PROBLEM-BASED LEARNING MODEL ON BIOLOGY SUBJECT TO DEVELOP THE APPLICATION OF INQUIRY PROSPECTIVE TEACHER COMPETENCE

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Abstract

The purpose of this research are: 1) to develop problem-based learning model (PBM) in biology subjects to improve the prospective teacher in applying inquiry; and 2) to obtain the expert assessment of the accuracy of the PBM model developed. This research is the development (research and development) by using a systems instructional design approach. PBM model is developed based on a needs analysis biology teacher competence, and the review of the literature regarding the characteristics and process of problem-based learning. The result PBM model development is validated by two experts biology use instruments such as scale ratings on five aspects of the learning model of the structure (syntax), the social system, the role of the studyr, support system, and instructional impact. Data evaluation from expert is analyzed by descriptively. The early stage of this development is created PBM model on three subjects biology, namely biology Learning Strategies, I PPL and PPL II to improve prospective teacher in applying inquiry. PBM model structure on the three subject consists of three stages: problem identification, planning, problem solving, implementation of problem solving, presentation of the results of troubleshooting and problem solving reflection. The fifth stages of the PBM model implemented in several cycles repeatedly solving during one semester. The expert assesses PBM model that is developed accordance with the characteristics of problem based learning and its good to enhance the competence of prospective teacher in applying inquiry.

Keywords: PBM Model, biology subject, prospective teacher, applying competency inquiry

INTRODUCTION

The development of the future by globalization requires human resources has particular competence particular to adapt. National Education Standards Agency (2010) to formulate the necessary competence to face development in the 21st century is of critical thinking and problem solving, communication and collaboration, creating and updating, information technology literacy and communication, contextual learning, and information and media literacy. The competency development requires improved education system.

The government has launched the efforts to improve the education system through the implementation of Curriculum 2013, which is an improvement Education Unit Level Lessons (KTSP). Curriculum 2013 began to be implemented gradually in the school since the academic year 2013/2014. Standard learning process on Curriculum 2013 in all subjects is santifik approach (National Education Minister Regulation No. 16 Year 2008 on Academic Qualification Standards and Competencies Teacher). The scientific approach includes five stages of learning: observing, asking, investigating, reasoning, and communicating. The five stages are interrelated and basis for developing skills, attitudes, and knowledge of students. In science, including biology, scientific learning approach is similar to the essential features of inquiry approach (Chiappetta & Koballa, 2015; Krajcik & Czerniak, 2014). Five essential features of inquiry are asking questions, investigation, explaining the evidence to answer questions, clarify the explanation of the evidence with scientific knowledge, and communicate explanations.

The application of scientific approach and inquiry in learning biology K13 in the school requires teacher and prospective teacher have the competence. Competence implement inquiry can be defined as the ability to plan and carry out the subject matter of learning through inquiry approach. The definition is based on a combination of pedagogical aspects and professional competence teacher in Permendikbud Number 16 of 2007 on Academic Qualification Standards and Teacher Competency. The incorporation the two competencies of teacher in applying the definition of competence of inquiry by the concept pedagogical content knowledge by Shulman (1986). In pedagogical content knowledge, knowledge of pedagogy is not separate from knowledge of content. Mastery of the material and thought processes related to these materials become part of the

development of the pedagogic aspects of planning and implementing learning.

The efforts to improve the competency of biology teacher applies scientific study has been carried out through a variety of training. Teacher education institutions, began in 2013, involved socialize the standard approach of Curriculum 2013 through PLPG activities. However, the increasing of the teacher competence program also needs to be balanced by increasing the competence of prospective biology teacher in internal teacher education institutions. The result of a case study of prospective teachers of biology in FKIP Bengkulu University indicates that the competence implement guided inquiry has not been mastered by most students (Aryulina 2010; Aryulina, 2013), nor the ability to guide reasoning which is part of the competence of implementing inquiry (Aryulina, 2014).

The Competence implementing the inquiry involves the ability to Troubleshooting problem in the process of designing, implementing, and evaluating learning outcomes. The ability to Troubleshooting problems through the science is part of a national qualifications framework Indonesia (Presidential Decree No. 8 of 2012 on KKNI) at levels 6 and 7 for graduates of teacher education (Higher Education, 2012). Problem-solving skills is the rate of the most complex cognitive learning (Gagne, Wager, Golas, Keller, 2004). According to Dick, Carey, and Carey (2015), the intellectual skills equivalent to the ability to analyze, evaluate capabilities, and the ability to be creative on the taxonomy of cognitive learning outcomes of Bloom. Problem-solving skills and ability to analyze the equivalent is if the problems are Troubleshootingd well defined, while the equivalent the ability to evaluate and be creative if the problem is ill defined. Arends (2008: 52) limit the issues that are unclear or complex as the problem can not be Troubleshootingd with a simple answer, and have many solutions.

Thus, the competence of prospective biology teacher implements inquiry involving problem-solving skill can be improved, need to change the pattern of learning on the subjects that belong to pedagogical knowledge of subject matter that is subject learning skills (MKKPP) and subject field expertises (MKBK). The core curriculum of teacher education (Directorate General of Higher Education, 2012), MKKPP group includes theory and practical implementation of the learning process. The subjects were included in this group on education prospective biology teacher candidates include Biology Learning Strategies. MKBK group associated with academic competence substance of the main study, which include subjects Field Experience Program (PPL). The pattern of studys on the subject group needs to be change into active learning which allow prospective teacher to develop problem-solving skills in implementing inquiry in the school. The emphasis on active learning in line with the standards of learning in higher education (article 6 of Law No. 12 of 2012 on Higher Education). One of model the active learning in university is recommended to be applied is problem-based learning (USAID, 2010).

Based on the literature, the development or application of PBM model has been conducted on a variety of subjects in biology for prospective biology teachers. Application of PBM in the subjects of biology, among others in General Biology (Setiawan & Susilo, 2015), Zoology Invertebrates (Rusyana & Rustaman 2011), Plant Ecology (Istikomayanti, 2015), Environmental Science and Population (Safryadi, Ali, & Nurmaliah, 2013) , Physiology (Primiani, 2012), Genetics and Evolution (Darmawati & Mahadi, 2014). Development and application of PBM model in general education subjects and biology seems not many do. Fakhriyah (2014) implement PBM in Science Learning subject, Redhana (2013) on Introduction to Education, Sugiharto, Prayitno, & Suciati (2011) in Biology Learning Strategies, Brears, MacIntyre, and O'Sullivan (2011), and Thomas et al. (2013) on Science Learning Methodology. PBM on the subject has not been specifically developed and sustained on related subjects, including among subjects with PPL Learning Strategy to improve the competency of implementing inquiry by prospective teachers.

Based on the description above, the research was conducted to: 1) develop a model PBM in Biology Learning Strategies subject, PPL I and PPL II to improve the capability of implementing inquiry-prospective teachers; and 2) obtain an expert assessment of the accuracy of the model who was developed by PBM. The result of this study can contribute to enrich the knowledge about model of problem-based learning in university, particularly in science prospective teacher education. Practically, PBM model which is developed then it can be used as an effort to improve the competence of applying inquiry on prospective science teacher.

PBM is defined by Howard Barrows and his team as an early developer of problem based learning at McMaster University Medical School in Canada in the 1970s, as an approach centering on learners are in small group using real-world problem and solution as stimulus learning (Borhan, 2014; Karakas, 2008). Real world problem or also called authentic problem is a problem that occurs in a particular context in the community (Arends, 2008; Tan, 2004). In the context of the teaching profession, authentic problems is related learning problem, for example the problem of student learning styles are diverse (Karakas, 2008), classroom management, assessing learning, building relationship between teacher and parent (De Simone, 2014). Tan (2004) does not isolate the problem on PBM only real problem but can also be designed simulation problems similar to authentic problems. Simulations on PBM is characterized by unstructured or complex (Arends, 2008; Tan, 2004). Ill - defined is a problem that can not be Troubleshootingd with a simple

answer, and vary solution. The process of obtaining the solution of these problems require learners assess prerequisite knowledge of several fields related or interdisciplinary. Knowledge and information obtained through various sources. According to Loughran (2006) and Collins & Gillespie (2009), the real problem learning in theschool should be included in studys for prospective teacher in order to understand the relevance of prospective teacher who studied with his future profession.

PBM appropriate to help learners to develop higher level thinking skills and problem-solving skills, and attitudes required in real life is an active-independent but also able to work together (Arends, 2008; Tan, 2004). PBM has been applied to a variety of subjects for prospective teacher to improve metacognitive (Brears, MacIntyre & O'Sullivan, 2011; Setiawan & Susilo, 2015), critical thinking (Fakhriyah, 2014; Redhana, 2013; Rusyana & Rustaman, 2011), process skills (Istikomayanti, 2015; Primiani, 2012), understanding of the concept (Primiani, 2012; Sugiharto, Prayitno, & Suciati 2011; Safryadi, Ali, & Nurmaliah, 2013), the teaching skills of science (Thomas et al., 2013), problem solving (Darmawati & Mahadi, 2014; Redhana, 2013; Temel, 2014), a positive attitude towards the working group (Mohamed, 2015). The study on the application of various studies conducted PBM Borhan (2014) indicates that the model develops skills needed for future teacher is critical thinking skills, analytical and problem solving; skill learning and reflection; as well as the skills of self-regulation and social skills. In addition, PBM also develop knowledge of pedagogy, content material, and also basic knowledge of learning. Erdogan (2013), based on the result of the research with experimental method, conclude that PBM is better effect than conventional learning to high-level cognitive abilities prospective teacher.

PBM learning process is oriented towards the problem being Troubleshootingd gradually learner in the group and ends with self-reflection for improvement next problem. Arends (2008) develop a syntax PBM in five stages, the orientation of the problem, the organization of learners, independent investigation and group, the development and presentation of problem-solving, and evaluation of problem-solving process. Syntax PBM according to Arends (2008) is applied explicitly by Fakhriyah (2014), Darmawati & Mahadi (2014) Primiani (2012), and Redhana (2013). Tan (2003) also developed a similar syntax is cyclical is facing the problem, analyze the problem, the discovery and reporting, presenting solutions and reflection, and also the integration and evaluation. Safriadi, Ali, & Nurmaliah (2013) apply the PBM syntax that consists of presenting contextual issues, conduct investigations, develop the finding, finding solution, evaluate. Stages PBM applied Barron (2013) is the identification of problems at school, completion of assignments and group work, presentation, evaluation, and reflection.

The learning process for obtaining solutions to problem on PBM is done by learners actively independent, cooperative and collaborative (Tan, 2004). Learners are encouraged to set hisself and be responsible for the learning process in the group. In the group are expected to occur for dialogue and interaction work together to Troubleshooting the problem, including learning basic knowledge and skills, and sharing of roles and tasks in solving the problem and presented a solution. According Arends (2008), a group of learners is a small group or may be just two people. The role of the studyr as facilitator is characteristic of learning based-problem. As a facilitator or tutor, studyr in charge of guiding but not preachy, determine the group and the rules and roles within the group, creating condition conducive learning, guiding interaction between learners with the attitude of academic, pushing a variety of resources, including the Internet, monitor the progress of a task on a regular basis, guiding ways of presenting the result of solving the problem, guiding reflect the result and problem solving processes, assess performance and provide feedback on the performance of the group as constructive (Fry, 2009). According Arends (2008), De Simone (2014) and Tan (2004), the facilitator can present a complex problem that requires the application of higher-level thinking as a base PBM. The facilitator encourages each individual in the group to contribute to problem solving and responsible role as chairman, sekretary, or member (Baron, 2013). Further emphasized, so that the role performed alternately by the individual in the group. Guidance troubles problem process are given by around from one group to another group as needed group (De Simone, 2014). In accordance with the development of self-reliance group, further guidance is gradually reduced (Brears, 2011; De Simone, 2014. Baron (2013) and Tan (2004) suggest the use of a guide, instruction, and question in guiding learners. In addition to the guidance and feedback from the facilitator, supplying or directives use learning resources will encourage the active involvement of learners (De Simone, 2014).

RESEARCH METHOD

This research is the research and development using instructional design system approach of Dick, Carey, and Carey (2015). According to Gall, Gall, & Borg (2003), a systems approach instructional design most widely used in the research development of education. Development of PBM model in this research consists of seven from ten components system instructional approach design namely: 1) identify the purpose of learning, 2) analyze of learning, 3) analyze the learner and the context, 4) formulate the purpose of learning, 5) develop an instrument assessment, 6) develop strategies for learning, and 7) develop the basis of learning. In the sixth, the

characteristic of the model pbm based on the literature referenced to develop a study on three the biological education namely strategy learning biology, the field experience (PPL) I, and the PPL II.

The formative evaluation of learning model is a component eighth pbm from approach system instructional design .Evaluation formative on research is an evaluation by experts matter and learning (Dick, Carey, & Carey, 2015: 282) Evaluation required obtaining a judgment and suggestion model pbm improvement. Model pbm assessed is a model pbm description of the third subject and operating jabaran on syllabus, sap, sheets of duty , and instruments the competence of students .An pbm experts models are two education biology professor at the university of surabaya.

The expert judge model pbm in all three subject biology education by using an instrument assessment. An instrument for model pbm consists of two parts namely the judgment closed and the judgment opening and suggestion. Closed assessment is scale assessment by score 1 - 4, such as 1: very bad, 2: bad , 3: good , and 4: very good for each item aspects PBM model. Scale assessment PBM model is developed five major aspects model lessons learned from Joyce, Weil, & Calhoun (2011) they are the structure a model (syntax), the social system, the role of studyrs, the support system, and the impact instructional.

Evaluation data by expert is nalyzed descriptively (Borg, Gall, & Gall, 2003). The quantitative description uses rerata every aspect and all of PBM model. Identification carried out on similarity aspect assessed under the category of very well by two experts. Identification is also carried out on an open assessment and suggestion both similar and spefisik by two experts.

RESULT AND DISCUSSION

a) PBM model on biology learning strategies subject PPL I and PPL II

PBM model developed in the third Biology subject which is described using the learning aspect model based on Joyce, Weil, & Calhoun (2011), based on the characteristic and the process of problem-based learning, based on Arends(2008); Brears, MacIntyre, O'Sullivan (2011) ; De Simone (2014); FRY, Ketteridge, Marshall (2009); and Tan (2004). The fifth aspects of PBM model namely instructional impact, model structure, social system, the role of the studyr, and support system are outlined below.

The impact of instructional model in PBM on third Biology subject set out at the beginning of the development model that is in the student competency standard. Formulation of the standard of competence is based on KKNI (presidential Regulation number 8 in 2012), teacher competency standard (National Education Minister Regulation number 16 in 2008), and the elements of competency in the curriculum of teacher education (higher education, 2012). Standard competence on SPB subjuct is the student able to develop design strategies inkuiri biology learning to overcome students learning problem so that the learning objectives are achieved. On PPL I and PPL II, the competencies standard are students able to make plan and execute the inkuiri biology learning to overcome learning problem of students so that learning objectives are achieved.

Standard competence in each of subject outlined basic competence on aspect attitude, knowledge, and skill. Target competency on SPB subject is: 1) has an attitude as prospective teacher, such as diligent, independent, cooperating, creative, and critical; 2) understand inquiry strategy on biology learning curriculum 2013; 3) assess the draft biological learning strategy to Troubleshooting the students learning problem so the learning objectives are achieved; 4) developed strategy inquiry biology learning to Troubleshooting the students problems so that learning objectives are achieved.

Basic competence on PPL I and II subject are: 1) has an attitude as a prospective teacher such as diligent, independent, cooperating, creative, and critical, 2) develop biology inquiry learning plan to troubleshooting the students problem so that to learning objectives are achieved, and 3) carry out learning biology inquiry to troubleshooting the students learning problem so that learning objectives are achieved. Basic competence on PPL I and PPL II subject are similar, because both of them are learning practices. The difference, practice on PPL I is the practice of simulation is limited to peer group, whereas the practice on PPL II is the practice of directly at the school.

Structure or syntax PBM model on the third subjects consists of five stages i.e. identification of problem-solving, planning, implementation of problem solving, presentation of the result of problem solving, problem solving and reflection. The stages of PBM model implemented repeats in a cycle repair troubleshooting during the study or guidance. In SPB subject, the stages of learning model is implemented in five cycles (Table 1). On PPL I and PPL II subject, the third and fourth stages are combined in a single activity, namely the practice of learning. PBM model in the PPL I is implemented in two cycles, whereas in PPL II is implemented in three cycles during the practice of social interactions (Table 2).

Table 1. Syntax PBM model on subject SPB

Syntax	Cycle/Material	Meeting
Problem Identification → Planning Troubleshooting → The implementation of the Troubleshooting → Presentation of The Results → Reflection on Problem Solving	– I: Diskoveri – II: Inkuiri – III: Problem-based learning – IV: project-based learning – V: Scientific	2 – 3 5 – 6 8 – 9 11 13
	– I: Diskoveri – II: Inkuiri – III: Problem-based learning – IV: project-based learning – V: Scientific	4 7 10 12 14 – 16

The identified problem on the third biology subject is the problem biology teacher. On SPB subject, the problems as the basis for the accompanying study are: 1) how the assessment of inquiry learning strategy in learning biology curriculum 2013 to troubleshooting student learning? 2) How the draft strategy inkuiri in learning biology curriculum 2013 to troubleshooting student learning? The first problem will be troubleshooting to each group of students on a cycle I up to IV in each cycle is associated with one of the approaches to learning in the curriculum 2013 i.e. diskoveri, inkuiri, problem-based learning, project-based learning, or (table 1). The students learning problem on each approach defined simulatif authentic based on students brainstorming. Troubleshooting in the second cycle is troubleshooting on the first cycle, and so on. The second issue will be Troubleshooting on cycle V. Each group of students makes the draft scientific strategies to troubleshooting student learning problem that is observed during the week when the Apprentice II activities in the school when the end of the semester.

Table 2. Syntax PBM on subject PPL PPL I and II

Syntax PBM	PPL I		PPL II	
	Cycle	Meeting	Cycle	Meeting
Problem Identification → Planning Troubleshooting → The implementation of the Troubleshooting → Presentation of The Results → Reflection on Problem Solving	I II	2 – 4 10 – 11	I II III	2 4 6
	I II	5 – 9 12 – 16	I II III	3 5 7

On PPL I and II, the problem as the basis of study or guidance is: 1) how to plan inquiry learning in learning biology curriculum in 2013 to troubleshooting student learning?; 2) How the

implementation of inquiry learning in learning bio - logy curriculumin 2013 to troubleshooting student learning? The students learning problem who will troubleshooting through the planning and implementation of simulation learning biology in PPL I was brainstorming based on simulation of students problem. Troubleshooting is done in two cycles or twice learning simulation by each group of student pair (Table 2). On PPL II, the students learning problem will troubleshooting is authentic problem which is observed in the class on learning before. Three learning cycles will be conducted by each students practice.

Biology subject social system based problem include interaction with lcturer, students interaction in the group and outside groups. During study or guidance in one semester, the interaction between student and studyr less than students interaction. Student interaction with studyr is done mainly on activities on problem identification stage and discussion activity in the planning and implementation stages of troubleshooting. studnets interaction in the group held in the discussion planning and implementing the resolution. On SPB subject, students group discuss and cooperate to troubleshooting four problems related draft assessment of learning biology inkuiri to troubleshooting the problem of student learning, and one issue draft learning biology inkuiri to troubleshooting students learning problems. Studets interactions outside the group was held on the result presentation stage of problem solving. Student group are encouraged to scrutinise the result of other group problem solving. Each group consists of 4 – 5 students.

On PPL I and II subject, students in groups discuss and cooperate to troubleshooting problem at the stage of planning to make learning biology inquiry draft to troubleshooting students learning problem. Student groups at PPL I just two people, whereas in PPL II consists of 2-3 students on the school location in the same practice. The implmentation stage and presentation are done by student in the learning practice. Student partner in his group acted as assessor. The result of peer assessment, studyr assessment and self-assessment through the learning obervasi recording is used by student practise as material for reflection to improve the planning and implementation next learning.

The study role in the academic activity is as a facilitator and supervisor active-limited. As a facilitator, studyr gives the material, determines the student groups, establishes the schedule, provides a guide to troubleshooting tasks, and provides or demonstrates media and learning resources. Learning resources provided are power point learning materials, learning inkuiri movies downloaded from the internet, and prints the document Curriculum 2013. Guide the task groups are also given to students in order for the execution of the task. As an active supervisor-limited means more active studyr guide student learning rather than lecturing. Power point learning material used as complementary learning resources, while discussion group and class. Guidance provided also pays attention to the development of student's self-reliance so that gradually reduced guidance.

SPB subject Based problem require supporti ng such as media, tutor high school biology teacher, and a real process of learning biology in school. Learning media needs to be sought by students is RPP biology through inquiry. This RPP will be analyzed at a study in the first cycle up to four cycles. RPP gains in the library and also can be accessed through the internet. Curriculum downloaded by the internet will be facilitated by the studyr, neither film inkuiri, power point, studyr material, and learning material. Airing movies and power point requires the availability of the LCD projector.

Biology teacher and also a real process of learning biology will be the basis of identification of the students learning problems. Design learning strategies to troubleshooting itselft is developed in studys in the fifth cycle. Biology teacher as a resource and a real process of learning biology will capitalize on the implementation of the internship program in the school. Internship program II is directly observing students learning program, and learn from a teacher about the curriculum, learning, and evaluation of learning biology. Subject PPL I-Based Problem requires supporting such as media and means of learning. The curriculum document downloaded from the internet will be facilitated by the studyr, both power point study ma terial, and learning material. Power point serving requires the availability of the LCD projector. The practice of simulation learning requires the availability of the recorder, tool and material experiment. Recording practices of learning will be facilitated by a studyr, while tools and materials or model experiment using the facilities of the laboratory subjects. Learning guidance on PPL II-Based Problem requires supporting such as media and means of learning. The curriculum document downloaded from the internet will be facilitated by the studyr, both recorder and guide the task group.

b) The expert assessment to PBM model develop- ment

The result of the biology expert assessment (table 3) shows that PBM model developed on the third subject Biology is categorized very well by the average value is 3.7 a maximum score is 4. Average rated aspect PBM model is very good 72 %. The fifth aspects are not optimal although PBM model categorized very good or good. Average values in the syntax aspect, the support system, and the impact of their respective learning model is 3.8; the social system aspect is 3.7; while the role of the studyr aspect is 3.5.

Table 3. Expert assessment to PBM model

No	The Assessment aspect	Score	
		A1	A2
A. Structure/Syntax			
1.	Conformity with the principles of the exacting tiered learning think simple to complex.	3	3
2.	Conformity with the principles learned through contextual problem-solving.	3	4
3.	Conformity with the principles of cooperative learning to Troubleshooting problems.	4	4
4.	Conformity with the principles of active learning towards the independent of Troubleshooting the problem.	4	4
5.	Conformity with the principle of learning through the exchange of learning experience.	4	4
6.	Conformity with the principle of learning through self-reflection.	4	4
B. Social System			
7.	Appropriateness of activities and associated costs to encourage interactions between individuals in a group of students.	4	4
8.	The precision of the study activities to encourage students to investigate the interactions.	4	4
9.	The precision of the study activities to encourage interaction individual/group of students with a studyr.	3	3
C. The Role of Studyr			
10.	The precision of the role of the studyr as a facilitator of learning.	4	4
11.	The precision of the role of the studyr as active supervisor-limited for students.	3	3
D. Support System			
12.	The ease of obtaining student learning tools (e.g., RPP, curriculum documents).	4	4
13.	The practicality of college students obtains information about student learning problems in school.	4	4
14.	Ease of studyrs provides media study (film example learning, power point material, material).	3	3
15.	The ease of the existence of means of studys (LCD).	4	4
E. The Impact of Learning Model			
16.	The ability to develop the attitude of a student as a prospective teacher, among other things, independent, persevering in collaboration, creative, and critical.	3	4
17.	The ability to develop an understanding of concepts in students.	4	4
18.	The ability to develop the skills of solving problems on college students.	4	4

On syntax aspect, assessment of compliance with the principle of learning stages and by the principles learned through contextual problem-solving assessed not optimal because it has not explicitly spelled out in the scenario in the study event unit (SAP). Thus, it is recommended learning study each meeting same with a certain problem-solving stage spelled out in more detail in the respective SAP subjects. PBM syntax t able format needs to be improved to make it more easily understood. The Expert argues PBM model will be applied is a simulation of what will be done by the student when they became teacher. Construction comprehension strategies learning inquiry through such study has a high retention rate.

The precision of the study activities to encourage interaction individual/group of students and studyr in social aspect system also rated is not optimal by two experts. Social aspect on PBM model associated with the role of the studyr aspect. Student interactions with studyr and between students are advised to specify on SAP. On SAP, every indicator KD outlined activities interactions or how its education.

On the support system aspect, the ease of media and associated needs to be improved. The expert suggests that the film will be accessible in the social media such as youtube need to included a complete site address. Textbook supporters also need to be coupled with a reference book of biology as a subject matter.

The impact of instructional aspect PBM model on all three subjects are generally rated very good. The expert argues that PBM model on all three subjects can develop the learning outcomes emphasize critical thinking problem solving, for example when the find drawbacks scenario learning or practice inquiry, and creative thinking when developing a scenario learning inquiry. Assessment strategy and impact learning assessment in attitudes, knowledges, and skills need to be enhanced in order to be aligned with the basic competence indicator on the syllabus. Thus, the impact learning assessment more purposeful, the goal of study on SAP is

advised to formulate a detailed and comprehensive appropriate with basic competence.

Discussion

The draft PBM syntax on third subject learning strategy of biology, PPL I and PPL II developed similar to the syntax based on Arends (2012) and Barrons (2013), namely the existence of a planning process, implementation, and evaluation-reflection problem solving. The difference, every stage of PBM model developed is more specific in accordance with the characteristic of the solution process and problem-based, so that the sequential stagess it is called identification problem, planning, implementation of problem solving, and the result presentation of problem solving, reflection of problem solving. Additionally, on each subject the fifth stages were performed in some of the problem-solving cycle.

Based on the result of the assessment, PBM model which was developed according to achieve competence of applying inquiri on a prospective biology teacher. The applying inquiry competence in the basic competence formulation on Biology Learning Strategy i.e. Analyze and draft scientific learning strategy, and also on subject PPL I and II that is making the draft a similar strategy and practices, is an indicator of the solving problem skill. This is supported by Dick, Carey, Carey & (2015) high level thinking skill according to taxonomy Bloom i.e. analyze, evaluate, and create by skills to troubleshooting problem from Gagne (Gagne et a., 2004). The troubleshooting problem skill is one of the ability which is expected by PBM impact (Arends, 2008; Tan, 2004).

The third issue on base and associated Biology i.e. related scientific approach to application generic approach on the curriculum 2013 at school so it can be classed as authentic problems. According to De Simone (2014) and Caracas (2008) authentic problem in context of the teaching profession is related problem learning in the schoolThe specified issue also resonated with Loughran advice (2006) as well as Collins & Gillespie (2009) to include the real problem of learning in school in study for prospective teacher so understand the relevance that studied with their future profession.

Social system and the role of lecturer in activities designed on PBM model that is a group discussion and facilitated class discussion, in accordance with the characteristic of PBM model. A combination discussion group and class discussions on PBM also applied among others by Barron (2013), Etherington (2011), Lee (2014), Redhana (2013), Sugiharto, Prayitno, & Suciati (2011) Tan (2004), and Temel (2014). Through group discussion, group member learn to rely on each other by the aim of creating a resolution. Class discussion to problem-solving group result presentation helps to develop attitude openness and reflective thinking to revise meaning if needed (Tan, 2004). The provision of or referral source usage learning will encourage t he active involvement of studnts (Brears, MacIntyr e, O'Sullivan, 2011, De Simone, 2014; FRY, Ketter idge, Marshall, 2009).

Some aspects of PBM model rated by expert not optimal indicated that the developed mo del needs to be improved. According to Dick, Carey, Carey & (2015), the input of experts can be used to improve the model before tested on the third study.

CONCLUSION

This research resulted in the design of PBM model on three subject biology namely Biology Learning Strategies, PPL I, and II to impeove the prospective teacher ability in applying inkuiri. Model structure on the third subject consists of five stages i.e. identification of problem-solving, planning, implementation of problem solving, presentation of the result of problem solving, problem solving and reflection. The PBM model implemented stages repeats in improving cycle troubleshooting during one semester with study-based learning problem characteristic. PBM model developed for the expert public appraised very well though there is a part of the design model that needs to improve. The improvement needed on the part of these five aspects of the PBM model i.e. the syntax, the social system, the role of the studyr, support system, and instructional impact reflected in the syllabus and study events and device unit subject are among other assessment instruments is the students competence.

PBM model development needs to be adjusted with the intention of certain studys and students characteristic. Draft revised constantly for better results through a free trial on subject related, subsequent assessment conducted by experts against the result of the revision.

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