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The Effectiveness of Teaching Program of CIPP Evaluation Model: Department of Mechanical Engineering, Politeknik Negeri Bali

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Abstract

This study aimed at finding out the level of effectiveness of the implementation of the teaching at the Department of Mechanical Engineering Politeknik Negeri Bali (PNB) viewed from the interrelatedness of the components of context, input, process, and product, This study used the evaluative study model of CIPP (Context, Input, Process, Product) and was done in two stages. The data were collected using a questionnaire, interview guide, and related documents that have proved to be highly valid and reliable. The data were analyzed descriptive-qualitatively and descriptive-quantitatively. The result showed that the implementation of the teaching program at the Department of Mechanical Engineering PNB viewed from the interrelatedness of the components of CIPP falls into the fairly effective category. On the other hand, the constraints encountered in the teaching program implementation were faced in the components of context and product. The greatest constraints were found in the variables of process and product related to the evaluation of nonacademic learning achievement.

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1. Introduction

The world is currently entering the era of the Industrial Revolution 4.0 or the Fourth World Industrial Revolution in which information technology has become the basis in human life (Kemristekdikti, 2018). Education plays a very important role since it is through education that quality and competent human resources are produced in the area of knowledge and skill learned and in the long run it will give an impact on the environment.

Hasan *et al.*, (2015), Coombs (1982), Forouzandeh *et al.*, (2008), Education gives an impact on all aspects of life, therefore the development in the educational sector becomes one of the focuses of attention of the government of Indonesia. One of the important forms of education developed is vocational education. Vocational education lies in

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the professional stream with a different objective from that of the academic. The former puts more emphasis on the preparation of skilled human resources both at the high education and the higher education (diploma) levels.

Polytechnic is one form of higher education that runs vocational education in various disciplines and/or technologies, preparing the students for jobs with certainly applied expertise up to those with undergraduate programs. To graduate from Polytechnique a student needs to take courses that are appropriately designed in response to the development of the era and technology.

Department of Mechanical Engineering is one of the departments at PNB with the vision of becoming a department that produces professional, competitive professionals with an international perspective in mechanical engineering and sustainable technologies. One of the mission is to produce professionals who hold high ethics and professions in mechanical engineering.

To prepare the students to enter the job market, at the Department of Mechanical Engineering teaching program uses a package system that requires the students to take and pass all the courses set out in the curriculum for each department. This package system has the following characteristics: 1) the students are required to take all the courses programmed and have to pass them at each semester according to the effective regulation; 2) the student's success in their study is determined by their academic achievement and course attendance, and 3) the week hours for every course are determined based on the ability and skill that the students have acquired.

Teaching is an interactional process that occurs between the teacher and the students in the classroom and the laboratory. In the process, there are two activities that occur: teaching and learning (Sardiman, 2010). Teaching is an actualization of the curriculum that requires the teacher to be active in creating and producing preprogrammed activities in the students that are expected to produce a change in the latter in ability, education, and competence. The essence of teaching lies in its effectiveness, the level of which depends largely on internal and external factors as well as the approach to learning determined by learner characteristics and student and teacher behaviors (Syah, 2000).

The teaching system as an integral part of the educational system is the phenomenon that has to be improved and developed by the implementers and stakeholders. This is related to the curriculum, method, teaching media, teaching materials, evaluation, etc. to produce a good future-oriented teaching system.

A teaching program is one of the important factors to improve educational quality (Mardapi, 2003). Evaluation is one of the important factors in teaching. To improve educational quality, the implementation of evaluation has to become an important part and is implemented sustainably. Evaluation is also important for the top management of the educational institution (principal, rector, etc) as a feedback for the educational program which he or she is responsible for. Evaluation can develop interest and motivation in the students to learn more seriously and the teachers to improve their performances and professionalism. The activities in evaluation do not only focus on the evaluation of learning achievement, but also on the evaluation of input and process of learning (Mardapi, 2003). By conducting an evaluation of the teaching program it is expected that the quality of the teaching process will improve and in the long run, the quality of education, in general, will also become better.

Success in achieving the objective of teaching program (output) depends very much on its implementation (process) and this depends largely on the level of readiness in every aspect (input) that is required (Slamet, 2005). Therefore, in implementing a teaching program the implementers should not think and act partially. On the contrary, they should think holistically in an integrative way.

A school or an institution of higher learning is a system that consists of the components of context, input, process, output, and outcome. Each of the components influences the component next to it in the order. The context influences the input and the input the process a so on and so forth. In a system, there is a synergy of mutual support in achieving the objective, in this case, the objective of the teaching program.

Majid (2009), Mulyono (2008), Popham (1999), Rossi *et al.*, (2004), every program, including the teaching program at ME has strengths and weaknesses in its implementation. This study was done to find out the weaknesses of the teaching program at the Department of Mechanical Engineering PNB. It is expected that the result of this study can be used as a basis to improve the quality of teaching in the future. To this end, a systematic and comprehensive evaluation was done, using a standardized program evaluation model.

There are many program evaluation models that are frequently used by evaluators. One of them that is popularly and dominantly connected with the evaluation of implementations of teaching programs is the CIPP (context-input-process-product) model developed by Stufflebean, *et al* in 1971 (Suharsimi, 2009). This evaluation model is seen to be strategic for use to improve the quality of educational programs (Shang, *et al*, 2011). A survey with the members of Training and Development in the United States found that the CIPP model is preferred to other evaluation models (Galvin, 1983).

According to the CIPP model, an evaluation is a process of delineating, acquiring, and selecting meaningful information that can be used as the basis to make a decision and to select alternative decisions. This evaluation model uses context, input, process, output as the targets of evaluation and considers that the program under the evaluation as a system (Suharsimi, 2004). The CIPP model is a standard evaluation model and has some strengths compared to other evaluation models. The strengths are among other things: 1) it gives a very detailed or very wide description of a project, starting from the context up to the process of the implementation,; 2) it has the potential to move in the domains of formative and summative evaluation that it is as good as doing an improvement during the program and giving final information; 3) it is more comprehensive or more complete in selecting information; and 4) it can provide a good basis for making a decision and policy in designing a further program (Suharsimi, 2009).

Gronlund & Linn (1990), Hasan *et al.*, (2015), Komariah & Triatna (2005), evaluation of context will produce information on the need, to what extent a deviation has occurred between what is expected from what has been realized through the program. Evaluation of input stresses the importance of providing information on the strengths and weaknesses of the strategies and procedures of the activities selected in the process of attaining the objectives that have been set out. The evaluation of process stresses the importance of "what" of the activities done in the program, "who" were appointed as the person in charge, "when" the activities were over. While the evaluation of final output (product) stresses more on to what extent the result has been achieved is in accordance with the desired objective, and whether an activity needs to be stopped, continued, improved, etc.

The evaluation of the final output (product) has the objective of relating the information on the final output and the objective, setting, input, and process that have been determined before (Stufflebeam & Shinkfield, 2007; Suharsimi, 2009; Zhang, *et al.*, 2011; Warju, 2016).

The result of the CIPP evaluation model can be used as the basis for four types of decision: (1) planning (it influences the selection of the objectives of the activity); (2) structurization (it determines the optimal strategy and the design of the program and the improvement of the existing program); (3) implementation (it provides tools for implementing the program and program improvement); and (4) it recycles (whether an activity needs to be continued, changed, or stopped). The result of this evaluation will give many indicators on what has been done and what has not been done, whether the process of teaching followed the plan that has been designed, whether the materials are given by the lecturers a be understood by the students, and in accordance with the standard of contents of the teaching implementation. Whether the implementation has referred to the National Standard of Education stipulated in the Regulation of Minister of Education No. 49 on the National Standard of Higher Education (Kemdikbud, 2014). All information obtained will be used as a reference to improve the quality of education at the Department of Mechanical Engineering PNB.

2. Materials and Methods

This study was an evaluation study using a mix method by combining quantitative qualitative methods (Sugiyona, 2012). The study was done in two stages, the first stage was done in 2017 that developed the instruments for the CIPP evaluation model that is valid and reliable. Suartika *et al.*, (2013). Waluyati (2012), Widoyoko (2009), the developers used the method of the 4D Model of Research & Development (R&D) and could produce a set of instruments for the CIPP evaluation model that is valid and reliable. The level of the content validity of each instrument is at the lowest 0.60 and the highest 0.90. The level of reliability falls into the very high category (Gunung & Darma, 2017). The second stage was done by measuring the level of effectiveness of the teaching program by using the CIPP (Context, Input, Process, Product) evaluation model. The design of the evaluation is as seen in Figure 1 below.

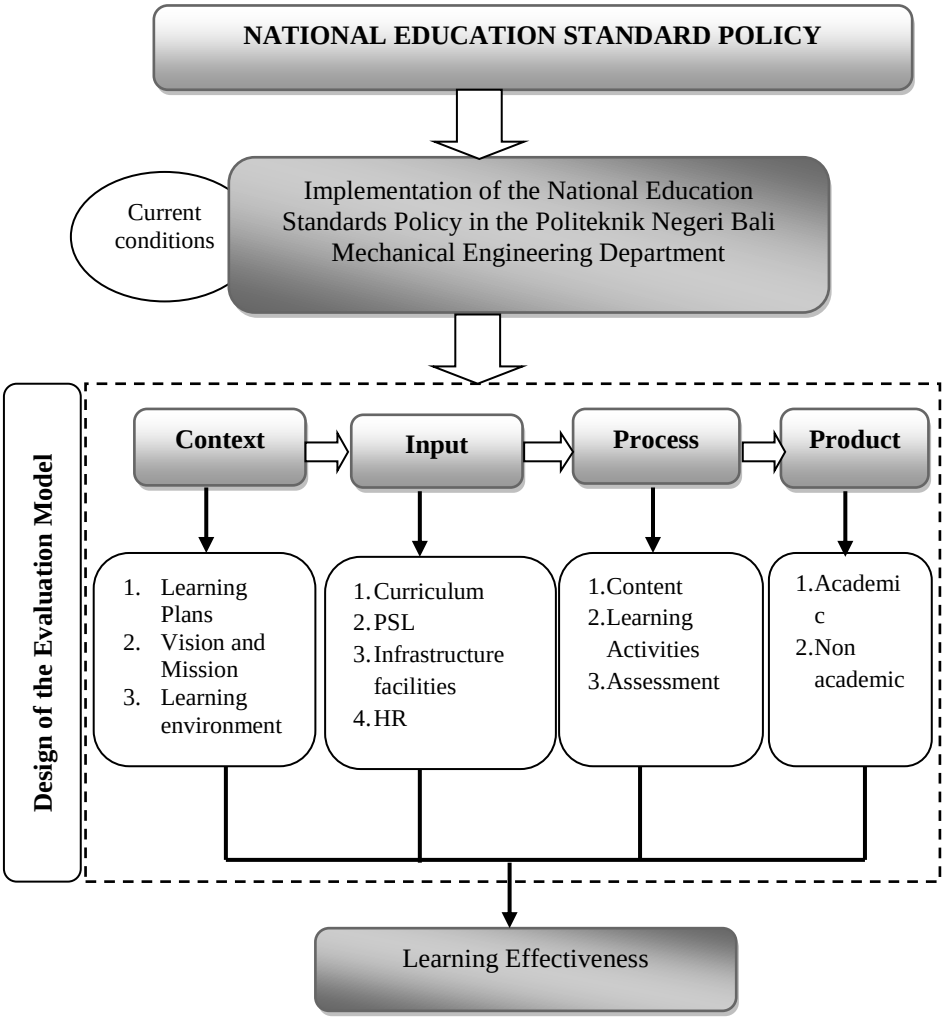

Figure 1. The Design of the CIPP Model Evaluation on the Implementation of Learning in the PNB Mechanical Engineering Department

The data were collected using the instruments of the result of the development in the first year which was then continued by analyzing the data collected descriptive-qualitatively and descriptive-quantitatively, using the Z-score and T-score (Arikunto, 2012). The T-score and the Z-score were computed using the following formula.

$T_{score} = 50 + 10Z$ and $Z_{scor} = \frac{x - M}{SD}$ (Sudjana, 2012)

The ideal mean of each variable was compared to the obtained mean. The mean was classified in terms of its tendency into five categories with the ideal normal theoretical curve norm as follows.

Mi + 1.5 SDi < x ≤ Mi + 3 SDi = Very High
Mi + 0.5 SDi < x ≤ Mi + 1.5 SDi = High
Mi - 0.5 SDi < x ≤ Mi + 0.5 SDi = Medium
Mi - 0.5 SDi < x ≤ Mi - 0.5 SDi = Low
Mi - SDi < x ≤ Mi - 1.5 SDi = Very Low

Note:

Mi = 1/2 (maximal score + minimal score)
SDi = 1/6 (maximal score - minimal score)
(Mardapi, 2016)

The effectiveness of the program implementation for each variable was classified according to the percentage of achievement. The criteria for the classification based on the level of achievement is are as follows.

A = (81 - 100) % : very high
B = (61 - 80) % : high
C = (41 - 60) % : medium
D = (21 - 40) % : low
E = (0 - 20) % : very low
(Ebel, 1972)

The qualification of the score of each component was computed using the T-score. If T > 50 then it is positive (+), and if T-score <50 then it is negative (-). If the number of the positive scores is more than or the same as that of the negative scores then the result is positive or ∑ score (+) ≥ ∑score (-) = (+). On the contrary, if the number of the positive scores is less than that of the negative ones, then the result is negative or ∑ score (+) < ∑score (-) = (-).

To find out the effectiveness of the teaching program, an analysis was done using Glickman's quadrant model analysis of the components of context, input, process, and product (1981) that consists of four quadrants (Gregory, 2000; Saherian, 2000). According to this analysis, if the analysis shows all positive (+) results, falling into quadrant I, it means that the teaching program is very effective. On the contrary, if it shows all negative (-) results, falling into quadrant IV, it means that it is very ineffective. If the analysis shows that three of the components are positive (+), then it falls into quadrants II, meaning that it is effective enough, while, if the analysis shows that one of the components has a negative (-) result, then, then it falls into quadrant III, meaning that it is less effective (Gregory, 2000).

Accordingly, there are 4 models of qualification of the effectiveness level of the teaching program at the Department of Mechanical Engineering PNB as described below.

If the CIPP position shows + + + +, then the implementation of the teaching program will fall into the effective category. If the CIPP position shows - + + + or + - + + or + + - + or + + + - , then the implementation of the teaching program will fall into the effective enough category. If the CIPP position shows + - - - or - + - - or - - + - or - - - + or + + - - or - + -+ or - - + + or + - + - or - + + - or + - - + , then the implementatino of the teaching program will fall into the less effective category. If the CIPP position shows - - - -, then the implementatino of the teaching program will fall into the ineffective category.

3. Results and Discussions

The recap of the data of the result of the measurement of the components of context, input, process, and product of the implementation of the teaching program at the Department of Mechanical Engineering PNB is shown in Table 1 below.

Table 1
Description of the data of the result of the measurement of the components of context, input, process, and product of the implementation of the teaching program at the department of mechanical engineering PNB

Statistic	Context	Input	Process	Product
N	63	63	63	168
Mean	105.40	142.00	118.05	16.10
Median	105.00	139.00	119.00	16.00
Mode	103	1.39	112	16
Std Deviation	4 05	8.38	8.043	2.08
Variance	16.44	70.23	64.69	4.33
Range	20	43	35	10
Minimum	94	121	99	11
Maximum	114	164	134	21

On the basis of Table 1 it can be explained that the mean of the variable of context, is 105.40, the median 105.0, the mode 103.0, the minimum score 94, the maximum score 114, the range 20, the standard deviation 4.05 and the

variance 16.44. In the details of the recap of the level of the achievement of each indicator in the variable of context can be seen as in Table 2 below.

Table 2
Recap of the result of analysis of the level of achievement in the variable of context

No	Indicator	Total Score	Mean	Percentage of Target Achievement (%)
1	Instructional Design	30	23.9	79.74
2	Vision and Missions	35	31.08	88.8
3	Learning Environment	55	50.4	83.99
4	Mean of the Variable	120	105.04	87.83
	Category			Very High

Based on the result of Table 2, the implementation of the teaching program at the Department of Mechanical Engineering PNB was viewed from the variable of context with 3 (three) indicators that constituted the variable, namely, instructional design, vision and mission and learning environment, the percentage of the achievement of the ideal maximum score shows that instructional design (course plan) was 79.74% (high), vision and missions 88.8% (very high), and learning environment 83.99% (very high).

The result of the measurement of the variable of input showed that mean = 142.00, median = 139, mode = 139, minimum score = 121, maximum score = 164, range = 43, standard deviation = 8.38, and variance = 70.23. The measurement was done in 4 (four) indicators that constituted the variable of input, namely, curriculum, Semester Course Plan (RPS), infrastructure and facilities, and human resources. The details of the recap of the level of achievement in each component of the variable of input can be seen in Table 3 below.

Table 3
Recap of the Result of Analysis of the Level of Achievement in the Variable of Input

No	Indicator	Total Score	Mean	Percentage of Achievement (%)
1	Curriculum	20	16.81	84.27
2	Semester Course Plan (RPS)	25	20.23	82.51
3	Infrastructure and Facilities	75	62.95	84.02
4	Human Resources	50	41.62	83.81
	Mean of the Variable	170	141.7	83.14
	Category			Very High

Based on the result of Table 3, the percentage of the maximum score shows that the percentage for curriculum was 84.27% (very high), semester course plan 84.1% (very high), infrastructure and facilities 84.02 % (very high), and human resources 83.81% (very high). In general, the percentage of achievement of the variable of input was 83.14%, falling into the very high category.

The measurement of the variable of the process covered the implementation of the teaching activities, consisting of the aspects of content, teaching activities and evaluation. The result of the measurement shows: mean = 118.05, median = 119.00, mode = 112, maximum score = 134, range = 35, standard deviation = 7.2, and variance = 64.69. The details of the recap of the level of achievement in each indicator of the variable of the process can be seen in Table 4 below.

Table 4
Recap of the result of analysis of the level of achievement in the variable of the process

No	Indicator	Total Score	Mean	Percentage of Achievement (%)
1	Content	15	12.97	86.4
2	Teaching Activities	35	30.04	85.81
3	Evaluation	90	75.1	83.45
	Mean of the Variable	140	117.79	84.14
	Category			Very High

Based on the result of Table 3, the percentage of the achievement of the ideal maximum score shows: content = 86.4% (very high), teaching activities = 85.81% (very high), and evaluation = 83.45% (very high). In general, the percentage of achievement of the variable of the process was 84.4%, falling into the very high category.

The measurement of the variable of the product covered students' learning achievement in the form of academic and non-academic achievements. The result of the measurement of mean showed: mean = 16.1, median = 16.0, and variance = 4.33. The detail of the recap of the level of achievement of each indicator in the variable of the product can be seen in Table 5 below.

Table 5
Recap of the result of analysis of the level of achievement in the variable of product

No	Indicator	Total Score	Mean	Percentage of Achievement (%)
1	Academic	4	3.8	89.62
2	Non-academic	20	12.37	61.84
	Total	140	16.17	66.47
	Category			Very High

Based on the result of recap in Table 5, the percentage of achievement of ideal maximum score shows academic achievement = 89.62% (very high), and non-academic achievement = 61.47% (high).

The level of effectiveness of teaching was seen from the frequency of positive and negative scores in the variables of context, input, process, and product. The recap of the frequency of the computation is shown in the following table.

Table 6
Recap of Computation of Frequencies of the Variables of Context, Input, Process, and Product

Variable	Category of Frequency		
	∑f (+)	∑ f(-)	Result
Context	34	29	+
Input	24	39	-
Process	37	26	+
Product	72	96	-
Total	167	190	+ - + -
Result	Effective Enough		

Note: T ≥ 50 shows that the value of its component is positive (+); T<50 shows that the value of its component is negative (-)

Based on Table 6, it is apparent that the variable of context has a higher number of positive (+) frequencies than that of the negative (-) , the result is positive, for the variable of input , the number of its positive (+) frequencies is higher than that of its negative (-), the result is positive, for the variable of process, the number of its positive (+) frequencies is higher than that of its negative (-), the result is positive, and for the variable of product, the number of

its positive (+) frequencies is lower than that of its negative (-), the result is negative. Hence, on the whole, to determine the level of effectiveness of the implementation of the teaching program at the Department of Mechanical Engineering PNB, the data of the computation of the T-score of each of the variables are verified into Glickman's quadrant as shown in Figure 2 below.

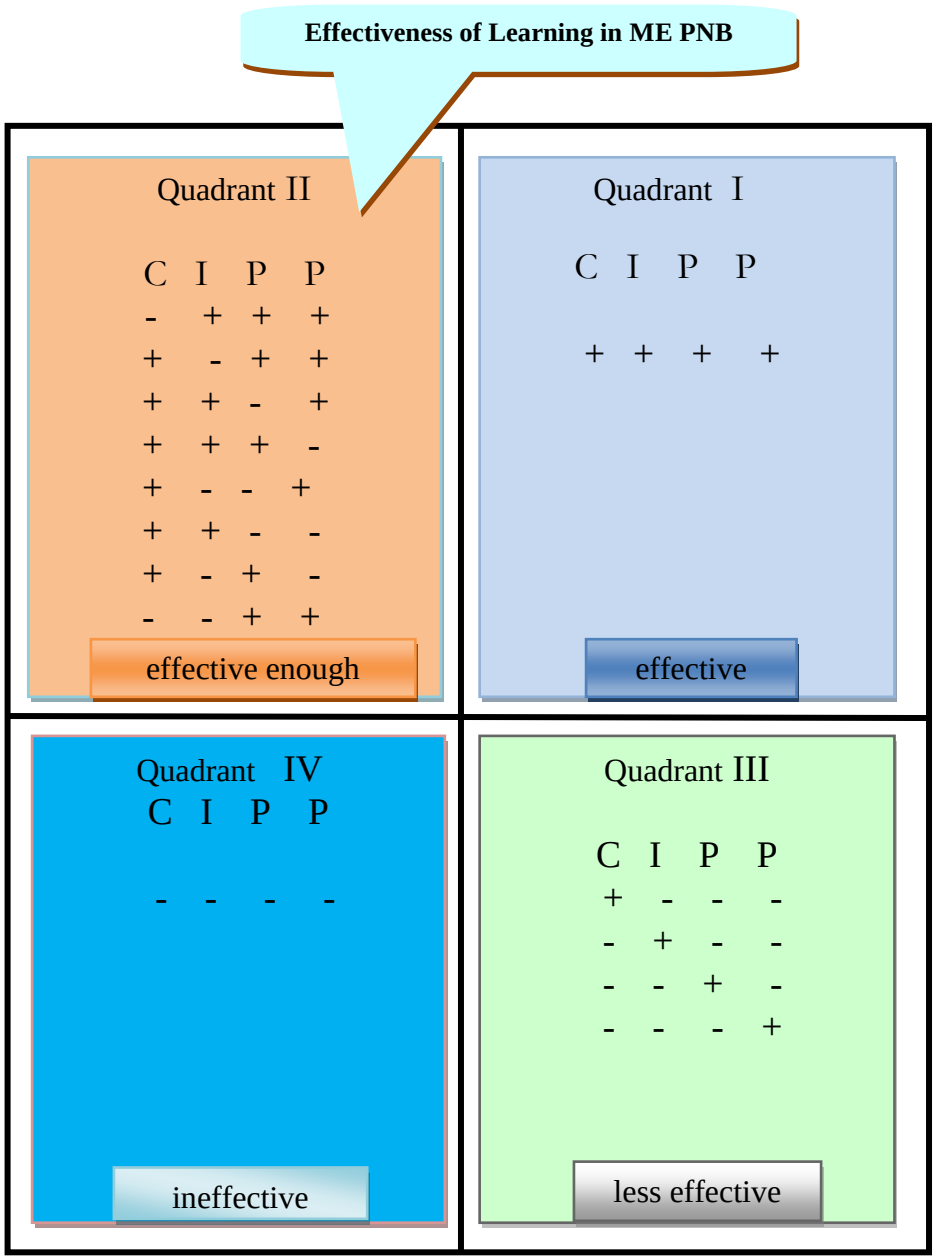

Figure 2. Glickman's quadrants of teaching implementation effectiveness at the department of mechanical engineering PNB (Glickman, 2000; Sahertian, 2000)

The verification result of the measurement of the data for each variable is shown in Figure 2, the position of the values of CIPP follows the + - + - a pattern of Quadrant II. This position shows that the condition of the program implementation falls into an effective enough category. Hence, it can be concluded that the teaching program implementation at the Department of Mechanical Engineering PNB was effective enough.

The teaching program implementation at the Department of Mechanical Engineering PNB, viewed from the component of context was effective, as shown by the mean of the sores of the computation of the variable of the context of 105.04. The proportion of the achievement of the ideal maximum score was 87.83, falling into the very high category, the difference between the number of positive (+) frequencies and that of the negative (-) frequencies and the T-score produced a positive (+) result. Each of the components showed a strong correlation (the average coefficient = 0.5) with the variable of context. The components of the variable of context were course plan, vision and missions and learning environment at the Department of Mechanical Engineering PNB were very supportive to the effectiveness of the teaching implementation. If looked at from the context of the aspect of course planning, vision and missions, and learning environment there was no constraint in the teaching program implementation. However, the aspect of course planning needs to be improved.

Viewed from the component of input the teaching program implementation at the Department of Mechanical Engineering PNB was ineffective. The difference between the number of positive (+) frequencies and that of the negative (-) ones in the T-score produced a positive (+) result. This condition was caused by the fact that there was only one component of the input that produced a positive (+) result, namely human resources. While others like curriculum, semester course plan (SCP) and infrastructure and facilities produced a negative result (-). If looked at from input, human resources support the teaching effectiveness, while curriculum, semester course planning, infrastructure, and facilities became constraints in the teaching program implementation. The adequacy of curriculum, semester course plan (SCP), infrastructure and facilities need to be improved.

In terms of the component of the process the teaching program implementation at the Department of Mechanical Engineering PNB has been effective. The difference between the number of frequencies of positive (+) frequencies and that of the negative (-) ones in the T-score produced a positive (+) result. The effectiveness of the teaching program implementation was caused by the fact that there was only one component of the process produced a negative (-) result, namely, evaluation. In the meantime, other components like content, and teaching activities were positive (+). Each component showed a strong correlation with the process variable. Thus, in terms of the component of the process, the aspect of assessment became a constraint in the teaching program implementation at the Department of Mechanical Engineering PNB, while others were not. The assessment implemented was not suitable for the standard of evaluation stipulated in the Regulation of Minister of Education and Culture No. 49 of 2014 on the National Standard of Higher Education. The implementation of assessment of the students' learning achievement is an integral part of the teaching process, even it is often seen as one of the three main pillars that are critical in the teaching activities. Hence, the assessment has to be designed and implemented according to the planning and implementation of the teaching program good quality teaching has to be followed with a good assessment implementation too (Sani, 2016).

Viewed from the component of the product, the teaching program implementation at the Department of Mechanical Engineering PNB was ineffective. The difference between the number of positive (+) frequencies and that of the negative (-) ones in the T-score produced a negative (-) result. Academically, and non-academically, the result of the students' learning did not support the effectiveness of the teaching program implementation. The components of the variable of the product as a whole did not support the effectiveness of the teaching program implementation. However, there was still a chance to be optimized. The percentage of the students that got a below average learning achievement was higher (42.14%) compared to that of those who got an above average learning achievement (50.74%). The level of graduation weakly supported teaching effectiveness. The percentage of the level of academic learning achievement was very high (89.62%). However, that of non-academic was only 61.84%, the aspect of the non-academic learning achievement needs to be improved, especially in relation to research and non-academic participation in student academic writing competitions both at the local and national levels.

In the CIPP evaluation model the interrelation among context, input and process influence each other and the product. Effective context, input, and process tend to produce an effective result/ product. However, the effectiveness of each component cannot be separated from the support of its substances (Nasution, 2001).

4. Conclusion

The level of effectiveness of the teaching program implementation at the Department of Mechanical Engineering PNB viewed from the interrelation of the components of context, input, process, and product fell into the effectiveness category.

The constraints in the teaching program implementation at the Department of Mechanical Engineering PNB were those at the components of context, input, process, and product. The most obvious one occurred in the variable of product. The constraints in the context component were course planning and learning environment. In the input component, the constraints were the adequacy of curriculum, SCP, and infrastructure and facilities. The constraint in the process component was the assessment system. While the constraint in the product component was the quality of the non-academic learning achievement.

Conflict of interest statement and funding sources

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Statement of authorship

The author has a responsibility for the conception and design of the study. The author has approved the final article.

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