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SSCS Model Based E-Worksheet: Needs Analysis to Stimulate Critical Thinking Skills

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Abstract: This study aims to determine the need to develop an e-Worksheet based on the SSCS model to stimulate critical thinking skills. This study uses a qualitative descriptive method to provide an overview of the implementation of critical thinking skills in high school during learning that implements the independent curriculum. This research was conducted in March 2023. The data source was obtained using the non-test technique in the form of an open questionnaire. The subjects in this study were 15 physics teachers spread across 3 provinces in Indonesia, including Lampung, Central Java and South Sumatra. The data analysis technique is the Miles & Huberman (2018) analysis technique which is carried out continuously until the data is saturated. Data analysis involves three steps, data reduction, data presentation, and verification. The results of the study show that critical thinking skills have not been fully implemented in physics learning in senior high schools in the independent curriculum. Therefore, the development of an e-Worksheet based on the SSCS model is needed to stimulate students' critical thinking skills.

Keywords: Critical thinking skills; E-worksheet; SSCS model

Introduction

Twenty first century skills are the basic skills that every individual must possess to adapt to the dynamics and problems of an ever-evolving and changing era. The World Economic Forum (WEF) (2016) developed a 21st Century Skills Framework which consists of three major skills including Foundational Literacies which include Literacy, Numeracy, Scientific Literacy, ICT Literacy, Financial Literacy and Cultural and Civic Literacy; Competencies which include Critical Thinking/Problem Solving, Creativity, Communication and Collaboration; and Character Qualities which include Curiosity, Initiative, Persistence/grit, Adaptability, Leadership and Social and Culture Awareness. While there are many descriptions of skills that must be possessed in the twenty-first century, students' ability in critical thinking is one of the most frequently recorded and most widely studied. This ability is interconnected with other cognitive skills such as problem solving, decision making, and creative thinking (Cossio et al., 1988; P. A. Facione, 2015), and has contributed to being an important part of educational goals since the 1980s (Binkley et al., 2012). Consequently, critical thinking skills play a fundamental role in defining, assessing, and developing twenty-first century skills (Bao et al., 2019). The literature on critical thinking is extensive (Bangert-Drowns et al., 1990; P. A. Facione, 1990; Glaser, 1942). There are several different definitions with the same basic principle. Broadly speaking, critical thinking is the application of cognitive skills and strategies that address and support evidence-based decision making. This is the thinking used to solve problems, draw conclusions, calculate probabilities and make decisions (Halpern, 1999). This is "rational reflective thinking that focuses on what to believe or what to do" (Ennis, 2011). Critical thinking is recognized as a way to understand and evaluate an issue; creating reliable information and enhancing thinking itself (Paul, 1991; Siegel, 2013). Therefore, this ability is very crucial to be taught to students, especially during learning activities.

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The results of the 2018 PISA (Program for International Student Assessment) show that 50 out of 78 OECD countries get an average score of scientific ability that is lower than the international average score 489 (Schleicher, 2019). Meanwhile, the TIMSS 2015 results (Trends in International Mathematics and Science Study) show that 16 of the 53 participating countries have an average score in science lower than the international average score 500 (IEA, 2015). The results obtained by Indonesia in the 2018 PISA were ranked 72 out of 78 countries, while in TIMSS 2015 Indonesia was ranked 44 out of 49 countries. This is quite a worrying result. Both PISA and TIMSS in carrying out their tests use the criteria of HOTS questions which require skills in applying scientific concepts, reasoning, critical thinking and other higher order thinking skills. This indicates that most students in several countries including Indonesia have low critical thinking skills.

Critical thinking skills are also characters that are developed in the implementation of the latest curriculum currently in force in Indonesia. In the implementation of the independent curriculum, the new learning paradigm that was developed was the strengthening of the character of the Pancasila student profile which included faith, fear of God Almighty, and noble character, global diversity, mutual cooperation, independence, critical reasoning, and creativity. Critical thinking skills or critical reasoning are one of the indicators that are measured in the learning process. However, the fact is that the critical thinking skills of Indonesian students are still low and are still below the expected average (Alexandra et al., 2018; Kirana et al., 2019; Nurazizah et al., 2017). One of the factors that influence the improvement of critical thinking skills is the teacher's ability to choose learning strategies and learning models (Kurnia et al., 2014) as well as the teaching materials used. One model that is believed to improve critical thinking skills is the SSCS (Solve, Search, Create, and Share) learning model. Learning using the SSCS model teaches a problem solving process and develops problem solving skills (Lartson, 2013). The steps taken include search (looking for topics), solving (designing research), Create (make products) and Share (demonstrating products) (Milama et al., 2017). Several studies have shown positive implications of learning with the SSCS model in improving critical thinking skills (Arisa et al., 2021; Milama et al., 2017; Saregar et al., 2018). However, this research is still limited to the application of the SSCS model in learning activities and has not penetrated teaching materials. Meanwhile, research by Wulan et al. (2021) revealed that SSCS-based modules are able to train critical thinking skills, however this research is limited to the subject of biology, the results are unknown when applied to the subject of physics. Through the use of appropriate teaching materials, students will be able to develop their critical thinking skills. Thus, the purpose of this study is to determine the need for the development of the SSCS Model-based e-WORKSHEET. The results of this study are expected to be the basis for the development of the SSCS Model-based e-Worksheet to train critical thinking skills.

Method

This study uses a qualitative descriptive method to provide an overview of students' critical thinking skills in secondary schools. Descriptive research is the collection of information based on facts found in the field (Arikunto, 2019). Qualitative research helps us to understand individual points of view, describe the process, and explore detailed information about the research subject. This research was conducted in March 2023. The subjects in this study were 15 physics teachers spread across three provinces in Indonesia which included the provinces of Lampung, Central Java and South Sumatra. Participants in this study were selected based on a purposive sampling technique, with the condition that they had implemented the Independent Curriculum and agreed to become research subjects.

The data collection procedure uses a non-test technique in the form of an open questionnaire equipped with reasons for each answer. After all the information from the questionnaire was complete, triangulation of data sources was carried out so that conclusions could be drawn. The data analysis technique used is the Miles & Huberman analysis technique (Ridder et al., 2014) which involves three steps, namely data reduction, data presentation, and drawing verification.

Results and Discussion

This research involved 15 physics teachers in schools who had implemented the Independent Curriculum in three provinces in Indonesia, namely Lampung, Central Java and South Sumatra. The results of the study show that physics learning in schools has implemented differentiated learning in accordance with the demands of the implementation of the Independent Curriculum. The differentiation made by the teacher includes product, process and outcome differentiation. Differentiation of the process carried out by the teacher includes the use of various learning models and methods that are adapted to the characteristics or needs of students. To meet the varied needs of students, teachers teach not only by lecture method but also in the form of discussions, projects, experiments, demonstrations and exercises. However, the results of

the study show that students' critical thinking skills have not been fully trained in learning. Although some teachers are indirectly involved in activities that lead to critical thinking, not all learning that takes place is explicitly intended to engage in critical thinking. This is known because not all indicators of critical thinking are included in learning activities, teaching modules and assessments. The Worksheet used by the teacher is still limited to summarizing material, practicing questions and generally doing practicum assignments, and has not yet led to critical thinking exercises. Table 1 summarizes several questions that contain indicators of critical thinking and the responses given by the teacher.

Table 1. Results of Identification of Critical Thinking Ability in schools

Indicator	Teacher Response
Learning trains students to understand and express the meaning or meaning of a problem	Already: conducting experiments, collecting problems, analyzing and drawing conclusions, problems adapted to lesson plans, problems given at the beginning of learning, discussion of learning problems using group methods, students are given time to ask questions about learning problems, explanations about the material and giving practice questions according to the questions daily. Not yet: because students are less interested in learning, it is considered that they can understand the meaning of the questions, the teacher is not used to carrying out activities in learning.
Learning trains students to identify and conclude relationships between statements, questions, concepts, descriptions or other forms	Already: using measuring instruments, giving questions in the form of relevant cases found every day, identifying the relationship between questions and concepts, giving practice questions, and presenting experimental results. Not yet: because class time is limited, teachers are not used to it, students are less active in learning, and learning information only comes from the teacher.
Learning trains students to identify and use the elements needed in drawing conclusions	Already: practicum in class, implementation, differentiating learning by giving various assignments to students, and group discussions. Not yet: because it only focuses on solving calculation problems. Time constraints with the amount of material that must be done. So that only the core material is learned.
Learning trains students to assess the credibility of various statements or representations and is able to logically assess the relationship between statements, descriptions, questions and concepts	Have: activated students in practicum, analyzed practicum results data, involved them in processing practicum results, processed practicum statements with the concepts given, explained experimental results with various representations and provided practical assignments at home. Some haven't: because the teacher only follows the lesson according to the LKS, and the teacher never conducts credibility assessment activities during learning.
Learning trains students to determine and give reasons logically based on the results obtained .	Already: by involving students in practicum, taking experimental results, presenting arguments from experimental results, collecting data from various theories through group discussions. And invites students to write down experimental results accompanied by arguments based on theory. Not yet: because the teacher is only used to giving calculation questions during learning, and the learning process follows the existing worksheet.

The first question was about the involvement of students in understanding and expressing the meaning of a problem, most of the teachers answered that this activity had been rehearsed during the lesson. However, some of the answers provided do not contain detailed information about the actions taken and do not reflect the purpose of the questions asked. In fact, it refers to how students can express basic information systematically, especially when dealing with complex problems. For example, in the Discharge and Continuity section on Dynamic Fluids, students are given problems related to how to determine the right pump to use to pump water so that the water level in the tube is maintained.

These problems require an in-depth understanding of the meaning of a problem where students need to collect basic information first to be able to solve the problems presented, such as knowing the correct discharge concept, knowing the height of the hole, knowing the distance of the jet hole and so on. This is one of the key characteristics of interpretation ability which consists of several sub-abilities, namely categorizing, rewriting problems, and explaining problems in detail. Students may not be able to solve the problem correctly if they do not understand the problem given. Students must be able to show the principal parts of the problem, what is asked, what is known and the prerequisites. The stage of understanding this problem requires students to be able to write down what is required by the problem. What is known, what is desired by the questions, students are required to be able to rewrite it. The main key in solving problems is knowing and understanding what the problem is. Therefore, giving students time to understand in detail the

problems given is the main key that teachers need to do to train students' critical thinking skills (Azizah et al., 2019).

The teacher's response to the second question regarding student activities in identifying and concluding relationships between statements, questions, concepts, descriptions or other forms, shows that these activities are rarely practiced during learning. Several teachers who answered that they did not practice these activities gave the excuse that class time was limited, so the teacher only focused on the essential material without practicing identification skills and concluding relationships between statements. Apart from these reasons, the problem that is the reason is that the teacher is only used to giving material, without practicing other abilities during learning. The activeness of students in class is also the reason the teacher does not practice the ability to identify and conclude these statements during learning. Even though some teachers answered that the activity had been practiced during the lesson, the method of training described did not represent the intent of the questions given. This means that the teacher may not understand the purpose of the activity.

The purpose of identifying and concluding concept relationships is the skill to identify the correct intentions and conclusions between statements, questions, concepts, descriptions based on beliefs, decisions, experiences, reasons, information or opinions (P. Facione, 2011). This ability can be trained by reflecting and organizing information such as data, evidence, statements, questions, concepts, opinions, and other forms of representation, to create sense and meaning. This requires the ability to analyze and sort information to find patterns and build conceptual relationships within them (Ennis, 2011) by doing these actions in learning can train students' critical thinking skills during learning.

The third question related to the involvement of students in identifying and using the elements needed in drawing conclusions, most teachers gave the same response as the previous question where the teacher still had difficulty practicing these abilities due to limited learning time and only focusing on counting questions. The teacher who answered had trained him in practicum activities and group discussions. However, this answer is not in accordance with the context discussed in the question. So that in general the identification ability to draw conclusions is still very rarely trained by teachers during learning. The ability intended in identifying the use of elements to draw conclusions is the skill to identify and select the elements needed to form reasonable conclusions or form hypotheses by taking into account relevant information and reducing the consequences arising from data, statements, opinions, concepts, descriptions, questions, or other forms of representation (P. Facione, 2011). It is used to draw effective conclusions. In order to make effective conclusions, one first needs to understand the problem or situation about which decisions need to be made, to obtain criteria for assessing decisions (Ennis, 2011). Understanding the decision criteria requires not only an analysis of the current situation in terms of constraints and demands but the ability to recognize what would constitute the ideal outcome (P. Facione, 2011). By practicing this, students' critical thinking skills will increase when trained in the learning process.

As for the response to the fourth question related to training students to assess the credibility of various statements or representations and to be able to logically assess the relationship between statements, descriptions, questions and concepts, the teacher who answered had not done so, considered that the learning activities carried out only followed Worksheet and textbooks so that it is not applied. Whereas the teacher who answered that he had done so provided a clear description of the activity, but the credibility assessment described was not clear and detailed.

When assessing the credibility of various statements or representations the teacher can provide explanations or descriptions of one's perceptions, experiences, situations, judgments, beliefs or opinions and to assess the logical strength of actual or intended inferential relationships including statements, descriptions, questions or forms of representation other. Several teacher respondents have done this by processing the practicum data results into other forms of representation such as graphs, tables, sketches, or others. This indicates that some teachers have used this indicator of critical thinking, although others have not yet practiced it in learning. To practice this ability, teachers can provide learning in processing experimental results or analysis results using multiple representations (multi-representation). The use of multi representation in processing and presenting data in learning can train students' thinking skills (Rahmat et al., 2019).

On the fifth question, some teachers answered that students had been trained to implement plans by writing down experimental results accompanied by arguments based on theory. However, the activities carried out have not fully represented the desired answer. The ability to determine and give reasons logically based on the results obtained can be trained by stating the results of reasoning, justifying that reasoning based on consideration of evidence, concepts, methodology, criteria and context and to present reasoning in the form of convincing arguments (P. Facione, 2011). This ability is not fully carried out by

simply writing down experimental results, but also having to analyze evidence, concepts, and arguments according to the results of in-depth reasoning. This can be trained if students are active in discussing and reviewing material concepts that have been applied during the experiment. To improve this ability the teacher must get used to ending learning by stating results, justifying procedures, and presenting arguments appropriately. Arguing precisely according to procedures and concepts requires deep thought. The main characteristic of critical thinking, namely deciding about a belief, is an argument, by assessing the arguments of others and developing one's own. Argumentation has a significant contribution in developing critical thinking skills with distinctive characteristics, namely assessing sources of information, evaluating arguments and generating arguments and presenting them (Roviati et al., 2019).

Based on the description above, it is known that critical thinking skills have not been fully implemented in learning physics in the implementation of the independent curriculum. The description of the answers written by the teacher illustrates that some teachers do not understand the indicators of critical thinking so there is confusion in practicing them during the learning process. Even though critical thinking skills are the main competencies that students must have, especially in the implementation of the independent curriculum where the core of the independent curriculum is an increase in the 6 dimensions of the Pancasila student profile including critical thinking skills. In addition, critical thinking skills are a major component of the skills needed in the 21st century. Students with higher critical thinking skills can use prior knowledge more proficiently when learning new content; thus, their learning is faster and deeper. Critical thinking has been considered an indicator of academic achievement and a leading indicator of achievement in other skills. Given the increasing importance and need for critical thinking now and in the future, students' abilities are not accompanied by an increase in critical thinking skills, so continuous research is needed to improve students' critical thinking skills (Erlistiani et al., 2020). Improving critical thinking skills can be trained during the learning process, so in this case it is necessary to develop a Student Worksheet that can train critical thinking.

Conclusion

Based on the results of the research, it was concluded that critical thinking skills had not been fully implemented in learning physics in the implementation of the independent curriculum. The description of the answers written by the teacher illustrates that some teachers do not understand the indicators of critical thinking so there is confusion in practicing them during the learning process. Therefore, it is necessary to develop a learning media that can train critical thinking. SSCS Model-Based e-worksheet is needed as a learning medium in training critical thinking skills.

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Author Contributions

The author's contribution in the field of education is to provide an overview of the profile of Indonesian students' critical thinking skills in spectacles learning in the implementation of the independent curriculum. It aims to improve the physical quality of education in Indonesia.

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The findings in this study are to obtain an overview of the critical thinking skills of Indonesian students which are still low in terms of physics learning in the independent curriculum, so it is necessary to develop an SSCS Model-Based e-LKPD as a learning medium in training critical thinking skills.

Conflicts of Interest

No Conflicts of interest.

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