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Developing Instruments to Measure Student's Creative Thinking Skills in Vocational Schools

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Abstract. Introduction: Learning activities require creative thinking skills in supporting sustainable development. Instruments that measure the creative thinking skills of vocational school students are still very limited. Purpose: This article aims to develop and validate instruments in measuring the creative thinking skills of vocational school students. Methods: Research data obtained through tests of creative thinking skills based on sustainable development. Item analysis to determine the internal consistency criteria used Pearson Product Moment on data collected from thirty-five students. The instrument consists of a verbal test (28 questions) and a figural test (2 questions) in measuring the components of fluency, flexibility, originality, and elaboration. Instrument reliability was determined using the Cronbach alpha coefficient. Result: The internal consistency criteria of each component is relatively high. The lowest average degree was 0.536 for the flexibility component, and the highest average degree was 0.727 for the fluency component. The Cronbach alpha coefficient for the reliability test was 0.723. Conclusion: The results revealed that the instrument of creative thinking skills is a valid and reliable tool for assessing the creative thinking skills of vocational school students.

Keywords: *Creative thinking skills, Vocational school students, explanative study, Instruments, sustainable development*.

INTRODUCTION

The main priority of vocational schools is to make graduates ready to work in the business or industrial world. This emphasizes the importance of synergy between vocational schools and business people. A strategic partnership between the world of industry and the world of work to create a link & match is a necessity that must be done to prepare human resources who are ready to face a sustainable future [1], [2]. Links & matches through the Vocational Home include curriculum alignment, learning process alignment, capacity building for vocational human resources, internships, structured fieldwork practices, guest lecturers/teachers, graduate absorption, scholarships, competency certification, assistance with infrastructure, introducing technology and work processes industry, as well as applied research.

Aligning the quality of learning in the form of skills that can solve existing needs and problems. This is in line with the basic concept of 21st-century learning, namely students must have high-performance standards and mastery of learning material in depth so that they can face the complex challenges of the era [3]. Students in vocational schools today need to equip skills that are different from those learned by students in the past. These skills reflect special demands in the face of a complex, competitive, knowledge-based, information age, and technology-based society economy [4].

Creative thinking is a special skill that vocational school graduates demand in dealing with the complexities of society. Steps that can be taken to create adaptive graduates are to develop creative thinking skills using learning

methods that are implemented in the learning process [5]. Creative thinking skills are at the core of the learning process so that students have competence in solving problems related to everyday life [6]. Students without thinking skills will certainly have an impact on failure in facing the complexity of problems encountered in the challenges of the times.

Teachers play an important role in realizing educational goals in developing students' creative thinking skills. However, the fact that students' creative thinking skills tend to be low [7], [8]. For that creative thinking skills of students must be a serious concern considering the low percentage of each indicator. This is caused by a lack of understanding of what dimensions of creative thinking are measured. Many teachers fail to formulate what creative thinking constructs will be measured [7]. Assessment of creative thinking skills is subjective, this is due to the difficulty of measuring unknown indicators.

A valid and reliable instrument in measuring creative thinking skills in vocational schools is needed to know the level of student's creative thinking skills. This study focuses on developing and validating instruments for teaching creative thinking skills. The use of such an instrument can pinpoint specific areas where teacher education and professional development are needed to better teach and enhance the teaching of creative thinking skills.

METHOD

This research is a sequential mixed methods research study [9]. The data collection and analysis at the initial qualitative stage were derived from the results of the review of three experts regarding the validity of the instrument content. The quantitative stage of data collection and analysis was carried out in the form of a survey study of vocational school students. To develop the instrument, the authors first made items based on a thorough literature review. Next, three experts in language, curriculum, and literature reviewed these points. After revised items based on expert reviews, the instrument items were tested on students for revision and validation.

Respondents in this study were thirty-five vocational students who were recruited through sampling from three different vocational schools in Klaten, Central Java, Indonesia. Respondents were 85% male, and 15% female. Respondents were given 30 items on the creative thinking skills instrument trial. The results of the revised instrument trial were then reviewed by three experts until they met the standards of the experts.

The elements in a measuring instrument must be truly relevant and represent the construct by the measurement objectives [10]. For this reason, [11] suggests calculating the content validity coefficient based on the results of the expert's assessment of n people on an item in terms of the extent to which the item represents the measured construct. The item analysis technique to determine the internal consistency criteria [12] was carried out using Pearson's product-moment. Items with an internal consistency criterion value lower than 0.30 mean less consistency and should be excluded from the instrument. Reliability test using Alpha Cronbach. An instrument is defined reliably if the reliability coefficient is 0.7 or more. All statistical tests were two-sided with a significance level of 0.05.

RESULT AND DISCUSSION

1. Development of instruments

This instrument was developed based on Torrance tests of creative thinking (TTCT) [13]. The research begins by compiling a construct based on theory, resulting in four constructs, namely fluency, flexibility, elaboration, and originality. Each construct is further developed for each indicator of each construct. Based on these indicators, the next step is to sort out items that are not by the field of the survey by considering items that are unreliable and reliable in vocational school learning. Next is to adjust the terms used in the other items to better suit the vocational school context since the study [13] is in the context of psychology. After that, write down the additional items needed to fulfill the minimum item for each indicator. This step resulted in the proposed survey items for four constructs of creative thinking skills consisting of a total of 30 items. Fluency and flexibility each consist of 8 items, while elaboration and originality each consist of 7 items.

2. Content validity

The first thing to do after the preparation of the instrument items was to validate the content. The instrument is called valid if it measures what it should be measured [14], [15]. After the establishment of the initial item set, three experts in language, curriculum, and literature on creative thinking skills individually reviewed all items. Based on the results of the linguist's study, it is necessary to make some changes to the structure or meaning of the items. Also, more precise synonym words need to replace some words. Based on input from curriculum experts, the

instrument needs some improvement so that the words or sentences used must lead directly to the specific characteristics of vocational knowledge so that it is easier for respondents to understand. The fix is to replace words or sentences that do not lead to the vocational field with sentences that focus on the vocational field.

Experts in instrument tools and the creative thinking skills literature provide content validation. Paul Torrance [13] identifies four main characteristics of the creative process, including originality (having unique ideas), flexibility (alternative thinking about ideas), fluency (abundant ideas), and elaboration (adding to the complexity and richness of ideas). Creative thinking skills are part of a divergent thinking process that stimulates curiosity. Paul Torrance [13] also does not see creativity as a fixed condition but believes that creative thinking can be developed. This study views creative thinking as a combination of four constructs. This research uses theoretical literature review and empirical research literature review as a source of information that helps describe the model being built.

Based on suggestions for improvement from three experts, improvements were made and the results were consulted again with the experts. And so on until the expert approves the improvements made. Thus, the results of content validation in the form of a model built for creative thinking skills consists of four components, namely FU, FL, OR, and EL.

3. Reliability

Reliability is determined by repeatedly measuring the construct or variable interest. The higher the degree of association between the scores obtained through repeated measures, the more reliable the scale. In this study, the variable reliability test was measured using Cronbach's alpha. Cronbach's Alpha is a reliability measure that has values ranging from zero to one [16]. According to [17], the minimum reliability level for Cronbach's Alpha is 0.70.

The Cronbach alpha coefficient generally increases as the correlation between items increases. Table 2 presents the results of the instrument reliability test. In table 2, it can be seen that the Cronbach instrument's alpha coefficient is 0.723. Therefore, it is categorized as relatively high. The results show that the instrument can be used to measure several of the same indicators.

Table 2. The reliability level of Cronbach's alpha instrument.

N of Items	Cronbach's alpha coefficient
30	0.723

4. Item analysis

The instrument made at the beginning of the research planning must be seen on the reliability of each item. Each item must support the construct [16]. This means that the faithful item must be positively correlated with the total score because the total score is considered to represent the construct. In other words, each item must be consistent with its total score. The internal consistency of each item is seen from the correlation between the scores of these items and the total score. The results of calculating the internal consistency index with the product-moment correlation formula from Karl Pearson are as shown in Figure 1.

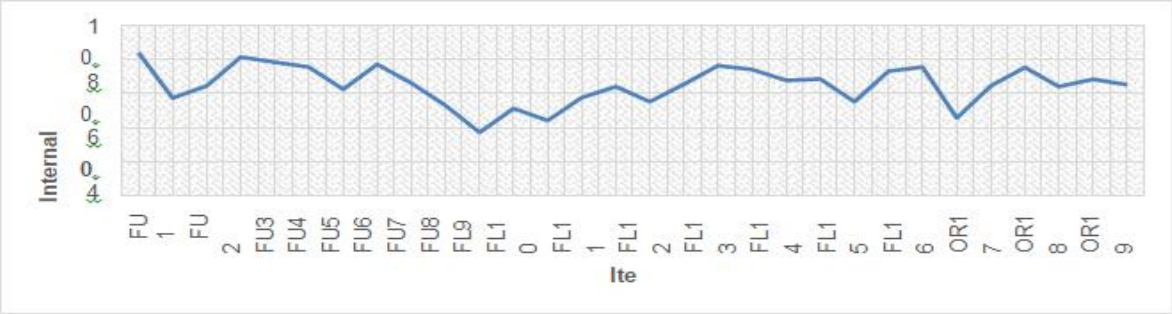

FIGURE 1. The criterion of internal consistency

As seen in Figure 1, these thirty items have an internal consistency criterion of more than 0.30. According to [12], a questionnaire item has good internal consistency if the internal consistency index is equal to or more than 0.3. This means that all of these items have good internal consistency so that it is said that all items are positively correlated with the total score.

The components of creative thinking with the highest and lowest mean of internal consistency criteria were Fluency (mean FU = 0.727) and Flexibility (mean FL = 0.536), respectively. A high standard of internal consistency indicates that these items are closely related in each component [13]. Thus, high internal consistency means that the

instrument measures all aspects of a construct. In contrast, low internal consistency means that the response varies from article to object, possibly not properly structured items. Therefore the respondents may interpret it differently.

CONCLUSION

This paper aims to describe the instrument development process and the validity of reliability. Through a series of validations carried out by experts, the theoretical model of the instrument is found to be valid. The internal consistency criteria of each instrument construct were relatively high. The reliability test using Cronbach's Alpha Coefficient produces a reliable instrument category. Thus, it can be concluded that the instruments developed in this study have consistency for measuring creative thinking skills when used in different measurement times. Reliable instruments will produce small measurement errors. So, a reliable instrument is an instrument with a small error rate in measuring the creative thinking skills of vocational school students.

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