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Development of High School Students' Creative Thinking Skill Assessment Instruments on Practicum the Effect of Surface Area of Touch Field on Reaction Rates

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Abstract

The purpose of this study was to develop an Assessment Instrument for High School Students' Creative Thinking on the Effect of Surface Area of Touch Field on Reaction Rates. The research was conducted on 15 class XI students at a high school in Bandung City and divided into 3 groups. The instruments developed were in the form of Basic Competency 4.7-based tasks and rubrics, with 8 indicators and 12 assignments, with 4 assessment rubrics per assignment. The instrument was validated by experts using a quantitative approach to validating the CVR content before being tried out. The quality of the scale is determined by the adequacy of the content using expert judgment, and an online Inter-rater Reliability test is administered and obtained by assessing students' knowledge of practical skills through the developed student worksheets. The results of this study were developed instrumentally, valid at CVR = 1, very reliable, and classified as very good with a Cronbach alpha value between 0.867 and 1.000. Based on the results of the study, it can be concluded that the performance assessment instrument developed fulfills the requirements as a good evaluation tool so it is suitable to be used as an assessment instrument to assess and measure Students' Creative Thinking Skills in practicum Effects of Surface Area of Touch Field on Reaction Rate.

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INTRODUCTION

Today's education requires students to develop higher order thinking skills including analysing, evaluating, and creating(Ramadhan et al., 2019). The 21st century is a time of growth in all aspects of life, including technology, science, society, the economy and education. A quality education will enable a student to achieve her 21st century educational goals. One of its goals is creative thinking skills(Howard et al., 2015). In education, students with advanced creative thinking skills tend to be more motivated and interested in carrying out mathematics learning activities at school(Hidayat & Widjajanti, 2018). These skills can be identified through an assessment process.

Assessment plays a very important role, because through evaluation the teacher can determine someone being taught has the competencies to be achieved(Kurniah et al., 2021). In general, the assessment does not only assess knowledge, but includes all methods used to collect information about knowledge, abilities, understanding, attitudes, and motivation(Fauziah et al., 2021). This means you can enhance learning by providing accurate and descriptive feedback to your students and engaging

them in the assessment process. One of them is the evaluation of the student's ability by the practicum method.

Practicum plays an important role in science education, because it can provide scientific method training to students by following the instructions detailed in the instruction sheet(Suryaningsih, 2017). Many researches on performance appraisal have been carried out, showing that performance appraisal assessed in practical skills are not limited to skills in using tools, but also must understand the steps involved, practical steps and how to use certain tools and materials. The resulting performance appraisal instrument can assist teachers in making assessments, but in practice it requires more than one appraiser and in conducting performance appraisals in practicum should be done individually not in groups to assess each skill each student(Firmansyah et al., 2020; Nahadi et al., 2017; Siswaningsih et al., 2017).

Based on the results of interviews with a chemistry teacher at one of the high schools in Bandung, information was obtained that when the practicum material on the factors that affect the reaction rate was carried out in one meeting, the teacher gave an assessment of the students based on the report on the results of the practicum and the students' motivation to do the practicum. Due to lack of tools and materials at school(Nahadi et al., 2017), the skill aspect was not paid attention to and the teacher was more focused on cognitive assessment, this could be due to a lack of knowledge about skill instruments, lack of facilities and low teacher motivation(Diawati et al., 2017).

Evaluation is the process of gathering data in the form of information that can be used for decision making. A chemistry performance assessment assesses what a student can do with all the knowledge and skills acquired. Evaluation activities need a means of reference in the implementation process. Building on the history of development, the creation of assessment tools is based on an approach that emphasizes validity and reliability, teachers and students(Lyon, 2011). The assessment tools developed in this study are in the form of tasks and rubrics [8]. Rubrics are guides for evaluating student performance and work.

Thinking skills are reflective, internal, and directed intellectual processes involving the formation, application, analysis, collection (synthesis) of concepts, or evaluation of information generated through observation, experience, reflection(Ghanizadeh, 2017), or communication as a basis for action. It is a reflective, critical, and creative thinking activity(Oncu, 2016). Creative thinking skills are also called alternative thinking skills(Alkhatib, 2019). This means that you can look at the problem from different angles and generate new ideas. Williams (1968) discusses the indicators of creativity further: fluency, flexibility, originality, and elaboration of ideas(Wijayati et al., 2019).

The quality of a good assessment instrument is reflected in aspects of its validity and reliability. Validity is a measure of how well a measuring instrument measures what it is designed to measure(Almanasreh et al., 2019). An instrument is said to have high validity if it can actually measure a student's measurement ability. Reliability is a measure of the degree to which a measuring device truly and reliably provides a person's capabilities. If the instrument is reliable, repeated measurements will give the same information(Schwartz et al., 2019).

So far, there has been no research that performance assessment instruments for creative thinking skills have been developed. Therefore, the purpose of this study was to develop a Creative Thinking Assessment Instrument for Senior High

School Students on the Effect of Surface Area of Touch Field on Reaction Rates.

RESEARCH METHODS

This study was conducted using referenced and modified development and validation methods from those used by Adams and Wieman(Adams & Wieman, 2011). The participants involved in this study were 15 students of class XI IPA who studied the factors that affect the rate of reaction. Data analysis was carried out to determine the feasibility of the developed instrument based on validity, reliability and practicality.

In this study, content validity was tested on 5 validators using the CVR method, and the reliability method used was inter-evaluator reliability(Schwartz et al., 2019), with the determination of Student Worksheets carried out by measuring the consistency of more than one observer. This reliability was carried out on three groups of students (low, medium, and high student groups). The data collection process for this reliability test is carried out online via WhatsApp and email applications and processed using the IBM SPSS 20 application.

Validity testing was carried out by asking for expert judgment from five validators. The results obtained from the consideration of experts were then analyzed using the Content Validity Ratio (CVR). The CVR results were then compared with the minimum CVR value of one-sided significance of 0.05 with a total of 5 validators which was 0.99. The reliability test used the inter rater method with three raters and calculated the Cronbach Alpha value.

RESULTS AND DISCUSSION

Instruments Quality Based on Content Validity

In testing the content validity of the developed instrument, it is done by looking at the considerations and decisions of experts or validators consisting of four lecturers from the UPI Chemistry Education department and one chemistry teacher. In this validity test using a validation sheet in the form of a table containing indicators of skills, performance aspects (tasks), rubrics, suitability of skills indicators with performance aspects (tasks), suitability of performance aspects (tasks) with rubrics, and suggestions for improvement by providing a checklist in the column "Yes" if there is a match, and provide a checklist in the "No" column if there is no match between indicators, performance aspects and rubrics.

The results obtained from this content validity test are the CVR (Content Validity Ratio) value which is a content validity approach to determine the suitability of items with the measured domain based on expert judgment. The results of this CVR calculation are compared with the minimum CVR value with a one-tail test significance level of 0.05 the minimum CVR value with a total of five validators is 0.99.

Of the 13 performance aspects developed, there are eight performance aspects with a CVR value of 1 or greater than the minimum CVR value, and five performance aspects having a CVR of 0.6 or less than the minimum CVR value. The rating rubric has been improved. The CVR based on validator suggestions is 0.6, maintaining the performance aspect of CVR 1. In order for the developed instrument as a whole to be declared valid, the instrument is assigned a high degree of validity as to whether it can actually measure measurability(Almanasreh et al., 2019).

Instrument Quality Based on Inter-Rater Reliability

The instrument for assessing the creative thinking skills of high school students in the practical effect of Surface

Area of Touch Field on Reaction Rates developed is provided in table 1.

Table 1. Creative Thinking Assessment Instrument for Senior High School Students on the Effect of Surface Area of Touch Field on Reaction Rates

Indicators	Task	Rubric
1. Choose the materials and tools needed for the practical factor of Surface Area of Touch Field on the reaction rate with an adequate and relevant amount (fluency and flexibility)	1.1 Select the materials used for the practical factor of Surface Area of Touch Field on the reaction rate in an adequate and relevant amount	**Scoring guidelines:** 3: choose materials and reagents that can show the occurrence of reactions quickly and easily obtained with the right amount 2: choose materials that can show the occurrence of reactions quickly and chemical reagents that are difficult to obtain in the right amount 1: choosing materials and chemical reagents that are difficult to obtain and showing the occurrence of reactions in the right amount 0: choose materials and chemical reagents that do not show the occurrence of a reaction
2. Designing work steps to carry out practical work on the factor of the Surface Area of Touch Field on the reaction rate in detail and sequentially (fluency and Elaboration)	2.1 Designing work steps to carry out practical work on the factor of the Surface Area of Touch Field on the reaction rate	**Scoring guidelines:** 3: designing work steps in detail and sequentially 2: planning work steps sequentially but not in detail 1: designing work steps in a non-detailed and non-sequential way 0: not planning work steps

Determination of reliability of the instruments developed in this study was performed using inter-rater methods to determine inter-rater consistency in assessing student work. The test for this study used his student worksheets as a data collection tool given to students. The student worksheets included questions in the form of developed achievements and choices in the form of rubrics developed with the 15 students.

After the performance class, they are divided into three groups. Initial recognition of the students, namely high group, medium group, low group and her three observers who are students of the Department of Chemistry Education. Data collection for this reliability study was done online using Whatsapp and email applications as the students involved were engaged in distance learning. The grouping is based on the summary results of student performance obtained from her three observers who evaluated. A comparison of cronbach alpha value can be seen in figure 1.

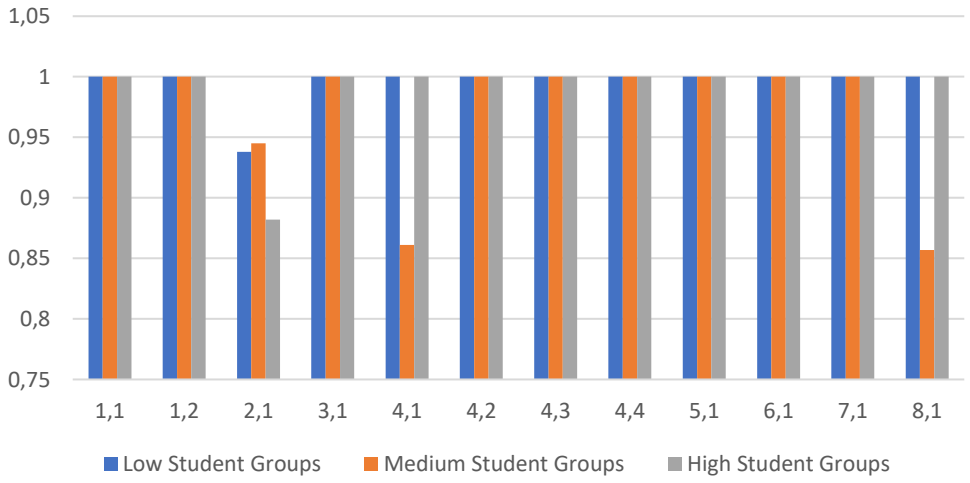

Figure 1. Comparison of Cronbach Alpha Value

Based on figure 1, it can be seen the Cronbach alpha values of the high and low groups have almost the same charts and are higher than the middle group. This may occur due to differences in observer accuracy and concentration, which diminishes as the observer gives each student a score. This is because all students are evaluated at the same time and the number of students in the middle group has a higher number, high group and low group.

Overall, the more frequently occurring Cronbach alpha values between 0.867 and 1.000 have very high values(Bhatnagar et al., 2014). It can be said that it is highly reliable and consistent(Schwartz et al., 2019). In other words, if the instrument is reliable, repeated measurements of the same object under the same conditions will yield the same or nearly the same information. This can be caused by 1) Observer evaluation is usually straightforward. That is, giving points to her Student Worksheets which the student completed using a clear and pre-determined rubric; and 2) Students have the opportunity to learn about the same practicum implementation.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the research conducted, the creative thinking skill assessment instrument developed based on the validity test met the valid requirements valid at CVR = 1, highly reliable, and very well classified with Cronbach alpha values between 0.867 and 1.000. So this instrument can be used to help teachers assess creative thinking based on student performance and also can be used as a motivation for teachers and students to learn in an practicum way.

Based on the research that has been done, there are several recommendations for several parties, including: 1) It is necessary to conduct direct trials to determine real reliability; 2) The student worksheet used in this study's data collection process can be used as material to determine students' initial knowledge abilities before carrying out direct practicum; and 3) It is important to test the validity of a number of performance elements that have been corrected.

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