Analysis the development of sprider learning models to improve student’s critical thinking skills in natural science learning junior high school

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Abstract. This article discusses how the SPRIDER learning model is used to improve student’s critical thinking in natural science learning junior high school. Critical thinking skills are a person’s ability to analyze ideas or ideas logically, reflectively, systematically and productively to help making evaluation and decisions about what is believed or will be done so can solve the problem. The development model used in this study is the Thiagarajan 4-D development model. Result of the need analysis questionnaire, overall 100% of teachers support the development of learning models that are integrated with religious aspects with expectations that it will strengthen the student’s religious character to produce an intelligent and religious generation. The first syntax model for SPRIDER is stimulation; provide a stimulus that student interested in the material to be studied with religious integration. The second stage is problem orientation; provide problems that can improve student’s critical thinking skills. The third stage is reading; student read material related to the problem given. The fourth stage is investigation; students conduct investigations in groups to solve problems. The fifth stage is discussion; students discuss in their groups to find solutions. The sixth stage is evaluation; the last stage where the teacher will evaluate the learning activities that have been implemented to determine the level of student’s understanding about the material that has been learned.

1. Introduction
The world of education is currently facing the challenges of industrial revolution 4.0 [1]. The 4.0 industrial revolution is changing the world around us. Artificial intelligence (AI), robotics, big data, and the internet are inseparable things in human life. Human work will gradually be replaced by machines. This implies that the industrial revolution 4.0 will not only affect industry but will also affect the field of work and education. For this reason, the educational paradigm must also begin to change. The education paradigm facing the industrial revolution 4.0 must be able to form a critical, creative, innovative and competitive generation. With this guidance, the teachers are also required to mastering expertise and have the ability to adapt new information and technology, so it will produce a generation that is ready to face the industrial revolution 4.0.
Natural science learning is one of the learning activities that can help create a creative, creative, innovative and competitive generation. This is because in learning science students are required to think critically, creatively, collaboratively and communicatively. But in reality, sometimes science learning activities in the classroom do not support students' skills for critical thinking yet. Teachers sometimes still do not provide a contextual learning experience in everyday life. In addition, teachers also have not maximized the use of learning models that can develop students' critical thinking skills. Though critical thinking skills are needed in solving complex problems, analyzing, evaluating and creating [2].

Based on the results of PISA research in 2018, Indonesian students' scientific skills still ranked 70 out of 78 participants [3]. From this result, it can be said that Indonesian students' scientific skill, in this case is critical thinking skills are not developed yet. This low achievement can be caused because the students' critical thinking ability is not developed yet, because students are not able to solving problems in daily life. The learning process still does not facilitate students to think critically as it is needed.

One of the effort to develop students' critical thinking skills is using alternative learning models, furthermore the appropriate alternative is known as problem based learning model [4], it presents a variety of authentic problem situations and plays for students who can function as a stepping stone for investigation or inquiry [5]. The implementation of problem based learning model is done by bringing the contextual problem when the learning process takes place [6]. The contextual problem used in learning process can encourage students to think critically (including analysing, evaluating, and creating or making conclusions) [7]. Students in solving problems not only need to understand the materials but also need to analyze, evaluate, and make conclusions on the subject matter to find solutions to the problem.

Critical thinking skills as one of 21st century skills which are realizable to the cognitive aspect [8]. In learning process, teachers do not focus to the cognitive aspects of students, but also pay attention to spiritual attitude that will form characterized human resources mainly in science learning [9], for example by integrating religious aspect in the learning model. The previous research states that to improve students' critical thinking skills can be done using the Problem Based Learning learning model [10]. In addition, mentioned that the application of problem-based learning models can improve students' critical thinking skills. [11]. In another research states that religious-based Problem Based Learning can train and build students' critical thinking skills [12].

2. Methods
The type of research is a development research. Development research is research that produces certain products, that is a SPRIDER (Stimulation - Problem orientation – Reading – Investigation – Discussion – Evaluation - Religious integration) learning model. This development research uses Thiagarajan's 4-D development model which consists of 4 stages; (1) define, (2) design, (3) developing, and (4) disseminate [13]. The define phase aims to define learning requirements begins with a preliminary study conducted with a questionnaire analysis, need assessment through Google Form for junior high school science teachers. This step for learning about the difficulties and needs in schools. The results of the questionnaire then used as the basic for the preparation of learning models.

The design phase is the process of planning the development of the SPRIDER learning model which includes test preparation activities, media selection, format selection and draft. The development phase is the stage of preparing the guidebook for applying the SPRIDER learning model and determining the SPRIDER model set in the form of a syllabus, RPP (Learning Implementation Plan), student worksheets, test questions and instrument validation sheets. After the learning tools using the SPRIDER model are complete and valid, a small group test is implemented. The results of the small group test if there is a revision and are declared valid then can be continued in the large group testing. Then the large group test results will be revised if they are still unvalid. Disseminate phase is the stage of spreading the SPRIDER learning model which consists of three activities, validation test by the natural sains teacher, packaging the manual distributed to other schools so it can be absorbed and adopted in their class (diffusion and adaptation).
3. Result

3.1. Need assessment

The results of need assessment questionnaire that have been filled out by 14 teachers from different schools shown in the following table:

| No. | Question                                                                 | Teachers responses |
|-----|---------------------------------------------------------------------------|--------------------|
| 1.  | Do you use certain learning models when teaching in class?                | 100%   -            |
| 2.  | Have you ever integrated religious aspects in the learning model used in class? | 100%   -            |
| 3.  | Are there any difficulties in integrating religious aspects in the learning model used in class? | 36%   64%           |
| 4.  | Is the learning model that used can develop students’ critical thinking skills? | 93%   7%            |
| 5.  | Do you know about the indicators of critical skills?                      | 100%   -            |
| 6.  | Is there any difficulty in developing students’ critical thinking skills in the learning model used? | 86%   14%           |
| 7.  | Is it necessary to develop an integrated learning model of the religious aspects to develop students’ critical thinking skills? | 100%   -            |

The questionnaire table shows that 100% teacher used certain learning models in class, whereas 14% (2 teacher) use problem based learning, 21% (3 teacher) use inquiry learning and 64% (9 teacher) use discovery learning as shown in Figure 1.

![Figure 1. Learning models often used in science class.](image)

The questionnaire result shows that 93% (12 teachers) notice the learning model they use has developed students’ critical thinking skills, and 7% (2 teacher) learning model can’t develop student’s critical thinking. 100% teachers already know the indicators of critical thinking skills, but 93% (12 teachers) still find the difficult to develop critical thinking skills. They have integrated religious aspects in their learning, but 36% (5 teachers) still find the difficult to integrate religious aspects in learning. Overall, all teachers support the development of religious integrated problem-based learning models to improve students’ critical thinking skills. They were agreed that the development of a problem-based learning model integrated with religious aspect with expectation that will strengthen the student’s religious character to produce an intelligent and religious generation facing the 21st century.
3.2 Result of developing learning model.
This development research resulted new learning model, the SPRIDER (Stimulation-Problem orientation-Reading-Investigation-Discussion-Evaluation-Religious integration) learning model. Stages of learning activities in the SPRIDER learning model are efforts to overcome the weaknesses of the problem based learning model, the unwillingness of students to solve problems because the material is considered too difficult. The development of problem based learning model is in the form of additional stimulus, reading and integration of religious aspects in stimulus stages. Providing stimulation at the beginning of learning, students are expected to become more interested in the material to be studied. Using religious integration, students are expected to be more interested in science learning from the religious point of view. The SPRIDER learning model consist of 6 stage, stimulation, problem orientation, reading, investigation, discussion and evaluation. The results of application SPIDER learning model in the learning process are predicted to improve student’s critical thinking skills integrated with religious aspects.

The Concept map of SPRIDER learning model is illustrated in Figure 2.

**Figure 2.** The concept map of SPRIDER learning model.

The syntax of the SPRIDER learning model is:

| SPRIDER Learning Model Stage | Student’s Activity                                      | Teacher’s Activity                                                                 |
|------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------------------|
| Stimulation                  | - Observing pictures and asking questions related to the material to be studied with religious integration | - Displays pictures related to the material to be learned and explains the benefits of studying the material with religious integration |
|                              | - Doing pre test                                       | - Gives a pre test                                                                 |
| Problem orientation          | - Identify contextual problems given by the teacher    | Provide contextual problems that will be investigated and discussed the solution in learning activities by students |
|                              | - Formulating questions related to the investigation   |                                                                                     |
| Reading                      | Read material from various sources that are relevant to the problem to be solved | Asks students to read material from various sources that are relevant to the problem to be solved |
| Investigation                | - Form group                                           | Guides students to investigate to solve problems in groups                           |
|                              | - Collecting data                                      |                                                                                     |
4. Discussion

4.1 Result of need assessment

The needs assessment questionnaire filled by 14 science teachers from different schools. The result stated that all teachers had implemented a specific learning model. The learning models they use have been able to develop students' critical thinking skills, but it is still difficult to develop learning models that can improve students' critical thinking skills even this is in accordance with the characteristics of learning in the 21st century facing the 4.0 industrial revolution, namely students must have four important 21st-century skills, that is communication skills, critical thinking, collaboration, and creativity [14]. One learning models that can develop students' critical thinking skills among others is by presenting problems in their learning, that is problem based learning model [15].

Result of the questionnaire also mentioned that 100% or 14 teachers said they had integrated religious aspects in their learning and 36% or 5 teachers still had difficulty integrating aspects of religion in their learning models. The learning model they use still does not use verses in the holy book, the teacher still uses religious character values in science learning. In a learning model that is integrated with religion, students not only learn science, but also learn science, which is associated with religion.

The religious integration in the SPRIDER learning model done by showing verses from the Qur'an or hadith at the stimulation stage for moslems, and and for other religions by showing the verses in the holy book that relate to the material to be studied. For example, on topic The Sources of Energy, teacher shows the verses found in Al-Qur'an surah Ar-Rum verse 48 for Muslims and shows the verses in the Bible Matthew 8: 23-27 for Christian students. Stimulation with verses in the holy book aims to show students that the science they learned also contained in the holy book, this can be used to contemplate the greatness of God Almighty.

In SPRIDER learning models stage, some critical thinking skills can be trained such as skills to provide simple explanations and build basic skills, as well as skills to provide further explanation [16]. The integration of aspects of religion in the learning model that has been carried out by the teacher aims to strengthen the religious character of the students to create an intelligent and religious generation accordance with UU no. 20 Tahun 2003 about the national education system. Whereas Indonesia's national education system aims to produce human resources who have the ability to live as individuals and citizens who are faithful, productive, creative, innovative, and affective and are able to contribute to the life of society, nation, state, and world civilization.

4.2 SPRIDER learning model system

The learning system of the stimulation-problem orientation-reading-investigation-discussion-evaluation-religious integration (SPRIDER) learning model is as follow:
4.2.1. Social system
The social system that applies in the SPRIDER learning model is the interaction between students in group during the investigation and discussion and interaction between groups during class discussions. There is also interaction between teacher and students through question and answer for making conclusions about learning outcomes on the evaluation stage.
In the learning process, students are formed in groups of 3-4 children, they interact through discussion in small groups. The teacher also interacts with each small group. Furthermore, group representatives communicate the results of discussion in small group to the class, while the other groups respond.
The interaction model expected in the SPRIDER learning model as seen in the following Figure 3.

Figure 3. The interaction model in SPRIDER Learning model.

4.2.2 The principle of reaction
The principle of reaction in the SPRIDER learning model is the teacher’s function as a facilitator of students in conducting investigations, discussing to develop problems solution and monitoring students when presenting the results of group discussions in front of the class, providing clarification of the results of class discussions and evaluating the learning outcomes that have been carried out through post-test activities.

4.2.3 Supporting system
The support systems of SPRIDER learning model consist of media and facilities. Media include textbooks, ppt shows and videos. Facilities include a laptop, tools and materials needed for investigation.

4.2.4 Instructional impact
The instructional impact of the SPRIDER learning model are improve student’s critical thinking skills in solving contextual problems as one of the skills needed in the 21st century and also improve student learning outcomes.

4.2.5 Indirect Impact
The Indirect impact of SPRIDER learning model includes increasing student’s curiosity, collaboration, respecting the opinions of others and daring to express opinions during discussion and presentation activities.

4.3 Critical thinking skills in the SPRIDER learning model
Critical thinking skills is one of the skills that student’s must have during the industrial revolution 4.0 [17]. Critical thinking skills are one’s ability to analyze and evaluate evidence, identify questions, and build logical conclusions [18]. Critical thinking skills indicator according to Ennis includes [19]; 1) elementary clarification, 2) basic support, 3) inference, 4) advance clarification, 5) strategy and tactics. The SPRIDER learning model uses 3 indicators of critical thinking skills, elementary clarification, basic support, and inference as shown in table 3.
### Table 3. Critical thinking skills indicator uses in SPRIDER learning model.

| No. | Indicator          | Sub indicator                                      |
|-----|--------------------|----------------------------------------------------|
| 1.  | Elementary clarification | Focusing question                                   |
| 2.  | Basic support       | - Consider whether the source can be trusted or not   |
|     |                     | - Investigate and consider investigative reports        |
| 3.  | Inference           | Induce and consider induction results                 |

The SPRIDER learning model is predicted to improve students’ critical thinking skills. In this learning model, critical thinking skills are trained in each learning activity. The first syntax; stimulation, the stage of giving stimulus by providing interesting video or images and illustrations of material to be studied with religious integration to attract students’ interest. Stimulation in the learning process also helps facilitating in learning so student be able to develop and assist students in the investigation process [20].

The second syntax is problem orientation, orientation towards contextual problems. Problem orientation is the basis of the problem solving process [21]. The problems identified will be formulated into questions that must be answered through investigation. Formulating and asking questions are one of critical thinking skills indicator [22]. The third syntax is reading, students read material that relevant to the problem. Reading is not only about expressing what is in the text but also process of constructing meaning [23] Besides that, reading has a strategic position in developing students’ thinking skills [24]. In reading, student consider whether the source can be trusted or not. The fourth syntax is investigation, students’ critical thinking skills can be developed through investigation to answer the formulation of questions that must be solved. The fifth syntax is discussion, students discuss in small groups and then presented in class discussions to develop solutions to problems. The sixth syntax is evaluation, student and teacher induce and consider induction result from discussion to make conclusions from the material that has been studied. In this stage, the teacher also evaluates learning outcomes to determine the level of student’s understanding with questions that contain indicators of critical thinking skills.

### 5. Conclusion

The SPRIDER learning model is developed from a problem based learning model modified and integrated with religious aspects. It is predicted to improve student’s critical thinking skill. The SPRIDER learning model has 6 syntaxes that is stimulation, problem orientation, reading, investigation, discussion and evaluation with religious integration. The SPRIDER learning model system are social systems, the principles of reaction, support systems, instructional impacts and indirect impacts. Critical thinking skills measured in this study include 1) elementary clarification, 2) basic support, 3) inference. Critical thinking skills can be found in the syntax of the SPRIDER learning model, where elementary clarification found in stimulation and problem orientation stage, basic support found in reading and investigation stage and Inference found in discussion and evaluation stage.

In this study only measured three indicators of critical thinking skills from Ennis, therefore for further research, the researcher recommends indicators of critical thinking skills as a whole. Besides that, it is necessary to hold further research about validation of the SPRIDER learning model so can be disseminated.

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