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Evaluative Studies of Project-Based Mathematical Learning: Reviewed from National Standard for Education Process in Indonesia

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Abstract: Evaluative Studies of Project-Based Mathematical Learning: Reviewed from National Standard for Education Process in Indonesia. **Objectives:** To describe the effectiveness of the implementation of project-based learning in junior high school mathematics learning in terms of process standards. **Methods:** This study adopted the CIPP evaluation model with state junior high school mathematics teachers as respondents.The analysis technique refers to the calculation of the T score in consultation with the Glickman quadrant prototype. **Findings:** T score for each variable, namely CIPP (+ - + +) with a comparison for the Context variable: F+ (71.43%) and F- (28.57); Inputs: F+ (28.57%) and F- (71.43%); Process: F+ (71.43%) and F- (28.57%), Product: F+ (71.43%) and F- (28.57%) with quite effective category. **Conclusion:** Project-based mathematics learning in terms of process standards is quite effective, and can be recommended to improve the quality of mathematics learning.

Keywords: evaluation of mathematical learning, project-based learning, process standards

Abstrak: Studi Evaluatif Pelaksanaan Pembelajaran Matematika Berbasis Projek: Ditinjau dari Standar Nasional untuk Proses Pendidikan di Indonesia. ***Tujuan:*** *Penelitian ini bertujuan mendeskripsikan efektifitas penerapan pembelajaran berbasis projek pada pembelajaran matematika SMP ditinjau dari standar proses.* ***Metode:*** *Penelitian ini adalah studi evaluasi yang mengadopsi model evaluasi CIPP dengan responden guru matematika SMP negeri. Teknik analisis mengacu perhitungan skor T yang dikonsultasikan dengan prototipe kuadran Glickman.* ***Temuan:*** *Skor T untuk setiap variabel, yaitu CIPP (+ - + +) dengan perbandingan untuk variabel Context: F+ (71,43%) dan F- (28,57); Input: F+ (28,57%) dan F- (71,43%); Process: F+ (71,43%) dan F- (28,57%), Product: F+ (71,43%) dan F- (28,57%) dengan kategori cukup efektif.* ***Kesimpulan:*** *Pembelajaran matematika berbasis projek ditinjau dari standar proses terlaksana cukup efektif, dan dapat direkomendasikan untuk meningkatkan kualitas pembelajaran matematika.*

Kata kunci: *evaluasi pembelajaran matematika, pembelajaran berbasis projek, standar proses.*

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INTRODUCTION

Education is a major factor in efforts to improve human resources (Mustagfiroh, 2020). The existence of quality human resources certainly depends on the quality of their education. For that reason, almost every country is competing to improve the quality of their education. Education developed today must follow the development of globalization that is happening today. The development of globalization in the field of education that occurs today is known as 21st-century learning (Kusaeri et al., 2017; Palinussa et al., 2021). Improving the quality of education in line with the demands of 21st-century learning is certainly influenced by the increase in factors related to it. Factors that have a big role in efforts to improve education include the curriculum, learning model, and how to teach teachers (Almonacid-Fierro et al., 2021; Erman, 2012).

The curriculum is an important factor in improving the quality of education (Abi, 2017; Rudhito & Prasety, 2016). The curriculum is a series of plans that contain learning stages designed for learners regarding educational institutions in which they contain both static and dynamic processes and contain competencies that must be owned by learners (Daryanto, 2014). The curriculum used in education in Indonesia today is the 2013 curriculum. The 2013 curriculum emphasizes the modern pedagogical realm by using a scientific approach (Dwi Ferdiani, 2020; Intasoi et al., 2020)). Learning with the scientific method can be understood as learning that consists of observing, asking questions, gathering information, reasoning, and communicating solutions. The 2013 curriculum change regarding process standards by the Regulation of the Minister of Education and Culture contains ideal criteria for the implementation of learning in elementary and secondary education units to meet the achievement of graduate competence. In the Regulation of the Minister of Education and Culture No. 22 of 2016 on Process Standards emphasizes strengthening scientific, thematically integrated (thematic between subjects) and thematic (in a subject) and the application of discovery/inquiry learning (Chairunnisa et al., 2020; Syahrul Azmi, Hapipi, 2019).

The Ministry of Education and Culture (2016) explains that "Standard processes are criteria regarding the implementation of learning in educational units to achieve Graduate Competency Standards." Process standards include the planning of the learning process, the implementation of the learning process, the assessment of learning outcomes, and supervision of the learning process. One of the learning models that suits these demands is the application of the Project-Based Learning model, hereinafter abbreviated as PjBL (Lou et al., 2012).

PjBL is a learning model that uses projects as learning outcomes. Learners conduct exploration, assessment, interpretation and synthesis to produce various forms of learning outcomes. In the PjBL Model, teachers act as facilitators for learners to get answers from guiding questions given. In the implementation of PjBL learners are accustomed to working collaboratively, assessment is done authentically and learning resources are very flexible. The use of this model is expected to be able to increase the activity of learners' ability to produce contextual work, both individual and group (Lou et al., 2012). Therefore, it is highly recommended to use a learning model that produces problem-based work (Chairunnisa et al., 2020),

Based on the research conducted in Singapore about the implementation of PjBL, the learning transformation framework for analyzing the change process of how learners experiment new ideas, explore alternative ideas and eventually come to a consensus to accept new ideas during PBL in a collaborative project environment (Pan, 2019). In line with the research conducted in

various countries such as Spain, Portugal, Poland, Serbia, Bulgaria, Greece, Turkey, Romania, Croatia and Iceland has a result that the students cooperated for the project, they want to developed under guidance of the teachers and learned about solution methods by separating the problems in basic parts and communicating and additionally, the students learned how to communicate with classmates in different countries and widened their perspectives regarding education (Hogenbirk, 2019). Through both of this research we know that PjBL has a good impact on student learning result.

This paper is about evaluating whether the implementation of the PjBL model is in accordance with the standard process of The Regulation of the Minister of Education and Culture No. 22 of 2016 and to find out how effective the implementation of PjBL is. This is closely related to the feedback that teachers will receive to improve the implementation of their learning. Lack of understanding and insight of teachers to the reference of the standard of the Regulation of the Minister of Education and Culture process No. 22 of 2016 will hinder the implementation of this model ideally (Syahrul Azmi, Hapipi, 2019). This research uses the CIPP evaluation model, so that in this paper it is reviewed from 4 components, namely in terms of context, input, process and product.

This is supported by the results of previous research that states that the implementation of the PjBL model reviewed from the process standards in general is quite effective (Dantes et al., 2013). Starting with a basic score of 42.11%, in cycle one it increased to 57.89% and in the second cycle it increased to 68.42% (Tyas et al., 2014). While in similar studies, the results of the assessment of context variables obtained 69.14% in the criteria table fall into the good category, for the assessment of input variables obtained 41.75% in the criteria table into sufficient categories, for the assessment of process variables obtained 52.75% in the criteria table into enough categories, and for the assessment of product variables obtained 71% in the criteria table into the good category (Dahono, 2017).

METHODS

This research includes evaluative research. Evaluative research is an activity related to collecting, documenting, providing, describing, and assessing the work of something (Kantun, 2017; Yuniarti et al., 2021). This study used a quantitative descriptive research approach (Sugiyono, 2012, 2017). Research is conducted to examine a particular sample or population, with sample selection done randomly, data collection done through research instruments, and data analysis done quantitatively or statistically aimed at testing existing hypotheses. This study evaluates the effectiveness of the implementation of learning models applied through comparison with the implementation of ideal learning, referring to The Regulation of the Minister of Education and Culture No. 22 of 2016 regarding the standards of primary and secondary education processes.

The evaluation model used in this study is the CIPP evaluation model. The CIPP evaluation model is an evaluation model proposed by Stufflebeam et al. The CIPP evaluation model was based on the initial four-letter abbreviation of the variables evaluated in this model, namely the evaluation of context variables, input variables, process variables, and product variables (Doyok, 2021). The four variables are the targets in this evaluation. The process of collecting data in the study was carried out by giving questionnaires and supported by interviews with sources and documentation. In the variables context that were evaluated were the progress of science and technology, community values and expectations, government and community support, government policies, juridical foundations, economic demands, demands for globalization, demands for

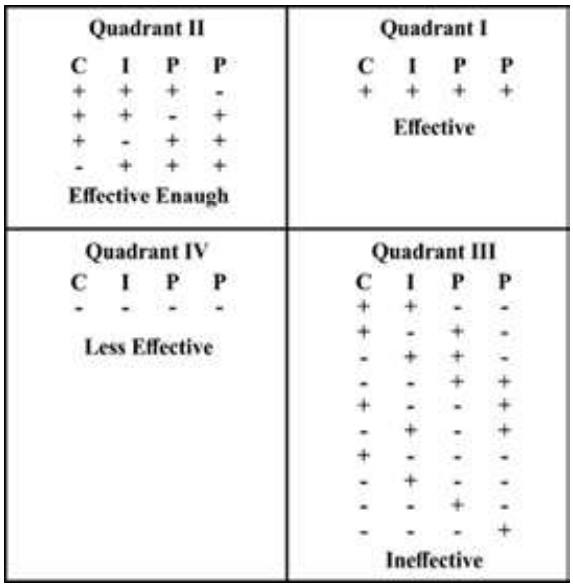
self-development and output opportunities for success. The input variables evaluated were curriculum, personnel, funds, facilities and infrastructure, school regulations, school organization, school administration and school culture. The process variables that are evaluated are the assessment of management, leadership and the teaching and learning process The product variables evaluated are student achievement (Doyok, 2021).

The population of this research is all mathematics teachers of State Junior High Schools located in Singaraja City, Buleleng Regency, Bali - Indonesia Province who apply the PjBL model in their learning, namely SMPN 1 Singaraja, SMPN 2 Singaraja, SMPN 3 Singaraja, SMPN 4 Singaraja, and SMPN 6 Singaraja which numbered 34 people. The selection of this school as a place of research is due to the findings of researchers on the implementation of mathematical learning that applies the project-based learning model in the school concerned. Furthermore, using the Simple Random Sampling technique, 3 schools were established as research places, namely SMPN 1 Singaraja, SMPN 4 Singaraja, and SMPN 6 Singaraja. The number of all math teachers in these three schools is 19 people with distribution: 7 people in SMPN 1 Singaraja, 6 people in SMPN 4 Singaraja, and 6 people in SMPN 6 Singaraja. Of these 19 teachers, 7 were assigned as a sample of research. Using proportional random sampling techniques, the distribution of teachers is 3 people in SMPN 1 Singaraja, 2 people in SMPN 4 Singaraja, and 2 people in SMPN 6 Singaraja.

The instrument used in this study was a questionnaire. Yusuf (2015) explains that through a questionnaire, often referred to as a questionnaire, it can collect relevant information according to the purpose of the assessment, and valid and reliable information. This questionnaire is compiled using a closing statement and its suspension using a Likert scale with five alternative answers, namely SS (Strongly Agree), S (Agree), KS (Disagree), TS (Disagree), and STS (Strongly Disagree). Before being used, this questionnaire has been tested for validity and reliability. The validity test, which consists of a content validity test and an item validity test, shows that the instrument is valid. From the test results, the instrument reliability level is 0.982, so the questionnaire is included in the very good category. Furthermore, the effectiveness of applying project-based learning models to mathematics subjects is reviewed from the process standard (The Regulation of the Minister of Education and Culture No. 22 of 2016) on each indicator analyzed with ideal theoretical criteria of five scales. In this study, the researcher used several research instruments, the first was a closed questionnaire where the respondent chose only 1 (one) of the 5 (five) alternative answers provided which were deemed to be in accordance with the respondent's opinion regarding the statements displayed, namely very appropriate, appropriate, quite appropriate, not suitable, very inappropriate. The use of closed questionnaires is carried out with the aim that the scope of the research is not too broad so that it is focused on getting answers that are in accordance with the expectations of the researcher. Next is the documentation method, which is data collection carried out by collecting important notes related to the research carried out. So that complete data will be obtained referring to the available document evidence. In this study, the documentation method is a supporting method that supports and strengthens the data obtained through filling out a questionnaire. The last is interviews, while in this study unstructured interviews are used where researchers follow up on answers that have been stated by respondents to the questionnaire in order to get more in-depth reinforcement of the answers given.

To get a conclusion the overall results of the respondent's score are analyzed using a T score. In the calculation using the T score, the Z score must be calculated first, then the formula: T score = 50 + 10Z is used (Carey & Delaney, 2010). Based on the T score obtained for each variable then the conclusion will be obtained by the rule:: if the T score is greater than 50 then the variable analyzed will fall into the positive category (+), whereas if the T score obtained is less than or equal to 50 then the variables to be analyzed will fall into the negative category (-). Conclusions about the category for variables that fall into the positive or negative category are obtained if the number of positive values (+) from respondents is more than the negative value (-) then it can be concluded that the variable belongs to the positive category (+), and vice versa. The results of the T score calculation obtained were consulted with the modified Glickman Quadrant prototype (Ardiyanti et al., 2020). Glickman Quadrant's display modified to evaluate the effectiveness of implementing project-based learning models in mathematics subjects is shown as follows (Ardiyanti et al., 2020).

Figure 1. Prototype effectiveness of the evaluation of glickman theory adaptation process (1981)



RESULT AND DISCUSSIONS

The effectiveness of the application of the PjBL model in mathematics subjects in SMP Negeri in Singaraja-Bali city is reviewed from the standard process (Syahrul Azmi, Hapipi, 2019) on each indicator analyzed with ideal theoretical criteria on a five-scale. Referring to the ideal theoretical criteria, results are obtained for analysis on each indicator on each variable as follows: The analysis of the effectiveness of the context variable consists of Community values and expectations, Government and community support, Government policy, Juridical foundation, Economic demands, Globalization demands, Self-development demands, Output opportunities for success, with the variable average score is 25.00. Based on the a range of the scores that the application of the project-based learning model in mathematics subjects is reviewed from The Regulation of the Minister of Education and Culture No.22 of 2016 with the results of theoretical ideal criteria analysis. Because it is in the average score range of 23.3–27.9, it can be said that its implementation is effective.

For the input variable effectiveness rate analysis, it can be seen that all of the total variables, which are Curriculum, Manpower, Funds, Facilities and infrastructure, School regulations, School organization, School administration, School culture, has a total score of 695. Due to the input variable instrument there are 32 statements, so the average score for the input variable is 21.7. Based on this, it can be concluded that the input variable for the application of the PjBL model in mathematics subjects based on Regulation of the Minister of Education and Culture No.22 of 2016 through calculations using theoretical ideal criteria analysis can be said to be quite effective.

We also analyzed the process variable effectiveness rate, from the result it can be concluded that in the variable process of implementing the PjBL model in mathematics subjects reviewed by The Regulation of the

Minister of Education and Culture No.22 of 2016 through the results of the calculation of theoretical ideal criteria, it can be said to have been implemented effectively because all of the indicators, which are Management, Leadership, and Teaching and Learning has the average score range of 23.30–27.90.

The next step is analyzed the Product variables effectiveness rate, it can be seen that the product variable has a total score of 145. Due to the product variable instrument there are 6 statement items, the average score for the product variable is 24.16. Based on this, it can be concluded that in the product variable the application of the PjBL model in mathematics subjects when viewed based on The Regulation of the Minister of Education and Culture No.22 of 2016through the results of calculating the theoretical ideal criteria can be said to have been implemented effectively. To get more accurate analysis results to support the analysis obtained through the calculation of the theoretical ideal criteria, the data will also be analyzed using the T score calculation. The results of the T score values obtained will later be analyzed by referring to the Glickman quadrant. In the calculation using the T score, the Z score must be calculated first. then the following formula is used: Score T = 50 + 10Z. based on the value of the T score obtained for each variable then conclusions will be obtained with the following rules: if the value of the T score is greater than 50 then the variables analyzed will fall into the positive (+) category, while if the value of the T score obtained is smaller or the same with 50 then the variables to be analyzed will fall into the negative category (-). In this case, if the variable is in the positive category, it means that the implementation of the PjBL model on that variable has been implemented effectively based on the reference to The Regulation of the Minister of Education and Culture No.22 of 2016, while if the variable is in the negative category, it means that the implementation of the PjBL model on that variable is not implemented effectively. based on the Minister of Education and Culture No. 22 of 2016. To get a conclusion regarding the category for a variable included in the positive or negative category, if the number of positive (+) values from respondents is more than negative (-) values, it can be concluded that these variables are included in the category positive (+) and vice versa.To be able to draw conclusions, thoroughly done analysis using the calculation of the score T. The results of the analysis of the four CIPP variables using the calculation of the T score are presented in the following table.

Table 1. calculation of T score of each variable

No	Variable	Frequency		Result	Category
		F+	F-		
1	Context	71.43	28.57	+	Positive
2	Input	28.57	71.43	-	Negative
3	Process	71.43	28.57	+	Positive
4	Product	71.43	28.57	+	Positive
Result				+, -, +, +	Positive,negative,positive,negative

Based on the results of the category analysis obtained through the T score in Table 1, further conclusions can be drawn thoroughly by using Glickman quadrant references on the implementation of project based learning models in mathematics subjects reviewed in The Regulation of the Minister of Education and Culture No.22 of 2016. The results of

calculations related to context, process, and product variables are positive, while input variables have negative values (CIPP = +—+-"). Based on this, it is known that there are 3 variables that, according to the calculation of the T score, are said to have run effectively in accordance with the ideal process standard of The Regulation of the Minister of Education and Culture No.22 of 2016, while 1 variable, according to the results of the calculation of the T score, is said to have run less effectively in accordance with the ideal process standard of The Regulation of the Minister of Education and Culture No.22 of 2016. The results were then consulted with the Glickman model quadrant (Ardiyanti et al., 2020; Doyok, 2021; Yuniarti et al., 2021), which found that the implementation of PjBL model in mathematics subjects based on The Regulation of the Minister of Education and Culture No.22 of 2016 can be said to have been running quite effectively.

The effectiveness of the application of the project-based learning model in junior high school mathematics subjects in Singaraja-Bali city refers to The Regulation of the Minister of Education and Culture regarding the standard of education process No.22 of 2016 reviewed through context.

Table 2. Context variable T score calculation

No	Score	M	X-M	SD	Score Z	Score T	Category	
							T ≤ 50	T > 50
1	79.00	75.00	4.00	5.12	0.78	57.81		+
2	79.00	75.00	4.00	5.12	0.78	57.81		+
3	66.00	75.00	-9.00	5.12	-1.75	32.42	-	
4	78.00	75.00	3.00	5.12	0.58	55.85		+
5	78.00	75.00	3.00	5.12	0.58	55.85		+
6	68.00	75.00	-7.00	5.12	-1.36	36.32	-	
7	77.00	75.00	2.00	5.12	0.39	53.90		+

Based on the acquisition of a T score on a context variable, as shown in Table 2, this variable belongs to a positive category. Argumentation of the facts that support the existence of various support aspects can be seen from the attention of parents of learners in meeting the needs of learners in following learning so that it can be done optimally, in this case, supporting the implementation of mathematical learning that applies the PjBL model. Then another factor is the development of technology and information, which also provides support in line. The availability of science and technology progress support is very helpful in providing learning resource facilities that are able to improve the understanding of students' mathematical concepts, reasoning skills, and problem solving in the implementation of PjBL model in mathematics subjects (Abdurrahman, 2019; Chairunnisa et al., 2020; Han et al., 2015). In line with the support of these indicators, other factors also show positive support, such as support provided by the government and the community, the role of the community in terms of providing support to support the implementation of learning in schools through donations of funds, and so on. In addition, the role of the community in the school is a contribution in the form of high enough attention to the educational condition of its learners. This can be seen through the involvement of enthusiastic parents in meeting the needs of their students' schools, both in terms of costs and facilities. This, of course, has a significant influence on the effectiveness of the learning process, which

has an impact on increasing the competence of the student. In terms of the government, in this case, the government determines the direction and policy in the field of education clearly and purposefully. The government's attention certainly has a significant impact on the implementation of junior high school mathematics learning in Singaraja city, where every educator is given an incentive every month by the city government to motivate teachers to improve their performance. Therefore, the city of Singaraja can be said to be quite advanced in paying attention to the quality of learning and the quality of education in its area and is able to create competitive human resources.

The effectiveness of the application of the PjBL model in junior high school mathematics subjects in the city of Singaraja-Bali refers to the Minister of Education and Culture concerning the standard of the educational process No. 22 of 2016 in terms of input.

Table 3. Calculation of the T score of the input variables

No	Score	M	X-M	SD	Score Z	Score T	Category	
							T ≤ 50	T > 50
1	113.00	115.43	-2.43	5.37	-0.45	45.47	-	
2	114.00	115.43	-1.43	5.37	-0.26	47.33	-	
3	115.00	115.43	-0.43	5.37	-0.07	49.20	-	
4	122.00	115.43	6.57	5.37	1.22	62.23		+
5	124.00	115.43	8.57	5.37	1.59	65.96		+
6	107.00	115.43	-8.43	5.37	-1.56	34.30	-	
7	113.00	115.43	-2.43	5.37	-0.45	45.47	-	

Based on the results of the calculation of the score T in Table 3 above, although the overall conclusion is obtained based on the results of the negative T score, this input variable is analyzed in more detail and in depth in relation to which indicators fall into the positive category (already effective) and which indicators are included in the negative category (ineffective) in order to find alternative ways out as a follow-up to the weaknesses found.

Table 4. Calculation of T score of each input variable indicator

No	Variable	Frequency		Result	Kategori
		F+	F-		
1	Curriculum	42.85	57.14	-	Negative
2	Manpower	42.85	57.14	-	Negative
3	Funds	42.85	57.14	+	Positive
4	facilities and infrastructure	42.85	57.14	+	Positive
5	School regulations	42.85	57.14	-	Negative
6	School organization	57.14	42.85	+	Positive
7	School administration	71.42	28.57	+	Positive
8	School culture	57.14	42.85	+	Positive

By referring to Table 4, it can be seen that the effectiveness of the application of the PjBL model in mathematics subjects seen from the input dimension for each indicator can be explained. This means that when viewed from curriculum indicators, the implementation of the PjBL model in mathematics subjects obtained negative T score calculation results. This means that when viewed from curriculum indicators, there are still irregularities in the curriculum carried out with the ideal curriculum that is expected in accordance with the reference standards of the educational process contained in The Regulation of the Minister of Education and Culture No.22 of 2016 (Ardiyanti et al., 2020; Yuniarti et al., 2021). The available manpower factor gets a negative T score calculation. This is stated by arguing the fact that there is still a lack of teacher knowledge in implementing this learning model ideally, such as how to create a classroom atmosphere that is able to raise students' abilities in exploring concepts and solving mathematical problems. In addition, the indicators of facilities, infrastructure, and funding obtained are still in the negative category, meaning that there are still obstacles to the implementation of the ideal learning model influenced by this. Based on the findings of researchers, the availability of facilities and infrastructure in schools that are used as research objects has been very high, considering that this school is a flagship school in Singaraja city, so it always gets good attention from the government regarding the availability of facilities and funding that support the learning process in schools, but based on the findings of researchers, the availability of facilities and infrastructure has not been managed properly, so that some inventory supporting the implementation of learning is not utilized as it should be.

The effectiveness of the application of the PjBL model in junior high school mathematics subjects in Singaraja-Bali City refers to The Regulation of the Minister of Education and Culture regarding the standard of education process No.22 of 2016 reviewed through the process aspects.

Table 5. Calculation of process variable T score

No	Score	M	X-M	SD	Score Z	Score T	Category	
							T ≤ 50	T > 50
1	210.00	217.86	-7.86	6.46	-1.21	37.83	-	
2	208.00	217.86	-9.86	6.46	-1.52	34.73	-	
3	219.00	217.86	1.14	6.46	0.17	51.76		+
4	226.00	217.86	8.14	6.46	1.26	62.60		+
5	226.00	217.86	8.14	6.46	1.26	62.60		+
6	218.00	217.86	0.14	6.46	0.02	50.21		+
7	218.00	217.86	0.14	6.46	0.02	50.21		+

Based on the acquisition of a T score on the process variable as shown in Table 5, it shows that the implementation of the PjBL model in junior high school mathematics in Singaraja-Bali has been running effectively. This is supported by aspects of management, leadership, and the teaching and learning process. When viewed through the realm of management and leadership, it appears that there is teacher support in this indicator, including planning, implementation, assessment, and supervision of learning that is carried out well in accordance with the reference for implementing learning according to the standard process of The Regulation of the Minister of Education and Culture No.22 of 2016 (Sugiyanto et al., 2015; Syahrul Azmi, Hapipi,

2019). Furthermore, if viewed based on the teaching and learning process, it appears that teacher support in carrying out the teaching and learning process includes preliminary, core, and closing activities that have been implemented properly, so that the implementation of learning can be said to be effective. This is due to the continuity between the implementation of the learning process, which is the implementation of the Learning Implementation Plan (RPP). In this case, it can be seen that the teacher has been able to implement the lesson plans into the learning pattern in the classroom well.

The effectiveness of the application of the PjBL model in junior high school mathematics subjects in Singaraja-Bali city refers to The Regulation of the Minister of Education and Culture regarding the standard of education process No.22 of 2016 reviewed in terms of products.

Table 6. Calculation of product variable T score

No	Score	M	X-M	SD	Score Z	Score T	Category	
							T ≤ 50	T > 50
1	18.00	20.71	-2.71	1.48	-1.83	31.69	-	
2	22.00	20.71	1.29	1.48	0,87	58.72		+
3	22.00	20.71	1.29	1.48	0.87	58.72		+
4	21.00	20.71	0.29	1.48	0.20	51.96		+
5	19.00	20.71	-1.71	1.48	-1.16	38.45	-	
6	21.00	20.71	0.29	1.48	0.20	51.96		+
7	22.00	20.71	1.29	1.48	0.87	58.72		+

Based on the acquisition of a T score on the product variable as stated in Table 6, it shows that the implementation of the Project Based Learning learning model in junior high school mathematics subjects in the city of Singaraja-Bali when viewed through this variable has been running effectively. The product dimensions show effectiveness can be seen based on the acquisition of students' mathematics learning achievements, both in the academic field and in the product dimensions. Such as the high average acquisition of the final semester exam scores (UTS) and the average acquisition of the final semester exam scores (UAS) in mathematics subjects for the academic year 2020/2021.

Another factor that shows the effectiveness of the implementation of the PjBL model in terms of product variables is that very few students participate in the remedial program because most students are able to get good grades or above the Minimum Completeness Criteria (KKM).

This is supported by the results of previous research that states that the implementation of the PjBL model reviewed from the process standards in general is quite effective (Dantes et al., 2013). This can be seen through the results of a review of planning, which shows the results of 56% supporting learning so that it can be said to be effective; a review of the implementation showing 64% results so that it can be said to be effective; a review of the assessment showing 48% results so that it is said to be ineffective; and a review of supervision, where the learning process shows the results of 57%, so it can be said to be effective. In line with the results of other relevant studies, student learning outcomes show positive results, namely an increase in the percentage of students who achieve the KKM score. Starting with a basic score of 42.11%, in cycle one it increased to 57.89% and in the second

cycle it increased to 68.42% (Tyas et al., 2014). While in similar studies, the results of the assessment of context variables obtained 69.14% in the criteria table fall into the good category, for the assessment of input variables obtained 41.75% in the criteria table into sufficient categories, for the assessment of process variables obtained 52.75% in the criteria table into enough categories, and for the assessment of product variables obtained 71% in the criteria table into the good category (Dahono, 2017). But there is a different thing that the authors found in this study, namely that the non-academic achievement of students in mathematics subjects has not been found.

Constraints in the implementation of project-based learning models in mathematics subjects

Through the results of the questionnaire and supported by interviews conducted, the researchers found several obstacles in the implementation of the PjBL model in junior high school mathematics subjects in the city of Singaraja-Bali that could affect the effectiveness of the implementation of this learning model, namely as follows.

There is a negative paradigm that mathematics is a difficult subject and tends to be unpleasant (Putu Pasek Suryawan, 2020; Suarsana et al., 2019). This makes students less motivated to learn. Therefore, in the context of input, it is necessary to pay attention to the motivation of students in learning mathematics.

Limited lesson time. This is felt by the teacher to tend to be lacking because in carrying out the demands of the ideal learning process, it goes through quite a long series of stages, namely introduction, core, and closing. In addition, the assessment process must be done quite complexly, namely by paying attention to assessment for the competence of knowledge, attitudes, and skills simultaneously

The number of students in one class mostly exceeded 32 people. This will have an impact on the lack of focus and control of the teacher in providing guidance, guidance, and overall assessment to all students. Overcoming this requires a strict rule related to the maximum number of students in one class.

At least 2 teachers (28.57%) of the 7 teachers who teach junior high school math subjects in Singaraja-Bali city are in the age group that has exceeded 50 years of age, while at that age, teachers have begun to experience a stagnation in innovation in conducting learning activities.

There are still teachers who have not been able to carry out planning, implementation, assessment, and supervision of mathematics subjects ideally. This will be an obstacle to making the implementation of mathematical learning effective. Based on the results of interviews conducted by researchers, although socialization and seminars have been conducted by the central and regional governments, it is still difficult for teachers to implement them in the field.

There has been no provided forum in the form of a forum by the Head of Education Unit to exchange the experience of learning in the classroom including dealing with the obstacles faced and as a place to share the results of the experience of attending training and seminars. So this makes it possible that there are still many teachers who do not understand thoroughly about the existence of process standards that are used as references in planning, implementation, assessment and supervision in the ideal learning process (Dantes et al., 2013; Sugiyanto et al., 2015).

Follow-up to the Evaluation Results

Follow-up recommendations provided by researchers based on the results of the study are, first for the Head of Education Unit is expected to provide opportunities for teachers for training

and facilitate the dissemination of training results to other math teachers in the form of workshops and seminars that aim to improve teacher readiness in carrying out learning following the reference implementation of the ideal learning model, namely the standard of education process contained in The Regulation of the Minister of Education and Culture No.22 of 2016 (Chairunnisa et al., 2020). It is also expected to be able to supervise, monitor, report, and follow-up on the learning process (Sugiyanto et al., 2015). This needs to be done so that the learning process in the classroom can take place properly so that it is in accordance with the design of the learning plan that refers to the ideal process standard reference.

Second one to create an effective implementation of the PjBL model in mathematics subjects so that it can meet the standards of implementation of learning following the standard reference process, it is not only imposed on the teacher, but the ability of students must also be a concern, because this can be a central point for realizing the effectiveness of learning (Tyas et al., 2014). This is based on the assumption that if there are good input aspects, there will be good outputs as well. Therefore, the existence of input aspects must be considered properly, such as confirming the number of student study groups per class, which is a maximum of 32 people, so that classroom management by teachers can be carried out more optimally.

■ CONCLUSIONS

Based on the findings of this study, it was concluded that: (1) the application of the PjBL model in junior high school mathematics subjects in the city of Singaraja-Bali in terms of context which included an assessment of indicators of progress in science and technology, values and expectations community, government and community support, government policies, juridical basis, economic demands, globalization demands, self-development demands and output opportunities for success are quite effective; (2) the application of the PjBL model in junior high school mathematics subjects in the city of Singaraja-Bali in terms of input which includes an assessment of the curriculum, personnel, funds, facilities and infrastructure, school regulations, school organization, school administration and cultureschool are quite effective; (3) the application of the project-based learning model in junior high school mathematics subjects in Singaraja-Bali city was reviewed in terms of processes such as management, leadership, and teaching and learning processes are quite effective, and (4) the application of the PjBL model in junior high school mathematics subjects in Singaraja-Bali city in terms of products such as assessment of student learning achievement are quite effective.

PjBL model in mathematics subjects so far is effective towards the standards of implementation of learning following the standard reference process, it is not only imposed on the teacher, but the ability of students must also be a concern, because this can be a central point for realizing the effectiveness of learning. In the simplest way, we can say that the **implication** of the PjBL model is quite effective in mathematics when viewed from a product perspective which includes an assessment of student achievement. The **limitation** of this research is evaluation, it only refers to process standards and has not reviewed other standards for a more comprehensive study, such as graduate competency standards, content standards, and assessment standards. Therefore, to get a more in-depth study, it is necessary to evaluate

project-based mathematics learning in terms of the Minister of Education and Culture Regulation No. 20, 21, and/or 23 of 2016.

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