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Validity of the CDR-Po Learning Model to Develop Students' Creative Thinking Skills in Middle School Science Learning

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Abstract:- The purpose of this study was to determine the validity of the learning model of Construction Deconstruction Reconstruction - Provocation (CDR-Po) which was developed to train students' creative thinking skills in middle school science learning. The research subject was the CDR-Po model. The validity of the model is obtained through the assessment of three experts who are competent in Chemistry and Science Education. Assessment of validity includes content validity and construct validity. Data collection techniques are applied by averaging the scores of the assessors for each assessment indicator. Data analysis techniques are descriptive qualitative. The results showed that the CDR-Po learning model was concluded to be valid and reliable to develop students' creative thinking in junior high school science learning.

Keywords:- *Validity, CDR-Po Learning Model, Creative Thinking Skills, Middle School.*

I. INTRODUCTION

Creative thinking is one of the keys to achieve success in life. Creative thinking is the ability to think of ideas in new and different ways and to produce unique solutions [1]. The 21st-century global learning framework accommodates efforts to increase creative thinking through core subject learning, including Science subjects [2]. Creative thinking is the essence of creativity. Efforts to improve creativity through the learning process are becoming crucial; because 2/3 of one's creative abilities are obtained through education and the remaining 1/3 is obtained genetically [3].

Creativity is a habit so that it can be trained. Training students' creative thinking in learning Science needs specific learning models. Science tends to require ability to think convergently. On the other hand, production of ideas requires the ability to think divergently. A learning model has been developed to train students' creative thinking in science learning, namely the Construction Deconstruction Reconstruction-Provocation (CDR-Po) model.

This study is aimed to determine the level of validity of the CDR-Po learning model in junior high school science learning.

II. MATERIAL AND METHODS

A. CDR-Po Learning Model

The CDR-Po learning model has undergone several revisions of the original model [4]. The CDR-Po model has four characteristics. First, a creative atmosphere must be created at an early stage. Creative atmosphere is an open, relaxed, comfortable atmosphere through the use of humor. Creative atmosphere could build students' intrinsic motivation. Second, convergent thinking skills are needed. Convergent thinking is necessary in building Science concepts in students' mind. Students learn the concepts of content learned through cooperative activities in small groups. Third, divergent thinking skills are needed. Divergent thinking is needed in generating ideas. Finally, provocation techniques are used to generate ideas. Provocation is a technique of generating ideas individually by lateral thinking [5]. Lateral thinking is seeing things extensively and from various points of view [6].

The syntax of the CDR-Po learning model consists of four phases as presented in Table 1.

Phase	Activity
1	Creating a creative atmosphere (humor and intrinsic motivation)
2	Constructing the concept
3	Deconstructing concepts and generating ideas
4	Reconstructing the concept and accepting the idea

Table 1:- Syntax of Learning Model CDR-Po

B. Methods

The validity of the learning model is a certain characteristic of the model as indicated by the content validity and construct validity [7]. Content validity model is assessed through indicators such as the need for model development and recent knowledge (state of the art knowledge). Construct validity means that there is consistency between the developed model with the underlying theories. Construct validity models were assessed through 7 aspects, namely rationale of the learning models, theoretical support, syntax, social systems, reaction principles, support systems, instructional impacts and accompanying impacts.

Validity of the model was evaluated by 3 experts in Chemical Education and Science Education. The score range of validity level for each aspect of the assessment is 1 to 4, namely: (1) poor, (2) sufficient, (3) good, and (4) very good. The validity of each indicator of evaluated aspect is the average of the three experts' evaluation scores with criteria according to Table 2.

Score Interval	Criteria
$3.25 < P \leq 4.00$	Very valid
$2.50 < P \leq 3.25$	Valid
$1.75 < P \leq 2.50$	Less valid
$P \leq 1.75$	Invalid

Table 2:- Validity Criteria

Data were analyzed using qualitatively descriptive technique and the validity of the model determined by total criteria mode.

Model reliability is assessed through a percentage of agreement [8].

$$R = [1 - \left\{\frac{A-B}{A+B}\right\}] \times 100\%$$

where R: reliability coefficient
A: the highest score of the three validators
B: the lowest score of the three validators

The CDR-Po learning model is classified as reliable if the percentage of agreement (R) is greater than or equal to 75% [8].

III. RESULT AND DISCUSSION

A. Result

Validation result of the content validity of the CDR-Po learning model which was assessed using indicators of model development requirement and indicators of state of the art knowledge were very valid and reliable.

Validation result of the construct validity of the learning model are assessed by the seven aspects measured are valid and reliable, as shown in Table 3.

No	Assessment aspects	Validity criteria	Reliability
1	Rational learning model	Valid	Reliable
2	Theoretical support	Valid	Reliable
3	The synthax of a learning model	Valid	Reliable
4	Social system	Valid	Reliable
5	Principles of reaction	Valid	Reliable
6	Support system	Valid	Reliable
7	Instructional impacts and the accompanying impacts	Valid	Reliable

Table 3:- Validation of the Construct Validity of the CDR-Po Learning Model

B. Discussion

The content validity of the CDR-Po learning model was classified as very valid and reliable. This means that the model fit to the model development requirement in order to meet the 21st century skills demand, namely increasing creative thinking skills. The development of the model is new so that it meets the state of the art requirement.

Construct validity of the CDR-Po learning model is classified as valid and reliable, judging from the seven aspects measured. Valid rational learning model indicates that there is a fit between the rational and the purpose of the learning model. Theoretical support for models is valid as viewed from cognitive theory, sociocognitive theory, constructivity theory, and intrinsic motivation theory (creativity component theory). These theoretical supports are well represented in model syntax. The phases in the syntax indicate the existence of mutually supportive interrelationships and order of rational learning activities. Validity of the social system is indicated by the relationship pattern between teacher and student, and student and other students. The social system is classified as valid. The pattern of teacher and student relations allows students to proactively respond to assignments, shows the role of the teacher as a facilitator can be realized and can be managed by the teacher, and shows a student-centered learning. The pattern of teacher and student relationships gives students the opportunity to interact with teachers and other students. Validity of reaction principle is indicated by teacher's behavior in motivating and reminding students to maximize their ability of convergent and divergent thinking, giving students the opportunity to obtain the widest possible information, and giving appreciation and enthusiasm to students that they want to train their creative thinking in learning Science. Teacher behavior in each phase of the syntax is clearly stated. The support system of the learning model is very valid as indicated by Learning Implementation Plan (lesson plan), Student Books, Student Activity Sheets (student worksheets), and Assessment sheets which are supporting the operational of the CDR-Po learning model. The instructional impacts and accompanying impacts are classified as valid indicating both impacts are stated clearly and logically. The instructional impact in the form of creative thinking skills and understanding of the concept of Science shows the direction and objectives to be achieved. The accompanying impacts are the students' familiarity with humor, motivation to generate ideas, and motivation to learn Science voluntarily. In addition, the learning environment of each phase of the syntax is logical.

Theoretical support for the first phase of syntax (i.e. creating a creative atmosphere) of the CDR-Po learning model comes from cognitive theory, sociocognitive theory, and intrinsic motivation theory. Cognitive theory states that if students interact with the environment, they will experience relatively lasting changes in their mental structure [9]. If there is information that attracts students' attention, students will assimilate [9]. Sociocognitive theory states if students observe the behavior of others, then the mental structure of students will experience changes that are relatively enduring [9]. Theory of intrinsic motivation states that if students are motivated, then they will have more focus on carrying out their tasks [6]. If students are intrinsically motivated, then their creativity will increase [10;11]. According to Amabile, everyone has the ability to think creatively so that everyone can be creative [12].

Theoretical support for the second phase of syntax (i.e. constructing the concept) of the CDR-Po learning model comes from cognitive theory, sociocognitive theory, constructivity theory, and intrinsic motivation theory. According to cognitive theory, the better student's understanding of a discipline, the higher their ability to create [9]. If students master the domain, the divergent thinking of these students will lead to creative products [9]. The more knowledge students have, the more ideas are generated [13;14;15]. In the second phase of the CDR-Po model syntax, students work on the lesson plan cooperatively so that each has the opportunity to observe the behavior of other students. According to sociocognitive theory, if students observe the behavior of others, their mental structure will experience relatively lasting changes [9]. Vigotsky's constructivity theory states that students's interaction with others will trigger the construction of new ideas and enhance their intellectual development [16]. If students learn through interaction with more mature adults or more capable peers, then learning outcomes become available to everyone [17]. Theory of intrinsic motivation supports that if students do the tasks they like, then the students will become more creative [11].

Theoretical support for the third phase of syntax (i.e. deconstructing concepts and generating ideas through provocation techniques) of CDR-Po learning models come from cognitive theory, sociocognitive theory, social constructivity theory, and intrinsic motivation theory. As in the second phase, cognitive theory supports the third phase in domain mastery. The better the student's understanding of the discipline of knowledge, the more capable the student is in creating and divergent thinking which will lead to creative products [9]. If students face new and confusing experiences and try to overcome the discrepancies caused by this new experience, their intelligence will develop further [17]. In this third phase students' self-efficacy is likely to emerge. According to sociocognitive theory, if students have high self-efficacy, they will produce ideas in finding solutions to problems [9]. In this phase, usually some students need scaffolding from the teacher. According to the theory of social constructivity, if the assignment given goes far beyond the students' actual level of development, they need scaffolding [16]. If students interact with people who are more skilled in terms of creative thinking, these students will experience cognitive apprenticeship [17]. According to the theory of intrinsic motivation, if students do a task they like, they will become more creative [11].

Theoretical support for the fourth phase of syntax (i.e. reconstructing the concept and accepting ideas) of the CDR-Po learning model comes from cognitive theory, sociocognitive theory, and Vigotsky's theory of constructivity. This last phase is supported by cognitive theory that if students master the domain, divergent thinking of students will lead to creative products. The better students' understanding of a scientific discipline, the more capable they are to create [9]. Sociocognitive theory highlights the potentials of self-efficacy generated in this phase. If students have high self-efficacy in a particular domain, these students will tend to work on challenging problems in the domain and survive in the face of difficulties [9]. Vigotsky's constructivity theory states that if students' social interaction with others will trigger new ideas and improve their intellectual development [16].

IV. CONCLUSION

Based on expert assessment studies of content validity and construct validity models, it was concluded that the CDR-Po learning model developed to train students' creative thinking skills in junior high school science learning was valid.

REFERENCES

[1]. Santrock, J.W., "Educational psychology,"5th Ed. New York: McGraw-Hill, 2011.
[2]. Trilling, B., & Fadel, C.,"21st Century skills: learning for life in our times," San Fransisco: John Wiley & Sons, 2009.
[3]. Dyers, J.H., Gregerson, H.B., & Christensen, C.A.,"The Innovator's, DNA" (Online). http//hbr.org/2009/12/the-innovators-dna.
[4]. Harahap, F., Yuanita, L., & Ibrahim, M., "Simulation of the CDR-Po learning model for foster the creative thinking of Junior High School students in learning natural science," Proceedings of the National Science and Science Education Seminar XI, 2018, pp. 101-107. ISSN: 2087-0922. http://callforpapers.uksw.edu.
[5]. De Bono, E., "Serious creativity," The Journal for Quality and Participation," 18(5):pp.12-18, 1995.
[6]. Sternberg, R.J., Lubart, T.I., Kaufman, J.C., & Pretz, J. E., "Creativity," In: Holyoak, K.J., & Morisson, R.G. (Eds.), *The Cambridge handbook of thinking and reasoning*, pp. 351-369. New York: Cambridge Univ. Press, 2005.

[7]. Nieven, N., “Prototyping to reach product quality,” In: Akker, J., Branch, R., Gustafson, K., Nieven, N., Plomp, T. (Eds.), Design approaches and tools in education and training. Dordrecht: Kluwer Academic. pp.125-136, 1999.
[8]. Borich, G.D. , “Observation skills for effective teaching,” New York” Macmillan Publishing Co.
[9]. Moreno, R., “Educational Psychology,” NJ: John Wiley & Sons.
[10]. Tsai, K. C., “The interplay between culture and creativity,” Cross-cultural Communication. 8(2), 2012, pp.15-20.
[11]. Amabile, T.M., “Componential theory of creativity,” Encyclopedia of management theory, Kessler, E.H. (Ed.), Sage publications, 2013.
[12]. Gregory, E., Hardiman, M., Yarmolinskaya, J., Rinne, L., & Limb, C., “Building creative thinking in the classroom: from research to practice. International journal of educational research, 62, 2013, pp: 43-50.
[13]. Boden, M. A.,”Creativity and knowledge,” In Craft A., Jeffrey, B., & Leibling, M. (Eds.), Creativity in education, NY: Continuum.
[14]. Sternberg, R.J.,”The nature of creativity,” Creativity research journal. 18(1). 2006. Pp. 87-98.
[15]. Lau, J.Y.F., “An introduction to critical thinking and creativity. Think more, think better, NJ: A John Wiley & Sons, 2011.
[16]. Arends, R.I., “Learning to teach,” 9th Ed., New York: Mcgraw-Hill.
[17]. Slavin, R.E., “Educational Psychology,” Theory and Practice,” 8th ed. Boston: Pearson Education, Inc. 2006.