THE DEVELOPMENT OF THE CONCEPTUAL LEARNING DESIGN MODEL BASED ON GENERIC SKILLS

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ABSTRACT
This study as part of larger study aimed to specify a product development model of problem-based learning design to improve generic skills of learners. Specifically, this study aimed to identify how to construct the components of the problem-based learning design model to improve generic skills as conceptual models, and how to represent components in the form of problem-based learning design models to improve generic skills as conceptual models.
Keywords: the problem-based learning, design model, Indonesia

INTRODUCTION

The problem being faced in Indonesia is about low educational quality as a quality of human resource printing. In this case, the quality of chemical education resulted in declining the competitiveness in the current era of globalization. The low level of chemical mastery can be seen from the average value of the national chemical examinations from 1999-2000 ranging from 4.4 to 5.0 (Surapranata, 2004). This indicates that the success of an educational curriculum depends on the teacher's performance in developing the learning activities in the classroom. Teachers are most responsible for realizing qualified human resources capable of responding to changes occurred during the development of science and technology. For that, the need for efforts to prepare qualified teachers from an early age started from the lecture (Khambayat & Majumdar, 2010). It means that the realization of qualified teachers can be carried out since the preparation of prospective teachers before deployed to the field. This is in accordance with the opinion of Lawrence-Lightfoot (2008) which states that teacher coaching needs to be carried out since pre-service education. McDermott (1990) argues that the mastery of subject matter knowledge of a prospective teacher is determined by the learning process he experienced. Klausner (1996) provides an example, if a science teacher (including a chemistry teacher) is expected to teach an inquiry-based science then the prospective teacher must have undergone an inquiry-based course, as well as to develop critical thinking skills, be creative, able to solve problems and be able to communicate. Prospective high school teachers need to be equipped with school-oriented lectures. Poedjiadi (2005) suggests that the lecture model for potential chemistry teachers needs to be more focused on student-centered learning reflecting the nature of chemistry, chemistry as a process, chemistry as a product, and chemistry as an attitude.

Chemistry lecture conditions recently for prospective teachers at the Development Institute of Information and Communication Technology still does not reflect the ideal state according to the nature of chemistry as mentioned above. In fact, the Directorate General of Higher Education (Ditjen Dikti) since 2003 has published High Education Long Term Strategies 2003- 2010 or known as HELTS. Most universities including educational institutes of educational lecturer need to be bound in one goal formulated in the vision 2010 of Indonesian Higher Education, which in 2010 has been able to realize high education system with a healthy college so as to contribute to the competitiveness of nations that have quality features, access and justice, and autonomy and decentralization.

The HELTS program, assurance and quality control efforts need to be applied in all universities (including the Development Institute of Information and Communication Technology) that produce prospective teachers. Concrete steps pursued are improvements in lecture activities of prospective teachers. Educational institutes of educational lecturers need to pursue lectures in accordance with field demands. Therefore, it needs to be more serious handling in pursuing a model of chemistry lectures for prospective teachers in line with the chemical characteristics and oriented to its tasks in the field later. The success of learners after taking the learning during their college at the undergraduate level, especially in the educational program is not only seen from the achievement of Student Achievement score as a prospective teacher, but also further importantly seen from the ability to carry out the task of learning in the place of duty. This ability is also called teacher competence. A teacher performs his/ her duty will look more professional if it has a minimum skill called a generic skill or called basic skills.

The essential generic skills are owned by every prospective teacher as a stock to run the profession later. This is confirmed by the Key Life Area (KLA) Curriculum Guides (Primary 1 to Secondary 6) in 2017 that generic skills should be developed in all stages of education, in all major subject areas (Curriculum Development Officer, 2017). Learners should be able to transfer them from one context to another, whether in science or not. The transfer of these skills will help learners continue to learn and succeed in personal development and lifelong learning. Key Learning Area (KLA) Curriculum Guides (Primary 1 to Secondary 6) in 2017 emphasizes that there are nine generic skills recommended in learning; collaboration skills, communication skills, creativity, critical thinking skills, information technology skills, counting skills, problem solving skills, personal management skills, and research skills. Of these skills, a priority should be placed on communication skills, creativity and critical thinking skills, and specifically for science education; problem-solving skills.

The author’s report (2015) in a survey study of potential chemistry teachers on the initial generic skill profile of prospective teachers in basic chemistry courses includes low-profile generic problem solving skills (54), low critical thinking (40,7), and low communications (45) . Thus, in general, when basic chemistry courses are conducted, students have low generic skill level, while (mean = 46.3) so they need to improve through generic skills-oriented lectures as well as integrating generic skills; basic chemistry lectures. Certainly, before the lecture takes place the appropriate design and intact, learning design integrated generic skills is mediated by problem-based learning.

Besides lecturer and learner components, it is also influenced by lecture component components integrated in the curriculum. Science curriculum should provide many opportunities and rich learning experiences for learners to develop generic skills. Learning science is a process of providing some experience to learners and the process of guiding them to use the science knowledge (Gallagher & Gallagher, 2013). Activity such as scientific investigation, experiments, project, fieldwork, group discussions, debates, which enable learners to be actively involved in the learning process. This is an effective way to motivate learning and develop generic skills (Curriculum Development Officer, 2017).

A 25-year lecturer's experience as well as observations and interviews with several colleagues shows that students are less accustomed to having an authentic learning experience grounded by problem-based learning, so the generic skills expected to carry out their profession are also low. This is evidenced by the results of interviews with chemistry lecturers, they admitted that at the beginning of their duties as lecturers still need additional generic skills. Problem-based learning uses problems as the first step in collecting and integrating new knowledge based on experience in real activity. Problem-based learning is designed to be used on complex issues that learners need in investigating and understanding it. The theoretical and empirical background led the author to argue that we need to develop a model of instructional design that is specific to problem-based learning so as to enhance the generic skills of learners. It aims to create a guide to problem-based learning design to improve the generic skills guiding the author and peers.

In general, this study aimed to specify product development model of problem-based learning design to improve generic skills of learners. Specifically, this study aimed to identify how to construct the components of the problem-based learning design model to improve generic skills as conceptual models, and how to represent components in the form of problem-based learning design models to improve generic skills as conceptual models.

LITERATURE REVIEWS

The design of the concept-based design development of problem-based learning to improve generic skills adopts the type of synthesis procedure of ID model development by Lee and Jang (2014) with type 1. F1-O1-S1-A1 such as Clifford (2009), Moallem (2003) and You (2002) and continued with type 8. F2-O1-S2-A4 such as Spector et al model. (1992). This study was limited to conceptual development generated problem-based learning design concepts to improve generic skills.

Instructional Design Models

There are several ID models that have been developed such as Reiser and Dick (1996), Zook (2001), ASSURE (2005), Dick, Carey and Carey (2009), Morrison, et al (2011) and ARCS Model (2004). While none of these models are designed for learning with a specific subject. All of these models are designed for general purposes. These models may apply to generic skills oriented chemistry learning while no specific explanation given how models can be used for generic skill- chemistry oriented learning. That is the reason why it is necessary to construct an ID model specifically designed for chemistry learning, with consideration of the objectives and characteristics of chemistry-oriented learning differently generic compared to other learning.

DISCUSSIONS

Sorting the components of problem-based learning design

The problem-based design components and generic skills have been described in the previous explanation. These components are the steps in the implementation of problem-based learning design activities. A learning design should illustrate its advantages and show the actual design task (Gustafson & Branch, 2002). The sequence of components of a problem-based design model for improving generic skills was shown in the following table 1:

Table 1. The sequence of problem-based learning design model components to improve generic skills

NO	Main Components	Sub- Components
1	Need Analysis	Identifying generic skills gaps Analyzing the cause of the gap Taking a conclusion of need
2.	Analyzing learners and learning environment	Identify initial generic skills Identify student characteristics Analyze the learning environment
3.	Formulating learning goals	Define competency standards Determine learning achievement Determine sub- learning achievement Formulate learning experiences Formulate assessment indicators
4	Developing materials	Classify learning materials Provide authentic issues
5	Developing learning strategies	Choose learning methods Develop learning steps Provide intensive training
6	Developing learning media	Develop problem-based learning media Determine alternative media
7	Developing assessment tools	Create a grid of questions Create questions Create an answer key
8	Evaluation	Implement problem-based learning Perform an authentic assessment Revise the learning program

Construct the style of the instructional design model

In this step, a model of instructional design based on the sequence has been constructed from the previous stage. According to Branch and Kopcha (2014), a model is easy to understand if its compilation is descriptive and prescriptive. If there is a relationship described the design process of interactive elements, explained, and showed those relationships, then it was called as descriptive appearance. While it is prescriptive if the model of instructional design can guide, explain the procedure, and generate the right strategy.

There are various illustrations of the design model of learning by exposing its advantages and disadvantages (Branch & Kopcha, 2014; Gustafson & Branch, 1997; Gustafson & Branch, 2002). The rectilinear portrayal design model is widely used for novice designers because of its simplicity, generic and applicable to various contexts. A row of squares is connected by a straight line of arrows with some parallel lines that describe the revision process (feedback). The weakness is too passive, step locked and marching, the implementation of this rectilinear form cannot recognize its complexity (Branch, 1997). Branch and Kopcha (2014) asserted by Bichelmeyer, Boling, and Gibbons (2006) suggests that the rectilinear model is unable to provide explanations to novice designers about the learning design process (figure 1).

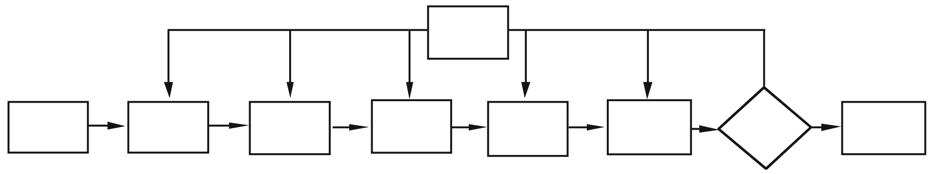

Figure 1: Learning design model (rectilinear portrayal)

Furthermore, *curvilinear* model can overcome the lack of rectilinear shape, this model can be oval, rounded rectangular horizontally and vertically connected by curved lines, two-way arch and the order of components visualized in circular form. Additionally, the advantages to each stage is a linkage so that it can affect each other for the sake of revision and analysis. While the weakness in some stages is still a liner such rectilinear form (picture 2).

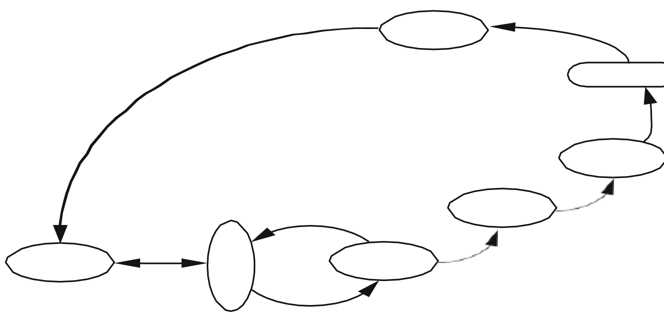

Figure 2. Learning design model of curve shape (curvilinear portrayal)

The third is a nested portrayal design model. This model is different from the previous two models, the model is not linear (figure 3). The advantage of this model is smaller components, clumps and parts of a larger component in one place as if it is nested. This means that certain components can occur simultaneously, not sequentially. It can be said that this form is a combination of rectilinear and curvilinear (Branch & Kopcha, 2014).

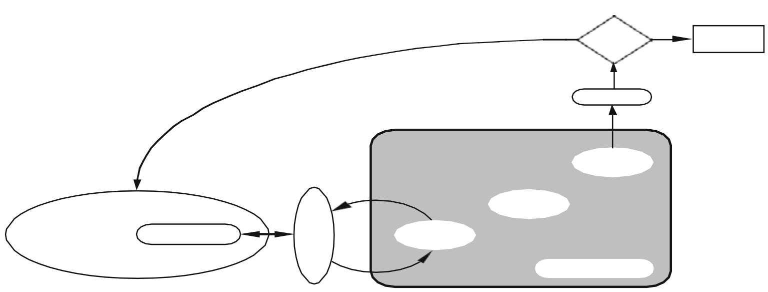

Figure 3: Learning design model of nested form (nested portrayal)

The concurrent shape presents the design stage as a series of overlapping rectangles (figure 1e). This representation is very useful in situations where the design should occur quickly and major design steps must occur simultaneously or almost sequentially. Procedures occur simultaneously, or like overlap during the design process, and tend to communicate simultaneous repetitions that characterize the way instructional design is generally practiced (Rowland, 1992; Visscher-Voerman, 1999).

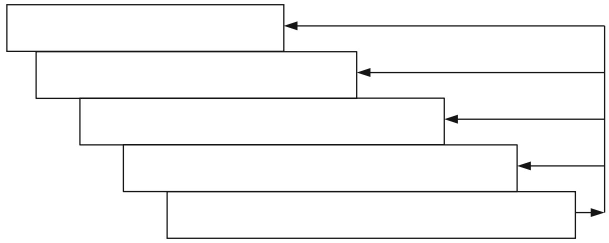

Figure 4: Concurrent design model

Some of the latest models have adopted spiral or recursive designs to show highly iterative nature of the process. This model is used to create rapid prototypes that emphasizes early development of simple and incomplete prototypes and then evolves into a complete design because the problems and types of desired solutions are increasingly evident by developers (Bichelmeyer et al., 2006; Jones & Richey, 2000). The spiral or recursive model is shown in Figure 4 below:

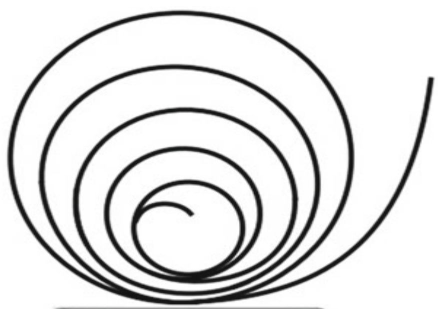

Figure 4: Learning design model of recursive form (recursive portrayal)

Visualization of the Model of Problem-based Learning Design to Improve Generic Skills
Considering the advantages and disadvantages of the model theory, the results of the analysis and the compilation of the sequence of components, as well as the characteristics, the application of the knowledge types, the participants, the characteristics of the learning such as the experience and flexibility of the instructional design model intended. It agrees with Branch and Kopcha (2014) to consider the characteristics of (1) the nature of the situation (2) types of applicable knowledge (3) target audience (4) the nature of learning in terms of curriculum, such as experience (5) the degree of flexibility inherent in the learning model design.

The selected model is a mixture of curvilinear and nested models, arguing that in the early stages of component analysis needs and components analysis learners and learning environments that is an inseparable group or entity in a nested place. Both components are important component to guide the formulation of the objective component, where these components affect each other, therefore need to be given alternating arrows. Component of learning goals play an important role because it is pleased with the success of the program to be achieved. These components are also determinants of subsequent components such as components of developing teaching materials, strategies, media and instruments. These four last- components mentioned are in a non-linear nested box that can be started anywhere. For instance, they start from the development of teaching materials and so on by staying guided by the purpose of learning. The last group is an evaluation component called the learning evaluation group. Thus, it can be said that the model of problem-based learning design to improve the generic skills divided into components of input category analyzed needs, learners and the environment. The components of the process categories are to formulate learning objectives, develop assessments, develop learning strategies; develop learning materials and develop learning media. The component falling into the category of output is evaluation.

The considerations mentioned above are supported by Gustafson and Branch (2002). There are nine characteristics of design model preparation: (1) the type of outcomes associated with the preparation of the lesson; (2) the resources to develop; (3) represents business in the form of groups or individuals; (4) skills and experience in designing expected lessons from individuals or teams; (5) most teaching materials will be selected from existing sources or represent original design and production; (6) the number of preliminary analysis performed; (7) anticipate the nature of technological complexity in the development environment and delivery system of learning; (8) the number of trials and revisions, and (9) the amount of dissemination and follow-up occurred after the construction process.
Visualization of the problem-based learning design model to improve the generic skills is shown in Figure 5 as follows:

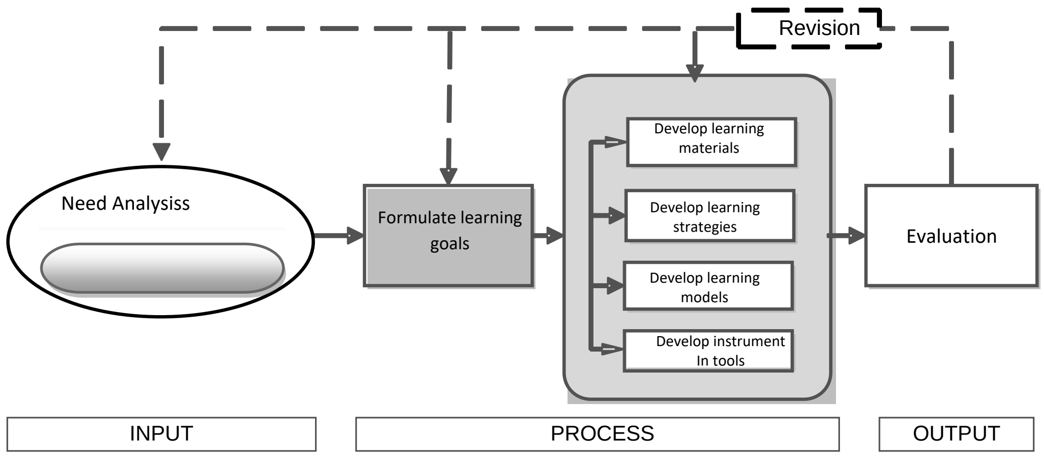

Figure 5: Model of problem-based learning design to improve generic skills

CONCLUSION

The procedure of drafting the concept of problem-based learning design model to improve generic skills was explained as; 1) determine relevant instructional design models, following the factors influenced such (a) determine the categories of instructional design models (b) analyze the advantages and disadvantages of learning design models with class-oriented categories, products and systems. 2. Analyze the components of learning design model, with steps comprised; (a) determine the reason for selecting nine learning designs, (b) summarize the components of the instructional design models that have been analyzed, (c) analyze each component of the learning design model into matrix form, (d) select components from a combination of nine learning design models. 3) Construct the components of the learning design model based on the results of the analysis in the previous stages. 4) The order of components and the form of problem-based design model. In order to determine the order of the components of the constructed design model, it takes a style or model visualized the characteristics of the components by; (a) sorting the problem-based learning design components, (b) visualizing the model of problem-based learning design to improve generic skills.

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