Development of Science Learning Model towards Society 5.0: A Conceptual Model

Sajidan¹, Sulistyo Saputro², Ryzal Perdana³, Idam Ragil Widianto Atmojo⁴, Dewanta Arya Nugraha⁵
¹,²,⁴,⁵Doctorate Program of Science Education, Faculty of Teacher Training and Education Sciences, Universitas Sebelas Maret, Indonesia
³Doctorate Program of Educational Science, Faculty of Teacher Training and Education Sciences, Universitas Sebelas Maret, Indonesia

e-mail: ¹sajidan@fkip.uns.ac.id

Abstract. The development of the world of education is entering a very important period. Not only to provide quality and optimal education services. But it is also an important period that will determine the continuation of education itself. The mastery of abilities and skills needed by the future is the responsibility of the education world. The future with the construction of Community 5.0 requires schools to transform teacher-centered learning into student-centered learning so that students can think critically, deductively, and inductively in learning science in the era of disruption. Learning system through rote learning is not following the learning paradigm, which emphasizes cognitive understanding. Therefore, an appropriate learning model is needed to overcome the problem of the discrepancy of the paradigm of community learning 5.0. As a strategic stage of achieving competence, learning activities need to be designed and implemented effectively and efficiently to obtain maximum results. One research method that can be done to develop a learning model by applying the steps of the Research and Development (R & D) research procedure. Conceptual models that have been developed in welcoming 5.0 are Social Inquiry Complex (ISC), and Creativity-Based Learning Skill Entrepreneurship (CEL-BaDiS).

1. Introduction

The development of the world of education is entering a very important period. Not only to provide quality and optimal education services. But it is also an important period that will determine the continuation of education itself. Today, the challenges in education are increasingly complex and require very serious preparation and thinking. At present, learning throughout the world is faced with a rapid and non-linear change. This is as a result of the rolling of the Industrial Revolution 4.0 era.

The hustle and bustle of the Industrial Revolution 4.0, which was accompanied by the development of a disruption era, was suddenly shocked by the emergence of Society 5.0. The concept of Society 5.0 has been rolling for a long time. This concept appears in the "Basic Policy on Economic and Fiscal Management and Reform 2016" which is a core part of the strategic plan adopted by the Japanese Cabinet, January 2016. The concept of Society 5.0, was adopted by the Japanese Government in anticipation of global trends as a result of the emergence of the Industrial Revolution 4.0.

Society 5.0 is a natural thing that must have happened due to the rise of the Industrial Revolution 4.0. The Industrial Revolution 4.0 has given birth to various innovations in the industrial world and also society in general. Society 5.0 is the answer to the challenges that arose as a result of the
Industrial Revolution 4.0 era accompanied by disruption characterized by a world of turmoil, uncertainty, complexity, and ambiguity.

Society 5.0 is a society that can solve various challenges and social problems by utilizing various innovations born in the era of the Industrial Revolution 4.0 such as the Internet of Things, Artificial Intelligence, Big Data, and robots to improve the quality of human life. Society 5.0, a time in which human-centered societies balance economic progress with the resolution of social problems by systems that integrate cyberspace and physical space. Society 5.0 will balance economic development and solve social problems.

The mastery of abilities and skills needed by the future is the responsibility of the education world. Children who are now attending school are future owners. The future with the construction of Community 5.0 requires schools to transform teacher-centered learning into student-centered learning so that students are able to think critically, deductively, and inductively in learning science in the era of disruption (Afandi & Sajidan, 2017; Gardiner et al, 2017; Kuhltlau, 2007; Trilling & Fadel, 2009; Soong, 2005; Vong & Kaewurai, 2017).

Learning system through rote learning is not following the learning paradigm which emphasizes cognitive understanding (Zivkovil, 2016; Kuhltlau, 2007). Students must learn faster and have a lot of knowledge through direct experience (Bugg & Dewey, 1934; Fullan, 1991; Trilling & Fadel, 2009), because with direct experience students will have knowledge that will be more complex to understand (L. Vygotsky, 1986; Lev Semenovich Vygotsky, 1978).

Therefore, an appropriate learning model is needed to overcome the problem of learning paradigm gap Society 5.0. In designing learning systems, models usually describe the steps or procedures that need to be taken to create learning activities that are effective, efficient, and interesting, especially on natural science subjects.

Science (Natural Sciences) is a part of science that studies about nature (natural science), while science itself is essentially a reflection of the scientific method which is a combination of rational thinking and empirical ways of thinking that limits scientific review to the scope of scientific epistemological sciences which requires the existence of empirical verification in the process of finding or compiling statements that are scientifically true (Jujun S. Suriasumantri, 2005).

Related to the learning and learning process, according to its nature, science can be seen as a process, product, and attitude (Carin & Sund, 1989). Science learning is seen as a process, meaning that science learning is a way to gain knowledge through several science process skill activities by way of self-inquiry, observation, and experimentation. Not all learning models are appropriate for all learning materials. Certain learning models are only appropriate for certain learning materials. Conversely certain learning materials will be able to succeed maximally if they use certain learning models. Therefore the teacher must analyze the statement formulation of each basic competency, whether it tends to disclosure learning (Discovery / Inquiry Learning) or the learning of the work (Problem Based Learning and Project-Based Learning).

2. Stages of Development of Learning Models

As a strategic stage of achieving competence, learning activities need to be designed and implemented effectively and efficiently to obtain maximum results. One of the research methods that can be done to develop a learning model by applying the steps of the Research and Development (R & D) research procedure (Budiyono, 2017) with the design of development using Dick & Carey (Dick, Carey, & Carey, 2009).

The learning design developed by Dick & Carey (Dick, Carey, & Carey, 2009) is a procedural model, a model that suggests that the application of learning design principles be adjusted to the steps that must be taken in sequence. The following are the steps for developing learning designs according to Dick & Carey.
2.1. Identify Instructional Goal(s)

The initial stage of this model is to determine what students want when they have completed the learning program. Learning objectives may be derived from a list of goals, performance analysis, a needs assessment, practical experience with students' learning difficulties, analysis of people doing a job (job analysis), or from other requirements for new instructions.

2.2. Conduct Instructional Analysis

This step, first classifying goals into the realm of Gagne's learning, determines step-by-step what people do when they do these goals (recognize subordinate / subordinate skills). The final step in the process of learning analytics is to determine the skills, knowledge, and attitudes, known as entry behaviors, which are needed for students to be able to start Learning. Concept maps will illustrate the relationship between all the skills that have been identified.

2.3. Analyze Learners and Contexts

This step carries out student analysis, analysis of the context in which they will learn, and analysis of the context in which they will use it. Student skills, choices, and attitudes that students already have will be used to design learning strategies.

2.4. Write Performance Objectives

These statements come from the skills identified in the learning analysis. It will identify the skills to be learned by students, the conditions under which the skills must be performed, and the criteria for successful performance of learning process.

2.5. Develop Assessment Instruments

This step is to develop parallel grading points (benchmark reference tests) to measure students' abilities as predicted from the goal. The main emphasis is placed on the type of skills described in the objectives and assessments requested.

2.6. Develop Instructional Strategy

The learning strategy sections emphasize components for developing student learning, including pre-learning activities, content presentations, student participation, assessments, and follow-up activities.

2.7. Develop and Select Instructional Materials

Learning materials include all forms of learning such as teacher guides, learning modules, overhead transparencies, videotapes, computer-based multimedia, and web pages for distance learning.

2.8. Design and Conduct Formative Evaluation of Instruction

Formative evaluations are expert evaluations, one-on-one evaluations, small group evaluations, and field trials. Each type of evaluation provides different information for designers to use in improving learning outcome. Similar techniques can be applied to a formative assessment of material or learning in class.
2.9. Revise Instruction

The learning strategy is reviewed, and finally, all of these considerations are incorporated into the learning revision to make it a more effective learning tool.

2.10. Design And Conduct Summative Evaluation

The results in the previous stage are the basis for writing the tools needed. The results of the device are then validated and tested in class/implemented in class with summative evaluation.

3. Conceptual Learning Model Inquiry Social Complexity

Meaningful learning occurs when a person engages in social activities such as interaction and collaboration with his environment (Ataizi & Donmez, 2014; Scott, 2015; Young & Collin, 2004). Also, Vygotsky (1978) argues that learning is a continuous movement from the current intellectual level to a higher level than more closely approaches the potential of students. This process occurs in the zone of proximal development (ZPD) as a result of social interaction.

Conceptual social inquiry model (ISC) is built based on learning theory, namely, behaviorism theory, cognitive theory, constructivist theory, social constructivism theory and complexity social theory as learning outcomes. The Inquiry Social Complexity (ISC) model was developed from the inquiry model, which was analyzed for its shortcomings so that it underlies the birth of new syntax and modification of existing syntax. Ontologically inquiry social complexity (ISC) considers the pattern of interrelation of the learning flow so that there is a match between the expectations and the reality in achieving learning objectives.

The learning model developed is adapted from the needs in teaching-learning process. The problem in learning are analyzed through preliminary studies. The result of preliminary studies in this study used to improve the learning process. Conceptual models are developed for packaging and presenting material, oriented towards the achievement of subject competencies so students can have critical thinking skills and creative thinking skills. The conceptual model has considered packaging material and comprehensive learning tools according to the principles in the Subject Specific Pedagogy (SSP).

Table 1. Review literature level of inquiry, level of cognitive, teaching activity dan level of social complexity (Perdana R, Budiyono, Sajidan & Sukarmin, 2019)

| Model of Inquiry | Discovery Learning | Interactive Demonstration | Inquiry Lesson | Inquiry Laboratory Integrated Skills | Real-World Application | Hypothetical Inquiry Advanced Skills |
|------------------|--------------------|---------------------------|----------------|--------------------------------------|-----------------------|-------------------------------------|
| Level Of Student Skills | Rudimentary Skills | Basic Skills | Intermediate Skills | Observation | Manipulation | Generalization | Verification | Application |
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the study of some literature due to social elements are very important to do in learning process to empower the students cognitive and skills from low level to high level. (Trif, 2015; Russo, Vernam, & Wolbert, 2006).

A child's ability to be influenced by the ability to solve problems and exchange information with others who know more about this will be clearer (Woo & Reeves, 2007). In this case, the teacher can be used as a source to guide and allow students to find out to what extent the students' understanding of studying the lesson.

Social complexity is a force that drives a person to be able to socialize and exchange ideas with those around him so that his cognitive abilities are expected to be in harmony with the development of information exchange. In the 21st century, it is known as effective communication that can facilitate the achievement of the ability to exchange information (NcRel & Metiri Group 2003).

The Inquiry Social Complexity (ISC) model that was developed based on the results of modification and development there are five syntaxes (learning steps) in the Inquiry Social Complexity (ISC) model, namely: Observation Team, Reconstruction, Socialization, Verification, Applied Communication. The five steps of learning the Model Inquiry Social Complexity (ISC) are carried out in an orderly and gradual manner through the learning process.

1) Observation Team: students work together in teams to observe phenomena that have been provided by the teacher in the form of video/demonstration of events to bring up problems that will be researched and studied in learning.

2) Reconstruction: students in each team create ideas and collect data, both qualitatively and quantitatively. Data collection is done through the preparation of practicum tools and materials made by students in groups.

3) Socialization: students in small groups express ideas between groups on the data collected, 1 participant in the group stays in the group then other members play a role in finding the results of other groups through sharing that is presented by other groups which will then be explained again by him to his group friends about what participants get from sharing other groups, each student has an important role to participate effectively in the group.

4) Verification: Students in the team conduct tests and analyze the truth of the facts they find by linking them with the theoretical basis they already know from the previous stage.

5) Applied Communication: students in groups express their opinions using oral or written through the media presentations from the results of group discussions in turn to then be agreed on the truth with the teacher's direction, which is true in learning and can be applied in everyday life.

The Inquiry Social Complexity (ISC) learning model facilitates cooperative learning so that interaction is established between students, between students and teachers. In the Inquiry Social Complexity (ISC) model the teacher acts as a facilitator and motivator during the learning process. The teacher gives phenomena at the beginning of learning, which is then observed by students in groups according to groups that have been predetermined. Through this activity students are given the motivation to investigate through experimentation or exploration of material using the internet and other sources to solve the phenomena they are investigating. Students discuss according to their group to make a conclusion following the material given by the teacher and then communicate the findings that will be applied to the daily life of the results of his parents.

Learners are directed to achieve learning outcomes following the objectives expected in the process of learning activities, the instructional impact of the Inquiry Social Complexity (ISC) model includes:

1) Students are more actively involved in intellectual and emotional learning activities.
2) Students will be able to maximize the logic of their thinking.
3) Students who have high-level thinking skills especially critical and creative thinking (CCT) skills.
4) Increased cognitive abilities significantly and better in conveying their opinions to be communicated with others.
5) Development of cognitive processes, self-confidence, and improve the ability to evaluate in analyzing something and solving a problem.
6) Students will be actively disciplined, skilled in conceptualizing, applying, analyzing, synthesizing, and evaluating information collected from, or produced by observation, experience, reflection, reasoning or communication, as a guide for beliefs and actions.
7) Students will be motivated, inspired, and encouraged to have high expectations of the material learned.
8) Increase their sharpness and imagination to think creatively and positively.
9) Someone can choose ideas or ideas that are more creative, more original, and more useful for themselves or the environment around them.

The Inquiry Social Complexity (ISC) model developed will have an instructional impact and the accompanying impact of learning outcomes obtained directly following the learning objectives (instructional effect) that facilitate the activities of socializing and exchanging ideas between students so that it has an impact on critical and creative thinking (CCT).

4. Conceptual Model of Learning Creativity Entrepreneurship Learning-Based Discovery Skills (CEL-BaDiS)

The CEL-BaDiS Conceptual Model was built based on three learning theories, namely, information processing theory (cognitive theory), constructivism theory, and the theory of behavior change as learning outcomes. These three theories underlie the development of learning models in this study. In epistemology, the learning model developed is essentially a strategy that is carried out to obtain knowledge, in this study through applied science learning. Ontologically, the model developed in this study has been conducted based on a review of the philosophy of science.

The truth in reconstructing the original knowledge by applying philosophical principles contributes to building the structure of scientific thinking that existed before. In axiology, the CEL-BaDiS Model aside from being knowledge also contains values, especially ethics, so that the model has the attitude aspects obtained from the teaching and learning process. The CEL-BaDiS model was developed from the discovery skills that were analyzed for its shortcomings so that the underlying new syntax and modification of the existing syntax were based, ontologically considering the pattern of learning flow interrelationships so that there was a match between expectations and reality in the achievement of science learning goals.

The model developed is adapted to the needs in teaching applied science learning. The problem of applied science learning is analyzed through preliminary studies in this study and requires improvement in the learning process. The conceptual model in this study, developed for the packaging and presentation of material, is oriented towards the achievement of competencies in applied science courses so that students can have the ability of creativity and entrepreneurial skills. The conceptual model has considered packaging material and comprehensive learning tools according to the principles in the Subject Specific Pedagogy (SSP).

Describe the structure of the model that contains stages or steps in learning. The stages of the CEL-BaDiS model are the development of discovery skills by adding a new syntax that is communication through posters and modifying networking syntax into networking with persuading Figure 1. The implementation of the CEL-BaDiS stage in science learning is expected to be able to empower entrepreneurial creativity and skills.
The CEL-BaDiS Model design was developed from discovery skills that have five skills. Design development is carried out after repeated implementations of applied science learning using discovery skills to identify weaknesses and weaknesses of discovery skills. Based on the results of repeated implementations, preliminary studies, and studies of the stages of discovery skills and skills in the 21st century are still needed new stages and modifications to empower creativity and entrepreneurship.

The new stage chosen was communicating through posters, which became the fifth stage of the CEL-BaDiS conceptual model and modifying the sixth stage into networking with persuading. The conceptual CEL-BaDiS Model is carried out through a colloquium review and discussion before an expert assessment and testing phase is carried out. After conducting analysis problems in the field and implementing discovery skills that collaborate with practitioners obtained some input and revision about the implementation of the discovery skill syntax. The CEL-BaDiS model that was developed and then carried out a search and analysis of various articles can be ascertained not found the same model in terms of the name and syntax of the model. Based on the results of modification and development, there are 6 stages (learning steps) in the CEL-BaDiS model, namely Associating, Questioning, Observing, Experimenting, Communicating through posters, and Networking with persuading. The five steps of learning are carried out in an orderly and gradual manner through the learning process.

The CEL-BaDiS learning model facilitates cooperative learning so that interaction is established between students, between students and lecturers. In the CEL-BaDiS model, the lecturer acts as a facilitator and motivator during the learning process. Lecturers provide phenomena, examples of simple biotechnology that are up to date via video or open information directly on the internet. Through this activity students are given motivation to ask questions and argue with regard to the phenomenon given by the lecturer. Students discuss in groups to make a new product according to the material given by the lecturer.

The lecturer must guide, motivate and facilitate by emphasizing the implementation of each stage of learning. Strategies for implementing CEL-BaDiS to be more effective so that the objectives are achieved through: lecturers enrich teaching material that will be delivered from research results, learning materials raise the latest issues, design teaching materials with the latest issues, so students can learn to do analysis and evaluation of the issue, the lecturer gives several questions so students...
need to study literature, synthesize, make observations and experiments and conclude and communicate the results of their experiments.

CEL-BaDiS learning is a method that resembles a scientific approach and includes student-centered learning. Therefore, CEL-BaDiS has the opportunity to develop learning methods including integrating entrepreneurial values in applied science material, active participation of students in the implementation of learning, development of new products created by students through the learning stages.

5. Conclusion
The highest ability needed in facing Society 5.0 is the ability to solve complex problems, critical thinking, and creativity. The mastery of the three main abilities needed by the future is the responsibility of the education world. Inevitably, future holders are not sufficiently equipped with heaps of knowledge, but also ways of thinking. The way of thinking that must always be introduced and accustomed to is a way of thinking to adapt in the future, namely analytical, critical, and creative which is usually called the high-level thinking (HOTS: Higher Order Thinking Skills). HOTS ability can be trained in the learning process in the classroom. Namely, by giving space to students to find the concept of activity-based knowledge. Conceptual models that have been developed in welcoming 5.0 are Social Inquiry Complex (ISC), and Creativity-Based Learning Skill Entrepreneurship (CEL-BaDiS) This can encourage students to build creativity and critical thinking. It is hoped that in future research, it can be applied in learning to advance society 5.0.

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