Analysis of Items Using the Assessment Instrument Based on the Structure of Observed Learning Outcome

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Abstract. The purpose of this study was to analyze items that will be used in taxonomies based on the observed learning outcomes structure (SOLO) to categorize student responses so that items can be used in future studies. The research is descriptive research. Data were collected using a non-test method of a questionnaire consisting of 10 questions. Subjects in this study consisted of 3 lecturers and 5 teachers. The results showed that the items analyzed were grouped into SOLO taxonomy based assessment instruments with 14.2% unistructural, 29.6% multistructural, 29.6% relational and 29.6% abstracts expanded. The results also showed that the instrument the SOLO taxonomy-based assessment used included a very valid category with a score of more than 35. In conclusion, all of these items have met the category of SOLO-based taxonomy assessment instruments with very valid categories, so that it can further be used to measure students' ability based on SOLO taxonomy on buffer.

1. Introduction
Educational assessment is the process of gathering and processing information to determine the achievement of student learning outcomes. For this reason, an assessment standard is needed. Educational assessment standards are national education standards relating to mechanisms, procedures, and instruments for assessing student learning outcomes. The principal sees assessment as formative, while the teacher sees it as summative. Teachers who hold an administrative role argue that assessment has a formative purpose, as is the opinion of the principal, while other teachers consider assessment to have a summative purpose [1].

Statistical program, postgraduate students are expected to use their reasoning in making comparative conclusions from two plots [2]. The reasoning is a cognitive process that changes the information provided to reach conclusions. SOLO Taxonomy can be used to assess inferential reasoning because students are able to compare two plots that have been developed. These two plots consist of descriptions of the level of reasoning and interview assignments that can be used to gather evidence of inferential reasoning of students. Good teacher will definitely make the concept of learning trajectory for students, although implicitly it will know how dialogue can be used to change concepts into social action [3].

The PPMP report mentions that students' incompleteness in UN Basic Competencies is partly because the questions used by teachers in schools are still very standard and do not empower students' high-level thinking skills [4]. According to the National Accreditation Council, the analysis of completeness of the UN Basic Competencies in 2015 and 2016 was followed by an analysis of school needs to be conducted based on eight National Education Standards (SNP) which included content
standards, process standards, graduate competency standards, standards of educators and education personnel, and assessment standards.

[5] assumed that the classification given by Piaget is only hypothetical. They refer to as HCS (Hypothetical Cognitive Structure) and this cannot be measured directly and is fixed. On the other hand, a student's real response to a task can be very different from its level in HCS. Bigg and Collis classify the real responses of children called SOLO Taxonomy or the structure of learning outcomes that can be observed. One example of solo taxonomy is the prospective teacher's view of the definition of a model grouped at the pre-structural level, which is the lowest level and no view identified at the highest level, which is an expanded abstract. The prospective teacher's view of the use of the model is generally at the pre-structural level and is not structural and no view in the expanded abstract level can be identified [6]. Solo taxonomy was also used in mathematics lessons [7].

The SOLO taxonomy model is considered very attractive to be applied in learning in schools because in addition to being hierarchical it also requires the ability of students to provide several alternative answers or solutions as well as being able to associate some of the answers or solutions. Solo taxonomy can also be used to design levelsgames, from simple games to more complicated games [8]. Programming research shows that the mapping process used to define programming construction at unistructural level is still not consistent [9, 10]. This taxonomy provides opportunities for students to always think alternative (ability at a multistructural level), compare between an alternative with another alternative (ability at the relational level), and provide opportunities for students to be able to provide a new and different than usual (ability to extended abstract level). This means that taxonomy in addition to accommodating direct objectives is also seen as being able to accommodate the indirect objectives of chemistry learning and demanding students in high-level cognitive abilities.

2. Methods
Product trials in the study aimed to collect data about the feasibility of the questions used both in terms of concept, content validity, construct validity, and from the readability of the questions developed. The validation sheet given to the validator contains an assessment of the content, format and grammar on the question. The validator gives an assessment in the form of a score of 1-4, comments and suggestions and provides a conclusion that the item is worthy of being used for small-scale trials or still needs to be revised again, if something needs to be revised again the researcher will correct the error. Product trials are carried out as follows:

2.1. Validation of experts and senior teachers
The purpose of validation to experts and senior teachers is to ensure the feasibility of the product developed before being tested by the user.

2.1.1. Validation design
- Planning: explain to experts and senior teachers about product development evaluation instruments.
- Implementing: providing initial draft product development to experts.
- Reflecting: distributing questionnaires about expert responses to products developed and analyzing the information obtained.
- Application: revise the product based on the data obtained.

2.1.2. Validator
The validators used in the study were three lecturers and five senior teachers.

The development product which is still in the form of SOLO's taxonomy based assessment instrument is then reviewed by experts. Experts are asked to assess the assessment instrument based on
SOLO Taxonomy based on the format of the grading item. This assessment format uses the score that has a rubric or criteria and a suggestion column for improvement.

The validity test conducted is divided into two, namely expert validity and content validity. Expert validation is used to test logical validity or content and constructs. The objective of expert validation is to test content validation in the form of assessment instruments in terms of compatibility between competency standards, basic competencies, cognitive taxonomy and material used with the questions, and construct validation in the form of how far the items are able to distinguish students' abilities so that they can be distinguished between students who have high, moderate and low thinking abilities. Besides that, the language and writing were validated as well as the readability of the questions.

The experts used in the study are people who have a linear science field with the aim of product development. Senior teachers are teachers who have taught chemistry for more than 10 years. The feasibility data of the evaluation questions were measured using the criteria of the feasibility of the questions from the Ministry of National Education in 2008. The data obtained is then analyzed, if the validation results of the validators are not feasible then the product is revised according to the validator's suggestion, then validation is done again. The results of the validation are draft 1 essay questions that are ready to be tested by users at school.

3. Result and Discussion
Experts or experts assess the SOLO Taxonomy-based assessment instrument based on the format of the validation sheet. This validation format uses an assessment indicator and an assessment score number with a rubric or criteria and a suggestion column for improvement. Assessment instruments are declared valid by experts or experts so that they can be used for research. The draft assessment instrument was revised after receiving an assessment from an expert. Revisions made are based on suggestions and input provided by experts. Revisions made include improvements to the assessment guide based on advice from field practitioners and development experts. Improvements in grammar are based on the advice of linguists. Repairing the answer key is based on the advice of the chemist. The results of the activity at this stage are the compilation of assessment instruments based on SOLO Taxonomy on chemistry subjects in class XI SMA competency of buffer solutions that are ready to be tested.

The quality of learning products will increase with an increase in motivation, support and academic motivation in cognitive learning outcomes [11]. Two universities that implement SOLO taxonomy are able to provide improvements to the syllabus, because previously the teacher only used the syllabus he made himself [12].

The assessment instruments that will be validated consist of the questions grid, essay questions, answer keys and assessment instructions. Validation sheets consist of validation sheets and validation rubrics. The validation sheet consists of 10 assessment items which include the content, format and language style of the questions made. The value of each item is maximal 4, so that the highest valuation item gets 40 points and the lowest gets 10 points. Then the results of the evaluation of each validator are summed and concluded according to the rules in table 3 so that the conclusions of the items are obtained. The results showed that the items analyzed and validated by 3 expert lecturers and 5 senior teachers could be grouped in the SOLO taxonomy-based assessment instrument with details of 14.2% structural, 29.6% multistructural, 29.6% relational and 29.6% expanded abstract.

| Table 1. Assessment Instrument Expert Validation Score. |
|--------------------------------------------------------|
| Validator | Total Score | Validation |
| Chemist | 38 | Very valid |
| Expert in Development Field | 37 | Criteria Very valid |
| Linguist | 39 | Very valid |

| Table 2. Senior Teacher Validation Score Assessment Instrument. |
Table 3. Validation Criteria for Assessment Instruments.

| Range   | Valid Criteria |
|---------|----------------|
| 33 – 40 | Very valid     |
| 25 – 32 | Valid          |
| 17 – 24 | Enough valid   |
| < 17    | Less valid     |

The SOLO taxonomy-based assessment instrument can be said to be valid if it gets a minimum score of 25. The three experts stated that the assessment instrument was very valid for all items with scores reaching more than 35. That is, descriptive development for each SOLO category could be operationalized for the purpose of categorizing student responses to explanations in each SOLO category [13].

4. Conclusion
This assessment instrument is included in the SOLO taxonomy-based assessment instrument. This SOLO taxonomy-based assessment instrument is a very valid category so it can be used to categorize student responses.

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