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Project Based Learning and Academic Procrastination of Students in Learning Physics

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Learning physics at SMA, does not only involve memorizing facts, but it also engages the students in solving more problems without delay and attaining a real learning achievement. This study aimed to analyze the effect of project-based learning (PjBL) compared with direct instruction (DI) and student procrastination on student cognitive achievement in learning physics. This quasi-experimental study used a pretest-posttest non-equivalent control group design, involving 9 classes or 278 students of class X MIPA SMAN 1 Singaraja. The study sample consisted of 4 classes or 124 students. Data on student achievement and academic procrastination were obtained from the scores of a learning achievement test and an academic procrastination questionnaire. The data were analyzed descriptively and the two-way covariance analysis. The results of the study revealed that, first, there was a significant difference of academic achievement between students learned in the PjBL and DI models. Higher academic achievement was achieved by the students who learned with the PjBL model. Second, there was a significant difference of academic achievement between students who had high academic procrastination (HAP) and low academic procrastination (LAP). Higher learning achievement was achieved by students who had a LAP. Third, there was an interactive effect between the learning model and academic procrastination on the student academic achievement. Strong interaction occurred in low procrastination for both learning models.

Keywords: project-based learning model, direct instruction, student achievement, academic procrastination, physics learning

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INTRODUCTION

Science and technology in the 21st century is experiencing a very rapid development. This is inseparable from a variety of innovations created as a result of thought and real research products that have been developed by experts (Prasetyo & Sutopo, 2018). This should be followed by an increase in the quality of existing human resources. One effort to make it happen is through high quality education given to the next generation, so that it can position students as the center of learning, not just being passive recipients of the material presented by their teachers (Tal & Tsaushu, 2017). Students are enthusiastic in learning if the lessons they learn are related to the experiences they get in everyday life (Asri *et al.*, 2017b). This condition can make students active and independent learners who discover and learn new knowledge from various relevant sources, so that high learning achievement is achieved. According to Julian (2017), students who are able to achieve high learning achievement also have a positive attitude towards the lesson. One factor that influences learning achievement is academic procrastination. The high academic procrastination students always postpone finishing academic assignments while the low academic procrastination students can complete academic tasks without delay (Schraw *et al.*, 2007). According to Roghani *et al*. (2015), by increasing academic procrastination students can reduce self-confidence and learning achievement.

Based on the Human Development Report 2016 issued by the United Nations which is one of the indicators of education, Indonesia only occupies the 113^{rd} position. Another fact that shows the low quality of Indonesian education is the low level of mathematics learning achievement of students from several junior high schools in Madiun Regency, Indonesia (Asri *et al*., 2017b). Especially in SMA physics learning in Bali, experiments have been conducted comparing the effect of Project-based learning (PjBl) and conventional learning (CL) on creative thinking, the results are on a scale of 100, M (PjBL) = 39.58, SD = 5.58; M (CL) = 31.05, SD = 5.68, both of them are very low qualified (Santyasa et al., 2017). Furthermore, experiments on different SMA have also been conducted to compare the influence between group investigation (GI) and direct instruction (DI) on critical thinking in physics learning in SMA, the result is M (GI) = 40.92; SD = 5.77; M (DI) = M = 28.05; SD = 6.29, the qualifications are low and very low respectively (Santyasa et al., 2018). The results of these studies indicate that physics learning is still vulnerable for SMA students to achieve adequate achievements. According to Roghani *et al*. (2015), learning achievement is one of the important dimensions of a country's education and has a significant relationship with self-confidence and academic procrastination. Low learning achievement can be caused by academic procrastination that students have during learning activities (Asri *et al.*, 2017b). According to Bakhshayesh *et al*. (2016), high academic procrastination can cause a decline in student learning performance, especially learning science such as mathematics. In addition to the decline in learning achievement, high academic procrastination can also increase students' stress level on a lesson in school (Çikrikci, 2016). In addition to the high level of academic procrastination, low student achievement is closely related to the incompatibility of the learning model used by the teacher. The teacher-centered learning model causes student learning achievement in Kenya to be low especially for the topic the classification of organisms in a biology

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class (Wekesa and Ongunya, 2016) and conventional learning in class reduces student interest in learning and lowers down scientific literacy (Afriana *et al.*, 2016).

The learning model used by the teacher should be student-centered and can attract students to learn so that they no longer become passive learners. Learning based on constructivism views is more of a cognitive problem solving using direct experience, collaborative interviews, and interpretation through a good self-regulation process (Santyasa (2017). The constructivism point of view maintains that knowledge is built through reflection done by students based on the experience they have gained (Jumaat *et al.*, 2017). One type of constructivist and student-centered learning model is Project Based Learning (PjBL). Project-based learning (PjBL) provides opportunities for students to actively build their knowledge and solve a problem through activities in producing a product (Asri *et al.*, 2017a). Through this learning model, students are facilitated to develop their scientific characters such as honesty, responsibility, and the ability to communicate and accept criticisms and suggestions from others (Suparti, 2015). The implementation of project assignments makes students active in finding references independently and guide them to learn more meaningfully and deeply because the material learned is associated with experience in real life (Iwamoto et al., 2016).

Better achievement is attained by students who study with the PjBL model. This is shown by research from Bilgin *et al*. (2015), that the achievement test scores of students who learn with project-based learning model are higher than those who learn with traditional teaching model. This is in line with the research of Ayaz and Söylemez (2015), that PjBL has a positive impact in improving science learning achievement compared to conventional learning, the highest increase in academic achievement among the three main branches of science occurs in physics. Students' learning motivation can increase during the PjBL so that it encourages students to develop their potential in learning to solve a problem (Chiang & Lee, 2016). Increased motivation is related to students' attitudes in following lessons, research from Julian (2017) shows a different trend towards different attitudes between students who take part in PjBL and those who follow conventional learning. Research from Rosales and Sulaiman (2016), shows that the reasoning and effort of students to study science, especially physics, is increasing because PjBL bridges between classroom learning material and its application in everyday life. Asri et al. (2017a), shows that the project-based learning model (PjBL) is very effective in reducing academic procrastination from students during learning, because the opportunity to be active in building knowledge is greater than when taking conventional learning. Meanwhile, academic procrastination is often the cause of student failure to obtain learning achievements (Deemer et al., 2014; Ojo, 2019). This finding suggests that high academic procrastination as a cause of failure is greater, whereas low academic procrastination has a greater opportunity to obtain better learning achievements in physics. The low level of academic procrastination will ultimately make the students attain a higher learning achievement (Bakhshayesh *et al*., 2016).

Based on the background above, the study aims to describe three main points, namely 1)

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the effect of the PjBL model compared with the DI model on student achievement, 2) the effect of academic procrastination on student achievement, and 3) the interaction of the PjBL and DI models with academic procrastination in achieving student achievement in learning physics in SMA.

CONTEXT AND REVIEW OF LITERATURE

Constructivist Paradigm

According to the constructivist paradigm, science is temporary related to developments that are mediated both socially and culturally, so that they tend to be subjective. Learning according to this view is more a process of self-regulation in resolving cognitive conflicts that often arise through concrete experience, collaborative interviews, and interpretation. Learning is an active activity of students to build their knowledge (Santyasa, 2017). Constructivist philosophers believe that full involvement of students in learning enables them to personally discover knowledge or 'truth' (Adom et al., 2016). The most important aspect that focuses on constructivism is the construction of knowledge as a process. The process involves active action individually and collaboratively through comparing, knowledge sharing, problem solving, debating, both between students and with facilitators (Bada, 2015; Dagar & Yadav, 2016). In general, there are five basic principles underlying the constructivist class, namely: 1) putting the problems relevant to the needs of students, 2) arranging learning around the main concepts, 3) respecting the views of students, 4) learning materials are adapted to the needs of students, 5) assessing learning contextually (Santyasa, 2017).

Project-based learning

According to Santyasa (2017) the Project Based Learning Model (PjBL) is centered on a relatively timed process, focusing on problems, meaningful learning units by integrating concepts from a number of knowledge components, or disciplines, or fields of study. There are several advantages of the PjBL in physics learning, which accommodates students' positive attitudes towards learning, fosters curiosity, stimulates the enjoyment of learning, guides active and creative involvement in learning, encourages collaborative independent learning, builds intimate personal and social relationships between students, and information literacy and technology (Santyasa et al., 2017). PjBL provides an effective educational experience for vocational high school teachers. This study explores the influence of the PjBL on learning motivation and problem-solving skills of vocational students (Chiang & Lee, 2016). The results showed that PjBL had a positive effect on student learning motivation. This study shows PBL can facilitate problem solving skills of vocational students. The PjBL model provides opportunities for students to freely conduct experimental activities, review literature in the library, browse the internet, and collaborate with teachers. Therefore, learning resources become more open and varied, including in exploring the environment. As a result, students will learn with full of sincerity because they are motivated by the desire to answer questions that have been raised so that learning becomes more effective and meaningful (Muderawan *et al*. In Pradita *et al*., 2015). Behind the superiority of the PjBL, previous research has also revealed that students have difficulty implementing

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PjBL in class. The PjBL implementation reveals that more than 75% of students cannot implement it optimally, because of the various challenges they face, namely the difficulty of choosing significant content, time management, monitoring and evaluation, and lack of supporting facilities (Aldabbus, 2018). However, the implementation of PjBL model must continue to be carried out. The implementation of this model follows five main steps, namely: 1) determining the theme of the project, 2) determining the context of learning, 3) planning activities, 4) processing activities, 5) implementing activities to complete the project (Santyasa, 2017).

Learning achievement

Learning achievement is the measurement result of students' learning activities and efforts delivered in the form of symbols, letters and sentences that describe their learning achievement (Heck in Yulianingsih & Sobandi, 2017). The factors that influence learning achievement (Ahmadi & Supriyono in Fajri *et al*., 2016) are as follows: 1) physical factors (physiology), 2) psychological factors, 3) physical and psychological maturity factors, and 4) spiritual and security factors in the environment. Educational taxonomy is divided into two dimensional structures (Anderson & Krathwohl, 2010), namely the dimension of knowledge and the dimension of cognitive processes. The dimension of knowledge is the dimension created from one of the main aspects in the formulation of learning objectives, namely the aspect of nouns, which states the type of knowledge referred to in that goal. The dimensions of knowledge in Anderson and Krathwohl's taxonomy consists of four categories described in Table 1.

Table 1
Knowledge Dimension Structure According to Anderson and Krathwohl

No	Knowledge dimension	Sub Dimension
1	Factual Knowledge: basic elements that students must know to learn a discipline or to solve problems in the discipline	1. Knowledge of terminology 2. Knowledge of specific element details
2	Conceptual Knowledge: Relationships between elements in a large structure that enable elements to function together.	1. Knowledge of classification and category 2. Knowledge of principle and generalization 3. Knowledge of theory, model, and structure
3	Procedural knowledge: How to do things, practice research methods, and criteria for using skills, algorithms, techniques, and methods.	1. Knowledge of skill in an area and algorithm 2. Knowledge of techniques and methods in an area 3. Knowledge of criteria to determine in utilizing a procedure precisely
4	Cognitive knowledge: knowledge of cognition in general and awareness and knowledge of self-cognition.	1. Knowledge of strategic 2. Knowledge of cognitive tasks 3. Self-knowledge

Source: Anderson & Krathwohl (2010)

The dimensions of cognitive processes in Anderson and Krathwohl's taxonomy consist of six categories which state different levels of process complexity. Each category is further divided into sub-categories that state more specific cognitive processes. The dimensions of this cognitive process are operational words that can be used as a reference in formulating learning objectives. Each category and sub-category in the dimensions of the cognitive process is presented in Table 2.

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Table 2
Dimension of Cognitive Process in the Anderson and Krathwohl's Taxonomy

No	Dimension and Sub Dimension of cognitive process
1	Remembering (recognizing, recalling)
2	Understanding (interpreting, exemplifying, classifying, summarizing, concluding, comparing, explaining)
3	Applying (executing, implementing)
4	Analyzing (differentiating, organizing, attributing)
5	Evaluating (checking, criticizing)
6	Creating (formulating, planning, producing)

Source: Anderson & Krathwohl (2010)

Academic Procrastination

Academic procrastination is a type of delay that is carried out on formal types of tasks related to the academic field (Ferrari *et al.*, 1995). Solomon and Rothblum (in Ferrari *et al.*, 1995) mention six academic areas to see the types of tasks that are often procrastinated by students, namely: 1) writing assignments, 2) learning assignments, 3) reading assignments include, 4) doing administrative tasks, 5) attending meetings, 6) delays in overall academic performance. Milgram stated that procrastination consists of four dimensions (in Ferrari et al., 1995), namely: 1) a series of procrastination behaviors, 2) producing sub-standard behavior, 3) involving a number of perceived tasks that are important for procrastinators to do, 4) producing emotional states which is not fun. In summary, the dimensions and indicators of academic procrastination are shown in Table 3.

Table 3
Dimension and Indicator of the Academic Procrastination

No	Dimension	Indicator
1	A series of delaying behaviors	Delay in academic assignments
2	Produce substandard behavior	Lags in working on tasks
		Time gap between plan and actual performance
3	Involves a number of tasks that are perceived as important for procrastinators	Do other activities that are more fun
4	Produce an unpleasant emotional state	Emotional anxiety

Source: Sari in Wulandari)2016).

METHOD

Model of Research

This research belonged to the type of quasi-experiment with the pretest-posttest nonequivalent control group design. Quasi-type experiments are used, because the subject is human, so perfect control cannot be done. The use of the pretest-posttest design on the experimental type aims to influence the difference in initial conditions (pretest scores) on the dependent variable (posttest scores) between groups can be eliminated by controlling it statistically. The control group was the group of subjects who used the DI model who wanted to be replaced with the PjBL model used by the experimental group when it was proven that the PJBL was superior empirically. The variables studied were learning achievement as the dependent variable, the learning

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model as the dependent variable consisting of two levels, namely the PjBL model for the experimental group and the DI model for the control group. In this study also studied academic procrastination as a moderator variable.

Population and Sample

The population in this study was all students of class X MIPA in SMAN 1 Singaraja which consisted of 9 classes or 278 students aged between 15 to 16 years. SMAN 1 Singaraja is one of the top schools in the city of Singaraja in Bali. The sample consisted of 4 classes (124 students, or 45% of the population, 47 men and 77 women) chosen by random assignment technique from 9 classes of the population. The determination of experimental and control classes was made randomly from 4 classes of sample and have been selected of class X MIPA 6 (30 students) and X MIPA 7 (30 students) as an experimental group and class X MIPA 5 (32 students) and X MIPA 8 (32 students) as a control group. The study was conducted from February to April 2018. The topics were work, energy, impulse, momentum, and collision.

Treatment

During the study the students of class X MIPA 6 and X MIPA 7 took the project-based learning model (PjBL) treatment, while students in class X MIPA 5 and X MIPA 8 received the direct instruction model treatment. The design of the treatment of the two groups is presented in Table 4.

Table 4
Treatments Design of the Learning Model

Activities	Activities description of PjBL	Activities description of DI
Introduction	The teacher conveys apperception about the topic beforehand and provides motivation to students. The teacher conveys the basic competencies and learning objectives of the day.	The teacher conveys the learning objectives. The teacher motivates the students by conveying the important of the topic.
Core activities	The teacher shares student worksheet about the project-based learning The teacher guides students to set the theme of the project Students explore project ideas based on problems presented in student worksheet	The teacher explains topic generally and shares student worksheet. Students record teacher explanations. Students do the worksheet
	Students set learning context Students in small groups divide tasks to answer problems in the worksheet	The teacher guides students in solve the tasks Students do the tasks
	Students plan actual activities Students browse learning resources that support the project Students collect tools and materials that support the project in worksheet	The teacher checks and gives comments about student work The teacher gives conclusions about the results of student work Students record the conclusions givens by the teacher
	Students follow the activity processes Students in small groups sketch the project to be carried out related to the topic	The teacher guides students to practice solving problem Students practice from one problem to another
	Student apply activities Students in small groups look for problem solving based on internet sources, books, and observations Each group write a report and presented it in class	Students do advanced training in solving problems Student try to solve more complex problems
Closing activities	Students check their understanding by doing the test given by the teacher Students confirm their understanding when the teacher explains important material The teacher rewards students' success Students confirm to the teacher about the next lesson	The teacher gives quizzes to students regarding the topic of the day The teacher gives home assignments and the next topic The teacher and students close the lesson by saying the closing greeting

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Data Collection and Analysis

In this study 35 items of an academic procrastination questionnaire were developed using a 4-point scale. Before being used, the questionnaire was tested in order to analyze the internal consistency of the items using product moment correlation and its reliability was determined by using Cronbach's alpha (Mehrens & Lehmann, 1984). Thirty items were obtained which were feasible to be used in the study with the distribution of grain-total correlation coefficients as presented in Table 5. The reliability of the 31 items of the procrastination questionnaire was 0.919, falling into the very high category.

Table 5
Coefficient Value of Item-Total Correlation (r_{xy}) of Academic Procrastination Questionnaire

Item No.	$r_{xy} \geq 0.3$	Item No.	$r_{xy} \geq 0.3$	Item No.	$r_{xy} \geq 0.3$	Item No.	$r_{xy} \geq 0.3$
1	0.6	9	0.5	17	0,5	25	0.6
2	0.5	10	0.6	18	0.4	26	0.7
3	0.3	11	0.5	19	0,6	27	0.6
4	0.5	12	0.5	20	0.6	28	0.4
5	0.6	13	0.7	21	0.4	29	0.6
6	0.4	14	0.6	22	0.7	30	0.5
7	0.5	15	0.5	23	0.6	31	0.5
8	0.4	16	0.5	24	0.6		

The learning achievement test consisted of 26 items in the form of open-ended questions using rubrics with a measurement scale of 0-5 for each item. Rubric for physics learning achievement tests is presented in Table 6.

Table 6
Rubric of Physics Learning Achievement Test

Score	Criteria
5	Provides complete and right solutions
4	Provides right solution, a little flawed, but satisfying
3	Provides right solution, many flawed, but almost satisfying
2	Provides solution that have elements of truth, but are not adequate
1	Tries to provide solution, but totally wrong
0	Does not provide a solution at all

Adopted from Santyasa (2014)

Before the test was used, it was tested first. After testing and considering the distribution of the items, discrimination index, level of difficulty, and internal consistency of the item (the distribution is presented in Table 7), 20 items were selected as a research instrument. The reliability of 20 test items was 0.921 falling into the very high category.

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Table 7
Summary of the Results of the Test of Learning Achievement Tests

No item	$r_{xy} \geq 0.3$	IKB (0.3-0.7)	IDB ($\geq$ 0.2)	No item	$r_{xy} \geq 0.3$	IKB (0.3-0.7)	IDB ($\geq$ 0.2)
1	0.5	0.4	0.5	11	0.7	0.4	0.7
2	0.6	0.4	0.3	12	0.4	0.7	0.4
3	0.3	0.6	0.2	13	0.7	0.7	0.4
4	0.8	0.6	0.7	14	0.3	0.7	0.4
5	0.6	0.4	0.5	15	0.7	0.6	0.6
6	0.8	0.4	0.9	16	0.7	0.3	0.3
7	0.8	0.5	0.7	17	0.8	0.5	0.9
8	0.6	0.6	0.5	18	0.7	0.5	0.6
9	0.7	0.6	0.6	19	0.7	0.4	0.7
10	0.6	0.3	0.4	20	0.8	0.5	0.9

In this study the data analysis techniques used were the descriptive statistical analysis and two-way covariance analysis (ANCOVA). This technique is to eliminate outside influences other than the influence of independent variables, so that the possibility of statistical F errors can be minimized (Hair et al., 1995). The covariance analysis was based on 3 assumption tests, namely 1) test of data distribution normality using Kolmogorov test and Shapiro-Wilk statistics; 2) homogeneity test of variance between groups using Levene's Test of Equality of Error Variance; and 3) linearity test between covariates and dependent variables using test of linearity.

FINDINGS

Descriptive Analysis Results

Data on the average value and standard deviation of the initial learning achievement of the pre-test (covariate) results and student achievement from the post-test results (dependent variable) in the 4 groups of analysis are presented in Table 8.

Table 8
Mean (M) and Standard Deviation (SD) Students' Achievement in Physics in the both PjBL and DI Each for the Low Academic Procrastination (LAP) and High Academic Procrastination (HAP)

	PjBL		DI	
	Pretest	Posttest	Pretest	Posttest
LAP	M_{11} = 12.7; SD = 4.5	M_{11} = 52.9 SD = 15.5	M_{21} = 12.2; SD = 4.7	M_{21} = 32.0 SD = 12.2
HAP	M_{12} = 11.8; SD = 3.6	M_{12} = 40.6 SD = 10.3	M_{22} = 8.7; SD = 4.1	M_{22} = 26.8 SD = 10.1

Table 8 shows before and after treatment students' physics learning achievements in the PjBL-PAR group and the PjBL-PAT group increased from very low qualifications to less, while the DI-PAR and DI-PAT groups remained in very poor qualifications. The bar diagram of the 4 learning achievement groups is presented in Figure 1.

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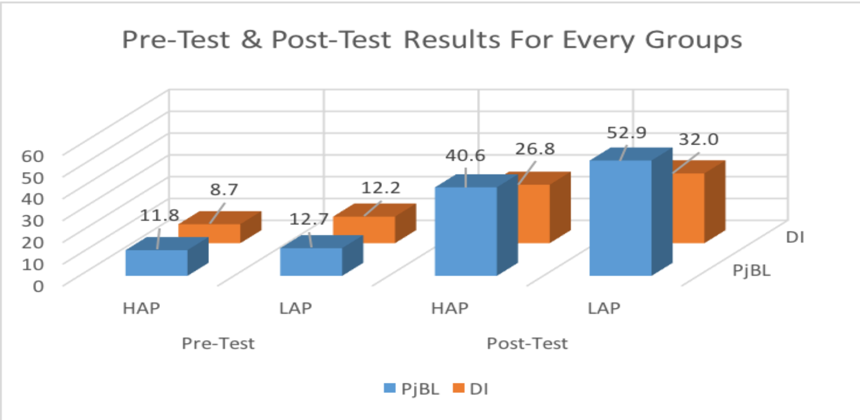

Figure 1
Students' Achievement Before and After Treatment on the Four Groups

Data Distribution Normality Test Result

The result of the analysis of the normality of the data distribution of the pre-test and post-test results in the 4 analysis groups (PjBL-PAR, PJBL-PAT, DI-PAR, DI-PAT) showed that the Kolmogorov-Smirnov and Shapiro-Wilk Test statistical values ranged from 0.1 to 0.9 with level of significance ranging from 0.1 to 0.6. Each level of significance was smaller than 0.05, so that all data distributions were normally distributed (Hair et al., 1995).

Variance Homogeneity Test Result

The result of the variance homogeneity test between the PjBL model and the DI model, both the variants of the pre-test and the post-test results showed the statistical values of F ranged from 0.1 to 0.8. Each of the levels of significance was smaller than 0.05. In addition, the Levene test also showed a statistical value of F = 1.311 with a level of significance of 0.276> 0.05. So, the learning achievement data before and after the treatment between the PjBL and DI showed the same variance.

Linearity test result

The result of the analysis showed that linearity statistics had the value of F = 28.9 with the level of significance of 0.01 <0.05 and deviation from linearity statistics showed the value of F = 1.0 with the level of significance of 0.5> 0.05, so that the covariate was linear to the dependent variable.

Covariance Analysis Result

After the data were tested for normality, homogeneity, and linearity, the hypothesis was tested using two-way covariance analysis. The result of the covariance analysis test is presented in Table 9.

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Table 9
Summary of Two-way Analysis of Covariance with Students' Achievement before Treatment as a Covariate

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Covariate	2566.2	1	2566.2	21.0	0.000
Model	4923.9	1	4923.9	40.2	0.000
Procrastination	780.2	1	780.2	6.4	0.013
Model*Procrastination	549.6	1	549.6	4.5	0.037
Error	10154.3	83	122.3		

Based on the summary of the results of the two-way analysis of covariance in Table 9, the following can be reported.

First, the source of covariate effect (initial learning achievement) on learning achievement variables showed a statistical value of F = 21.0 with a significance value of 0.001 smaller than 0.05. This means that the initial learning achievement covariates had a significant effect on learning achievement. Based on Figure 1, it appears that LAP students were not far apart, but the significant differences occurred in HAP students, where the PjBL group showed a higher initial learning achievement compared to the DI group. Therefore, relevant covariance analysis was used in this study.

Second, the source of the effect of the model showed the statistical value F (MODEL) = 40.2 with the level of significance of 0.001 which was smaller than 0.05. It could be decided H0 was rejected and HA was accepted. That is, there was a difference in learning achievement between students who learned with the PjBL model and those who learned with the DI model. Student learning achievement in PjBL group (MPjBL = 52.9; SD = 15.5) was higher than that of students in DI group (MDI = 32.0; SD = 12.2).

Third, the source of the effect of procrastination on learning achievement showed the value of statistical F (procrastination) = 6.4 with the level of significance of 0.013 which was smaller than 0.05. It is safe to say that Ho was rejected and Ha was accepted. In other words, there was a difference in physics learning achievement between the students with a low academic procrastination and those with a high academic procrastination. Physics learning achievement of the students with a low academic procrastination (LAP) (MLAP = 52.9; SD = 15.5) was higher than that of those with a high academic procrastination (HAP) (MHAP = 40.6; SD = 10.3).

Fourth, the source of the interactive effect between the model and procrastination (Model * procrastination) showed the statistical value F (model * procrastination) = 4.5 with the level of significance of 0.037 smaller than 0.05. It is safe to say that that H0 was rejected and Ha was accepted. In other words, there was an interactive effect between the learning model and academic procrastination on student learning achievement. The profile of interactions between learning models and academic procrastination is shown in Figure 2.

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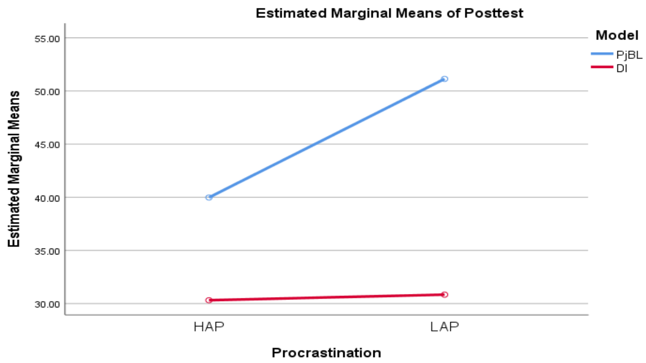

Figure 2
Interaction Profile between Learning Model and Academic Procrastination

Figure 2 shows that both learning models tended to interact strongly with LAP and weakly with HAP in learning achievement. The highest learning achievement occurred in the interaction between PjBL and LAP.

DISCUSSION

The Effect of Project-Based Learning (Pjbl) and Direct Instruction (DI) on The Students' Achievement

This research shows that PjBL model tends to be better than DI in achieving physics learning achievements. This result is consistent with the research conducted by Erdogan *et al* (2016) which shows that students who learn to use the PjBL model tend to be superior compared to those who study with DI in learning achievement. The findings of Iwamoto et al (2016) and Ayaz and Söylemez (2016) also show the same thing. They stated that the PjBL model was superior to the DI model in achieving physics learning. PjBL can improve student learning achievement in learning physics, emotional intelligence, and psychomotor skills, so they can replace traditional learning (Baran et al., 2018). Students give a positive response to the application of PjBL, so that they can increase their understanding of concepts in learning science (Yamin et al., 2017). PjBL does not only affect learning achievement but it also improves students 'attitudes towards the lesson in a better direction so that students' interest in the lesson can increase (Julian, 2017).

Basically, the PjBL model is a constructive learning model that positions students themselves as builders of knowledge they possess based on the knowledge they already have. Thus, students become active learners. Students will have high academic involvement as long as they learn with the PjBL model because they are facilitated with projects that are interesting, challenging, related to the phenomena of their daily lives and relevant to the needs in the community (Craft & Capraro (2017). The increase in student involvement can be seen from enthusiasm during learning, students become more active in gathering information related to the project and critical of the new things or knowledge that they obtain. The high involvement of students in PjBL provides

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opportunities for them to make their learning more meaningful, relevant, and useful in their lives.

During the PjBL process students who are faced with relevant projects tend to put more effort at acquiring knowledge related to the project and are more able to use their logic of thinking in solving the problems obtained and linking the principles or concepts acquired in real life (Rosales & Sulaiman, 2016) Through work activities and presentation of reports related to projects that have been done, students become more active in participating in group learning, working together based on the assigned division of tasks, and communicating the results of group work and knowledge they have (Suparti, 2015). Project work related to real life with groups makes students enjoy learning activities more and increases motivation in participating in learning because students perceive their knowledge to be more meaningful and can be implemented to solve the physical problems encountered in everyday life (Chiang & Lee, 2016). Students' attitudes and interests in physics during project-based learning activities and good social and communication skills in groups lead to a better learning achievement than those who learned with the direct instruction model. This is consistent with research conducted by Khaliq *et al.,* (2015) which shows that the conventional teaching model is not effective for teaching science. An effective physics learning uses the constructivist theory such as in the project-based learning model (Aina, 2017; Dykstra, 1996; Rose, 2018).

The ineffectiveness of the DI model is due to its monotonous nature and students are in the capacity as passive learners, meaning students gain knowledge from the material presented by the teacher during classroom learning (Baran et al., 2018; Samsudin et al., 2017). Students just listen to the explanation about the topic from the teacher and they can only recognize the concept without understanding it properly. As the result, classroom learning is less attractive and students just memorize the material and formulas given by the teacher, an activity that needs to be done in preparing themselves for an exam. DI makes students become individuals who do not have a developing vision and are unable to build their own knowledge and logic to connect a concept with other concepts because they are accustomed to just accepting the material provided by the teacher (Baran et al., 2018). The impact of this makes the students less optimal in the attaining the learning achievement.

During learning when working on student worksheets which must be completed in groups, students who have low academic abilities tend to only see and rely on their group friends who are considered to have moderate to high academic abilities to complete the student worksheets (Baran et al., 2018). As a result, when a friend who is considered smart is not able to solve the problem given, members of the group do not show an effort to work together to solve the problem and tend to ask the teacher directly. This shows that DI does not train students' persistence in learning and tends to spoil students to gain knowledge (Samsudin et al., 2017). The quality of knowledge possessed by students is relatively lacking and is only focused on answering textual test questions. The ability to solve contextual problems from students will be lacking because of inadequate understanding of concepts and too dependent on teachers.

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In general, this study shows that the learning achievement of the group of students who follow the PjBL model is better than the group of students who follow the DI model. However, individually the value of the majority of students participating in PjBL has not been able to achieve the minimum completeness criteria. This is caused by several factors as follows.

First, the adaptation of students who are slow in following the PjBL model because they are accustomed to following the DI model (Baran et al., 2018). During PjBL students who usually get material directly from the teacher are now faced with a worksheet based on the project and follow the steps in the PjBL model with the group to obtain knowledge related to the material under discussion. Students experience difficulties in following these steps or in dividing assignments between group members (Baran et al., 2018). In addition to the students' insufficient knowledge and low skill in writing a good report is also a factor that slows down the implementation of the PjBL model. During the learning process, most students only focus on concepts that are explicitly related to project work so that other supporting concepts are not considered.

Second, the prior knowledge and reasoning of each student is different so that there is a gap during the learning process between the students who have a good academic ability and those who lack academic (Samsudin et al., 2017). Studying in the same time frame does not make the students with an adequate academic ability experience difficulty in obtaining and understanding the concepts being studied compared to those who lack academic abilities or lack initial knowledge. Basically, each student has the potential to learn the same concept well, but the time it takes to learn is different from an individual to another because of the differences in their cognitive structures. If the learning time is tailored to the students' abilities, they will be able to achieve an optimal learning achievement. But in this study, this has not been fully achieved because of the limited time for learning and teaching activities.

Third, most students depend on group members so that in a test those who have a high dependence will get lower grades because they experience a crisis since they do not get the time to collaborate with their peers (Kristanti *et al*., 2016). The incompleteness of students' acquisition of knowledge and skill is caused by misconceptions in some parts of the material that are examined in tests or daily tests, the lack of interest in reading is one of the causes (Rachmawati, *et al*. 2017). When doing the project with the group, the students focus more on the material related to the project being worked on, without regard to other material because they assume that the latter does not contribute to the completion of the assignment.

The Effect of Academic Procrastination on The Students' Achievement

This study found that students with a HAP tend to attain a higher physics learning achievement compared to those with a LAP. This influence occurs because students' academic procrastination characterizes motivational, cognitive, self-efficacy, self-regulated learning, metacognitive beliefs, and achievement goal orientation factors of students are weak, so students do not immediately feel challenged to work on their learning tasks (Asri et al., 2017a; Asri et al., 2017b; Batool et al., 2017; Kandemir,

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2014; Ojo, 2019). This finding confirms Karatas' (2015) study that AP is one of the causes of not optimal performance achieved by a person during education. The relationship between AP and learning achievement is very close but is detrimental to the students themselves because the higher one's academic procrastination, the tendency that occurs is a decrease in learning achievement. Çikrikci (2016) also shows that the students' cognitive ability and learning achievement decrease because of HAP. The low learning achievement due to AP can also encourage an emergency and increase student pressure during learning activities. The pressure experienced by students with an AP will change their attitude and motivation towards negative things related to school, especially the lessons that make these students get low grades (Karmen et al, 2015).

Academic procrastination is also related to the low ability of students to control themselves in participating in learning so that optimal learning achievement is not achieved (Saerle et al., 2016). Low self-control causes delays or suspension of completion of academic tasks performed by students which ultimately leads to a decrease in student performance in learning so that learning achievement is less optimal (Bakhshayesh et al., 2016). Academic procrastination is one of the factors that influence the learning achievement achieved by students (Asri et al., 2017). The factors causing the high AP are 1) the students' assumption that the assignments given by the teacher are not important and not useful for their lives; 2) the task given by the teacher is considered too much and the time given is too short so that they tend to overloaded; 3) the students consider the task given by the teacher very difficult; 4) the students do not have an intention to complete the task given perfectly; 5) the students do not even have the ability to organize their learning activities, 6) the students experience fatigue during other activities outside of formal learning activities; 7) no support is given by the environment around students who are less conducive; and 8) the teachers are less disciplined and strict during the teaching and learning activities.

Thus, students who have a LAP less frequently or never delay completing tasks can attain an optimal learning achievement. Conversely, students who have a HAP have a low self-regulation in learning that the achievement they attain tend to be lower than that attained by students with a HAP (Asri et al, 2017). Based on this, procrastination can be considered as a powerful predictor to predict the learning achievement.

The Interaction Effect Between Learning Model and Academic Procrastination on The Students' Achievement

The research findings showed that there was an effect of interaction between learning models and AP. This result lends support to the research by Sæle et al., (2016) which shows that there is an interaction between the learning model and academic procrastination in learning achievement in the year university students.

Students who have LAP tend to get a higher physics learning achievement score than those with a HAP both in the PjBL model and in the DI model. But the PjBL model shows a higher main effect compared to DI. The habit of not delaying, completing assignments on time, and good learning management are the capital for students with a LAP. In contrast to students with a HAP, they tend to wait for help from friends from

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other groups and even teachers in working on student worksheet should be completed in groups (Bakhshayesh et al., 2016; Saerle et al., 2016). The increasing tendency of student AP is certainly accompanied by a decline in their learning achievement. An increased level of student AP is one of the factors causing passive involvement in learning. Inactive students are conditioned in the DI model, while active learners tend to have a LAP, they are accommodated in the PjBL model Çikrikci (2016).

CONCLUSION

There were significant differences in physics learning achievement between the students who learned with the PjBL model and those who learned with the DI model in class X SMAN 1 Singaraja. The students who learned with the PjBL model obtained a higher achievement than those who learned with the DI model. This finding is very useful in improving the quality of the learning process and increasing student learning achievement through the implementation of PjBL. Therefore, it is recommended that physics teachers understand PjBL deeply and apply it in learning. The Potential of Long-Distance Learning which can challenge and enhance the activeness of students in learning physics in the achievement of better learning products requires critical study in further research.

There were significant differences in physics learning achievement between the students who had a LAP and students who had a HAP. The learning achievement of the students who had a LAP was better than those who had a HAP. This finding is very useful in identifying trends in student academic procrastination. It is recommended that teachers involve more students who have LAP inclinations as peer tutoring friends who have HAP inclinations, thereby minimizing opportunities to postpone work for students who have HAP inclinations. The potential of peer tutoring as a supplement to PjBL requires critical study in further research.

There was an interactive effect between the learning model and AP. Both learning models tended to interact strongly with LAP. It can be concluded that the application of PjBL and AP model had a positive and significant effect on the students' achievement in learning physics of class X SMAN 1 Singaraja. This study has limitations related to the shortness of time and does not include collaboration assessment in treatment. In the design of learning, teachers should include collaborative assessments and provide enough time as an effort to encourage students to not have the opportunity to postpone doing assignments through PjBL. The potential of collaborative assessment as a supplement to PjBL in achieving physics learning achievement needs critical study in subsequent research.

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