

FINDING THE MISSING LINK IN THE DESIGN OF POLYTECHNICS COMPETENCE-BASED CURRICULUM

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Abstract

Competence-based curriculum has been initiated since early 1995 and developed in Polytechnics throughout Indonesia since 2006. The improvements of this curriculum to raise the quality of learning outcomes have been periodically conducted every 3 years, but until now in the implementation stage it is almost as the same as before. This study aim to reveals the source of the problem which caused obstructed in the improvement of learning outcomes quality. This study used mainly the qualitative approach supported by quantitative data, especially to encompass the opinion of learning outcomes quality. This study revealed: there was missing link in the design chance of polytechnics competence-based curriculum. There was no evaluation component in the design stage and no aligning process in the implementation stage. These caused the improvement of learning outcomes quality was very slow and almost no change.

Key words: missing link, competence-based curriculum, evaluation, aligning process, learning outcomes quality

1. Introduction

The first polytechnic was established as a pilot project in 1976. It was followed by establishing six polytechnics in the period 1979-1984 in Indonesia. Now Indonesia has 175 Polytechnics. The spring up of polytechnics has not yet increased the Human Development Index (HDI) significantly. HDI describe how good a country is. The low HDI described that the contribution of education, included polytechnics, to human development and economy growth were very low.

Polytechnics generally have a very high vision. Each polytechnic wants to become a superior institution and leading in vocational education. Therefore Polytechnics revised their curriculum periodically to realize their dreams. Competence-based curriculum (CBC) has been developed since early 2000, replace subject-based curriculum. CBC has been used to all polytechnics since ca 2006.

Polytechnics have attempted to improve the quality of their output by improving their curriculum every 3 years, but until now many industries are still in doubt the quality of polytechnics graduates. This is because of the worsen situation

between polytechnic and industries [1]. An evaluation research found a missing-link which has been impacted to educational process and its result.

2. Curriculum Design and Implementation

2.1 Curriculum Design

Curriculum is a key element in education process. The vocational and technical curriculum focuses not only on the educational process but also on the tangible result of that process. Strategic planning in education is needed to get optimal achievement of visions or goals. A program or curriculum should be developed through a process or series of steps [2]:

- a. examining the external environment and its impact on the organization now and in the future,
- b. conducting a self-examination,
- c. formulating vision and mission statements to guide the organization in the future,
- d. developing specific plans that will assist the organization to fulfill its vision and mission,
- e. applying the strategies included in the plans, and

- f. evaluating the organization through formative and summative approach

Curriculum is an engine of educational accomplishment which should be planned strategically. This strategic begins with an ideal vision from which an organization mission is derived. Strategic planning identifies results based upon an ideal vision. These results must be defined into measurable descriptions of knowledge, skills, attitude and abilities which are suitable for students in the future life. It has to link at three levels achievements: societal (outcomes), organizational (output or completers/leavers), and individual or small group (products). Input and process are one of determinant factors which impact on outcomes of education. Figure 1 shows the relationship between inputs and outcomes [3].

Mission statements have to be converted to mission objectives that are measureable on an interval or ratio scale. A mission objective is focused on ends (results), and not on means (process). An objective should be stated without confusion:

- a. who or what will demonstrate the performance or accomplishment,
- b. what performance it to be demonstrated,
- c. Under what conditions the performance will be observed,
- d. What the criteria will be used to determine success

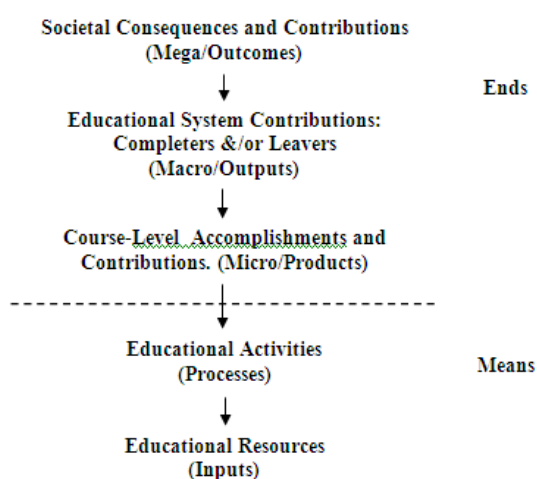


Figure 1. An Educational Results Chain

Curriculum design should be able to connect the elements of each level. The

arrows in Figure 1 connect the five organizational elements: mega/ outcomes; macro/outputs; and micro/ products, processes, and inputs. If there any missing alignment or lack of “fit” between any of the elements, the system is at risk.

Curriculum design and its implementation are influenced by environment. Educational policies (external and or internal), are environments that directly influence the curriculum design at mega, macro, and micro levels. One of the external policies (mega level) that strongly influence curriculum design is an Indonesian Qualification Framework (IQF). IQF contain a description of qualification standards. There are nine levels of IQF standard that relates to graduate level of education [8]. In addition, there are at least eight education components which are required to fulfill national education standards (SNP). These components are: content, process, human resources, graduate competencies, facilities, educational management, financial, and assessment of learning outcomes [4]. Curriculum as a macro level policy (organizational) must be designed strategically to provide qualified education result.

At micro level, professionalism of teachers, facilities, and methodology are the main factors that influence of educational results [7, 9]. Methodology relates to instructional design. It is used to manage and implement learning activities. Dick W [5] used a system approach to design instructional. This system consist of some components which interrelated to each other. A feedback as one important component of system will control the quality of instructional. It is obtained from the evaluation. Figure-2 shows a strong relationship between components. If there is any changing in one component, it will affect the others. Therefore all components must be designed simultaneously. A curriculum developer must understand fully the context within which a curriculum must operate.

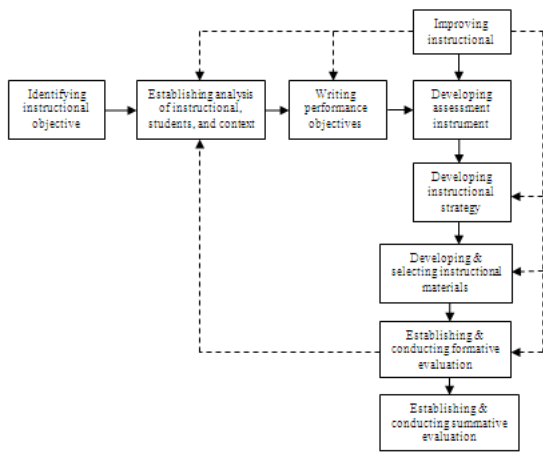


Figure 2. Instructional Design Model.
Adopted from Dick (2002)

The most critical problem in the process design of instructional is goals identification. There are many approaches to identify these goals. Frequently it can be determined by subject-matter expert, content outline, or performance approach. The last approach is suitable for competence-based curriculum. The goals can be identified by defining the knowledge, skills, attitudes, and abilities that must be mastered after students completed a training program.

2.2. Competence-based curriculum (CBC)

Competency and curriculum have many definitions. Sanghi has differentiated between competence and competency. Competence means a skill and the standard of performance reached, while competency refers to the behavior by which it is achieved [6]. Competence describes what people can do while competency focuses on how they do it. Competencies are the characteristics of somebody that lead to the demonstration of skills and abilities. Therefore, competency or competencies must be demonstrable, observable and measurable. Curriculum is the planning of learning experiences and assessment of students learning. Curriculum may be defined as the sum of the learning activities and experiences that a student has direction of the school [1]. Generally, curriculum should be designed by the answers to four questions [7]:

a. What learning outcomes do students should be achieved

(intellectual, social, practical & personal)?

- b. How well the course can help students to achieve these learning outcomes?
- c. How will we know if students on this course have achieved these learning outcomes?
- d. How will we know if and how our teaching have contributed to our students' learning outcomes.

Competency as a construct of learning outcome is a key word in the competence-based curriculum. Course and curriculum should be focused on student needs (student center learning philosophy) and be designed based-upon learning outcomes (intellectual, social, practical & personal). These learning outcomes can be measured by some of indicators which describe knowledge, skills, attitudes and abilities that have been mastered by students after completing a course.

2.3 Development and Implementation of CBC

Higher education graduates are expected to be competent at least in the five areas: professional expertise, functional flexibility, innovation and knowledge management, mobilization of human resources, and international orientation. Higher education graduate in most countries indicated that study program formed a good basis for starting work and a slightly lower percentage indicated that it was still useful five years later in their performance of their work tasks. By contrast, only around 20% indicated that higher education graduates have a good basis for developing entrepreneurial skills [10].

Polytechnic, in Government Regulation Number 17 of 2010 on the Implementation and Management of Education Chapter 1 verse 18, is a higher education institution that conducts vocational education in few specific fields. Vocational education in the historical record has always been associated with the supply of skilled workers, industries and economy of a country. Curriculum has always been designed to meet with these demands [1, 11, 12, 13]. Nevertheless, the development of

Polytechnic curriculum has been strongly influenced by the government's policies in education that didn't always meet with the demand. The education policies for vocational education should be related and synchronized to the policies for economy, industries, and human resource development. The relationship between education policies and other policies is still difficult to be aligned. The content of curriculum which was expressed by subjects has not been understood by industries. Therefore content or subject-based curriculum was changed into competence-based curriculum since 2000 until early 2009 in term to get closer or to improve communication between polytechnic and industries. CBC must be expressed by graduates' learning outcomes or what graduates can do (competences) or how they can do the tasks (competencies).

The CBC should changed all aspects of teaching, learning, assessment and evaluation approaches. A learning outcomes approach to curriculum design must be aligned with the teaching activities and assessment employed to measure that learning. Polytechnic curriculum must be focused not only on the knowledge development, but also on skills, attitude and abilities (competencies) which meet with the demand. How far do the teachers have understanding CBC?

Interviews with some teachers revealed their opinion of CBC. Most of them mention that CBC is more systematic than subject-based curriculum. They also believed that the educational process could be delivered better than before. It is because of the CBC should be derived from some of learning objectives and learning outcomes. But most of teachers (50%) argued that CBC is still difficult to understand. Therefore at the implementation level, it has not changed yet the content, methodology, and evaluation approach significantly. The survey shows that there is almost no change in teaching and learning method, and also assessment and evaluation approaches. Mostly the teachers have a good tool and approach to assess knowledge and cognitive skills relate to their subject, but they don't have any good tool to assess students' skills and attitude. Skills and attitude are as a part of students' learning outcomes.

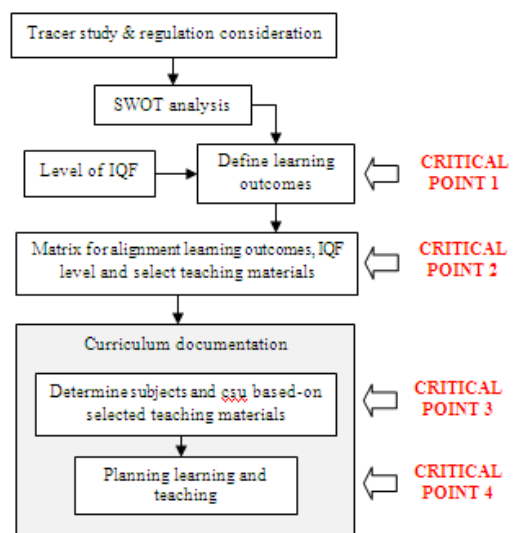


Figure 3. Model of Curriculum Design and Development

Learning outcomes-based curriculum is relatively new and difficult to be expressed. It must be aligned to the teaching activities, assessment and evaluation approaches [7]. Polytechnic curriculum has been designed and developed through the series of stages as shown in Figure-3. It shows that government regulations and the result of tracer study are the main materials to do SWOT analysis. Curriculum was designed with the assumption that input students mostly (70%-80%) come from general high school (not vocational high school). There wasn't any special treatment or matriculation for both kind of input. Polytechnic curriculum at each study program generally has 110-120 credit semester unit (csu) for D3 program, and 140-160 csu for Bachelor program. The load (number of csu) has been determined by government. These curriculums are structured as follows: generic subjects 25%, entrepreneurship subject 3%, and technical subjects 72%. The learning activities consist of theory (65%) and practical in laboratories (35%). This composition has been developed more by tradition in vocational education rather than the need to fulfill learning outcomes.

There are at least four indicated critical points in the curriculum development (Figure-3). Determining the learning outcomes is the first critical point. Teachers and curriculum designer team have difficulties to express learning outcomes. They also frequently ignored

their visions (institution and study program visions) and the background of input students (raw material) during design of learning outcomes. The team has seen regulations (government and internal regulation) as the greatest consideration in the curriculum development or design. It shows that government regulations have impacted strongly in the curriculum design and curriculum development.

The second critical point is the step of selecting teaching materials. The lack of achievement indicators causes each faculty or teacher has different perception about materials needed to teach. The proposed materials become very extensive. There is no idea to restrict these materials. The team of curriculum development does not know that it can be done by designing evaluation or assessment approach [3, 16]. Assessment and evaluation is important step in the curriculum and instructional design. But in Figure-3 does not show this step. The design of assessment and evaluation is an important thing to answer the question: how will we know if students on this course have achieved these learning outcomes. In another word, design of assessment and evaluation will impact on many things at the implementation of CBC. Survey revealed that tools of assessment or evaluation just valid for measure knowledge achievement. There was not any tool to measure skills and attitudes. At least there was not any indicator that can be used as a reference to measure skills, attitudes and abilities precisely.

The third critical point is categorizing and selecting subject based-on selected materials in the previous step and determining the credit-semester unit of each subject. The lack of achievement indicators and evaluation design causes no reference or reason to restrict the materials. The further impact is that the extensive materials become difficult to be categorized and organized. This raises many subjects in the curriculum. Team of curriculum development has no empirical data which can be used to restrict these materials and or to determine the time needed to achieve a learning outcome. The time is very difficult to be determined because of the absence of any achievement indicators that will be used as reference to determine the time

needed to achieve defined learning outcomes. It also causes difficulty to determine level of student qualification and level of IQF standard should be achieved.

The fourth critical point is at the step of planning teaching and learning. The impact of the absence of assessment and evaluation design also raises the difficulty to control quality of instructional and teaching and learning. Teachers have never known how well the course was conducted and or how well they can help students to achieve the learning outcomes. There was no reference to measure student competences (what student can do) and student competencies (how student can do a job) which can be used for determining a student qualification and also to improving instructions.

Now CBC will be changed into Indonesian Qualification Framework (IQF)-based curriculum. Socialization of this new type of curriculum has been conducted in early this year. IQF has been developed based upon learning outcomes. These learning outcomes have been arranged based upon a taxonomy which fit to students' qualification level that has to be achieved. IQF consist of nine levels of qualifications (Figure-4) [8].

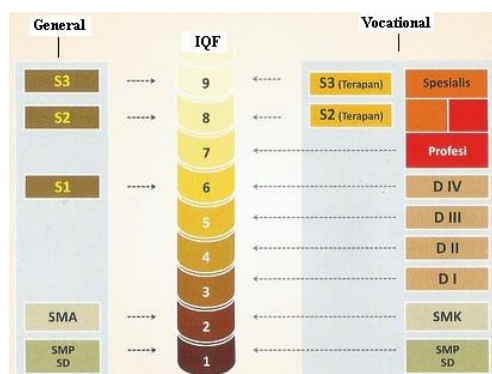


Figure-4. Learning Outcomes Equality in the Indonesian Qualification Framework (IQF)

The graduates of Polytechnics Bachelor program must be fit to 6th level and D3 program must be fit to 5th level of IQF. IQF-based curriculum essentially is a learning outcomes-based curriculum. The construct of a learning outcome is a competence that should be shown with some of indicators of achievement. These indicators must describe knowledge, skills, attitudes and

abilities of student after completed a course [7].

The explanation of the second critical point shows the importance of understanding about function and its impact on the loss of evaluation design stage in the curriculum design or curriculum development. All teachers must have understanding about it and have an ability to design and develop evaluation tools. These tools need to be aligned with their teaching objectives and activities. They also need to understand about new paradigm of teaching and learning which is oriented to the student needs.

The survey on six study programs at Electro Department in Bandung State Polytechnic (Polban) which is involving more than 40% of teachers revealed that teachers have different understanding about student needs and learning outcomes in term student center learning (SCL). The SCL is understood narrowly. Most of them interpret SCL as a learning approach in which the students are in active position, while the teachers are in tutor position (80%). In fact, SCL has wide meaning, for example, SCL can be interpreted as a learning approach to help students get the targeted competencies and support their career in the future (30%).

Learning outcomes have been understood by teachers in the same meaning as learning objectives. Kaufman differentiated these two terms. Learning objectives refer to what the student are expected to learn, while learning outcomes are more behavioral, describing what students are actually able to do in observable terms having successfully completed the course [7]. Gnahs [17] defined learning outcomes in term of knowledge, skill(s) and competence(s). Knowledge is described as theory or factual. It is the lowest level of student achievement [6]. Skills are described cognitive (including use of logical, intuitive and creative thinking), and practical (including manual dexterity, and use of methods and materials, tools and instruments). Skills are the abilities to use knowledge in the limited scope. Competences are described as amount of skills and knowledge that can be measured with the help on indicators of skills and knowledge. A learning outcome

must be derived into indicator achievements which are demonstrable, observable and measurable.

Most of the teachers have been able to define indicators which describe the student understanding of knowledge, but they have not been able to determine indicators which describe skills, attitudes and ability that must be mastered by students after completed their course.

At micro level (individual or class), the absence of achievement indicators drag the impact on almost of all teaching and learning aspects including instructional design and development, the methods of teaching, assessment and evaluation. At the organizational level, it is difficult to evaluate the effectiveness and efficiency of teaching and learning, and also educational program. This is because of no precise feedback or information which can be used to improve instructional and quality of programs. The missing of evaluation design in the curriculum chain impacts on all aspects of teaching and learning, valuing and evaluating a program delivery, measuring a customer satisfaction (students, teachers, and all element who involving in program delivery), etc. The effectiveness and efficiency of teaching and learning can not be measured without evaluation.

2.4 Evaluation Design

What is the importance of evaluation? There are four reasons for design evaluation in the curriculum chain. The most common reason is that evaluation design can be used to select the appropriate teaching materials and method. The second reason is to create and develop standard criteria of student achievements. The third is to measure the contribution of course and teaching method in the student achievements. The fourth is to improve future programs.

What is the impact of the missing evaluation design from the stage of curriculum development or design? It has been explained above in part 2.3. What will be evaluated? Evaluation at micro or individual level should be focused at least on the learning process, learning outcomes or achievements based on the student performance including mastered knowledge (cognitive skills), hard and soft skills and/or product of student performance, and

attitudes which are all summarized into student abilities.

What is to be measured? Evaluation should be able to measure knowledge, skills and attitude after they intended a course. When evaluation will be conducted? Evaluation can be conducted in the beginning of course, during the process and at the end of program. Evaluation in the beginning of course is called assessment and analysis which is used to find out whether actions are required to produce meaningful results. Evaluation which is conducted during the process is called formative evaluation. This evaluation will provide a feedback that can be used to improve the next step of teaching and learning method or improve the next program at the wider scope. Assessment and feedback to students are critical and significant part of an academic's work [15]. Evaluation which is conducted at the end of courses is called summative evaluation.

How to evaluate the learning outcomes? Assessment for learning focuses on the formative which is integrated into the curriculum, and is context embedded and flexible. Assessing for feedback is focused more on practices to improve student learning [14].

What kinds of evaluation tools can be used to measure the learning outcomes? There are many kind of tools which can be used to assess learning outcomes. The main assessment tools encountered in engineering disciplines are [15]:

- a. Written examinations which are appropriate in many areas for assessing knowledge of underpinning science in a traditionally structured degree program.
- b. Laboratory/practical reports as a part of students portfolios
- c. Analytical calculation
- d. Multiple choice questions, especially at lower level)
- e. Project report
- f. Portfolios or personal development plans
- g. Poster presentations
- h. Oral presentations

Assessment can be designed by using these tools in accordance with the level of

student achievement. Knowledge can be evaluated using written examination, while skills and attitudes examinations are more appropriate for assess the learning activities in the laboratory. Project report, poster presentation and/or oral presentation can be used to assess more complex skills and attitudes.

How to design evaluation system? The assessment design must be focused on learning outcomes. Evaluation and/or assessment should be designed before designing the content. The principle of assessment design is a consistency between the three related components of curriculum design [15]:

- a. What is expected student to learn,
- b. What teaching method will be use to enable them to achieve these learning outcomes
- c. What assessment tasks and criteria will be used to show that student has achieved the learning outcomes.

If one element of system is changed all the others must necessarily change in order to effect the desire learning.

3. Recommendation

Refer to Stefani model [9] in the planning learning and teaching and the reveals of this research are related to the last condition at implementation level in many study programs in the Polytechnic, there are a number of key steps to effective course and curriculum development and/or curriculum design as shown at Figure-3.

Curriculum should be developed or designed by considering the environmental requirements: government regulations as the main sponsor of polytechnic education and industrial needs. Developing curriculum starts from vision which will be achieved in the certain time in the future. All activities should be aligned and focused to get this vision. The second step is the defining learning outcomes and learning objectives. This step is the defining what student can do and what student need to learn. SWOT analysis need to know what elements should be enhanced, eliminated, and anticipated in order the program running well. Next step is the defining student

requirements that meet with this program. This step should provide the minimum qualification of student. Planning or designing assessment framework is an important step that will impact all of learning and teaching aspects directly. Each teacher has to develop an assessment tools which appropriate with his or her learning objectives. Learning and teaching materials (one of inputs materials), teaching method, learning activities and evaluation approach (process) must be aligned and synchronized with the assessment approach and learning objectives to provide qualified outputs or results.

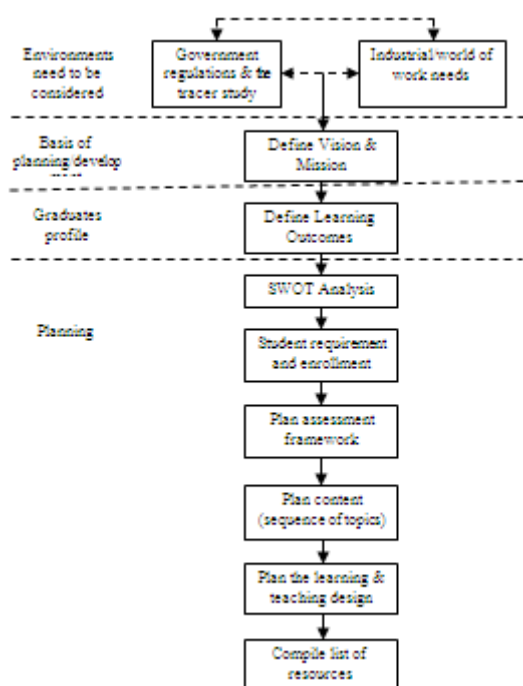


Figure 5. Key Steps to Effective Curriculum Design

The content of program is designed to be meet with the assessment has been planned. Teaching method and learning approach need to be planned to get results optimally. The last step is the compiling the list of resources including teacher qualification, facilities, information sources, finance, management and standard needed for marking or leveling the learning outcomes.

4. Conclusion

The assessment and evaluation are part of curriculum that must be designed before

determining the content or selecting curriculum materials, teaching method and learning activities. The lack of evaluation and assessment design in the chain of curriculum design will have an impact on a wide range of aspects of teaching and learning that leads to education quality. The assessment must be designed and focused on the learning outcomes. It needs to be aligned with the learning objectives, learning activities and teaching methods during process of learning.

The learning outcomes will be used as a standard measurement of learning achievement. It is defined in three terms, i.e. knowledge, skills, and competences. Knowledge is the lowest level of student achievement. Skills are the abilities to use knowledge in the limited scope. Competences are described as amount of skills and knowledge that can be measured. Therefore it must be measurable, observable, and demonstrable.

Assessment and evaluation will provide valuable information to improve further learning and teaching methods. It needs standard indicators to provide standardized competences which are the primary competences qualifications. These can be functioned as a bridge of communication between polytechnic and industries. The success communication leads to the achievement of both education quality and production on the other side.

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