

## Research Article

# Development of Assessment Instruments to Measure Scientific Performance

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**ORCID**Ida Farida: <https://orcid.org/0000-0003-2671-1735>**Abstract.**

This research aims to develop a scientific performance assessment instrument in the laboratory in experiment of analyzing the content of a compound in loose powder. The assessment instrument developed is in the form of worksheets and performance assessment sheets and rubrics. The method used in this research is design-based research (DBR) with two stages, namely the analysis stage and product design development. Data collection was carried out by validation tests to expert lecturers and the results were analyzed. The results of the validation test of scientific performance assessment instruments in the form of worksheets obtained a value of  $r_{count} = 0.83$  and performance assessment sheets  $r_{count} = 0.84$ . This value indicates that both instruments are valid.

**Keywords:** development, assessment instruments, science performance

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## 1. Introduction

Practicum is one of the important parts of the chemistry learning process, because students are given the opportunity to be creative and apply theory while fostering performance skills. In practicum activities, assessment is important to do in order to know the competency achievements of students. Assessment is an activity to obtain, analyze, and interpretation data about the process and learning outcomes of students which is carried out systematically and continuously so that it becomes objective information in decision making. The important aspect of assessment in practicum is the process skills of students in preparing tools and materials, conducting experiments, and activities after practicum in the form of performance [1].

One of the assessment instruments that can be used to assess the achievement of competence and process skills of students in practicum activities is performance assessment [2]. Performance assessment assesses the process and results of the

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learning process [3]. The assessment contained in the performance assessment must be integrated with the daily lives of students [4]. Performance assessment in practicum activities can motivate students to be more active during practicum activities, because there is an assessment of each student [5].

One of the chemistry lessons that usually does practical work is analytic chemistry. Practicum in the analytic chemistry course studies the determination of the concentration of an element or compound in a sample [6]. Most lab work rarely uses materials in everyday life. The rest, still use the materials available in the laboratory, meanwhile, practicum activities will be more interesting if they bring chemistry issues into everyday life. Therefore, in this research, tried to use talcum powder as an ingredient for quantitative analytic chemistry practicum so that the practicum was more contextual to everyday life.

The powder contains zinc oxide (ZnO) which serves to cover uneven skin tone and protect the skin from ultraviolet rays [7]. However, ZnO can become a hazard if its concentration exceeds the permissible threshold. The content of ZnO material used for protection from sunlight is allowed up to a concentration of 25% [8]. Therefore, it is important to analyze the content of ZnO in the talcum powder using the analytical method [9]. There are several advanced methods for determining zinc levels in powder samples, namely Ultra Violet Visible (UV-Vis) spectrophotometer and Atomic Absorption Spectrophotometer (AAS) [10]. However, this method is expensive. The conventional method that can be used in determining content of zinc is the titration method, usually the complexometric titration method is used [11].

In previous research conducted by [9] regarding the analysis of ZnO in talcum powder and ointment using the complexometric titration method concluded that the powder material is more efficiently applied for quantitative analytical chemistry practicum because the preparation method is easier and faster than ointment. However, there are no student worksheets and instruments for assessing student scientific performance in the practical analysis of content ZnO in talcum powder using the complexometric titration method. Based on this, this research developed instrument to assesment scientific performance of students in the practical analysis of content ZnO in talcum powder.

## 2. Research Method

The method used in this research is Design Based Research (DBR) method which aims to produce a product. According [12], this method has four steps, namely Analysis, Product

design development, Product trial and Product reflection. This research only does two steps, namely the analysis step and the product design development step. The analysis stage is carried out to analyze analytical chemistry practicum activities in the laboratory. Then analysis of lesson materials, and analysis of previous research journals related to lesson materials and problems that arise from practicum activities.

The product design development step was to design scientific performance assessment instruments in the form of practicum worksheets on analyzing the content of a compound in talcum powder and student performance assessment sheets in doing practicum.

Data collection was used to test the validation of the content design practicum worksheets and scientific performance assessment sheets to three expert lecturers in the field of chemistry and learning media by providing a validation questionnaire sheet containing several instrument criteria. The data from the validation test results from the three lecturers were analyzed and processed using the rcount value which was compared with the rcritical value which has a value of 0.3. If each criterion of the instrument produces a value of more than 0.3 then the criterion item is declared valid and if it is less than 0.3, then the criterion is declared invalid [13]. The equation used for the feasibility value (r) is as follows:

$$r = \frac{x}{N.n} \quad (1)$$

In the equation, r is the feasibility value, N is the number of items, x is the score of the respondent's answer, n is the total number of respondents.

### 3. Result and Discussion

Based on the results of research that has been done, at the analysis step, it is found that the problem in practicum is still rarely using everyday materials to practicum the analysis of the content of a compound or element. Therefore, to make it easier for students to do this practice, it is necessary to analyze the ZnO content in talcum powder using the complexometric titration method. The practicum of analyzing ZnO content in talcum powder has been done by several researchers using different methods.

Therefore, the practicum that was done tried to combine several studies that had been done to find a procedure that could be done easily and the tools and materials used were commonly found in the laboratory. However, the research in this practicum is only up to designing procedures based on several research journals, then compiling instruments to measure scientific performance form worksheets as learning media and

TABLE 1: Recapitulation assessment results of three expert lecturers on experimental worksheets.

No.	Criteria	$r_{count}$	$r_{critical}$	Result
1	The language used is easy to understand and not ambiguous.	0.91	0.3	Valid
2	The language used is in accordance with the rules of good and correct language writing.	0.83	0.3	Valid
3	The discourse displayed is in accordance with the indicators to be achieved.	0.83	0.3	Valid
4	Penyajian lembar kerja eksperimen dilengkapi dengan gambar dan ilustrasi yang menarik.	0.83	0.3	Valid
5	Illustrations or pictures are useful for motivation learning.	0.75	0.3	Valid
6	The procedures presented are systematic, easy to understand and can help in experimental activities.	0.83	0.3	Valid
7	The activities presented in the experimental worksheets trigger students' curiosity.	0.83	0.3	Valid
8	The instructions contained in the experimental worksheet easy to understand.	0.75	0.3	Valid
9	The experimental worksheet leads to critical, creative, and communicative thinking skills.	0.83	0.3	Valid
10	The questions used in the worksheet are in accordance with the steps of scientific performance measured.	0.83	0.3	Valid
11	The steps of the questions on the worksheet are systematic, easy to understand and can help in the experimentation process.	0.91	0.3	Valid
12	The activity steps presented provide hands-on experience in discovering concepts.	0.83	0.3	Valid
13	The questions given on the experimental worksheet help students to explore information.	0.83	0.3	Valid
14	The tools and materials used for the experiment to analyze the ZnO content in talcum powder were easily available.	0.91	0.3	Valid
15	The experiment of analyzing ZnO content in talcum powder can be done easily by students.	0.83	0.3	Valid
	<b>Average</b>	<b>0.83</b>	<b>0.3</b>	Valid

performance assessment sheets for the practicum that will be used in the practicum of chemical analysis on complexometric titration material.

The experiment of analyzing ZnO content in talcum powder using complexometric titration listed in the worksheet is the result of literature analysis and slight modification in the procedure. The following is analysis Procedure of ZnO Content in Talcum Powder which was modified from research [9], first Add 10 mL of the prepared talcum powder sample into a 250 mL erlenmeyer. Then add 15 mL of ammonia buffer solution pH 10

TABLE 2: Recapitulation assessment results of three expert lecturers on the performance assessment sheet.

No	Criteria	$r_{count}$	$r_{critical}$	Result
1	The language used is understandable and unambiguous.	0.83	0.3	Valid
2	The language used is in conformance with the rules of accurate language writing.	0.83	0.3	Valid
3	The instructions for the student scientific performance assessment sheet are easy to understand.	0.75	0.3	Valid
4	Systematize the scientific performance assessment sheet based on the indicators to be achieved.	0.91	0.3	Valid
5	The scientific performance assessment sheet is can help educators in assessing the scientific performance of each student.	0.91	0.3	Valid
6	The assessment in the measured scientific performance is good with a score range of 0-2.	0.83	0.3	Valid
	<b>Average</b>	<b>0.84</b>	<b>0.3</b>	Valid

and 3 drops of EBT indicator solution until the solution becomes purple. Then titrate using Na<sub>2</sub>EDTA solution until the solution turns blue. Do the titration in triplo and write each volume of Na<sub>2</sub>EDTA used for each sample solution. After that, calculate the ZnO content in the sample using the content calculation using the following equation.

$$\% \text{ZnO} = \times 100 \% \frac{M_{EDTA} \times V_{EDTA} \times BM \times \frac{V}{V_0}}{w} \quad (2)$$

In the equation, M EDTA is concentration of EDTA solution (M), V EDTA is volume of EDTA solution used (mL), BM is molecular weight (grams/mole), V is volume of prepared sample solution (mL), V<sub>0</sub> is: volume of sample used (mL) and w is sample weight (mg).

The worksheet developed is an experimental worksheet that has several stages, namely observing discourse, formulating problems, formulating hypotheses, designing experiments, conducting experiments, analyzing data, and making conclusions. The worksheets that have been made, then validated to three expert lecturers consisting of two chemistry expert lecturers and one learning media expert lecturer. The results of worksheet validation are valid with the average value 0.83 presented in Table 1.

In this research, the performance assessment sheet in the practicum of analyzing ZnO content in talcum powder was arranged including aspects of experimental preparation, data collection, group activities, and presentation of practicum results. The results validation of the performance assessment sheet is valid with the average value 0.84 presented in Table 2.

## 4. Conclusion

The instrument assessment scientific performance that has been developed to measure student scientific performance in the practicum of analyzing ZnO content in talcum powder is tested for content validation and analyzed for validity criteria. The results of content validation of instruments assessment scientific performance in the form of worksheets and performance assessment sheets along with rubrics were obtained from validity tests to three expert lecturers. Criterion validity of the developed instrument shows valid results.

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