Science teacher educator and authentic assessment: Attitude toward NoS and its assessment in science instruction

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Abstract. The focus of this study is mainly to the involvement of strategic lecturers in five universities in Indonesia that graduate science teachers, as there is relationship between attitude and competency with one’s experience in the process of constructing and implementing competency of authentic assessment in science learning and supervising prospective teachers during teaching practice at schools. A number of 63 lecturers in three courses (evaluation, practical works, teaching practice) participated in this study. Data were collected through questionnaire and from lesson plans. Research results show that their attitude toward assessment is good (3.92), also the factors supporting the effectiveness of authentic assessment (3.77), and very good for the objective of the authentic assessment (4.30). It was also found that level of respondent attitude towards “assessment based on each aspects” varied from transitional and close to constructivist for the four aspects. A number of patterns was found that relate assessment and instruction components. From the interview it was found that the lecturers for the two courses (evaluation, practical works) are sure that they have done the assessment properly even though they do not know the relationship, but no clear result about the attitude of lecturers for teaching practice due to the limited number of supervisor with science background who supervise students for KKN at the same time.

1. Introduction
Effort to develop teacher competency in the field should be handled seriously by university that graduate them. Nevertheless there are not many studies carried out their experience during their study. The focus of this study is mainly to the involvement of strategic lecturers in five universities in Indonesia that graduate science teachers [1]. It seems there is relationship between attitude and competency with one’s experience in the process of constructing and implementing competency of authentic assessment in science learning and supervising prospective teachers during teaching practice at schools.

In one of his writing, it was stated about the importance of rethinking about assessment [2]. Assessment is a cornerstone of education reform in 1990’s, because the use of paper and pencil as traditional assessment was no longer relevant and reflect continuous assessment and fair for the students. The limitation of conventional assessment as test, and the importance to use test in balance as one tools of measurement with the use of non-test or alternative assessment [3]. There have some benefit of assessment characteristics been offered to make it in balance with the use of tests.

Alternative assessment asks the students to perform, produce or do something, not only remembering or memorizing. Alternative assessment also grasp higher order thinking skills and problem solving; using tasks which represent meaningful instructional activity in advance with the implementation...
possibility in real life situation. The scoring of alternative assessment involves human being and their judgment. For all these, it needs in handling instruction and new assessment for science teachers. It becomes more important that alternative assessment performs students’ performance as product as well as process or skills as learning outcomes.

There is relationship among knowledge dimension, teacher perspective and attitude dimensions regarding assessment that is believed the teachers’ action in implementing assessment [4]. Therefore, it strengthened the perspective of stressing assessment literacy among educators at any level [5, 6]. From all the participant in the training with prospective, pre-service and in-service teachers as research subjects to choose the suitable assessment methods. Nevertheless it was found that the respondent groups show the lowest performance is on developing valid evaluation procedure, which also low in communicating assessment results. In terms of assessment purposes, according to Rogers & Riedel [7], the prospective and in-service teachers both think that the purpose of assessment is to determine students’ performance relevant with curriculum, achieve the education goal, and improve students’ performance.

2. Method

This study was conducted at five university (Previously: Teacher Education Institute) and 10 middle schools as teaching practice for prospective science teachers. Two types of instrument were used to detect the attitude of science educators toward assessments and the factors influent the attitude, namely: questionnaire and interview format. The questionnaire was planned covering three aspects of attitude: 1) attitude toward cognitive level being assess in assessment, attitude toward the type of assessment, and attitude toward evaluation criteria. At the end of the questionnaire a diagram to be sketched down the arrow to show direction (one direction or two ways direction) among components of teaching methods and assessment methods.

Participants: 63 lecturers of three courses (Evaluation, practical works, teaching practice) from five Universities in Indonesia which have science education program and graduate science teachers in five cities. The five cities are Bandar Lampung (UNILA), Bandung (UPI), Yogyakarta (UNY), Singaraja (UNDIKSA), and Makassar (UNM). Those universities are considered as representation of regions in Indonesia. The participants can be divided as 40 participant from three universities (teaching practice separated from KKN: UPI, UNDIKSHA an UNM) and 23 participants from two universities (Teaching practice + KKN: UNILA and UNY) 

Questionnaire and interview format were used as instruments to collect data. Interview format was used during forum group discussion with a number of Science educators or during individual interview. From lesson plans collected we can detect the instructional objectives, the teaching methods, the type of assessment and their relationship.

Interview format was planned through a number of open questions related to the attitude of science educators/scientists who teach in courses for prospective teachers. The open questions among others cover four dimensions (relationship between assessment ad instructions; determining of assessment, assessment methods and assessment criteria. The four dimensions were developed based on and considering subscale of the questionnaire (first instrument) and codification was developed referring to Campbell & Evans [8] and Lomax [9].

Attitude level of science educators/scientists towards assessment was determined with the use of descriptive statistics (average of score of respondents toward each statement in the questionnaire). Based on that later the attitude level of science educators was categorized into five criteria as follows: 0-0.80, Traditional; 0.81-1.60, close to traditional; 1.61-2.40, transition; 2.41-3.20, close to constructivist; dan 3.21-4.00, constructivist.

Attitude mapping of science educators toward assessment and instruction was analyzed and classified to grasp the patterns. Besides, the interpretation towards the pattern attitude mapping was found based on the direction of arrow put by the science educators which shows the interaction among the components of instructional methods, assessment methods, assessment criteria, evaluation criteria, and difficulty in implementing assessment in science instruction. Each of pattern of attitude mapping is then
described especially the interaction which indicate the comprehension of science educators toward assessment and science instruction which then will be shared towards science teachers and prospective science teachers in designing lesson plans as aspects to be debriefed during teaching practice at schools. Data correction technique, instrument, and data analysis is represented in Table 1. The instruments were adapted and validated in line with research needs.

Table 1. Data collection technique, instruments and data analysis.

| Target          | Subject                      | Instrument | Technique                          |
|-----------------|------------------------------|------------|------------------------------------|
| Attitude        | Science Educators, scientists| questionnaire | Distribute questionnaire, conduct interview |
| Mapping         | Science Educators and scientist | questionnaire | Filled in questionnaire             |
| Instrument Validation | Evaluation Experts | analysis format | Questionnaire & Filled in Format |
|                 |                              |            | Data Collection         | Data Analysis            |

3. Results and discussion

3.1. Attitude towards assessment

Research results show that their attitude toward assessment is good (3.92), also the factors supporting the effectiveness of authentic assessment (3.77), and very good for the objective of the authentic assessment (4.30). It was also found that level of respondent attitude towards “Assessment based on each aspects” varied from transitional and close to constructivist for the four aspects. A number of patterns was found that relate assessment and instruction components. From the interview it was found that the lecturers for the two courses (Evaluation, practical works) are sure that they have done the assessment properly even though they do not know the relationship, but no clear result about the attitude of lecturers for teaching practice due to the limited number of supervisor with science background who supervise students for KKN (Real Performance Course) at the same time.

In general the average attitude of science educators toward assessment is (2.31) in transition category. They comprehend that the aims of assessment is to place the students based on certain characteristic, transition from epistemology traditional to constructivist, not consider the nature of prospective teachers as the subject to construct their knowledge. Meanwhile the attitude level of science educators based on each aspect can be categorized as transition and close to constructivist (Table 2). The average value for each level mainly transition. They believe that assessment give feedback and determine the aims of the instruction, that the assessment is used for different purpose, and that the result of the assessment is used to help them learning.

Table 2. Attitude level of respondent toward assessment based on each aspect.

| Statement/ Assessment Aspect | Score average and Attitude level Category of Science Educators (n=63) |
|-----------------------------|-------------------------------------------------|
| I Level of assessment in relation to Cognitive level | 2.48 Close to constructivist |
| Level of assessment methods* | 1.95 Transition |
| Level of learning practice usage | 2.45 Close to constructivist |
| II Level of students’ performance judgment | 2.40 Close to constructivist |
| Level of assessment process difficulty | 2.19 Close to constructivist |
| III Level of assessment process belief | 2.90 Close to constructivist |
|  | Note: T= Traditional; CtT= Close to Traditional; Tr= Transition; CtC= Close to Constructivist; C = Constructivist |

This research results in general is in line with previous research findings [6]. It had been found that teachers’ attitude level towards assessment in Turkey can be categorized as “close to constructivist”. Attitude level of prospective teachers towards assessment can be categorized as traditional and
constructivist. Those terminologies used to explain assessment usage level based on traditional epistemology and constructivist epistemology. In traditional assessment model, the main goal of assessment is to place the students based on certain characteristics. Meanwhile the assessment goal based on constructivist epistemology is to determine the nature of students in knowledge construction [6, 10]. Further, it was stated that the dichotomy of prospective teachers’ attitude level towards assessment can be used for improving assessment debriefing process for prospective teachers.

3.2. Map of science educator attitude towards assessment and science instruction

The mapping of science educator’s attitude towards assessment and science instruction is shown in Table 3.

| Table 3. Mapping of science educators attitude toward assessment and instruction. |
|---------------------------------------------------------------|
| **Map of Assessment-Instruction relationship** | **Description** |
| ![Pattern 1](image1) | Assessment methods is the main focus, influenced by other components, especially Teaching methods (+assessment criteria+ evaluation criteria). Later the assessment methods have relationship with the difficulty implementation. |
| ![Pattern 2](image2) | Inter-components have interaction, not only between teaching methods and assessment methods, but also with other components and inter-components involved, except between teaching method with evaluation, and between assessment criteria with the difficulty implementation. |
| ![Pattern 3](image3) | Assessment methods is influenced by the selected teaching methods. These assessment methods further have relationship with other components, namely with assessment criteria, evaluation criteria and difficulty of assessment implementation. |
| ![Pattern 4a](image4) | (Special for Lecturers who manage practical works) There is interaction between teaching methods with assessment methods, and also between assessment methods with evaluation criteria. Nevertheless assessment methods tend to be influenced by assessment criteria, and assessment method with its difficulty implementation. |
Table 3. Cont.

| Map of Assessment-Instruction relationship | Description |
|-------------------------------------------|-------------|
| ![Map 1](image1)                          | **Pattern 4b**  
Like pattern 4a, but does not have interactions between assessment methods with evaluation criteria. Beside of interrelationship between evaluation criteria with assessment criteria, there is also relation with difficulty of assessment implementation. |
| ![Map 2](image2)                          | **Pattern 5a**  
There is interaction between teaching methods with assessment criteria and difficulty to implement assessment. Assessment criteria give contribution to assessment methods. Difficulty of assessment implementation has relation-ship with variety of teaching methods, and at last determine evaluation criteria. |
| ![Map 3](image3)                          | **Pattern 5b**  
There is an interaction between teaching methods and assessment criteria. Furthermore, the teaching method and assessment criteria contribute to the Assessment Method, which is related to the difficulty of applying assessment and evaluation criteria. |
| ![Map 4](image4)                          | **Pattern 5c**  
Like Pattern 5b, there is interaction between teaching methods and assessment criteria. Nevertheless teaching methods not directly give contribution towards assessment methods, but through assessment criteria and difficulty. Assessment methods strengthen or give support towards evaluation criteria. |
Table 3. Cont.

| Map of Assessment-Instruction relationship | Description |
|------------------------------------------|-------------|
| ![Map of Assessment-Instruction relationship](image1) | **Pattern 6**  
There is relationship between assessment methods and teaching methods and assessment criteria. Assessment criteria have relation to evaluation criteria, which later this criteria give contribution to difficulty of implementation.  
Pattern 5a and Pattern 6 clearly stated interrelationship and one direction of relationship between the methods. |
| ![Map of Assessment-Instruction relationship](image2) | **Pattern 7**  
There is contribution between instructional methods and assessment criteria with assessment methods which in turn give contribution toward the difficulty of implementing evaluation criteria, besides assessment criteria also give contribution towards evaluation criteria. |
| ![Map of Assessment-Instruction relationship](image3) | **Pattern 8**  
There is interaction between teaching methods and assessment methods. The relationship inter-components is shown through arrows (one direction) but the content or substance of each components has not been detail stated. |
| ![Map of Assessment-Instruction relationship](image4) | **Pattern 9**  
No signs indicate the interrelationship or relation among one component with other components, even though the substance of each component has been stated in detail. |

Table 3 shows patterns of science educators’ attitude mapping towards the relationship between assessment and instructions, and their descriptions. From the description and pattern mapping of interaction assessment-instructions and other components, it enable to be interpreted and predicted the dominant factors that influent them. From the patterns found in this research, some aspects can be interpreted as bellows. In general science educators have positive attitude towards assessment, but not
clearly shown in their actions neither regarding assessment methods used, nor comprehension the interaction between assessment criteria and evaluation criteria, especially the relationship between its difficulty in assessment implementation related to assessment criteria.

The dominancy of using instructional methods (lecturing, discussion and presentation) did influent onto the choice of assessment methods. Science educators who are responsible in evaluation and practical work courses tends to brace enough to determine the relationship of assessment and science instructions. Certain patterns (5a and 6) clearly show the interrelationship and the one way relationship. Both of them comprehend their relationship. These two pattern were obtained from science educator who has been eager to handle course in assessment from the beginning. Science educators who are responsible to evaluation and Practical works tend more explicitly state the relationship of the difficulties in implementing assessment towards assessment criteria. Pattern 9 resulted from science educator with pure biology background, even though they never have experience formally in science education at any levels (S1, S2, S3).

This research results support the paradigm that science educator experience tends to influent the decision to select assessment methods related to instructions as told by previous researchers [5-6]. This research results did support the researcher paradigm “assessing assessment” [6, 11] that prospective teachers tend to have attitude and knowledge in determining assessment methods, much better than their teachers. Therefore this research is in line with previous researches which focusing mostly at “assessing assessment”.

4. Conclusion
The attitude level of Science educators got from this research is relative not very good, only in transition, but their attitude level toward assessment based on each aspect tend in transition to “close to constructivist”. Temporary research results shows nine patterns of mapping the relationship of instruction and assessment. From the patterns of relationship between instruction and assessment some finding shows that it was needed to be interpreted among others are as follows. Firstly that science teachers should have positive attitude towards assessment, but also did not know exactly about the relationship between evaluation criteria. Nevertheless their knowledge is not clearly influence their action towards variety of assessment methods. They also do not comprehend the relationship between assessment criteria and evaluation criteria, especially the relationship between the difficulties in implementing assessment in terms of assessment criteria. Even though the science educators in evaluation course and practical course do not comprehend exactly, they have implemented the right things as they understand that in science teaching, nature of science is very important and should underlie the teaching and its assessment.

Acknowledgments
we would like to express our appreciation to Directorate General of Higher Education (DGHE) which has given funding for this study with specific scheme “Hibah Unggulan Perguruan Tinggi” years 2015. Science teacher educators, prospective science teachers, and science teachers who has been respondents in this study.

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