

## Impact of project-based learning in the human reproductive system to the student's self regulated learning

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**Abstract:** This study aimed to determine the effect of project-based learning models on Human Reproductive Systems material on the learning independence of students at SMAN 1 Bantul. This research is quasi-experimental quantitative research using the nonequivalent control group design. The sampling technique was cluster random sampling. Learning independence data was obtained using a questionnaire based on six aspects, namely independence of others, having self-confidence, behaving in discipline, having a sense of responsibility, behaving based on one's own initiative, and exercising self-control. Data was analyzed descriptively and inferential. Descriptive analysis was performed to show the mean value, standard deviation, and percentage. Inferential analysis using the T-test of independent data, to show the difference in the value of independent learning between the experimental and control classes. This inferential analysis was carried out after it is known that the prerequisites of the parametric inferential statistical test are met. The results show that the average value of students' learning independence in the experimental class was 74.36. While the control class was 72.27. It can be concluded that there was a positive and significant influence on the project-based learning model with student learning independence.

**Keywords:** *human reproductive system, project-based learning model, student independence*

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### INTRODUCTION

Biology as a science examined living things themselves and their interactions with the biotic and abiotic environments around them from molecular to biome levels. As part of science, biology is studied through scientific steps as scientists do, namely through observation and research or experimentation. As stated by Nuryani (2005, p. 33), the ability to make observations is very important in exploring the environment, and experimental ability requires high accuracy. The results of observations by professional researchers are in the form of data or evidence (Kementerian Pemuda dan Olahraga, 2010, p. 2), because of observing, it involves specific analysis and interpretation. Thus, learning Biology in schools must also follow these scientific principles. Biology learning which is a textbook will only result in memorizing concepts that lead to association associate as a rote science course, and of course this becomes very unattractive for students. This has become the thought of Dawson (2006, p. 2) who argues that one of the important results of science education is to develop students' deep understanding of the natural environment and to be able to follow relevant discourses about science in everyday life. Because in essence the nature around us is a source of learning biology.

The success of the science learning process depends on the curriculum, resources, learning environment, teaching effectiveness, and evaluation strategies (Sopyan & Wibowo, 2006). On the aspects that include good collaboration between students and teachers, self-management, appropriate methods used in learning, evaluation strategies applied, as well as external factors that indirectly determine the success of learning such as the cultural, social and environmental context in which the individual grows and develops (Tae, 2019). However, Klopfer on 1980 (in Nuryani, 2005, p. 33), considers the teacher to have the most important role, by thinking of designing in order to build students' knowledge through sensing, adaptation and abstraction, as well as building awareness of how knowledge is acquired and developed.

The learning process that encourages students to make connections between their knowledge and its application in their lives as family and community members, associating each material with real life and actual problems, is called contextual learning (Rusman 2012; Nurgiyantoro, 2011). The benefit of contextual learning is that it encourages students to make connections between their knowledge and planning in everyday life, as members of the family, community, and the world of work. It make that learning will be meaningful (Nurgiyantoro, 2011, pp. 14-16).

Project-Based Learning that abbreviated as PjBL, is a contextual learning approach (Nurgiyantoro, 2011, p. 17), where students are given the opportunity to work independently, in constructing learning and applying it in real products. This learning is also an application of active learning, which has the principle that children build mental models to think and understand the world around them, but in Papert's Construction, it is said that learning will be effective if students actively create an artifact that can be presented in the real world. So that the main idea of Constructionism is that thinking is learning by making something / learning by making which then develops learning by design in America (Rusman, 2012, p. 153).

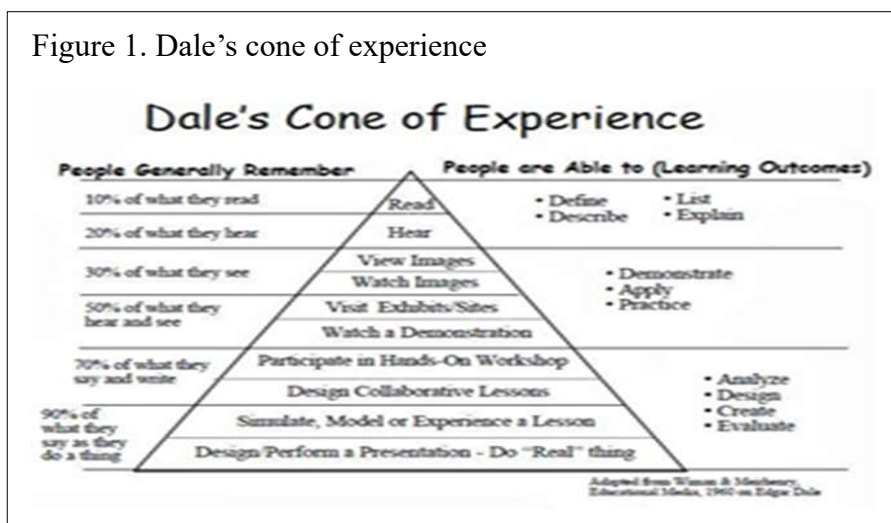
PjBL learning is known to have many positive values. This is evidenced by the following research results, including: significantly more satisfying and fun, with greater teacher support, and significantly more positive teacher-student relationships (Hugerat, 2016: 383), involving students in designing, solving problems, decision-making, or investigative activities, and provide opportunities for learning relative to students (Oguz-Unver, 2014, p. 123), the interdisciplinary nature of projects can support important aspects of student learning (Vogler, 2018, p. 457), enable collaboration in class or small groups, students learn from other students, learn how to help their friends learn, learn to assess work and learn to give constructive feedback, projects are assessed as a process, not a product so that there is always revision until the deadline is complete (Moursound, 2003, pp. 13-15), improvement in memory, time management, communication skills, learning how to work to get things done, public presentations students are fun to watch, involved and responsible on their own learning, creativity leads to improvement in the community, parents and community members can share what they know as content experts, guest speakers, or project consultants (Buck Institute for Education, 2014)

Syarif (2016, p. 25) explains that PjBL uses projects/activities as the core of learning. Students carry out exploration, assessment, interpretation, synthesis and information to produce various forms of learning outcomes. The characteristics of the PJBL model are challenges, students make decisions about a framework, design and determine solutions, are

responsible for solving problems, evaluate and reflect continuously, and learning situations are very tolerant of mistakes and changes.

Based on the K13 Implementation Training Module (2014, p. 81), in implementing PJBL, teachers and students can work together to design projects, design project plans, and compile schedules. The teacher designs worksheet instruments to guide student activities that are usually carried out outside the classroom, as well as prepares project assessment instruments. Meanwhile, Colley and Brooks-Young (Oguz-Unver, 2014, p. 127), teachers play a role in facilitating, advising, guiding, monitoring students, not only for conducting lectures and laboratory work. So that project-based learning is intended for students to find challenges, create new ideas, carry out investigations and apply knowledge to produce real products to solve authentic problems. So PjBL allows students to acquire science process skills, the ability to organize work, time planning and the ability to produce original productions. Learners need time to explore new phenomena on their own, pacing with their own understanding, learning content, strategies, and self-learning skills through collaborative problem solving, reflecting on experiences, and engaging in self-directed inquiry. If the learner's background is insufficient for inquiry, then new terms or concepts should be introduced by instructors, textbooks, videos, or other learners. Term recognition allows the instructor to introduce new terms and learners.

The activity and involvement of students in the design and manufacture of a project will strengthen students' memory about a concept of a being learned, because it is a direct experience, first-hand information for students, as described by Dale as follows along with the pyramid in Figure 1.



A person's learning outcomes are obtained through direct experience (concrete), the reality that exists in the environment. Direct experience will provide information and ideas contained in that experience, because it involves the senses of sight, hearing, feeling, smell, and touching. If in an investigation, this project-based learning will provide opportunities for students and their groups to carry out their own investigations, so that they can develop skills in conducting research, designing, carrying out problem solving, carrying out decision-making and self-investigation activities and the teacher as a facilitator (Rusman, 2012, p. 153). With the PjBL stages above, where the teacher's role is more as a facilitator, the independence

of student learning is important in preparing the project, as in the developmental stages of high school students who are already in the formal operational stage, who can make their own choices, while parents only direct.

In the standard process, Permen No. 22 of 2016, the learning process in educational units is held interactively, inspiring, fun, challenging, motivating students to participate actively, providing sufficient space for initiative, creativity, and independence according to their talents, interests, physical and psychological development of students through lesson planning. Some of the learning principles used include: the students being told to the students to find out; the teacher as the only source of learning to learning based on various learning resources; learning that emphasizes a single answer to learning with answers that are multi-dimensional in truth; verbalism learning to applicative skills; learning that prioritizes the culture and empowerment of students as lifelong learners; and the use of information and communication technology to increase the efficiency and effectiveness of learning. Thus, the project-based learning model can accommodate the mandate of the Minister of Education Regulation No 22 above, as well as generate student learning independence, as is the opinion of Brandt (2020: 22-23), that independence is a self-regulating ability that can be forged by the learning environment through collective problem solving, collaboration, and community involvement, as well as opportunities to make choices and practice independence, agency, and responsibility. personal answer.

The independence of student learning is very beneficial for success in continuing studies in higher education, as well as in the community. Learning in tertiary institutions provides a very large portion of independent assignments compared to learning in classrooms. Ghanizadeh (2017, p. 101) reveals that self-monitoring has a positive and significant effect on critical thinking, and has a significantly positive effect on understanding and reflection. Meanwhile Wolters et al (2017, p. 381) added that self-understanding if academic time management is a key aspect of independent learning, can be useful for understanding the extent to which students procrastinate when doing student academic work. Meyer in Rusman (2012, p. 354) explains that independence in learning is necessary so that students have the responsibility to regulate and discipline themselves, develop learning abilities for their own abilities which is a characteristic of the maturity of an educated person.

Moore (1983) argues that the main characteristic of independent learning is the opportunity given to students to determine the source objectives and evaluation of their learning. Independent learning programs are determined based on the size of the autonomy. However, the purpose of independent learning according to Harvest in Rusman (2012, p. 355), is not interpreted as self-learning which causes students to be alienated. Rusman further explained that the most important thing is the improvement of abilities and skills in the learning process without the helping of others, so that ultimately students do not depend on other people, but try themselves through the media, if they have experienced difficulties, then discussing with friends or teachers. Independent students will be able to find learning resources. So that the teacher's job is to be a facilitator. Whereas friends as a place for questions or discussions, become a measure of ability, if their abilities exceed their friends, they will be encouraged to learn the next topic. Likewise, the opinion of Knowless (1975) that students should not depend on assistance, they must have creativity and initiative. In terms of student autonomy, Knowless, Kozma, Belle, Willian, and Harvest (Rusman, 2012) only emphasize the selection of sources and learning methods.

Students who are very independent will have the following characters: Knowing exactly what they want to achieve in learning activities, choosing learning sources, where to find teaching materials, having the confidence to be able to interpret the content of teaching materials, knowing where to ask, do not require communication with teachers who are strictly scheduled, can already assess the level of ability to solve problems encountered (Rusman, 2012, p. 366). Student independence is measured based on the Independence Scale which is based on theory (Hidayati & Listyani, 2012) which consists of 6 indicators, namely: independence of others, self-confidence, disciplined behavior, sense of responsibility, behaves based on one's own initiative, and controls self

## **METHOD**

The type of this research is quasi-experimental with a nonequivalent control group design, with 2 class groups, namely the control class and the experimental class. Following Furchan (2011, p. 394), after the learning program, the teacher conducts a post-test, using questions that were equivalent to the pre-test questions. The schematic of the research design is shown in Table 1.

Tabel 1  
*Research design*

Group	Pretest	Treatment	Posttest
Experiment	A1	X1	A2
Control	A1	-	A2

Note: A1 : Pretest

X : Treatment of experimental class

A2 : Posttest

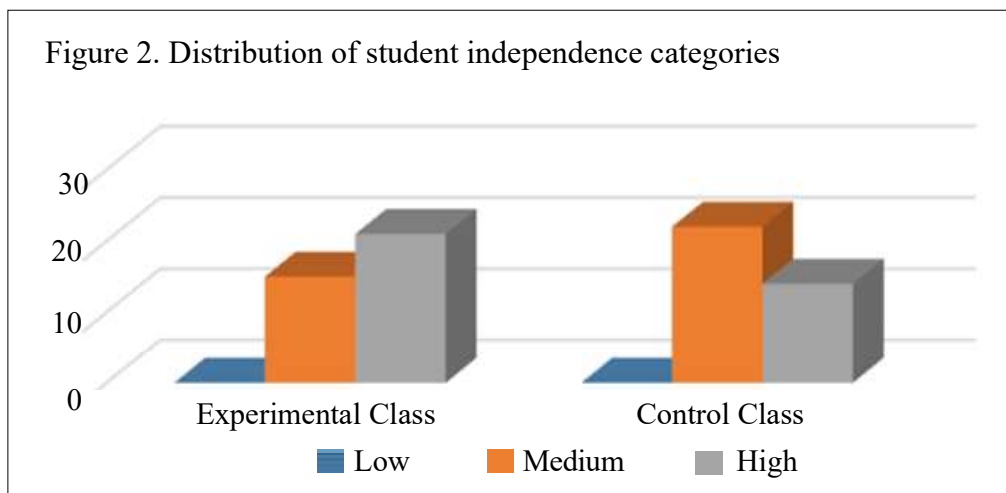
Population in this study was all students of class XI IPA even semester SMAN 1 Bantul, totaling 300 students and spread over 9 parallel classes. The samples of this research were students of class XI IPA 3 and class XI IPA 8, each of which totaled 36 students. The sampling technique was cluster random sampling. With this technique, from 9 parallel classes 2 classes were selected randomly (random), then all students from these two classes, namely class XI IPA 3 and class XI IPA 8 were the research samples.

The independent variable in this study was the learning model, which contains the project-based learning model (for the experimental class) and the non-PjBL learning model (for the control class). The dependent variable of this study is the student's learning independence. Measurement of students' learning independence in the experimental and control classes was carried out by means of a questionnaire or questionnaire containing questions on a Likert scale. This questionnaire is an adoption of the research results of Hidayati and Listyani (2012).

In the data analysis method, the data to be used in this research is independent learning. The data has been analyzed using inferential statistics. From this inferential statistic serves to generalize for the research results used in the sample for the population taken. This inferential statistic used in testing the hypothesis through the t-test which begins using descriptive analysis, and prerequisite analysis namely normality.

**FINDINGS AND DISCUSSION**

The results of the data analysis show that the mean total score of the students' learning independence in the experimental class and the control class is 74.36 and 72.27, respectively, from the ideal maximum score of 100. The experimental class shows higher scores than the control class. In the experimental class, as many as 58.33% (21 students) had high independence; 41.67% (15 students) have moderate independence; and none of the students are at a low level of independence. The control class as much as 61.11% (22 students) has moderate independence; 38.89% (14 students) had high independence; and none of the students are at a low level of independence as shown in Figure 2



The highest level of agreement on the aspect of independence of others is shown in the statement “I complete school/teacher assignments according to my own ability” for both the experimental class (M = 4.29; SD = 2.02) and the control class (M = 4.24; SD = 2.01) as shown in Table 2. This shows that high dependence on others will foster learning independence in students.

Table 2 shows students in improving their learning achievement are still motivated by other people the teacher who teaches them. The statement “I choose my own learning strategy/method” was also approved by the experimental class and the control class, but it was still high in the experimental class. This shows that students who apply the PBL model have a higher curiosity than the control class.

The statement “I choose my own strategy / way of learning” was also approved by the experimental class and the control class but was still high in the experimental class. This shows that students who apply the PBL model have a high curiosity than the control class. This is in line with Syarif (2016) who states that students are more enthusiastic and have more curiosity in problem-based learning, while students usually listen to the teacher, record definitions, given by the teacher in learning. In line with Rusman’s opinion (2012, p. 382), student-centered learning is indirect learning, students learn by searching and finding themselves through direct experience contextually, by exploring and elaborating their learning experiences.

The aspect analysis of having self-confidence is shown in Table 3. The highest level of agreement on the aspect of having confidence is shown in the statement “I dare to express

Table 2  
*Analysis of aspects of independence from others*

No	Independence on Others	Mean	
		Experiment (S.D)	Control (S.D)
1	I learn because of the teacher *	3.00 (0.85)	3.13 (0.97)
2	I increase learning achievement because it is motivated by others *	2.94 (0.85)	2,41 (0.65)
3	I choose my own learning strategy/method	4.20 (0.57)	4,07 (0.50)
4	I complete school / teacher assignments according to my own ability	4.29 (2.02)	4.24 (2.01)

Note: \* Negative statements

Table 3  
*Aspect analysis of having self confidence*

No	Having Confidence	Mean	
		Experiment (S.D)	Control (S.D)
1	I believe I can achieve my learning target	4.08 (0.93)	4.05 (0.82)
2	I am not sure I can overcome obstacle in learning activities that I face *	3.35 (1.28)	3.40 (1.30)
3	I dare to convey an opinion that is different from the other opinions.	4.14 (2.25)	4.19 (2.23)

Note: \* Negative statements

an opinion that is different from the opinions of others” both for the experimental class (M = 4.14; SD = 2.25) and the control class (M = 4.19; SD = 2.23). This shows that students who have high self-confidence will foster independence in students in learning.

The analysis of disciplined behavior aspects are shown in Table 4. The highest level of approval on the aspect of disciplined behavior is shown in the statement “I do not try to attend the class on time” for the experimental class (M = 4.22; SD = 1.54) while the control class (M = 3.83; SD = 1.58). This shows that students who have high discipline in attending class will affect the independence of students in learning.

The analysis of the aspect of having a sense of responsibility is shown in Table 5. The highest level of agreement on the aspect of having a sense of responsibility is shown in the statement “I build self-motivation to continue to be enthusiastic in learning” for the experimental class (M = 4.28; SD = 0.68) and the class control (M = 4.12; SD = 0.67). This shows that students who have a high sense of responsibility, namely building self-motivation to continue to be enthusiastic in learning will affect the independence of students in learning.

Table 4  
*Aspect analysis of discipline behavior discipline*

No	Having Discipline Attitude	Mean	
		Experiment (S.D)	Control (S.D)
1	I always plan/schedule my learning activities	3.77 (1.32)	3.98 (1.22)
2	I do not try to attend class on time *	4.22 (1.54)	3.38 (1.58)
3	I always collect teacher assignments on time	4.01 (2.41)	3.80 (2.47)

Note: \* Negative statements

Table 5  
*Aspect analysis of having a sense of responsibility*

No	Having a Sense of Responsibility	Mean	
		Experiment (S.D)	Control (S.D)
1	I build self-motivation to continue to be enthusiastic about learning	4.28 (0.68)	4.12 (0.67)
2	I don't try to implement my activity planning/ learning agenda as best as possible *	3.91 (1.74)	3.76 (1.58)
3	I am able to focus my attention on learning activities in class	3.94 (1.78)	3.68 (1.82)

Note: \* Negative statements

Analysis of behavioral aspects based on own initiative is shown in Table 6. The highest level of approval on aspects of Behavior based on Own Initiatives is shown in the statement “I am looking for and working on exercises in addition to do assignments from the teacher” for the experimental class (M = 4.20; SD = 2.74) while the control class (M = 3.99; SD = 2.76). This shows that students who have initiative behavior, namely looking for and working on practice questions other than the high teacher’s assignment will increase the independence of students in learning.

The analysis of the aspects of Doing Self-Control is shown in Table 7. The highest level of agreement on the aspect of Doing Self-Control is shown in the statement “I observe the increase and decrease in learning outcomes that I get” for the experimental class (M = 4.44; SD = 2.53) while control class (M = 4.43; SD = 2.49). This shows that students who carry out self-control, namely observing the increasing and decreasing in learning outcomes obtained, then the students will have high independence.

From the results of the pretest, the independent scores for the experimental class were 72.86, while the independent scores for the control class were 71.47. Based on the testing of the mean pretest value of the experimental class and the control class, it was found that both classes had the same initial ability (normal) and the two classes were homogeneous.



Table 6  
*Analysis of behavioral aspects based on self initiation*

No	Behaving Based on Self Initiation	Mean	
		Experiment (S.D)	Control (S.D)
1	I think consciously of my own will	4.15 (0.60)	3.91 (0.53)
2	I often do something because of myself	4.01 (0.46)	3.49 (0.603)
3	I do not plan my own learning activities *	3.44 (0.73)	3.16 (0.92)
4	I seek and do sosal-exercises other than assignments from the teacher	4.20 (2.74)	3.99 (2.76)

Note: \* Negative statements

Table 7  
*Aspect analysis through self-control*

No	Doing Self-Control	Mean	
		Experiment (S.D)	Control (S.D)
1	I believe that my learning activities are useful for myself	4.37 (0.93)	4.02 (0.91)
2	I do not reflect on/weigh my learning outcomes*	3.68 (2.02)	3.34 (2.06)
3	I pay attention to the increasing and decreasing in learning outcomes that I get	4.44 (2.53)	4.43 (2.49)

Note: \* Negative statements

After being independent, the two experimental and control classes were given a different learning process. For the experimental class, learning is applied using a project-based learning model. Whereas in the control class using conventional methods. At the end of the meeting, the child was again given a posttest. The purpose of giving the posttest is to determine the independence of the two classes after learning with a project-based learning model in the experimental class and conventional learning in the control class.

Based on the pretest and posttest data conducted in the control class, the pretest average was 71.4722 while the posttest was 72.556 (Table 8). These two scores were almost as insignificant as the experimental class. This shows that conventional learning models have not been able to influence students' independence in learning. Based on the average pretest and posttest scores, it can be seen that the experimental class experienced an increase in the average value after being treated with a project-based learning model, from 72.8611 to 76.1667. In summary, the results of the pretest and posttest independence of the experimental class are shown in Table 8.

Table 8  
*Data pretest and posttest humanity experiment and control classes*

No	Statistics	Experimental Class		Control Class	
		Pretest	Posttest	Pretest	Posttest
1	N	36	36	36	36
2	Total Score	2623	2742	2573	2612
3	Average	72.8611	76.1667	71.4722	72.5556
4	Standard deviation	4.46032	5.19065	5.4115	4.15723
5	Variance	19.894	26.943	29.285	17.283
6	Maximum	78	90	85	64
7	Minimum	60	67	78	56

This test is used to determine whether in a model, the independent variable and the dependent variable whether both of them have a normal distribution or not. A good model is to have a normal or almost normal data distribution. In this study, the Kolmogorov Smirnov test for normality can be used. The Kolmogorov-Smirnov Z value The experimental class pretest was 1.105 and the value Asymp. Sig. (2-tailed) is 0.174, Posttest Experiment class is 0.734 and the value Asymp. Sig. (2-tailed) is 0.655, Control class pretest is 1.292 and the value Asymp. Sig. (2-tailed) is 0.071 and Posttest Control class is 1.185 and the value Asymp. Sig. (2-tailed) of 0.121, which is obtained by each model more than a (0.05) ( $p > 0.05$ ), meaning that the data comes from a normally distributed data population.

After it is known that the experimental class and control class are normally distributed, then hypothesis testing is carried out. Hypothesis testing in this study uses a different test. The data used in testing the hypothesis in this study is the difference between the post-test average score and the pre-test average score in the experimental class and the control class.

Hypothesis testing is carried out by one-party test so that the criteria for accepting or rejecting  $H_0$  is if  $t_{count} > t_{table}$  at the real level  $\alpha = 0.05$   $H_a$  is accepted and  $H_0$  is rejected. From testing the independence hypothesis  $t_{count} > t_{table}$ , that is  $2.815 > 1.666$  then  $H_0$  is rejected and  $H_a$  is accepted. Thus it can be concluded that the average independence of students taught with the project-based learning model is better than the average independence of students taught by conventional methods or in other words the project-based learning model has a positive and significant effect on the independence of SMA Negeri 1 Bantul students

The results showed that the average student learning independence in the experimental class was better than the average learning independence in the control class, or in other words the project-based learning model had a positive and significant effect on the learning independence of students of SMA Negeri 1 Bantul. meaning that the project-based learning model can be used to increase children's independence in learning at school.

Project-based learning involves students in designing, solving problems, making decisions, or investigating activities, and giving students the opportunity to learn relatively (Oguz-Unver, 2014, p. 123). Based on this opinion, the application of the project-based learning model will encourage students to explore, assess, interpret, synthesize and

information to produce various forms of learning outcomes, independently, while the teacher acts as a facilitator. Whereas friends as a place for questions or discussions, become a measure of ability, if their abilities exceed their friends, they will be encouraged to learn the next topic. The principle of model is a learning process in which students do something tangible to make a product for a certain period of time independently. The main characteristic of independent learning is the opportunity for students to determine the source objectives and evaluation of their learning. Independent learning programs are determined based on the size of the autonomy.

These results support the research of Insyasiska, Zubaidah, and Susilo (2017), which states that based on the LSD follow-up test it shows that project based learning can affect student learning motivation. The learning process in educational units is carried out in an interactive, inspirational, fun, challenging, motivating way for students to participate actively, and provides sufficient space for initiative, creativity, and independence according to the talents, interests, physical and psychological development of students. We realize that student independence is very beneficial for success in continuing studies in tertiary institutions, as well as in society.

Students who are independent in learning will produce student creativity so that what has been understood, will be asked of the teacher after students understand first. So that this project-based learning model which focuses on the learning process in an interactive, inspirational, fun, challenging, motivating students to actively participate, and providing sufficient space for initiatives, student creativity will be able to encourage students to be independent.

Reproductive system material is biology learning material in junior high school and studied more deeply at the high school level. So that in general students have been familiar with this material beforehand. The content of the material is broad, including the structure of the functions of male and female reproductive organs, family planning, genital diseases, especially cervical cancer and HIV related to teenage relationships, so the PJBL learning model at the high school level can facilitate the development of student learning independence through the project undertaken. The teacher facilitates, guides, directs, and monitors student schedules in the preparation of the project.

In the learning process, after introducing the Human Reproductive System material with the scope of the structure and function of the reproductive organs, reproductive health related to 2 important things, namely promiscuity and HIV disease, the teacher then presented the learning scenario in a class discussion. In the next stage, students began working in groups, discussing designing a project to conduct interviews at the closest health center from a distance from the group member's house. In drafting the interview, it will encourage students to read and understand the related material. The formulation of boundary questionnaires, and licensing arrangements are monitored by the teacher. The results of the interview are made a report and become an introduction to real learning resources for students, field information so that it is expected to be more memorable for students.

Based on the results of interviews and observations about actual phenomena related to adolescent problems, namely promiscuity, young marriage and Human Immunodeficiency Virus (HIV), the teacher then encouraged students to make posters of these phenomena and present them in groups to the class. The discussion process was interesting and fun

to make students excited to express their arguments in a healthy manner. Furthermore, students are directed to compile a simple book about the Reproductive System with references from various sources. At the end of each lesson, the teacher always provides feedback in the form of input, evaluation of activities and motivation. As stated by Golightly and Raath (2015), that one of the steps that needs to be taken by a teacher to assess the discussion process of students is that one group member makes a presentation at the end of the problem investigation. Then, the teacher helps students to analyze and evaluate their thought processes as well as the investigative and intellectual skills they use. Summarize the important points that have emerged in the learning activities that have just been carried out.

## CONCLUSION

Based on the results of the data analysis that has been done, it can be concluded that there is a positive and significant influence between the project-based learning model on the learning independence of SMA Negeri 1 Bantul students on the material of the Human Reproductive System. School should complete media of learning to apply learning method based on the project. Teachers should use learning model based on the project to improve independence of students and critical thinking in learning .

## REFERENCES

- Dawson, C. (2006). *Practical research methods*. Oxford.
- Furchan, A. (2011). *Pengantar penelitian dalam pendidikan*. Pustaka Pelajar Offset.
- Golightly, A., & Raath, S. (2015). Problem-based learning to foster deep learning in preservice geography teacher education. *Journal of Geography*, 114(2), 58-68. <https://doi.org/10.1080/00221341.2014.894110>
- Hidayati, K., & Listyani, E. (2012). Improving instrumens of students, self regulated learning. *Jurnal Penelitian dan Evaluasi Pendidikan*, 14(1), 2010, 84-99.
- Insyasiska, D., Zubaidah, S., & Susilo, H. (2017). Pengaruh project based learning terhadap motivasi belajar, kreativitas, kemampuan berpikir kritis, dan kemampuan kognitif siswa pada pembelajaran biologi. *Jurnal Pendidikan Biologi*, 7(1), 9-21.
- Kementrian Pemuda dan Olahraga. (2010). *Pengembangan dan peningkatan prestasi olahraga berbasis olahraga unggulan melalui penguatan implementasi undang-undang sistem keolahragaan nasional*. Kemenpora.
- Knowless, M. S. (1975). *The adult learning: A guide for learners and teachers*. Gulf Publishing Co.
- Materi Pelatihan Guru Implementasi Kurikulum 2013 (2014). Kementrian Pendidikan dan Kebudayaan.
- Moore, B. & Stanley, T. (2010). *Critical thinking and formative assesment*. Eye On Education
- Moursound, D. (2003). *Project-based learning using information technology*. International Society for Technology in Education Books and Courseware Department.
- Nurgiyantoro, B. (2011). *Penilaian otentik dalam pembelajaran bahasa*. Gajah Mada Pers.
- Nuryani. (2005). *Strategi belajar mengajar biologi*. IKIP Malang Press.
- Oguz-Unver, A., & Arabacioglu, S. (2014). A comparison of inquiry-based learning (IBL) problem-based learning (PBL) and project-based learning (PjBL) in science education. *Educational Research*, 2(7), 120-128. DOI: 10.15413/ajer.2014.0129.

Paul, R., & Elder, L. (2001). *The miniature guide to critical thinking: Concepts & tools*.  
Foundation Critical Thinking.

Permendikbud Nomor 22 Tahun 2016 tentang SKL, Standar Isi, Standar Proses dan Standar  
Penilaian Pendidikan.

Rusman. (2012). *Model-model pembelajaran*. Gravindo Persada.

Syarif, M.. (2016). *Modul guru pembelajar kelompok kompetensi D*. PPPPTK IPA.