A development of performance assessment instrument for measuring cognitive and psychomotor competence on vinegar titration practicum

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Abstract. Implementation of learning can not be separated from the assessment activities. Performance assessment on chemical subjects are necessary to assess students' cognitive and psychomotor aspects. The purpose of this study is to produce a performance assessment instrument that assesses the cognitive and psychomotor competence of a quality and tested titration practice of vinegar acids, in students of Class XI SMA. The research method used is Research and Development (R & D), which consists of (1) development stage of instrument making (2) validation and limited testing phase, and (3) application stage in the form of implementation in learning. Instruments in this study include validation sheet by expert team, assessment instrument sheet in the form of task and rubric, observation sheet and interview guide sheet. This research is only at the stage of instrument development. This research is essential to assist teachers in delivering quality student performance assessment instruments and can be used for further research in developing performance assessment instruments on other chemical concept.

1. Introduction
Science is very important. Science including chemistry is a science that must be obtained by students. Chemistry is the study of matter, its properties and its changes. Chemistry is the science that studies the structure of the material, composition, energy, and material changes that accompany. Constituent structure in teaching materials, an educator should be able to provide a model. Therefore, in the assessment and study of chemistry must pay attention to the characteristics of chemistry as a product and process [1].

The chemistry lab is a study of chemical practice carried out in laboratories that predict, observe, organize data, and design experiments to confirm chemical concepts, principles, basic laws and chemical theories [2]. The advantages of using practicum method among others (1) provide a concrete description of an event; (2) students can observe the process; (3) students can develop inquiry skills; (4) students can develop scientific development; (5) help teachers to achieve learning goals more effectively and efficiently. According to Kempa & Ward to assess the competence of knowledge and skills can be done through laboratory practicum [3].

One assessment that may reflect the competence of a student's skills or performance is a performance assessment. This is in line with the Regulation of the Minister of Education and Culture No. 66 of 2013 on Education Assessment Standards explained that educators also assess the competence of skills through performance assessment. Kahl [4] explained that the increasing popularity of performance assessment emerged during the 1980s and 1990s because of dissatisfaction with
multiple choice knowledge tests. This performance assessment provides a new method of assessing students' performance abilities, not only through multiple choice tests and written tests. Performance assessment is considered to be the most authentic assessment compared to other types of authentic assessment because it can directly assess students' exact competencies according to certain indicators. Performance appraisals have strong relevance to the scientific approach in learning and can overcome the weaknesses of traditional tests (multiple choice and essay as it can provide a more complete picture of student performance [5].

The assessment of performance in chemistry subjects is essential to assess students' cognitive and psychomotor skills for more authentic assessment. Several studies have developed performance instruments such as Febriana on the topic of polar and non polar compounds. The study obtained instruments that were eligible to be used as performance assessment instruments [6]. Fay also developed a performance instrument in the form of rubrics for inquiry characterization of students in chemical laboratories as well as obtaining a viable instrument [7]. Other performance instrument researches are organic chemistry, diastereoselective synthesis, polymer [8,9,10].

Based on the 2013 curriculum for Chemistry lessons in SMA the material that allows for the development of performance assessment instruments is the materials of class XI and XII. The material of acid bases is one of the material that is very possible to do performance assessment because many components of student performance can be assessed. Nahadi has performed performance assessment on acid-base titration and obtained performance instruments with high validity and reliability. The instrument developed in the research is task and rubric because it has high value of validity, realibility and feasibility [11].

Based on the success of previous researchers, researcher would like to develop a performance assessment instrument to assess students' cognitive and psychomotor abilities on the titers of vinegar titration. This material is an enrichment material for high school XI students. In addition to the many components of performance aspects that can be assessed, this research is intended to float performance instruments in the form of tasks and rubrics on enrichment materials in high school chemistry lab.

2. Method
This research uses Research and Development (R & D) method that was conducted with sample a SMA in Bandung, grade XI students of 10 people with 3 rater.

This research process is divided into 3 phases: planning, development and implementation phase. Assessment data obtained from the results of performance assessment through observation using performance assessment instruments and interviews with high school teachers. Data is processed by using student value tabulation, performing instrument interpretation the students' performance assessment of the practicum, cognitive test results of the students, the creation of egori, the validity of the content with content validity ratio (CVR), calculate the instrumentality of cognitive ability and performance assessment instrument with correlation technique of rough number moment product, and calculate the reliability using the method halve or split-half method (odd-even division).

3. Result and Discussion

3.1. The initial product for development of performance assessment instrument of acid vinegar

The first step is to prepare Indicator skills and work procedures practicum on acidic vinegar materials. Than, compile a grid of the performance assessment instrument in accordance with the skills and cognitive indicators and practikum work procedures.

Table 1 shows the results of the performance grating of the created instrument. The grid considers 5 stages of performance aspect, ie preparation stage of practicum, making phase of NaOH solution and vinegar acid, titration stage, stage of safety and processing stage of observation result.

The total grains of instruments made overall amounted to 18 items. At the preparatory stage there are 4 aspects that can be assessed by 5 categories of assessment scales. At each stage of this early, direct psychomotor skills can be assessed by scoring at the stage of observation by the rater. The
highest score of 5 (max) means the student performs practicum work according to the procedure without making a mistake. Score 1 is the opposite (min). Furthermore, at the stage of making a solution of NaOH and vinegar there are 4 a performance spec that can be assessed by the numbers of 5-8, the stage of titration premises point 9-13, the stage of maintaining safety with the number of items 14-16 and processing the results of observations with the number items 17-18.

Table 1. Grades of performance aspect to assess students' psychomotor skills on vinegar titration practice

<table>
<thead>
<tr>
<th>No</th>
<th>Performance aspect</th>
<th>Grain number</th>
<th>Score</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preparing the lab</td>
<td>1,2,3,4</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Make a solution of NaOH and vinegar</td>
<td>5,6,7,8,</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Conducting titration</td>
<td>9,10,11,12,13</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Maintain safety</td>
<td>14,15,16</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Processing the observations</td>
<td>17,18</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

3.2. Example instrument for the cognitive assessment of student

Figure 1 shows results preparation of student cognitive assessment instruments after the acidic titration of vinegar titration. The instrument is a multiple choice item consisting of several questions tested on the student after practicing vinegar titration. Problem mentioned has a variety of cognitive levels C1 to C5. Item is guided by two categories namely knowledge of titration tools and chemical concept knowledge. Besides this instrument is also equipped with key answers on each item.
3.3 Performance Measurement Instrument Quality Assessment

a. Content Validity
Content validity is performed to assess whether the instruments that have been used or not meet the requirements of content validity. Content validity is done through expert judgement, and in this research the expert who is intended is five chemistry lecturer majoring in chemistry. The validation of this expert generates data in the form of suggestions from validators to correct writing errors, improper use of sentences, suitability of indicator ability with task, suitability of tasks with rubrics and consideration of performance components on the acetic acid titration of vinegar instrument. The entire test item is 100% valid from the CVR score after improvement based on the suggestion and input from the expert judgment, so that the validated and revised performance assessment instrument can be tested on the test sample. Instruments with high validity can be said to meet good criteria as an evaluation tool.

b. Reliability
Reliability is calculated to determine the degree of stability or trust of the instruments of performance assessment developed. reliability test can be done to 5 students with 3 rater who will assess the performance of the student. Instruments that have high reliability value, it can be said that the developed performance assessment instrument has a very high level of trust.

c. Implementation of performance appraisal instruments with limited trials
This limited trial is conducted so that the product can be used as a reference for teachers in preparing and developing a better performance assessment instrument for the assessment of students’ skills in experimenting on chemistry learning. Teachers' teacher data on in assassin strains shows the performance of the basic materials practicum, shown in Table 2

<table>
<thead>
<tr>
<th>No</th>
<th>Pertanyaan</th>
<th>Jawaban</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bagaimana menurut bpk/ibu tentang instrumen yang kami kembangkan?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Apakah instrumen yang dikembangkan layak digunakan sebagai instrumen untuk menilai kompetensi psikomotorik siswa dalam praktikum gel dan emulsif atau tidak?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bagaimana efektifitas instrumen yang dikembangkan terhadap alokasi waktu pembelajaran?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Apa kurangnya dari instrumen yang kami kembangkan?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Apa kritis dan saraf anda terhadap instrumen yang kami kembangkan?</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bagaimana menurut bpk/ibu tentang instrumen yang kami kembangkan?</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Teacher interview guidance on performance assessment instruments
4. Conclusion
The assessment performance can assess students' cognitive and psychomotor skills. The research process to develop performance assessment done by three phases: planning, development and implementation. In this study there are examples of the development of performance assessment instruments and vinegar practice test instruments that have not been validated.

After doing this research, the researcher suggested to continue this research until the validation and implementation stage to the students to get the highest performance instrument.

5. Acknowledgments
Thankyou to the supervisor and friends who have helped this research.

6. References
[7] Fay M E, Grive, Towne, Bretz 2007 A rubric to characterize inquiry the undergraduate chemistry laboratory Chemistry Education Research and Practice 8(2) 212-219