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The Validity and Practicality of the Contextual Analysis of Science and Laboratory Problems (CANLABS) Learning Model in Science Learning

Aris Singgih Budiarso[1*], Sutarto[1], I Ketut Mahardika[1], Pramudya Dwi Aristya Putra[1], Dian Nur Indah Sari[1], Finda Nor Laela[1]

[1] Science Education Study Program, Faculty of Teacher Training and Education, University of Jember, Kabupaten Jember, Indonesia

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Abstract. The learning model about Contextual Analysis of Science and Laboratory Problems (CANLABS) is a model that provides opportunities for students to choose several natural events around them that are relevant to the material which is being studied and then explore the phenomenon profoundly in the laboratory. This study aims to analyze the validity and practicality of the CANLABS learning model for science mastery for junior high school students. The trial results of the model development were carried out in the 7th grade of the former Besuki residency (Jember, Bondowoso, Situbondo, and Banyuwangi) with a total of 120 students. The sampling technique was carried out using a purposive sampling area. To measure the validity, use the model validity sheet carried out by experts through the Focus Group Discussion (FGD). Meanwhile, to measure practicality, an observation sheet on the implementation of the learning implementation plan was used by the observer. Based on the analysis, it was found that the content validation and construct validation respectively scored an average of 4.08 and 4.11 with the reliability of the model 96%. Meanwhile, the implementation of the learning implementation plan in preliminary activities, core activities, strengthening activities, closing, and classroom atmosphere with an average score of 3.39 is categorized as very good. Based on the results of the study, it can be concluded that the CANLABS learning model meets the criteria of validity and practicality so that it is suitable in science learning for junior high school students.

Keywords: CANLABS learning model; Validity; Practicality

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Introduction

Education has a vital role in the progress of a nation. Operationally education is implemented in learning in the hope of achieving national education goals through the achievement of learning objectives. Natural Sciences is one of the subjects taught in junior high schools. Science is related to how to obtain information about natural phenomena that is carried out sequentially, thus science is not only an accumulation of knowledge that is only related to facts, concepts and principles but also the process of discovery based on a scientific attitude. Science is concerned with explaining how and why something can happen by paying attention to norms and truth in finding a product (March & Smith, 1995). Science can help students understand scientific concepts from several alternative concepts through the research process (Laksana, 2017). Science is a collection of theories that are systematically arranged, related to natural phenomena that arise and develop through the scientific method (Hekmah, et al., 2019).

Science learning is built based on scientific processes, products, and attitudes (Pratiwi, 2019). In

*Email: singgiharis.fkip@unej.ac.id

the process, science learning can be done by observing an event, providing an understanding of what is being observed, utilizing new knowledge to predict an event, and testing hypotheses to find the truth (Mayer, 2008). Science learning can also be done by emphasizing direct experience in improving students' abilities and getting their own facts, concepts, principles, laws, models, and theories scientifically (Dewi, et al., 2012). Science learning aims to enable students to master the principles, as well as implement scientific methods based on a scientific attitude to solve problems in natural science and realize the greatness of Allah SWT (Suryawati & Osman, 2017). In addition, science learning prioritizes providing direct experience to develop students' abilities so as to facilitate the process of understanding the natural surroundings scientifically in the form of facts, concepts, principles, laws, and theories (Anisa, 2017).

Many factors determine the success of learning in school. These factors include the level of ability and intelligence of students who are not the same, the availability of educational facilities and infrastructure in schools, and the teaching strategies used by teachers. In general, science teachers face various obstacles including lack of time, equipment, teaching tools, knowledge of pedagogical content, and pedagogical skills (Nawzad, et al., 2018). Teachers are also constrained in making choices and applying learning strategies that have been determined in learning, even there are doubts regarding their success and students' ability to adapt when using a model or learning strategy so that the implementation of science learning that is theoretical and seems monotonous without giving students the opportunity to can directly interact with the environment and can cause students to feel bored, so as a solution in science learning it is more emphasized that there is a direct experience process (Hekmah, et al., 2019; Sadiqin et al., 2017).

Even though the use of learning models is very important to accommodate the development of students' mindsets and skills, science learning is currently more focused on transferring information than inviting students to do it (Mahanal, et al., 2019). The learning model is a conceptual framework that provides an overview of learning steps that are systematically arranged in organizing student learning experiences in order to achieve learning objectives, and for teachers to act as guides in planning and implementing the teaching and learning process (Sagala, 2011). Therefore, in the science learning process, teachers must have the ability to choose and decide the appropriate and appropriate science learning model.

The learning model chosen by the teacher must provide opportunities for students to carry out a series of scientific processes in which it is not only based on the achievement of formulas or knowledge but also the achievement of scientific skills and attitudes (Setiawan & Mustangin, 2020; Wicaksono, et al., 2020). However, the science learning model that accommodates the characteristics of students in former Besuki residencies (Jember, Bondowoso, Situbondo, and Banyuwangi) is still limited. In addition, based on the results of preliminary studies, research shows that students' ability to describe science phenomena around their environment is still relatively low and on the basis of this research it is recommended to accommodate students' abilities in describing science phenomena that occur in the surrounding environment on the basis of science as a process, product, and attitude. scientific research (Budiarso & Rohmatillah, 2020). This is reinforced by the results of research at schools in the districts of Jember, Bondowoso, Situbondo, and Banyuwangi which states that students' science learning outcomes are categorized as low (Kumalasari, et al., 2015; Khairah, et al., 2017; Agatha, et al., 2018). Students also have a tendency to only be able to describe the definition of material, but in solving problems in the form of images they have difficulty (Puspaningrum, et al., 2015). Based on these problems, it is necessary to innovate related to the development of models or strategies in science learning.

The CANLABS learning model can be seen as an innovation for teachers to use in classroom learning. This model is in line with constructivist, scientific, and STEM (Science, Technology, Engineering, and Mathematics) approaches. In addition, this model also has the same characteristics as the guided inquiry and guided discovery learning models. The CANLABS learning model is a learning model that gives students the opportunity to choose natural phenomena around them that are in accordance with the learning material being studied and conduct experiments in the laboratory-based on the selected phenomena with the aim of studying more deeply based on natural science principles (Budiarso, 2021). Still, according to (Budiarso, 2021) the CANLABS learning model in its use is relevant to the nature of science learning.

Method

This research is development research that is developing the CANLABS learning model for science learning in junior high school. Overall, in this study according to the following steps: preliminary research, design, initial product development, initial field trials, initial product revisions, wider field trials, product reviews, final product revisions, and product distribution (Borg & Gall, 2005). However, this research only arrived at the initial product revision. The stages of validity and practicality are used to make improvements in order to obtain a proper learning model. The results of the development of the learning model were implemented in grade 7 of the former Besuki residency (Jember, Bondowoso, Situbondo, and Banyuwangi) with a total of 120 students. The trial of the CANLABS learning model was carried out from October to November 2020. The development of the CANLABS learning model involved two experts, namely lecturers from the Science Education study program to determine the validity of the learning model. Purposive sampling area was used as a sampling technique in this study. The data collection instruments used in this study were: (a) observation, used to obtain data on the implementation of lesson plans and constraints during the implementation of learning; (b) test, used to obtain data on students' science mastery; (c) documentation, used to obtain evidence of learning implementation.

The data analysis technique for the validity of the CANLABS model uses the average score with the categories: very valid (4.2 < score ≤ 5), valid (3.4 < score ≤ 4.2), quite valid (2.6 < score ≤ 3, 4), less valid (1.8 < score ≤ 2.6), and invalid (1.00 < score ≤ 1.8) (modified from (Mustami, et al., 2019).The learning model is said to be valid if it meets Valid criteria for content and construct validation (Plomp & Nieveen, 2010) The data analysis technique of students' practicality on the implementation of learning follows the category 3.25 ≤ very good < 4; 2.5 ≤ good enough < 3.25; 1.75 ≤ less good < 2.5); and (1.75 < not good < 1.75) (Arikunto, 2010). The CANLABS learning model that has been developed was validated by 3 experts through a Focus Group Discussion (FGD). The reliability of the CANLABS learning model validation sheet instrument is calculated based on the percentage of agreement (R) ≥ with the developed learning model being declared reliable if it has a percentage of R 75% (Borich, 1994).

Result and Discussion

The CANLABS learning model was developed to improve critical thinking skills, confidence in facts based on their own experiments, increase curiosity, skills, draw conclusions, and train students to create truth based on observations that refer to a constructivist approach and an inquiry approach (Budiarso, 2021). Furthermore (Budiarso, 2021) also states that the CANLABS model is also based on cognitive theory, Vygotsky's theory of the Zone of Proximal Development (ZPD) and scaffolding, Bruner's theory of discovery learning, behavioral learning theory of character formation, Vygotsky and Piaget's theory of cognitive development.

According to Vygotsky, students carry out learning activities through interaction with adults or with peers who have higher expertise. This social interaction can accelerate the formation of new ideas and increase students' intellectual growth so that they can achieve higher levels of performance (Santrock, 2011; Xi & Lantolf, 2021). Bruner believes that the essence of learning is to connect things together and organize them into meaningful structures, and learning is the organization and reorganization of cognitive structures (Wen, 2018). According to Piaget, knowledge is created through assimilation and accommodation. If students get new information, then the new information is assimilated with existing cognitive structures so that new knowledge will be obtained. However, if the new information is not in accordance with the cognitive structure of the student, then the existing cognitive structure is restructured so that an adjustment occurs (accommodation) after which new knowledge is obtained (Umbara, 2017).

The CANLABS learning model was validated by three experts through a Focus Group Discussion (FGD) which showed that the model could train students' self-confidence, communication, and make students gain their own knowledge in solving problems relevant to the surrounding environment. The developed model was validated in terms of content and constructs. Content validation is related to needs and novelty, while construct validation is related to consistency between components of the learning model. The results of content validation can be seen in Table 1.

Table 1. Results of the Content Validation Analysis of the CANLABS Learning Model

Model Component	Validation Score	Category Validity	Reliability Coefficient	Reliability
Needs analysis	4.30	Very valid	97.00	Reliabel
Conformity with current knowledge	3.90	Valid	97.00	Reliabel
Model description	4.10	Valid	98.00	Reliabel
Learning environment	4.00	Valid	94.00	Reliabel

Based on Table 1. it can be seen that the four components of the model that were validated in terms of content were on average in the valid category with the percentage of agreement (R) in the reliable category.

This is because in the development of the CANLABS learning model several aspects are considered, including: (1) the development of a learning model according to the needs of science learning which in this case is in accordance with the characteristics of students in the former Besuki residency (Jember, Bondowoso, Situbondo, and Banyuwangi) and has a low ability to describe natural science phenomena around their environment so that they are in accordance with the learning environment; (2) development of learning models in accordance with current knowledge developments by accommodating students with critical thinking and problem solving skills, creativity, communication skills, and the ability to work together; (3) a description of the learning model developed in accordance with the characteristics of the learning model that links between natural phenomena around which are then studied further in the laboratory.

However, there are several inputs from validators related to content validation, including: (1) in the analysis of the components of conformity with current knowledge, it is certain that they really accommodate the nature of learning science which includes processes, products, and scientific attitudes, and is in accordance with the development of 21st century skills and knowledge. industrial revolution 4.0 so that this model can have adaptive expertise and can help schools improve the quality of science learning; (2) the CANLABS learning model should be oriented on how students learn strategies according to the stages of development so that there is effectiveness in learning. Students will also be more effective in learning if they do not feel anxious, afraid, or disturbed by urgent problems (Darling-Hammond, et al., 2020).

In addition to the CANLABS learning model, an assessment of content validation is also carried out on construct validation. The results of the construct validation analysis can be seen in Table 2.

Table 2. The results of the analysis of the construct validation of the CANLABS learning model

Model Component	Validation Score	Category Validity	Reliability Coefficient	Reliability
Rational learning model	4.10	Valid	98	Reliabel
Relevant theoretical support	4.00	Valid	91	Reliabel
Syntactic model	4.30	Very valid	95	Reliabel
Reaction principle	4.10	Valid	98	Reliabel
Social system	4.20	Valid	92	Reliabel
Support system	4.10	Valid	98	Reliabel
Instructional impact and accompaniment	4.00	Valid	99	Reliabel

Based on Table 2. which is the result of construct validation analysis, it can be explained that the six components of the model which include: rational learning model, relevant theoretical support, reaction principle, social system, support system, as well as instructional impact and accompaniment are, on average, valid categories. with the instrument having reliability > 70%, while the syntactic component of the model is categorized as very valid with the reliability of the instrument > 70% so it can be said that all expert assessment results use the construct validation sheet of the CANLABS learning model in the reliable category. The valid, very valid, and reliable categories were obtained because the development of the learning model was strengthened by theoretical studies and empirical studies so that the syntax of the learning model was composed (Plomp & Nieveen, 2010).

The syntax of the learning model describes a sequence of steps, plots, or stages which are usually accompanied by a series of systematic learning activities. Syntax describes a learning model, namely how to start learning or what happens next after carrying out a learning activity (Maksum & Purwanto, 2019). The relationship between the stages in the syntax of the CANLABS learning model is when students are given the opportunity to be able to choose natural phenomena around them that are relevant to the material being studied and carry out experiments in the laboratory based on these phenomena which aim to explore more deeply using science scientific rules so that students can Draw conclusions. According to (Prahani et al., 2017) a learning model is said to be valid if it shows the need, novelty, has a strong theoretical basis, and there is consistency between the components of the model. The CANLABS learning model is designed to improve students' understanding and high-level skills, help students achieve learning goals, and is supported by learning theory. This is in line with the statement of Eggen & Kauchak (2012) that the learning model has the following characteristics: (1) designed to accommodate students in developing their understanding of the material; (2) in the learning model there are steps to achieve the learning objectives; and (3) supported by theory and research related to learning.

However, in the assessment of content validation there are several inputs from the validator, namely as follows: (1) the CANLABS learning model in its syntax should make it easier for teachers to understand and use it in the learning process so as to facilitate the achievement of learning objectives; and (2) the CANLABS learning model needs to be ensured in accordance with the learning environment and preferably with the application of the model it is also expected to increase the learning environment more positively. In more detail, the components of the model are sequentially described as follows:

Syntactic

Syntactic is an operational phase that is used by the teacher as a guide in implementing the learning model (Joyce, et al., 2011). The syntax of the CANLABS learning model can be seen in Table 3.

Table 3. Syntactics of the CANLABS learning model

Syntactic Model CANLABS	Teacher Activities	Student Activities
Phase 1: Learning Orientation	1. The teacher increases students' attention so that they focus on the material being studied. 2. The teacher introduces problems related to the subject of learning being studied. 3. The teacher gives an introduction and asks questions that lead to problem solving based on the surrounding phenomena. 4. The teacher conveys the learning objectives related to the learning topic	1. Students pay close attention to the teacher. 2. Students pay attention with focus and are given the opportunity to ask questions. 3. Students pay attention with focus and are given the opportunity to ask questions. 4. Students still pay close attention to the teacher
Phase 2: Phenomenon Selection	The teacher organizes learning by dividing students into groups and presenting real phenomena related to the science concept being studied.	Students join their respective groups and understand what the teacher is saying.
Phase 3: Determination of Phenomenon Relevance	The teacher asks students to choose various predetermined phenomena according to the learning topic.	Students choose a phenomenon that is relevant to the topic to be studied.
Phase 4: Verification	The teacher gives direction to students about experiments that are in accordance with the chosen topic with the help of the Student Worksheet. In this phase the teacher acts as a facilitator who provides guidance, supervision, and direction so that students are active in building scientific knowledge and attitudes.	Students pay attention and follow according to work procedures.
Phase 5: Analysis	1. The teacher asks students to analyze why the chosen phenomenon can occur based on the results of the experiment in phase 4. 2. The teacher provides an opportunity for group representatives to present the results of their discussion	1. Students perform analysis in accordance with work procedures. 2. Each group representative presents the results of their discussion
Phase 6: Conclusion	The teacher guides and helps students in drawing conclusions	Students pay attention and draw conclusions

Reaction Principle

The principle of reaction is a form of activity that describes the teacher's response or reaction to the attitudes of both individual students and students as a whole in the class. The principle of reaction is also related to the method used by the teacher in responding to student behavior throughout the learning process (Joyce, et al., 2011). Student responses can be in the form of asking questions, providing answers, criticizing, daydreaming, wandering around, not doing assignments and so on (Ahmad, et al., 2020). The reaction principle built by the CANLABS learning model during the learning process is as follows: (a) the teacher acts as a guide or facilitator during the learning process; (b) the teacher poses problems or questions to students related to the learning topic; (c) the teacher conducts an assessment during the learning process both in practical and non-practical activities; (d) the teacher has a role as a facilitator who provides opportunities for students to formulate experimental plans and organize group formation; (e) the teacher regulates the need for tools and materials in practicum activities and explains things that must be observed so that learning objectives can be achieved; (f) the teacher acts as a consultant who provides criticism and input to groups of students who have not succeeded in the experiment and provide alternative solutions.

Social System

The social system explains the role of teachers and students, teacher-student interactions and the expected goals. The basic foundation listed in the pattern of social interaction is the existence of cooperation in solving problems between teachers and students, students with students or groups, as well as freedom of expression (Sukarni, et al., 2021). The social system of the CANLABS learning model occurs between teachers and students. Students as learning subjects, teachers act as counselors, moderators and facilitators. As counselors, teachers provide services when students have learning difficulties. As a moderator, the teacher builds conditions for students to be able to express their opinions and work together in learning, the teacher acts as a controller of all interaction processes that occur and provides explanations regarding the experimental steps that students must take. As a facilitator, the teacher acts as a provider of learning resources, motivates students so that their learning involves the senses and intellectuals, provides assistance to students in constructing knowledge and provides feedback to students.

Support System

The support system in the learning model includes facilities and infrastructure that can support smooth learning. Educational facilities and infrastructure include equipment, media, learning resources used in learning activities (Isrok'atun & Rosmala, 2018). The support system is concerned with all the things students need to get information in order to achieve learning objectives. In the CANLABS learning model, there are several support systems, including: learning media, textbooks, Student Worksheets, and additional experimental tools. Learning media is used to organize information and learning materials for students. Textbooks act as a reference and source of theory learned in learning activities. While the Student Worksheet acts as a guide for students to conduct experiments and a teacher guide to guide students in conducting experiments at the verification stage.

Instructional and Accompaniment Impact

The last component in the CANLABS learning model is the instructional impact and the accompaniment impact. The instructional impact is a change in student behavior in the expected knowledge aspect after following the learning process, while the accompaniment impact is a change in attitude that occurs in students (Joyce, et al., 2011). The instructional impact of the CANLABS learning model includes: (a) students can convey knowledge orally and in writing; (b) students can channel and direct their own knowledge in the form of concepts and rules in solving problems; (c) students can reject or accept information based on the verification phase that has been carried out; (d) student learning outcomes and 21st century skills can be improved by using this model; (e) students are accustomed to discovering their knowledge independently and thinking critically; (f) students' scientific process skills can be improved. This is because the CANLABS learning model is based on an inquiry and constructivist approach so that students acquire knowledge systematically based on physical evidence.

The accompaniment impact is an indirect or implied impact which refers to the experience or skills gained by students (Sari, 2019). The impact of the accompaniment on the CANLABS learning model are: (a) able to increase enthusiasm, creativity, and be able to create an atmosphere that evokes thoughts such as encouragement, attention, attitude, and treatment; (b) fostering solidarity among students; (c) increasing collaboration between students because the verification phase is accompanied by experimental activities in the laboratory which require students to work together with team members; (d) increase student activity in the learning process so that student learning outcomes will also increase; (d) extrinsic and intrinsic motivation can increase both during and after the learning process.

All the components of the model mentioned above were then tested in the field to measure practicality with a limited sample. The results of the practical analysis of the CANLABS learning model can be seen in Table 4.

Table 4. Practicality of the CANLABS Learning Model in Junior High School Science Learning

Learning Activities	Learning Implementation Score	Category Learning Implementation
introduction	3.50	Very good
Core activities	3.50	Very good
Strengthening Activities	3.40	Very good
Closing	3.50	Very good
Class situation	3.10	Pretty good

The practicality of the CANLABS learning model is expressed as the average score of the implementation of the Learning Implementation Plan. Table 4 above shows that the preliminary aspects, core activities, strengthening activities, closing, and managing the classroom atmosphere have been carried out well by the teacher so that those who have an average assessment are categorized as very good. However, when using this learning model there are several obstacles that occur, namely the lack of experimental KIT that supports conducting laboratory studies based on natural science phenomena. This is because one of the syntactics (verification phase) of the CANLABS learning model requires students to conduct experiments so that it requires an experimental KIT that is quite complete in its application. However, this can be overcome by making a simple experimental KIT with easily obtained materials so that the learning process can continue to run optimally. In addition, students are not familiar with learning with the CANLABS learning model. This is possible because students are familiar with the learning model commonly used by teachers in schools, so students feel surprised and experience difficulties at the beginning of learning activities. However, this problem can be solved by providing direction and information to students about learning with the CANLABS learning model which is expected to make it easier for students to participate in learning activities.

Another obstacle that occurs is that the time used by the teacher in studying the CANLABS learning model is quite short so that it has an impact on the implementation of the model implementation in the classroom. Teachers are less able to organize learning activities, which has an impact on the lack of learning time. This problem can be solved by distributing Student Worksheets that will be used at the previous meeting so that students are easier to understand. Based on the results of the analysis of the implementation of the Learning Program Plan, it can be concluded that the learning model can be implemented in science learning so that it meets the practical criteria (Jan van den, et al., 2006).

Conclusion

The CANLABS learning model that has been developed has an average score of 4.08 with valid categories on content validation and the reliability of the instrument is 96% and on construct validation has an average score of 4.11 in the valid category with 96% instrument reliability. The learning model applied in science learning meets the practicality criteria with an average score of 3.39 in the very good category. These results indicate that the CANLABS learning model meets the criteria of validity and practicality so that it is feasible and can be used in science learning. The use of the CANLABS learning model in science learning is still limited, especially to measure the effectiveness of the model on higher order thinking skills, 21st century skills, and other learning outcomes, so further research is needed.

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