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THE DEVELOPMENT OF AUTHENTIC ASSESSMENT MODEL FOR ASSESSING PROBLEM-SOLVING SKILL IN FIELD PRACTICE ACTIVITIES OF PRESERVICE BIOLOGY TEACHER

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Abstract

The research that aims to generate a model of authentic assessment that has distinctive characters and is proven that it can be used to assess problem-solving skills of preservice biology teachers in integrated field practice activities have been conducted. This study consists of several steps, which are Needs Analysis, Process and Learning Product Analysis, Determination of Objectives and Benefits of the Research, Authentic Assessment Model and Instrument Designing, and Validation of Developed Model and Authentic Assessment Instrument Design. The first three steps are based on interviews of lecturers as supervisors and participating students, and also direct observation of two field practice activities in coastal and rangeland ecosystems. The development of model and authentic assessment instrument designs are based on the results of needs analysis, while validation is done based on expert judgement and trials in limited audience. Authentic assessment instrument model developed in this research includes assessment of the realm of knowledge, and has logically and empirically adequate content and construction validity to assess problem-solving skill of preservice biology teachers in integrated field practice activities. Socialization of assessment aspects encourages the students to show their best performances, explore the knowledge by themselves, and be more scholarly during field practice activities. The existence of these authentic assessment instruments provide convinience for supervisors in determining learning objective achievement of students and further guiding actions.

Key words: authentic assessment, integrated field practice, problem-solving skill, preservice biology teachers' education

INTRODUCTION

Teachers play pivotal role in determining quality of education so that attempts on quality improvement of education should be righteously started from attempts on teachers' quality improvement which is directly correlated with teacher competence. Basically, teacher competence is a depiction of things teachers can do in doing their jobs, such as activities, behavior, and outcomes that can be presented or showed. The goverment, in Regulation of the Minister of National Education number 16 of 2007, has assigned national standard of teacher competence which is fully developed from four main compentence, namely pedadogic, professionalism, personality, and social, which are integrated in teacher performance.

In order to acquire the ownership of teacher standard competence, an effective Biology learning method for students of biology prospective teachers should be determined. Regulation of the Minister of National Education number 22 of 2006 states science learning (including

Biology) should be done through scientific inquiries. Attempts on giving experiences and understanding toward concepts of biology with inquiry-oriented learning method can be done through practical activites / field studies which observe and test problems directly on their habitats. Students can obtain many things through field practices if such activites are effectively managed. The chance of direct learning on the field can improve skills in solving problems and thinking critically. Moreover, field activities help students in understanding concepts and improving observing skill on a level that cannot be acquired by the combination of lecture and laboratorium activities.

In the impelementation stage, field practices can be done integratively, for instance by combining several subjects which have the same implementation schedule of field practices related to the location of the field practices. Integrated field practices is aimed at improving learning quality, improving students' understanding and skills related to the subjects they attend, and improving mutual communication between lecturers and students. However, implementation and observation of integrated field practices is not as much as expected until now.

Field practice implementation needs abundance of time, power, and cost. Hence, field practices should be done productively and meaningfully. In fact, many field practices have been done separately all this time on every practical subject with the low level of productivity and effectiveness. The result of direct observation and interview on participating lecturers and students shows that 90% of field practice activities are not accompanied with assessment with standard authentic assessment instruments, both on the process and on the resulting products; 75% of the field practice activities do not use specified assessment format; and 70% of students' responses toward field practice show that field practice activities are not effective as they only visit certain objects and the activities are only for enrichment of a learning process. The absence of assessing tools for assessing students' learning outcome acquisition seems to be an obstacle in determining effectiveness of field practice activities.

In recent years, there is a reaction toward overemphasis on written test as it cannot show the assessment of students' skills in learning process. Several suggestions are offered as the counterweight of written test, namely the need for more emphasis on authentic assessment, which is in the form of real life tasks. Muellller (2008) as cited in Abidin (2012) states that authenic assessment is learning assessment which monitor and assess students' capability in various chances of solving problems encountered in real-life situations or contexts land in a real learning process. In a learning process, authentic assessment measure, monitor, and assess all learning outcomes' aspects (included in the domain of cognitive, affective, and psychomotor), which appear as both the final result of a learning process and changes and development of activities, and learning outcomes during the learning processes in and outside the classroom.

Field practices need unique assessment. Powell et al. (2010) states several ways of effective and fair field practice assessment, namely student journal, field-based quiz, and level of participation. Lei (2010) suggests a number of assessment to assess learning and acquisition of students in the fiels which are in the form of formal assessment covering presence, participation, learning or reflective journal, field practice, portfolio, research report, research project, oral and poster presentation, self assessment, and peer assessment. Those aforementioned assessment methods lead to general skill assessment which someone should acquire, while literature related to assessment which assess problem-solving skill is still uncommon.

In this study, authentic assessment model assessing problem-solving skill in integrated field practice of students of biology prospective teachers will be developed. The study is conducted with purposes to assess students' learning and acquisition in the field, and to provide learning to the students regarding assessment model development for field practice activities so that they will have provision of adequate knowledge in carrying out their duties. An effective authentic

assessment model for assessing students of biology prospective teachers' problem-solving skills in the field practice activities is expected to be obtained in this present study. Students of prospective teachers with high score of problem-solving skills are expected to be more ready to face every challenge in real life.

RESEARCH METHOD

Objective Orientation

In the first year of implementation of the study (2014/2015), the general objectiv to be achieved is:

> To generate a model of authentic assessment that has particular characteristics and is tested so that it can be used to assess problem-solving skills of students in integrated field practice activities

Research Design

This study is designed to generate a product in the form of an effective and reliable authentic assessment model for assessing problem-solving skills of students of prospective biology teachers in integrated field practice activities. Research procedure is designed using model of educational research and development/ R&D developed by Dick and Carey (Gall *et al.*, 2003) with modification as needed. In the implementation, the study is designed to be implemented in three big stages, namely stages of planning, development, and dissemination. Every stage is conducted in the effective years of three consecutive years.

In the first year of the present study (2014/2015), the Planning stage covers these following activities:

1) Needs analysis for determining study objectives both for learning program and the resulting product
   a. Literature study regarding concepts and study results related to learning through integrated field activities, problem-solving skills, and assessment
   b. Field study especially on matters relating to prospective study subjects and locations, as well as their supporting capacities.
2) Learning analysis, particularly integrated problem-solving-based field practice activities for indentifying process and the resulting products in the activities.
3) Interpreting needs and learning objectives into specifc aims and signifance of the study.
4) Designing authentic assessment model and instruments which assess students' problem-solving skills in integrated field practice activities.
5) Design validation of authentic assement model and instruments which assess students' problem-solving skills in integrated field practice activities, through:
   a. *expert judgement*
   b. trial on limited audience

The Subjects of the Study

The main activity of this first-year study is conducted coinciding with the implementation of field practice of prospective-teacher students of Biology Education Study Program in a *Lembaga Pendidikan Tenaga Kependidikan* (LPTK) in Bandung. Subjek penelitian terdiri dari 30 orang sampel (dari 300 orang populasi) mahasiswa calon guru biologi peserta praktik lapangan terpadu yang berlangsung di dua tempat, serta 5 (lima) orang dosen pembimbingnya. The subjects of the study consist of 30 samples (out of 300 people of population) which are students of biology prospective teachers participating in an integrated field activitiy held in two locations, and 5 (five) lecturers which act as the students' supervisors.

Data Instruments and Data Collection

Several instruments arranged as needed were used in every step of activities. Instruments used in this study were:

1) Interview guidance consisting of questions related to needs of assessment instruments on the implementation of field practice activities
2) Questionnaire format containing questions related to identification of process and learning products
3) Performance rubrics to be used in authentic assessment in accordance with the developed model
4) Validation format referred to the validator experts
5) Assessment rubrics of success of developed model implementation trial

RESULT AND DISCUSSION

Results of the Study

a. Needs Analysis

In this stage of activity, two steps of the study were conducted, which are literature study and field study. Literature study provides knowledge of theories supporting understanding about concept of definition, techniques and instruments of authentic assessment on field practice activities, while field study conducted through interview and observation of field on location of field practice results understanding on needs of kinds and forms of developed authentic assessment instruments.

Interviewing 5 (five) lecturers which act as supervisors gain information that there has not been any standard assessment format to assess students' performance in field practice. Assessment on learning outcomes is only based on activity report in the form of paper written by students in the end of the activity. \ Assessment on report is done toward aspects of accuracy, content completeness and the way a report is presented, without any standard assessment yet personal opinion of the supervisor who assesses.

The result of interview with 15 pariticipating students of the field practice which were randomly chosen from three classes shows that 100% of students do not know assessment format used by the supervisor in assessing their performance in field practice. Not knowing the format and aspects assessed in field practice performance causes students do not know the exact learning objectives, and causes not knowing the standard reference of working ability that should be done.

b. Process Analysis and Learning Product

Process and learning products of field practice which are implemented by far were analyzed based on the result of interview with the supervisors and observation of lesson plan document, teaching material, students' worksheets, and product in the form of activity report. Interview and document observation show that integrated field practices still need discussion and repairment in planning stage, especially in material content, method, and assessment system of learning outcomes.

c. Design Development of Authentic Assessment Instrument Model

Based on the result of needs analysis which has been conducted, the development of authentic assessment instrument model design which is relevant and flexible for assessing learning outcome aspects in integrated field practice activities has been conducted. This activity was preceded and interspersed with consultation to experts, so that the activity is expected to generate an assessment model which is compatible, representative, and good in terms of quality.

The authentic assessment istrument model which has been developed was in the form of an instrument aimed at being able to measure students' competence in the realm of knowledge, skills, and behavior during the field practive activities.

Assessment of realm of knowledge is aimed at assessing skill of solving problems encountered in integrated field practice activities, with aspects of assessment include the ability to identify problems, the ability to formulate problems, the ability to design solutions, the ability formulate hypotheses, the ability to gather information, the ability to associate information, and the ability to make conclusion. Assessment on realm of skills is designed to be conducted through assesment of performance with assessment aspects of science process skill and portfolio with product types in the form of proposals, notes of field practice implementation process, reports of field practice results, and specimen collection of field practice result. Assessment on realm of behavior is designed to assess scholarly behavior of the students during field practice activities which covers curiosity, inventive, critical thinking, firm establishment, awareness of the limitations, evidence appreciation, honesty, objectivity, willingness to change opinions, open-minded and cooperative, as well as willingness and ability to ask. Each of assessment aspect on realm of knowledge, skills, and consists of indicators whose qualities measured by scoring with scale of 1 to 4 with criteria that has been set out in assessment rubrica. A complete design of authentic assessment instruments and their rubrics which have been developed are presented on the appendix of this report.

d. Design Validation of Authentic Assessment Instrument Model

Furthermore, model of authentic assessment instrument design of field practice activities which were developed through assessment/judgement of experts and test on limited audience.

1) Judgement Expert

Design of authentic assessment instrument model of field practice activities which has been developed are then reviewed and assessed by biology educational experts and practitioners of biology field observation activities. The result of experts' judgements and assessment were further used as the main bases of revision and correction of instruments so that model of authentic assessment instruments of field practice which have logic validity can be gained.

2) Test of Instruments of Development Result

Authentic assessment instruments of field practice activities which have been developed were tested on limited audience, namely on the implementation of integrated field practice of 30 students of biology prospective teachers of a private LPTK in Bandung held in Karapayak Beach, Pangandaran. Through the trial of the use of assessment instruments, it gains result that model of authentic assessment instruments of field practice which were developed have empirical validity.

In general, the result of instrument trial shows that instruments' ability to measure problem-solving skill of the students in integrated field practice. Following tables below show the assessment results of students' skills during integrated field practice.

e. Responses toward the Use of Instrument of the Development Result

To find out the usefulness level of the authentic instrument model that has been developed in this study, measurement on response of the students and lecturers as the instrument users were conducted through the structured questions in the form of questionnaire. Students' responses intended here are their opinions toward the effects of assessment on measured aspects and indicators during field practice activities for the quality improvement of their knowledge, performance, and scholarly behavior. The measurement of the lecturers' responses is aimed at finding out the convinience level of the use, measuring power, and compatibility of the developed authentic assessment instruments in this study with aspects that need to be assessed in accordance with the learning objectives.

The analysis result of responses on returned questionnaires shows that 82% of students feel challenged to show their best performances; 78% of students want to gain knowledge by

themselves, and 67% of them want to be more scholarly during field practice actvities. These happen after the students receive socialization about aspects and indicators of the assessment as mentioned in the assessment instruments which have been developed. Responses of the lecturers as the instrument users show that 80% of them find it more convinient to assess field practice skills of the students authentically and objectively, and suggest that the instruments can be developed more flexible so that the implementation can be broader.

Discussion

Field observation shows that the implementation of integrated field practice is less condusive as the number of participating students and supervisors is imbalanced. This is in accordance with the result of interview with students during in the field showing that the students were less supervised during in the field so that the students feel less satisfied in gaining knowledge. Students' performance still needs to be improved. Working skills during implementing activites, such as ways to collect plant specimens correctly, to record plant specimens as required, to keep the specimen result in accordance with storage criteria, to use identification manual, to identify plant specimens, and to give label on plant specimens have not met standard criteria yet. Several criteria need to be added relating to the implementation process of activities which requires the students to have good problem-solving skills so that they can develop their cognitive and logic by compiling theories gained in classroom and field practice activities in order to create a complete understanding of a concept.

Interviewing 5 (five) lecturers acting as supervisors gains information that there has not been any standard assessment format to assess students' performance in field practice. Assessment on report is done toward aspects of accuracy, content completeness and the way report presented, without any standardization of standard assessment yet personal opinion of the supervisor who assesses. The result of interview with 15 participating students of the field practice which were randomly chosen from three classes shows that 100% of students do not know assessment format used by the supervisor in assessing their performance in field practice. Not knowing the format and aspects assessed in field practice performance causes students do not know the exact learning objectives, and causes not knowing standard reference of working ability that should be done.

The analysis of the result of interview and observation in the field during the preliminary study shows that assessement system which refers to authentic assessment has not been implemented yet due to the absence of the standard authentic assessment format which is suitable with the needs in the field. Assessment rubrics which refer to authentic assessment which become assessment criteria have yet to be designed so that integrated field practices seem to look less meaningful. The lack of standard assessment format accompanied with rubrics and scroring guidance in doing authentic assessment in assessing students' performance significantly and directly makes field practice activities less meaningful. Departing from those aforementioned conditions above, formulation of assessment of performance in integrated field activites is obviously needed. Assessment aspects become very important in assessing a learning process so that the learning can become meaningful and give positive effects and motivations as well for students in doing integrated field practice.

Field practice activities basically train students to think and solve problems they encounter in the field based on the knowledge they have gained in lectures. Just like learning processes in general, achievements and acquisitions of students upon learning they are done need continuous assessment so improvement can be done and the learning objectives can be achieved as expected. In this assessment process, assessment tools which are representative and can assess problem-solving skill accurately are needed.

In accordance with the characteristic of field praactice that combines knowledge, skills and scholarly behavior in the unity of problem-solving performance, the integrated field practive activities require authentic assessment tools. This is similar to what Mueller has said

(2008) in Abidin (2012) that authentic assessment is assessment of learning which refer to real-world situations or contexts that require various approaches to solve problems which give a possibility that a problem may have more than one kind of solutions. In other words, authentic assessment monitor and assess students' skills in various possibilities of solving problems encountered in real-world situations or contexts and in real learning processes. In a learning process, authentic assessment measure, monitor, and assess all aspects of learning outcomes (which are covered in the domain of cognitive, affective, and psychomotor), both of which appear to be the final result of a learning process, and in the form of changes and developments of activities, and the learning outcomes during a learning process in and outside the classroom.

The design of authentic assessment instrument model that have been developed is in the form of instruments intended to measure students' competence in the realm of knowledge, skills, and behavior during field practice activities. Assessment on realm of knowledge is aimed at assessing skill in solving problem encountered in integrated field practice activities, with aspects of assessment include the ability to identify problems, the ability to formulate problems, the ability to design solutions, the ability to formulate hypotheses, the ability to gather information, the ability to associate information, and the ability to make conclusion. Assessment on realm of skills is designed to be conducted through assesment of performance with assessment aspects of science process skill and portfolio with product types in the form of proposals, notes of field practice implementation process, reports of field practice results, and specimen collection of field practice result. Assessment on realm of behavior is designed to assess scholarly behavior of the students during field practice activities which covers curiosity, inventive, critical thinking, firm establishment, awareness of the limitations, evidence appreciation, honesty, objectivity, willingness to change opinions, open-minded and cooperative, as well as willingness and ability to ask. Each of assessment aspects on realm of knowledge, skills, and behavior consists of indicators whose qualities measured by scoring with scale of 1 to 4 with criteria that has been set out in assessment rubric.

The design of authentic assessment instrument model of field practice activities developed in this study has been validated through assessment/judgement of biology educational experts and practitioners of biology field observation activities. In accordance with Sujana's (1995) opinion which states that the measurement result can provide accurate information if validation of content and construct of the measuring instruments used are firstly done. A measuring tool is considered to have content validity if the measuring tool measures what it is supposed to be measured; the tool materials are representative materials upon the materials of what to be measured. In terms of construct validity, a thing that shoul be prioritized is the existence of compatibility of behavioral construct covered by the measurement instruments determinded on the targeted objectives. To be able to make a measuring tool that meets content and construct validation, evaluation based on professional 'judgements' by a group of experts. The results of the review and assessment experts are then used as the main bases of correction and revision of the instrument so that the resulting model of authentic assessment instruments of field activities that have logical validity can be obtained.

This instrument is also validated through a trial in limited audience, namely trial implementation on an integrated field practice of 30 students of biology prospective teachers from a private LPTK of Bandung which was held in Karapyak Beach, Pangandaran. Through the trial of the use of the assessment instrument, the result shows that the model of authentic assessment instrument of field activities which was developed has empirical validity. In general, the trial result indicates the ability of the instrument instrument to measure problem-solving skills of students in the integrated field practice activities.

Usefulness of the authentic assessment instruments developed in this study is noticeably measured by measuring the response of students and lecturers as the users of such instruments through a questionnaire containing structured questions. Students' responses intended here are their opinions toward the effects of assessment on measured aspects and indicators during filed practice activities for the quality improvement of their knowledge, performance, and scholarly behavior. After receiving socialization about assessment aspects and indicators as mentioned in assessment instrument before field practice implementation, the students feel The measurement of the lecturers' responses is aimed at finding out the convinience level of the use, measuring power, and compatibility of the developed authentic assessment instruments in this study with aspects that need to be assessed in accordance with the learning objectives. The existence of authentic assessment instruments which are representative and can assess problem-solving skills accurately provides ease for supervisors to determine the achievement of learning objectives of students and further supervising actions.

CONCLUSION AND SUGGESTION

Conclusion

Based on the result of the study on the planning stage, namely the first year of three-year planned study, including activities of needs analysis, learning analysis, designing and validation assessment instrument model design, it can be concluded as follows:

a. Field training activities basically train students to think and solve problems encountered in the field based on the knowledge they have gained in lectures. The integrated field practice is aimed at combining several subjects in which there is a series of field practicum activities with cross-cutting subject material contents.
b. In order to check the achievement of learning objective in field practice activities, assessment with represented device of authentic assessment which can assess probelm-solving skill accurately is needed.
c. Authentic assessment instrument model developed in this study covers assessment of realm of knowledge, skills and scholarly behavior including assessment aspects with indicators which should be possessed by students of prospective biology teacher.
d. The model of authentic assessment instrument developed in this study has content and construct that are quite adequate logically and empirically to assess problem-solving skills of students of prospective biology teachers in the integrated field practice activities.
e. Socialization of assessment aspects to the students participating in integrated field practice encourages them to show their best performance, gain knowledge by themselves, and be more scientific during the activities.
f. The existence of authentic assessment instruments which is representative and can assess problem-solving skills accurately provides ease for supervisors to determine the achievement of learning objectives of students and further supervising actions.

Suggestion

Considering authentic instrument model developed in this study only reaches experts' assessment and test in limited audience to this extent, it is suggested that the instrument should be tested on the implementation of broader range of audiences with larger number of students and supervisors so that the test result can be more representative. Assessment on pre-, during, and post-field practice implementation are also needed so that the changes on knowledge, skills, and behavior of the students in solving problems they face as the effect of using this authentic assessment instruments is really measured. Therefore, the success of attempt of quality development of alumni of prospective biology teacher education through authentic assessment model development which asses problem-solving skill on field practice activities can be achieved.

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