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DEVELOPMENT OF AUTHENTIC ASSESSMENT BASED ON CREATIVE THINKING SKILLS IN A CARBOHYDRATES QUALITATIVE ANALYSIS PROJECT-BASED USING LOCAL MATERIAL

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ABSTRACT

Laboratory activities can improve creative thinking skills. This study aims to develop an authentic assessment based on creative thinking skills. This research is development research with the Rowntree development model. The research stages consist of the planning stage, the development stage and the evaluation stage. Data were analyzed using CVR and test description. This study was conducted with 33 participants. This research has produced an authentic assessment instrument consisting of learning indicators, written tests, test rubrics, product rubrics and psychomotor assessment rubrics. An authentic assessment developed in the qualitative analysis of carbohydrates with a CVR value obtained is +0.70, which can be considered valid for all validated components. The authentic assessment reliability test resulted in an average score of 56.56, a standard deviation of 25.06, and test reliability of 0.82. from the analysis, it was determined that the authentic assessment based on creative thinking skills of qualitative analysis of carbohydrates with local material developed had met the valid and reliable criteria.

Keywords: authentic assessment, carbohydrates qualitative analysis laboratory

INTRODUCTION

Improving the quality of education starts with improving the quality of learning. Improving the quality of learning can be started by setting the right learning objectives [1]. Learning is a comprehensive activity consisting of planning, process, and evaluation. The learning objectives consist of three aspects, knowledge, attitudes and skills. A learning goal can be achieved through the process of assessing learning outcomes. According to Permendiknas Number 20 of 2007 concerning Educational Assessment Standards, assessment is collecting and processing information to determine the achievement of student learning outcomes. Implementation of the assessment requires an assessment instrument in the form of questions to assess cognitive, affective, and psychomotor abilities. The assessment instrument can be used as a guide in evaluating learning activities [2].

The quality of assessment instruments will affect the accuracy of the students' evaluation result assessment. Some assessment instruments used in learning with

laboratory activities are pre-post-tests for cognitive learning outcomes and performance for psychomotor learning outcomes [3]. The learning achievement in the practicum of carbohydrate project-based qualitative analysis using local material is creative thinking skills.

Creative thinking skills are an important part of our daily lives and are important skills in practical courses [4]. There is much research on laboratory activities that drill creative thinking. The indicators of creative thinking skills are *flexible, fluent, unique* and *unordinary thinking*[5]. Creative thinking skill was developed through hands-on, experimental observatories, creative drama, modelling, and field studies used in a project [6]. Laboratory work was designed to develop creative thinking skills [7-10].

Carbohydrate qualitative analysis was designed on project-based, which utilizes local material (PjBLLM) [11]. Several previous research projects have stated that project-based learning supports creative thinking skills [12]. Students can develop their creative thinking skills to overcome their life obstacles and future work life. Project-based learning enables students to become creative [13]. Furthermore, Project-based learning in practicum can improve creative thinking skills [14-18].

Preliminary research concerning Biochemistry practicum on PjBLLM protein quantitative analysis enables the students to improve their creative thinking skills [19]. However, carbohydrate qualitative analysis practicum has not been obtained assessment aspects covering creative thinking skills, while there are many steps in the practicum which demand such skill.

The assessment of qualitative carbohydrate analysis is not sufficient if it only uses written assessment, which only measures the cognitive knowledge of the university students. The assessment of practicum activities uses an instrument that can assess the learning comprehensively and correctly. Authentic assessment is recommended in practicum courses since it can assess the students' real abilities. The use of such authentic assessment will provide more direct proof of the application of skills and knowledge [20].

Many studies have reported the development of authentic assessment instruments. For example, an assessment was developed through peer collaboration to develop high order thinking [21]. Another previous study has also developed inquiry-based authentic assessment [22]. Furthermore, an assessment developed authentic- peer assessment [23]. Authentic assessment can develop critical thinking skills [24]. This was developed as an authentic assessment for biology learning [25]. Based on the background above description, some studies have been done on the development of authentic assessments for practical activities. however, there are no studies that specifically develop authentic assessments that are specifically based on creative thinking skills.

METHODS

The research method employed in this research was Research Development. The development model used was the *Rowntree* development model using Tessmer's evaluation. The *Rowntree* model is a development model oriented towards producing a product, in this case, a teaching

material product. This model contains three stages, including the planning stage, the development stage and the evaluation stage [26].

1. Location and Research Subjects

The research was conducted in April-November 2020 at the Chemistry Education of Universitas Sriwijaya with 33 participants in semester 5 of 2020/2021 and 5 validators. The five validators consist of two evaluation experts, two biochemical content experts, and one media expert. The research subject was an authentic assessment instrument based on creative thinking skills to assess the Biochemistry practicum course's knowledge and psychomotor (performance test) aspects.

2. Research procedure

In this research concerning the development of authentic assessment instruments, the outcomes product is a written test instrument to assess the knowledge and performance test instruments that will be used to assess the students' practicum psychomotor skills. The research procedure was adjusted to the *Rowntree* development model [26].

3. Planning Stage

This stage has several steps; the first step needs analysis, which aimed to design the indicators of cognitive and knowledge abilities and psychomotor abilities in the Biochemistry practicum. Second, constructing a written test grid from the indicators of cognitive and psychomotor abilities.

4. Developmental Stage

At this stage, the assessment instrument was developed and then validated and tested at the validation and trial stages. At this stage, the authentic assessment stage and the development of the assessment rubric task are The development of test questions, tasks, and assessment rubrics becomes the design of authentic assessment instruments in written tests and performance tests.

5. Evaluation Stage

The evaluation stage includes the instrument validation stage and the instrument testing stage. The following are details of the research steps at the validation and testing stage of the instrument. The steps are the test instrument developed was validated by the expert judgement consisting of five expert lecturers, the results of the content validation by expert judgment were then analyzed using CVR analysis. Finally, the results of the CVR calculation are compared with the critical CVR values of the five validators. Content validation asks for expert consideration in the suitability of the items with the objectives achieved. Content validation also includes the suitability of the task with the objectives and the suitability of the task with the assessment rubric.

The results of the experts' considerations were analyzed using Content Validity Ratio (CVR) analysis [27]. Every item considered important by more than half of the validators has a good content validation level. Therefore CVR analysis was formulated

$$CVR = \frac{ne - \frac{N}{2}}{\frac{N}{2}}$$

ne: Number of experts stated the question item as important

N: Number of members of expert team

Based on comparing the calculated CVR value using the critical CVR, the validity of the developed items and tasks was obtained. In addition, according to the validation stage, notes of improvement and suggestions to improve the developed instruments were also obtained so that a valid test instrument was obtained.

The number of validators who validated the authentic assessment instrument developed was five validators. According to the Schipper table, the critical CVR value for five validators at a one-sided significance level of 0.05 is 0.573. Therefore, if the calculated CVR value is still above the critical CVR value, the instrument is valid to be used. Meanwhile, if the calculated CVR value is lower than the critical CVR value, the instrument is invalid to be used.

The valid test instrument follows the evaluation stage was then used in try-out to see the reliability and analysis of the question items. The reliability of the try-out result was calculated to know the reliability of the authentic assessment instrument in assessing the knowledge with 33 students in Carbohydrates qualitative analysis. The instrument reliability assessment used Anatest software description.

RESULTS AND DISCUSSION

The result of the research is explained according to the research stage.

1. Planning Stage

A needs analysis was performed for the authentic assessment instrument. The interviews results with lecturers who guide the development of authentic instruments are considered to be very much needed to support the implementation of a project-based qualitative analysis of carbohydrates using local materials. The needs analysis results in the field show that the practicum assessment has been carried out covering assignments, UTS and UAS. The value of the assignment is taken from the activities and practicum reports carried out by students; the UTS value is taken from the practical value of students. UAS is carried out with a written exam. However, no authentic assessment instrument is specifically devoted to practical activities that train creative thinking skills.

2. Developmental Stage

At this stage, the indicators of creative thinking skills were also developed. The indicator of creative thinking skills is Fluency, about Stating more than one idea about local materials surrounding them, which contain carbohydrates as practical materials that can be used in qualitative analysis of carbohydrates. Proposing methods and ideas related to procedures that can be used for carbohydrates qualitative analysis practicum by using local materials. **Flexibility**, Grouping local materials as practical materials, Finding and providing reasons for using local materials that are not commonly used as sources of carbohydrates in carbohydrates qualitative analysis. Finding at least two alternatives proposed appropriate practicum procedures for carbohydrate qualitative analysis using local materials through literature reviews and information technology. **Originality,** Able to adopt and adapt ideas to produce practicum procedure for qualitative carbohydrate analysis. **Elaboration**, Able to make clear details

regarding the practicum procedure in determining the monosaccharides, disaccharides and polysaccharides [28].

Creative thinking skills tests, creative thinking skills assessment rubrics, performance appraisal rubrics and creative product assessment rubrics are developed at this stage. The four instruments were validated at the evaluation stage. The design of this authentic assessment instrument must have gone through the validation stage both by experts and student readability.

3. Evaluation Stage

An expert conducts instrument design validation to get suggestions and feasibility of instrument design improvements. The Validation included indicators of creative thinking skills, tests and rubrics for creative thinking skills, performance/psychomotor assessment rubrics. Validation was carried out by five experts, who are biochemists and science education evaluation and media experts. The test was validated by testing the items on 33 students taking the Biochemistry practicum course. The results of the test validation were then analyzed using Anatest software description.

Validation sheets in the form of "judgments" on learning instruments were used to determine the validity of the content in this research. The results of Validation by experts were then analyzed using Content Validity Ratio (CVR) analysis as formulated by Lawshe [27]. The average CVR value for each component can be seen in Table 1.

Based on the CVR critical value table analyzed for five validators (α = 0.1), the critical value was 0.573, which means that only units with a CVR value more than 0.573 were considered valid [28]. The CVR value obtained was +0.70, which means that it can be considered valid for all validated components. The instrument improvements of the validation results can be seen in Table 2.

Table 1. Validation Results by Expert

No	Component	CVR	Follow-Up
1	Indicator of creative thinking skill	+1.00	Improved and able to be used
2	Test of creative thinking skill	+0.70	Improved and able to be used
3	Assessment rubric of the test of creative thinking skill	+0.60	Improved and able to be used
4	Assessment rubric of performance/ psychomotor	+0.60	Improved and able to be used
5.	Assessment rubric of creative product	+0.60	Improved and able to be used
	Average CVR	+0.70	

Table 2. Points for Assessment Instrument Improvement of the Validation Result

Component	Improvement based on Validation	Improvement based on Try-Out
Indicator of creative thinking skill	Improvement of sentence on the question	Sentence on the question was made clearer
Test of creative thinking skil	The assessment criteria was formulated clearer so that the assessment can be done easier	For example, determine the procedure of carbohydrate qualitative analysis into determining at least two procedures of qualitative carbohydrate analysis
Assessment rubric of the test of creative thinking skill		
Assessment rubric of performance/ psychomotor		
Assessment rubric of creative product		

Validation results is shown in Figure 1. The validator asks for an improvement in the sentence on the test. From Figure 1, it can be seen that the test has been arranged based on the indicators of creative rubric skills.

Tes Ketrampilan Berpikir Kreatif Analisis Kualitatif Karbohidrat

Kompetensi Dasar	Indikator berpikir kreatif	No soal	Soal	Kunci	Kategori	
					Sesuai	Tidak
Melakukan praktikum dengan terampil, berpikir kreatif dan menciptakan produk kreatif dengan memanfaatkan material lokal sebagai bahan praktikum biokimia analisis kualitatif karbohidrat .	***Kelancaran (Fluency)*** • Mencetuskan lebih dari satu gagasan mengenai material lokal di sekitar mereka yang mengandung karbohidrat sebagai bahan praktikum yang dapat digunakan dalam analisis kualitatif karbohidrat • Mengajukan cara, gagasan terkait prosedur yang mungkin digunakan untuk praktikum analisa kualitatif karbohidrat dengan memanfaatkan material lokal	1.	Sebagai mahasiswa anda mendapat tugas untuk menguji beberapa sampel makanan di pasar. Anda diminta melakukan uji kualitatif karbohidrat. a. Pilihlah 5 jenis makanan di pasar yang menurut anda mengandung karbohidrat.	Beras, kue, roti, biskuit, tempe, tahu, dll	✓	
			b. Uraikanlah cara mengidentifikasi karbohidrat secara kualitatif untuk 5 sampel yang anda pilih.	Pertama dengan identifikasi karbohidrat secara umum dengan menggunakan tes Molisch. Setelah hasil menunjukkan positif, dapat diidentifikasi dengan melakukan uji karbohidrat spesifik terhadap golongan karbohidrat baik monosakrida, disakarida dan polisakarida	✓	
	Keluwesan (flexibility) • Mengelompokkan material lokal sebagai bahan praktikum		c. Kelompokkanlah makanan yang kamu pilih tadi berdasarkan golongan karbohidratnya	Sampel positif terhadap tes Iodion= mengandung polisakarida Sampel positif pada tes Barfoed selama 7-12 menit = mengandung disakrida Sampel positif terhadap tes Barfoed selama 5-7 menit diikuti tes Tauber, Seliwanoff dan peragian= mengandung monosakarida	✓	

Figure 1. Sample of the validation

The validity and reliability of each item were performed using a try-out by the students who enrolled in the biochemistry practicum course. The try-out was conducted on 33 students with the description questions on the subject of carbohydrates qualitative analysis. The test results were analyzed using Anatest software description. Table 3 concludes the Anatest's results.

Table 3. Analysis Result of Carbohydrate Practicum Test Items

No Question	Carbohydrate Qualitative Analysis		
	% Discernment	Level of difficulty	Significance
1a	5.00	Medium	Not significant
1b	41.67	Medium	Significant
1c	25.00	Easy	Not significant
2a	87.50	Medium	Very significant
2b	83.33	Medium	Very significant
2c	33.33	Medium	Significant
3	91.67	Medium	Very significant

The item analysis results on the carbohydrates qualitative analysis included an average score of 56.56, the standard deviation of 25.06, and test reliability of 0.82. According to the results of Anatest, improvements were made to two items number. The items number 1 a and 1 c can be seen in Figure 1.

Figure 1, in question no. 1a the results of the analysis are not significant. The improvements made to question no 1a do not limit the answer by eliminating the word food ingredients, only local materials. While question no. 1. c is not significantly improved by clarifying monosaccharides, disaccharides, and polysaccharides

This research produced an instrument that has been developed according to the creative thinking skills indicators that have been also developed in the current research.

Creative thinking skills were drilled at all stages of the project-based learning model using local materials, including four indicators of creative thinking skills: fluency, flexibility, originality, and elaboration [29].

During the analysis, students involved saw whether the selected sample contains carbohydrates or not. The qualitative analysis practicum of carbohydrates requires students also to carry out a qualitative test of carbohydrates on local materials. Therefore, through the process, they can distinguish which material belongs to the monosaccharide, oligosaccharide and polysaccharide groups. Qualitative analysis of carbohydrates also began by formulating several questions related to practicum by students. The questions that arise include is it true that rice contains carbohydrates? Why do we feel full when eating *pempek*? Can drinking apple juice meet carbohydrates? The results of student analysis of apple juice can be seen in Figure 2 below.

Carbohydrate Test	Qualitative Target	Experience PjBLLM
Molisch Test (+) purple ring formed		
Benedict Test (+) a brick red precipitate is formed		
Barford test (+) a brick red precipitate is formed		
Seliwanoff Test (+) red solution		
Iodine Test (+) purple solution		

Figure 2. Qualitative test of carbohydrates in apple juice

These questions cause the students to find and select local materials (including pempek, bread, rice, noodles, sausages and some fruit juices example figure 2, apple juice) as the practical materials. Students' creative behaviour was developed when they

had to choose several unknown carbohydrates sources such as fruit juices in the qualitative analysis of carbohydrates. It is similar to what was done to determine the group and amount of carbohydrate content in ingredients that are not the main source of carbohydrates, milk [30]. The determination of carbohydrate groups was determined by the Molisch test, Iodine test, Benedict's test, Seliwanoff's test, and Barfoed's test [31].

Creative thinking was also developed when students determined the titles, objectives, equipment and materials, and chose what procedures to use to perform the carbohydrate qualitative test.

According to the practical stages of carbohydrate qualitative analysis, which implemented project-based learning, the practicum learning has achieved the creative thinking skill as the learning outcome. It is necessary to develop sufficient instruments to measure creative thinking skills. Thus, the authentic assessment was developed. This is in line with previous research was developed authentic peer assessment to see the laboratory capabilities [23,24]. Creative thinking skills in science learning with the projects equipped by assessment instruments, but not for laboratory activities [6].

CONCLUSION

A study has been conducted to develop authentic assessments in qualitative chemistry analysis lectures, in the form of creative thinking skills tests and practical assessment rubrics. Based on the findings and discussion, it can be concluded that the authentic assessment developed in the qualitative analysis of carbohydrates in this study was proven by The CVR value obtained was +0.70 which means that it can be considered as valid for all validated components. The assessment can be concluded that it can be used in the practicum of qualitative analysis of carbohydrates. The results of the authentic assessment legibility test resulted in an average score of 56.56, standard deviation of 25.06, and test reliability of 0.82. This research produced an instrument that has been developed according to the creative thinking skills indicators.

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