Creative-Scientific Decision Making Skills (CSDMS) Learning Model in Training Creative Thinking Skills and Student Decision Making Skills

Abstract

This study aims to validate the Creative-Scientific Decision Making Skills (CSDMS) learning model to improve creative thinking skills and decision-making skills. This study uses development research through validation study design by testing two criteria, namely content validity and construct validity. The validation involved three experts through Focus Group Discussion (FGD) activities. The results showed that the CSDMS model was valid and reliable. This is based on calculations using the Aiken formula, that the value of V on each item of the instrument is 0.75 V 1 with a very valid category and the reliability coefficient for each aspect of validity is in the range of 100% so that the developed validity results are reliable. It was concluded that the CSDMS model was declared valid both in terms of content validity and construct validity in order to improve students' creative thinking skills and decision-making skills.

Keywords: Model Creative-Scientific Decision Making Skills (CSDMS), Content validity, construct validity

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1. Introduction

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The industrial revolution 4.0 brings very fast changes in the world of education and technology. Rapid changes require students to be able to compete in the world of education and work. In order to compete in the world of education and work, students must have several skills. One of the skills that must be possessed by students is creative thinking skills and decision-making skills.

Creative thinking is basically a combination of logical thinking and divergent thinking based on intuition (Baer, 1993). Divergent thinking will produce many ideas and the truth of that thinking will be determined by logical thinking. According to Marzano & McNulty (1998) there are five aspects of creative thinking, namely: (1) Creativity is closely related to desire and effort; (2) Creativity produces something different; (3) Creativity requires more internal evaluation than external evaluation; (4) Creativity includes ideas that are not limited, and (5) Creativity often appears when doing something. There are four indicators of creative thinking, namely: (1) fluency, is the ability to generate many ideas; (2) flexibility, is the ability to generate ideas or ways that vary; (3) originality, is the ability to generate new ideas that did not exist before; (4) elaboration, is the ability to develop or add ideas so that more detailed and detailed ideas are produced (Hu & Adey, 2002). Humans who are able to express many ideas or ideas in solving a problem are creative thinking.

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Decision making is the result of a mental or cognitive process based on an act of choosing a path among several available alternatives. Decision making is the result of each individual's thinking in choosing one of the most appropriate answers from the various options available (Santrock, 2011). The most appropriate answer is a decision, so that each individual must be provided with education through coaching and training so that later they are able to make rational decisions and give birth to actions in dealing with problems in society. Boehm et al., (2002) the steps in making a decision include writing down questions, making choices, gathering information, making lists of pros and cons, and making decisions.

The reality in the world of education, especially in Indonesia, is that creative thinking skills and decision-making skills have not been trained on students. Students are only required to memorize the subject matter, without being given the opportunity to develop their knowledge and not being given the opportunity to make decisions. Knowledge that is only based on memorization will not last long in memory, especially if the student is not trained in making decisions, so that students' creative thinking skills and decision-making skills are very low. The low creative thinking skills and decision-making skills of students result in not being able to compete globally. The low creative thinking skills and decision-making skills are caused because they have not been trained intentionally to students. This can be seen from the absence of a learning model that has a syntax to train creative thinking skills.

This study aims to design a new learning model that can train, facilitate, and improve creative thinking skills and decision-making skills. The model is the Creative-Scientific Decision Making Skills (CSDMS) model. The

researcher developed the CSDMS model based on theoretical studies and empirical evidence from the PBL learning model and the DEAL-cycle model. The development of the CSDMS model uses a transdisciplinary approach to produce creative, original, and tested learning models in overcoming various educational problems, especially the problem of low creative thinking skills and decision-making skills. Based on the results of the synthesis of previous research on the application of the PBL model and the DEAL-cycle model to train creative thinking skills and decision-making skills, the researcher argues that it is necessary to carry out several syntaxes in the learning model, including: 1) problem orientation; 2) creative exploration; 3) creative elaboration; 4) develop group investigations; 5) strengthen decision making; 6) evaluation and reflection.

2. Method

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This research is a research and development (research and development, abbreviated R & D) that produces a product, namely the Creative-Scientific Decision Making Skills (CSDMS) learning model as a valid, practical, and effective product (Nieven, McKenney, Akker, 2009). The learning model is used to train students' creative thinking skills and decision-making skills. The product of this research also develops learning tools as an operational form of the CSDMS model.

The research design for the development of the CSDMS model refers to the development model design according to McKenney (Plomp, 2013). The stages of this research consist of: 1) the preliminary study stage includes needs analysis, literature study, and field survey; 2) the prototype model design phase, validation, and revision; 3) model testing phase. The stage of developing a hypothetical learning model can be shown in Fig. 1

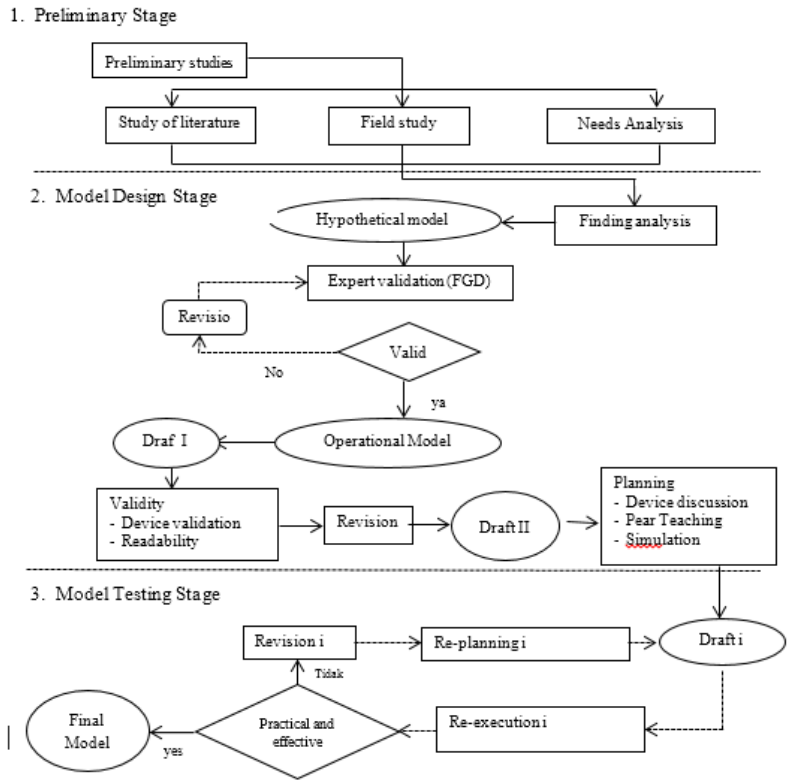

Figure 1. CSDMS Model Development Stage

A. Instruments and Data Collection

Data collection was carried out using the validation format of the CSDMS model and learning tools by the validator. This validation involves three validators who are in charge of reviewing, providing input and assessment on the validation sheet through Focus Group Discussion (FGD) activities. Three validators consist of two professors and one doctor who is an expert in physics.

A developed model is said to be of quality if it meets two criteria, namely valid in terms of content and valid in terms of constructs (Plomp, 2013). There are three types of instruments used in the validity test, namely: a) content validity of the CSDMS model; b) construct validity of the CSDMS model; and c) construct validity of learning tools that support learning the CSDMS model. Researchers used three types of validation sheet instruments as presented in Table 1.

Table 1. Instruments and Components of Validation Aspect Assessment

Instrument	Validity Aspects
Content validity of the CSDMS learning model	(1) The need for CSDMS model development, and (2) Model Design Meets the renewal of

Instrument	Validity Aspects
	knowledge (State of the art of knowledge).
Construct validity of the CSDMS learning model	(1) Overview of the model, (2) Theoretical and empirical support, (3) Planning and implementation, (4) Learning environment, (5) Evaluation techniques, and (6) A final thought
Construct validity of learning devices that support the CSDMS model	a. Syllabus (1) Constructed for every meeting, (2) Syllabus identity, (3) Syllabus table format, (4) Content, and (5) Language b. Lesson Plan (1) Lesson plan identity, (2) KKNI core competencies, (3) learning objectives, (4) learning materials, (5) learning model approaches, (6) media, tools, and materials, (7) learning activities, (8) Learning resources, and (9) Assessment c. Students' teaching materials (1) Design of student books, (2) Format of student textbooks, (3) Language, (4) Presentation, and (5) Innovation and quality improvement d. Students' worksheet (1) Systematics of students' worksheet, (2) Format of students' worksheet, (3) Language, (4) Presentation, and (5) Innovation and quality improvement E. Creative thinking instrument (1) Content validity, (2) construct validity, and (3) language

(Plomp, 2013; Nieveen and Plomp, 2013)

The content validity of the model measures two aspects, namely 1) the need for developing a CSDMS model, and 2) the design of the model. empirical, 3) planning and implementation, 4) learning environment, 5) evaluation techniques, and 6) a final thought (Plomp, 2013; Nieven & Plomp, 2013), while the construct validity of the learning tools developed in the CSDMS model are (syllabus, unit). Lecture Events, Student Teaching Materials, Student Activity Sheets, and Creative Thinking Instruments.

B. Data Analysis

Content validity (relevance) and construct validity (consistency) were analyzed descriptively using a qualitative statistical approach to conclude the quality of the developed model. The validity of the CSDMS model and learning tools was assessed using a validation instrument sheet with an assessment of 4 scales, namely 1) invalid; 2) less valid; 3) valid; and 4) very valid. Data from model validation and learning tools obtained from FGD activities were analyzed by calculating the average score for each aspect by 3 validators. The validity criteria are determined based

on the index proposed by Aiken as follows

$$V = \frac{\sum s}{n(c-1)} \qquad for\ s = r - l$$ (Aiken, 1980)

Description: r = number given by an expert

l = The lowest validity rating score (ie 1)

c = The highest validity rating score (ie 4)

N = number of raters

V = aiken validation index

The validity of each aspect of the CSDMS learning model and tool is determined by referring to the criteria contained in Table 2

Table 2 Assessment Criteria for Model Validation and Learning Tools

No	Aiken validation index (*V*)	Validity level
1	0,75 ≤ V ≤ 1	Very Valid
2	0,50 ≤ V < 0,75	Valid
3	0,25 ≤ V < 0,50	Less Valid
4	0,00 ≤ V < 0,25	Not Valid

(Aiken, 1980)

C. Validation Study Results

The CSDMS model is a learning model designed to train creative thinking skills with indicators: (1) fluency; (2) flexibility; (3) originality; and (4) elaboration. The CSDMS model has 5 syntaxes, namely: (1) problem orientation; (2) creative exploration; (3) creative elaboration; (4) guiding group investigations, and (5) evaluation and reflection. The CSDMS model is designed by taking into account: (1) theoretical studies and empirical studies; (2) the purpose of the developed CSDMS model; (3) learning activities; and (4) learning environment (Arends, 2012; Joyce et al, 2009). The syntax of the CSDMS model and learning activities are presented in Table 3.

Table 3 CSDMS Model Syntax and Lecturer and Student Activities.

Lecturer's Activities	Students' Activities
Phase I: Problem orientation	
1. Giving the initial question before the question of substance. 2. Motivating students with research activities 3. Organizing students to the problem of research activities. 4. Delivering cognitive, affective, and psychomotor learning objectives.	1. Listening to the lecturer's explanation and give answers. 2. Observing and asking questions on the phenomena presented. 3. Be actively involved in learning. 4. Discussing the learning steps.

Lecturer's Activities	Students' Activities
Phase II: Creative Exploration	
1. Describing the topic being taught 2. Exploring student experiences Provide knowledge or skills needed to carry out learning in the elaboration phase 3. Guiding students to raise questions 4. Inviting students to write down concepts, terms, theories that according to students are related to the learning topic	1. Listening to the lecturer's explanation 2. Raising questions. 3. Listing down concepts, terms, theories that according to students are related to the learning topic
Phase III: Creative elaboration	
1. Preparing LKM and all logistics (additional reading materials other than student books or tools and materials needed if the activities are in the form of experimental activities 2. Guiding students both individually and in groups in working on LKM. 3. Helping students in constructing knowledge, for example by giving questions that make students think (construction process) until students can construct their knowledge correctly.	Work in groups to understand concepts, theories, terms or relationships between them through the help of the LKM
Phase IV: Guiding group investigations	
Developing student responsibility in experimental activities and reviewing various sources of information referring to the LKM to solve scientific problems creatively and be able to make decisions	Trying to develop and study various sources of information to solve scientific problems creatively and be able to make decisions
Phase V: Evaluation and follow-up	
Involving students in evaluating creative thinking skills and making decisions and their follow-up.	Participating in evaluating creative thinking skills and making decisions and their follow-up.

3. Results

The results of the content validity and construct validity of the CSDMS model

1. Content Validity

Table 4. CSDMS Model Content Validity Assessment Results

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No	Assessment Aspect	Validation score	Mode	Category
1	CSDMS model development needs	4	4	Very Valid
2	Model Design Meets the renewal of Knowledge (State of the art of knowledge)	4	4	Very Valid
Conclusion		4	4	Very Valid

2. Construct Validity

Table 5 CSDMS Model Construct Validity Assessment Results

No	Assessment Aspect	Validation score	Mode	Category
1	Model overview	4	4	Very Valid
2	Theoretical and empirical support	4	4	Very Valid
3	Planning and implementation	4	4	Very Valid
4	Learning environment	4	4	Very Valid
5	Evaluation technique	4	4	Very Valid
6	A final thought	4	4	Very Valid
Conclusion		4	4	Very Valid

3. Results of the Validity of the CSDMS Model Learning Tool

Table 6 CSDMS Model Construct Validity Assessment Results

No	Assessment Aspect	Validation score	Mode	Category
1	Syllabus	4	4	Very Valid
2	Learning Event Unit	4	4	Very Valid
3	Student Teaching Materials	4	4	Very Valid
4	Student Worksheet	4	4	Very Valid
5	Creative Thinking Skills Test	4	4	Very Valid

4. Discussion

The data from the content and construct validity of the CSDMS model are based on the validator's assessment with very valid criteria to improve creative thinking skills because it meets the expected validity and actual validity. Expected validity, namely the experts agree that the CSDMS learning model is content valid because there are elements of current needs and knowledge, and is constructively valid because there is consistency and good logic between the phases in the model syntax, as well as between the model and its constituent components. The CSDMS learning model meets actual validity because the application of the CSDMS learning model can significantly improve creative thinking skills.

The CSDMS learning model is practical because the implementation of the CSDMS model is in the good category, which can be carried out by lecturers and students. The application of the CSDMS learning model can make learning more meaningful because it involves students in developing their knowledge in improving creative thinking skills which results in students getting a more active learning atmosphere.

Several obstacles that arise in the implementation of the CSDMS learning model in training creative thinking

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skills include: a) students are not accustomed to making a product as a result of the learning process, b) students are also not accustomed to creative thinking, c) students are not accustomed to using Phet simulation in Learning Activities. To overcome this, the lecturer provides structured guidance at each stage of learning contained in the syntax of the CSDMS model so that the implementation of learning can take place effectively

5. Conclusion

Based on the results of the study, it was concluded that the CSDMS model developed was valid, practical, and effective for practicing creative thinking skills. This study developed a CSDMS model consisting of 5 syntaxes, namely: (1) problem orientation; (2) creative exploration; (3) creative elaboration; (4) guiding group investigations, and (5) evaluation and reflection. It is necessary to disseminate the CSDMS learning model for teachers and lecturers to introduce and follow up on research findings as a reference for model improvement.

References

Aiken, L. R. (1980). Content Validity and Reliability of Singel Items or Questionnaires. *Educational and Psychological Measurement.*

Arends, R. I. (2012). *Learning to Teach*. New York: Mc. Graw-Hill.

Baer, J. (1993). *Creativity and Divergent Thinking: A Task Specific Approach*. London: Laurence Erlbaum Associated Publisher.

Boehm, R. G. & Webb, B. (2002). *Skills Handbook Using Social Studies*. Colombus, OH: SRA/McGraw-Hill.

Herman., Purba, R., Thao, N. V., & Purba, A. (2020). Using genre-based approach to overcome students' difficulties in writing. *Journal of Education and E-Learning Research*, *7*(4), 464-470. https://doi.org/10.20448/journal.509.2020.74.464.470

Herman, H., Shara, A. M., Silalahi, T. F., Sherly, S., & Julyanthry, J. (2022). Teachers' attitude towards minimum competency assessment at Sultan Agung senior high school in Pematangsiantar, Indonesia*. Journal of Curriculum and Teaching, 11*(2), 01-14. https://doi.org/10.5430/jct.v11n2p1

Hu, Weiping & Adey, Philip. (2002). A Scientific Creativity Test for Secondary Student*, International Journal of Science Education*, 24(4), 389-403).

Joyce, B., Weil, M., & Calhoun, E. (2009). *Models of Teaching,* Eight Edition. New York: Pearson Education Inc.

Marzano, R. J., Waters, T., & McNulty, B. A. (1998). *Dimension of Thinking A Framework for Curriculum and Instruction*. Virginia: Assosiation for Supervisions and Curriculum Development (ASCD).

Munthe, B., Herman., Arifin, A., Nugroho, B. S., & Fitriani, E. (2021). Online student attendance system using android. *Journal of Physics: Conference Series*, *1933 012048,* https://doi.org/10.1088/1742-6596/1933/1/012048

Nieveen, N., McKenney, S., &. Akker (2007). Educational design research dalam *educational design research*. New York: Routledge.

Plomp, T., & Nieveen, N. (2013). *Introduction to the collection of illustrative cases of educational design research. In T. Plomp, & N. Nieveen (Eds.), Educational design research – Part B: Illustrative cases (pp. V-XX).* Enschede, the Netherlands: SLO.

Plomp, T. J. (2013). Educational Design Research: An introduction. In Plomp, T. J. & Nieveen, N. (eds). *Educational Design Research, part A: An introduction, 10*-51. Retrieved 04/05/2016, from http://downloads.slo.nl/ Documenten/educational-design-research-part-a.pdf.

Santrock. (2011). *Educational Psychology*, Fifth Edition. New York: McGraw-Hill

Silalahi, D. E., Siallagan, H., Munthe, B., Herman, H. and Sihombing, P. S. R. (2022). Investigating Students' Motivation toward the Use of Zoom Meeting Application as English Learning Media During Covid-19 Pandemic. *Journal of Curriculum and Teaching, 11(5), 41-48*, DOI: 10.5430/jct.v11n5p41

Van Thao, N., Herman, Napitupulu, E. R., Hien, N. T., & Pardede, H. (2021). Code-switching in learning via Zoom application: A study in an EFL context. *Asian ESP Journal, 17*(3.1), 91-111