National Education Policy 2020 towards Achieving its Objectives. *International Journal of Management, Technology, and Social Sciences*, *5*(2), 20–41. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3676074.

Akinoglu, O. (2008). Assessment of the Inquiry-Based Project Implementation Process in Science Education Upon Students' Points of Views. *International Journal of Instruction*, *1*(1), 1–12. https://dergipark.org.tr/en/download/article-file/59811.

Arikunto, S. (2010). *Prosedur Suatu Pendekatan Praktik*. Rineka Cipta.

Budiman, H. (2017). Peran Teknologi Informasi Dan Komunikasi Dalam Pendidikan. *Al-Tadzkiyyah: Jurnal Pendidikan Islam*, *8*(I), 31–43. https://doi.org/10.24042/atjpi.v8i1.2095.

Cope, A. J., Vasilaki, E., Minors, D., Sabo, C., Marshall, J. A., & Barron, A. B. (2018). *Abstract concept learning in a simple neural network inspired by the insect brain*. Plos Computational Biology.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for the educational practice of the science of learning and development. *Applied Developmental Science*, *24*(2), 97–140. https://doi.org/https://doi.org/10.1080/10888691.2018.1537791.

Daryanto, & Rahardjo, M. (2012). *Model Pembelajaran Inovatif*. Gava Media.

Deslauriers, L., McCarty, L. S., Miller, K., Callaghan, K., & Kestin, G. (2019). Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. *Proceedings of the National Academy of Sciences*, *116*(39), 19251–19257. https://doi.org/10.1073/pnas.1821936116.

Durrani, N., & Nawani, D. (2020). Knowledge and Curriculum Landscapes in South Asia. In P. Sarangapani & R. Pappu (Eds.), *Handbook of Education Systems in South Asia* (pp. 1–31). Springer.

Dziuban, C., Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended learning: the new normal and emerging technologies. *International Journal of Educational Technology in Higher Education*, *15*(3). https://doi.org/10.1186/s41239-017-0087-5.

Ellis, V., Souto-Manning, M., & Turvey, K. (2019). Innovation in teacher education: towards a critical re-examination. *Journal of Education for Teaching*, *45*(1), 2–14. https://doi.org/10.1080/02607476.2019.1550602.

Erikson, M. G., & Erikson, M. (2019). Learning outcomes and critical thinking - good intentions in conflict. *Studies in Higher Education*, *44*(12), 2293–2303. https://doi.org/10.1080/03075079.2018.1486813.

Friedman, J., York, H., Graetz, N., Woyczynski, L., Whisnant, J., Hay, S. I., & Gakidou, E. (2020). Measuring and forecasting progress towards the education-related SDG targets. *Nature*, *580*(7805), 636–639. https://doi.org/10.1038/s41586-020-2198-8.

González-Zamar, M. D., Ortiz Jiménez, L., Sánchez Ayala, A., & Abad-Segura, E. (2020). The impact of the university classroom on managing the socio-educational well-being:

A global study. *International Journal of Environmental Research and Public Health*, *17*(3), 931. https://doi.org/10.3390/ijerph17030931.

Hanna, D., Sutarto, S., & Harijanto, A. (2016). Model Pembelajaran Tema Konsep Disertai Media Gambar Pada Pembelajaran Fisika Di Sma. *Jurnal Pembelajaran Fisika Universitas Jember*, *5*(1), 23–29. https://jurnal.unej.ac.id/index.php/JPF/article/view/3558.

Harris, A., Jones, M., Adams, D., & Cheah, K. (2019). Instructional leadership in Malaysia: a review of the contemporary literature*. *School Leadership and Management*, *39*(1), 76–95. https://doi.org/10.1080/13632434.2018.1453794.

Hartong, S. (2015). Global policy convergence through “distributed governance”? The emergence of “national” education standards in the US and Germany. *Journal of International and Comparative Social Policy*, *31*(1), 10–33. https://doi.org/10.1080/21699763.2014.977803.

Henderikx, M., Kreijns, K., Castano Munoz, J., & Kalz, M. (2019). Factors influencing the pursuit of personal learning goals in MOOCs. *Distance Education*, *40*(2), 187–204. https://doi.org/10.1080/01587919.2019.1600364.

İlçin, N., Tomruk, M., Yeşilyaprak, S. S., Karadibak, D., & Savcı, S. (2018). The relationship between learning styles and academic performance in TURKISH physiotherapy students. *BMC Medical Education*, *18*(1), 1–8. https://doi.org/10.1186/s12909-018-1400-2.

Imants, J., & Van der Wal, M. M. (2020). A model of teacher agency in professional development and school reform. *Journal of Curriculum Studies*, *52*(1), 1–14. https://doi.org/10.1080/00220272.2019.1604809.

Keiler, L. S. (2018). Teachers’ roles and identities in student-centered classrooms. *International Journal of STEM Education*, *5*(1), 1–20. https://doi.org/10.1186/s40594-018-0131-6.

Kromydas, T. (2017). Rethinking higher education and its relationship with social inequalities: past knowledge, present state and future potential. *Palgrave Communications*, *3*(1), 1–12. https://doi.org/10.1057/s41599-017-0001-8.

Mastuhu. (2003). *Menata Ulang Pemikiran Sistem Pendidikan Nasional dalam Abad 21*. Safiria Insania Press.

Muqarramah. (2016). Pendekatan Student Centered Learning ; Design Pembelajaran Aqidah Akhlak. *Jurnal Tarbiyah (Jurnal Ilmiah Kependidikan)*, *5*(2), 23–43. https://doi.org/10.18592/tarbiyah.v5i2.982.

Mutlu, G., & Yıldırım, A. (2019). Learning environment perceptions and student background variables as determinants of persistence in EFL learning. *SAGE Open*, *9*(4). https://doi.org/10.1177%2F2158244019898805.

Naz, F., & Murad, H. S. (2017). Innovative Teaching Has a Positive Impact on the Performance of Diverse Students. *SAGE Open*, *7*(4). https://doi.org/10.1177%2F2158244017734022.

Naziev, A. (2017). *What is and education? International Conference*. Future of Education.

O’Flaherty, J., & Liddy, M. (2018). The impact of development education and education for sustainable development interventions: a synthesis of the research. *Environmental Education Research*, *24*(7), 1031–1049. https://doi.org/10.1080/13504622.2017.1392484.

Osueke, B., Mekonnen, B., & Stanton, J. D. (2018). How undergraduate science students use learning objectives to study. *Journal of Microbiology & Biology Education*, *19*(2). https://doi.org/10.1128/jmbe.v19i2.1510.

Prameswari, S. J., & Budiyanto, C. (2017). The development of the effective learning environment by creating an effective teaching in the classroom. *IJIE (Indonesian Journal of Informatics Education)*, *1*(1). https://doi.org/10.20961/ijie.v1i1.11960.

Purwanto, M. N. (2017). *Psikologi Pendidikan*. Remaja Rosda Karya.

Rati, N. W., Kusmaryatni, N., & Rediani, N. (2017). Model Pembelajaran Berbasis Proyek, Kreativitas Dan Hasil Belajar Mahasiswa. *JPI : Jurnal Pendidikan Indonesia*, *6*(1), 60–71. https://doi.org/10.23887/jpi-undiksha.v6i1.9059.

Serdyukov, P. (2017). Innovation in education: what works, what deosn't, and what to do about it? *Journal of Research in Innovative Teaching & Learning*, *10*(1). https://doi.org/10.1108/JRIT-10-2016-0007.

Shrestha, E., Mehta, R. S., Mandal, G., Chaudhary, K., & Pradhan, N. (2019). Perception of the learning environment among the students in a nursing college in Eastern Nepal. *BMC Medical Education*, *19*(1), 1–7. https://doi.org/10.1186/s12909-019-1835-0.

Silaban, B. (2014). Hubungan Antara Penguasaan Konsep Fisika Dan Kreativitas Dengan Kemampuan Memecahkan Masalah Pada Materi Pokok Listrik Statis. *Jurnal Penelitian Bidang Pendidikan*, *20*(1), 65 – 75. https://doi.org/https://doi.org/10.24114/jpbp.v20i1.3072.

Slameto. (2010). *Belajar dan Faktor-Faktor yang Mempengaruhinya*. Rineka Cipta.

Sugiyarti, H., Sunarno, W., & Aminah, N. S. (2015). Pembelajaran Fisika dengan Pendekatan Saintifik Menggunakan Metode Proyek dan Eksperimen ditinjau dari Kreativitas dan Kemampuan Berpikir Kritis Siswa. *Jurnal Inkuiri*, *4*(4), 34–42. https://jurnal.fkip.uns.ac.id/index.php/inkuiri/article/view/7829.

Susianah, & Hidayat, M. Y. (2015). Pengaruh Motivasi Belajar dan Kedisiplinan terhadap Hasil belajar Fisika pada Siswa Kelas MIA SMAN 1 Marioriwawo Kabupaten Soppeng. *Jurnal Pendidikan Fisika*, *3*(2), 157–161. https://doi.org/10.24252/jpf.v3i1.4095.

Syam, I., Subaer, & Aslim. (2011). Hubungan antara Kreativitas Belajar dengan Hasil Belajar Fisika Siswa kelas VIII SMP Negeri 1 Sinjau Utara. *JSPF*, *31*, 1–19.

Tetep, & Suparman, A. (2019). Students' digital media literacy: Effects on social character. *International Journal of Recent Technology and Engineering*, *8*(2 Special Issue 9), 394–399. https://doi.org/10.35940/ijrte.B1091.0982S919.

Tharayil, S., Borrego, M., Prince, M., Nguyen, K. A., Shekhar, P., Finelli, C. J., & Waters, C. (2018). Strategies to mitigate student resistance to active learning. *International Journal of STEM Education*, *5*(1), 1–16. https://doi.org/10.1186/s40594-018-0102-y.

Vadakedath, S., Sudhakar, T., & Kandi, V. (2018). Assessment of Conventional Teaching Technique in the Era of Medical Education Technology: A Study of Biochemistry Learning Process among First Year Medical Students Using Traditional Chalk and Board Teaching. *American Journal of Educational Research*, *6*(8), 1137–1140. http://article.scieducationalresearch.com/pdf/education-6-8-11.pdf.

Vasconcellos, A. G., Foncesa e Foncesa, B. d., & Morel, C. M. (2018). Revisiting the concept of Innovatice Developing Countries (IDCs) for its relevance to health innovation and neglected tropical diseases and for the prevention and control of epidemics. *PLoS Negl Trop Dis*, *12*(7). https://doi.org/10.1371/journal.pntd.0006469.

Wena, M. (2013). *Strategi Pembelajaran Inovatif Kontemporer, Suatu Tinjauan Konseptual Operasional*. PT. Bumi Aksara.

Widyaningtyas, A., Sukarmin, & Radiyono, Y. (2013). Peran Lingkungan Belajar Dan Kesiapan Belajar Terhadap Prestasi Belajar Fisika Siswa Kelas X Sekolah Menengah Atas Negeri 1 Pati. *Jurnal Pendidikan Fisika*, *1*(1), 136–143. https://digilib.uns.ac.id/dokumen/detail/30353.

Winarsih, W., Asriati, N., & Rustiyarso. (2013). Pengaruh Disiplin terhadap Hasil Belajar Siswa Mata Pelajaran Ekonomi Kelas XI IPS di SMA. *Jurnal Pendidikan Ekonomi FKIP Untan*.

Zeithamova, D., Mack, M. L., Braunlich, K., Davis, T., Seger, C. A., van Kesteren, M. T., & Wutz, A. (2019). Brain mechanisms of concept learning. *Journal of Neuroscience*, *39*(42), 8259–8266. https://doi.org/10.1523/JNEUROSCI.1166-19.2019.