Hybrid learning on problem-solving abiities in physics learning: A literature review

Hybrid learning on problem-solving abiities in physics learning: A literature review

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Abstract: Difficulty in understanding and applying physics concepts is a problem that is often encountered in learning. Therefore, problem-solving abilities are needed in physics learning. The ability to solve problems in physics learning is an ability that students must have to find solutions to a problem, especially in understanding and applying physics concepts. Problem-solving in physics learning is certainly better if teachers explain directly. However, in certain situations such as the Covid-19 pandemic, teachers cannot help students directly. In hybrid learning, face-to-face learning can still be done virtually. Research in the last 10 years publish through reputable journals in various countries in the word (Taiwan, Belgia, Jerman and Indonesia) were are analyzed for the purpose of this article with the help of NVIVO 12 Software. Results of the analysis from various articles found that hybrid learning is a learning model that can be used as an alternative to help students solve problems in physics learning. For this reason, hybrid learning needs to be given serious support for the current learning process and teachers need to be given special and continuous training in the use of this learning model the learning process can be carried out well even in difficult situations like today.
Keywords: Difficult situations, Hybrid learning, learning models, Problem-solving abilities, Understanding and Applying concepts.

1. Introduction

One of the factors that influence future education is the development of technology and information [1]. Many benefits will be obtained when teachers and students apply technology in learning. By utilizing technology, learning will run effectively and easily [2], especially in solving physics learning problems. Problem-solving abilities in physics learning is an important thing for students to have [3] because it is one of the learning goals [4]. Through the problem-solving abilities, students can have a positive attitude towards learning [5], can solve problems effectively and flexibly [6], can understand and apply concepts, and can find solutions to problems in physics learning [7]. Unfortunately, in classroom learning, students' physics problem-solving abilities are relatively low [8], [9].

To overcome the problems, students need to have physics problem-solving abilities. Previous research has investigated problem-solving abilities in physics learning using several learning models, including the Hints and Answer model [10]. According to Henk J Pol, in the Hints and Answer model, students tend to choose answers available in books when they fail to solve problems on their own during independent learning without asking for feedback from teachers regarding the solutions. Another research has been done using the Dialogical Argumentation model [11] where students are taught how to generate arguments to solve problems and make statements from the solutions obtained. However, it requires more time to listen to the students' arguments one by one. A learning model that can provide feedback to students in solving problems promptly is needed. The hybrid learning model can be used as an alternative learning model in understanding concepts and finding the best solutions in solving problems. This model enables the students to have more time to solve problems because learning can be done anywhere and anytime [12]–[16].

A review of hybrid learning on physics problem-solving abilities needs to be done because not all teachers have the same expertise in applying hybrid learning. Even some teachers experienced confusion when implementing this learning model. So, it is necessary to have a review of hybrid learning on problem solving skills in learning physics.

2. Method

This article is in the form of a concept paper to see the problem-solving abilities of students in learning physics. Data was extracted from various scientific publications in the form of books and scientific articles from reputable journals. Reputable international journals in the Q1 category were 36.9%, the Q2 category was 14.13%, the Q3 category was 11.9% and in the Q4 category were 3.26% and international journals were 7.6%. Reputable national journals that were included in the S2 category were 7.6%, S3 category were 4.34%, and S4 categories were 6.52% and national journals were 7.6%. These articles were analyzed with the help of NVIVO 12 software.

3. Results of Literature Review

3.1 Problems in Physics Learning and Problem-Solving Abilities

Some problems are often encountered in physics learning, one of which is that students perceive physics as a difficult and boring subject [17]. Although teachers have acted as active material providers, students tend to be passive material recipients [18] so that the material cannot be conveyed properly [19]. One of the complex problems that are often encountered in physics learning is the difficulty in understanding and applying physics concepts [20]. Students often understood the concept but it is difficult for them to apply the concept in finding a solution to a problem [21]. When facing a problem involving physics concepts, more than one student experience difficulties [22], [23]. Students also tend to blindly obey teachers in solving problems, even though conceptual understanding is needed in solving physics problems [24]. Students have difficulty applying concepts [25] and applying knowledge in physics learning [26], Furthermore, misconceptions also occur in physics learning [27]. Learning that emphasizes problem-solving in physics learning is still lacking [28], such as analyzing [29] and identifying problems [22].

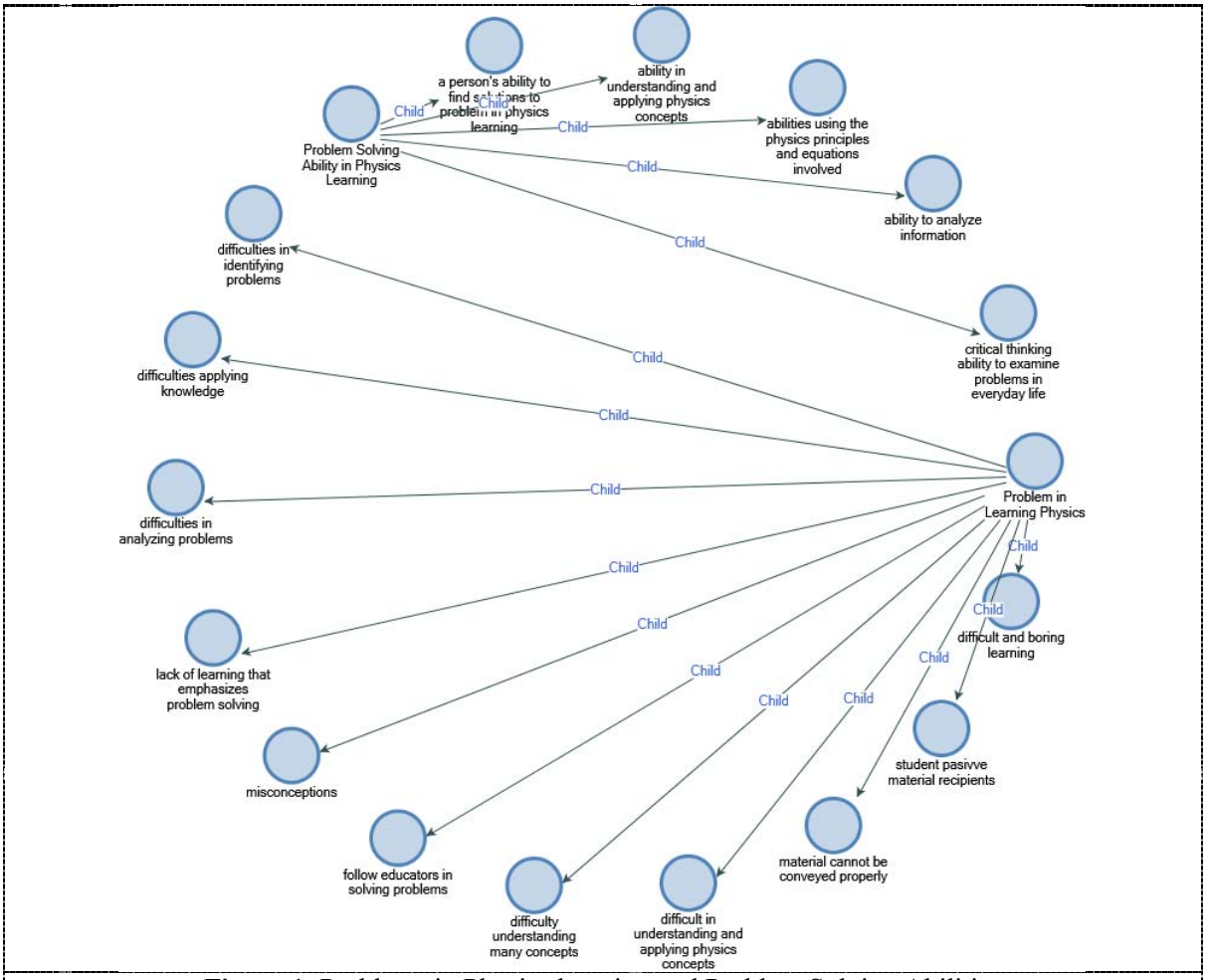

Figure 1. Problems in Physics learning and Problem Solving Abilities

The minimum attention to problem-solving in physics learning [30] resulting in many students experiencing difficulties in solving problems [8], [31]–[35]. The problems in physics learning referred to in this article are the difficulties to understand and apply physics concepts. Understanding and applying concepts in physics learning is the key to solving problems in physics learning [36] and is one of the main goals in physics learning [37], [38]. If teachers do not teach students to understand and apply concepts, students will have an incorrect understanding of phenomena, laws, and principles of physics [19]. Such understanding will also become a new problem when the students learn the next material. These problems are not resolved immediately [39]. For this reason, the problem-solving abilities in physics learning are something that must be owned by students to be able to solve problems properly.

Problem-solving abilities is a person's abilities to find a solution to a problem in physics learning [29], [40]–[42], especially in understanding and applying physics concepts [40], [43] using the physics principles and equations [44]. In solving problems, students do not only depend on memorization, but also in analyzing information [42] and critical thinking to examine problems in everyday life [45].

Indicators or stages in problem-solving consist of understanding the problem, making plans, implementing plans, and re-checking the solutions that have been obtained [46]–[49]. Teachers should teach

each of these stages to help students solve problems in physics learning [50]. Indicators of physics problem-solving need to be controlled by students to be seen as someone who has problem-solving abilities [34]. Also, a person needs to choose variables that are relevant to the statements, concepts, and principles in finding a solution [51].

According to Çalişkan, someone who has problem-solving abilities tends to analyze the problem first before proceeding to problem-solving [52]. According to Mestre, a person will focus on concepts that have been understood and those who lack problem-solving abilities tend to rely on equations and rely on examples that have been explained by teachers previously [43]. Some of the benefits when students have problem-solving abilities in physics learning can practice the learned concepts in everyday life [25], no longer having difficulties when facing problems that involve more than one concept [22], and able to understand and apply physics concept [53].

3.2 Hybrid Learning and Problem-Solving Abilities in Physics Learning

Hybrid learning is a learning model that combines face-to-face learning with online learning [54]–[59]. Face-to-face learning in the pandemic condition can be done through virtual [60] and online learning by utilizing social media such as email, Facebook, Twitter, Wiki, website, and blog [61]. According to Verawati, hybrid learning is a learning model that combines face-to-face learning and learning that is contained on computers, television, and others [62]. According to Hidayah, hybrid learning is an innovation in the world of education that collaborates face-to-face and online learning using sophisticated technology or internet networks [1]. Teachers can arrange the number of face-to-face meetings and how many meetings online [63]. From some of the opinions above, it can be concluded that the hybrid learning model is a learning model that combines face-to-face learning with online learning that utilizes the sophistication of the internet and technology. Hybrid learning does not attempt to replace the role of teachers, yet it seeks to make learning take place effectively [64] because the role of teachers cannot be replaced.

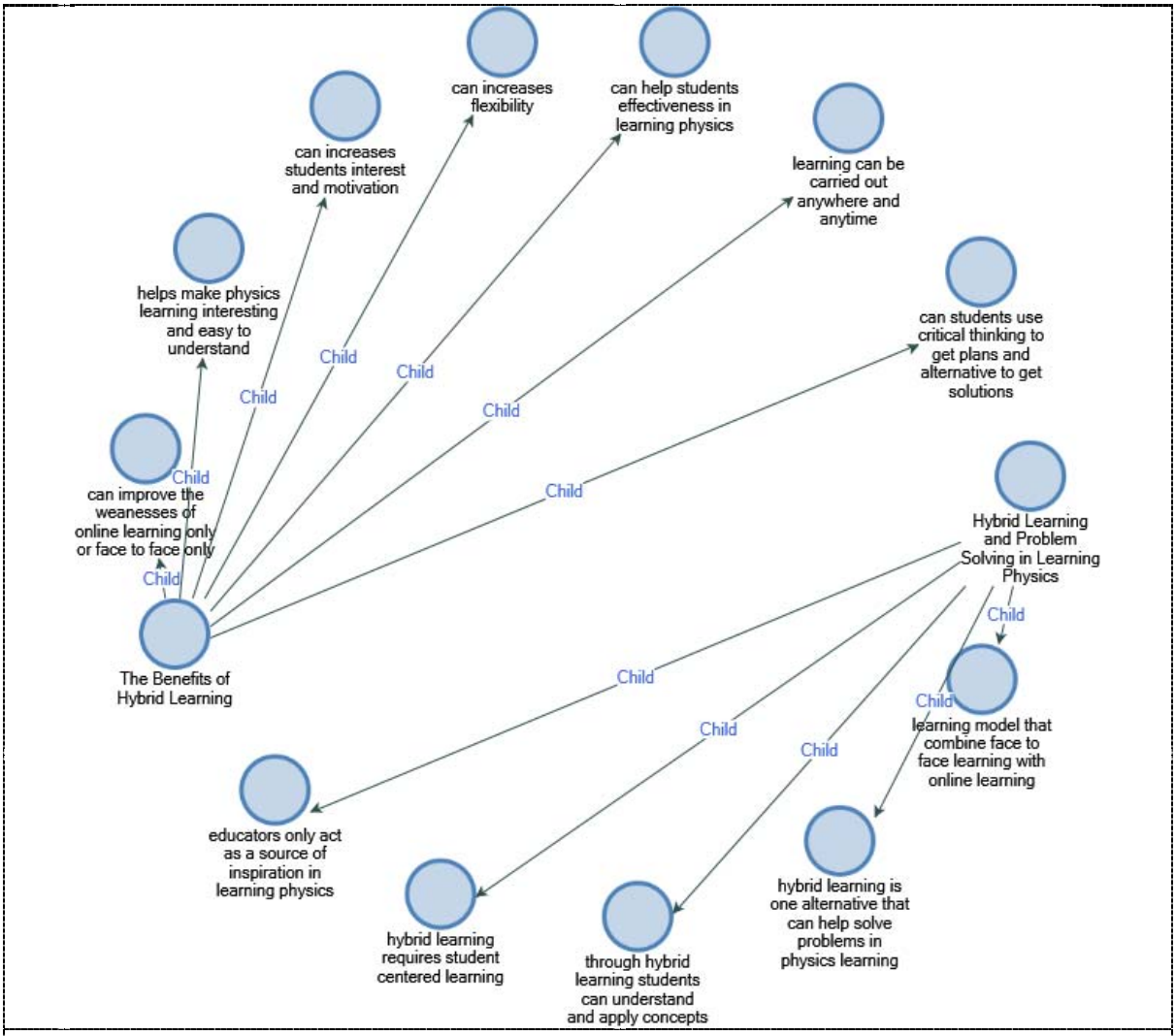

Figure 2. Hybrid Learning and Problem-Solving Abilities in Physics learning

Identifying learning models to assist problem-solving is necessary so that learning can be conveyed effectively [65]. One alternative that can assist the physics problem-solving is the hybrid model [13], [15], [16]. Through this model, students can understand and apply concepts so that they can solve physics problems in learning [66]. Hybrid learning requires student-centered learning where teachers only act as a source of inspiration [67]. Even without the presence of teachers, students can search for information on the internet to solve physics problems [12]. However, if students find it difficult to apply the concept, they are expected to ask questions either to teachers or fellow students who have already understood [68]. Questions can be asked when learning is taking place in class or during online learning. Through hybrid learning, students can acquire abilities beyond their abilities and expand their abilities in finding solutions [15]. Students will discuss and be free to search for information and literacy available on the internet [69]. Students will have the responsibility to produce arguments to solve physics problems.

The use of the hybrid model can improve the weaknesses of online learning and face-to-face learning [70], [71]. One of the weaknesses of this model is the students' activeness in learning. In face-to-face

learning, students are actively involved. They will ask questions if they have problems in learning. However, students lacked activeness in looking for the material. They are accustomed to being fed material. In online learning, they are less active although they are required to be active in obtaining and understanding the material. through hybrid learning, these weaknesses can be mutually enhanced. Students are given the freedom to access information and material via the internet network so that they can be more active in learning. The teachers-students interaction is possible via video conferences even though the results will not be the same as face-to-face learning in class.

Hybrid learning can be used as an alternative during the Covid-19 pandemic [72]. The coronavirus presents an unprecedented challenge [60]. Many activities have been postponed and canceled, including education [73]. Covid-19 changes and limits face-to-face meetings. However, the learning process can take place virtually through the hybrid learning model [60]. Digital platforms are used for remote information exchange where interactive video and audio enable the interactions between teachers and students [73].

Hybrid learning makes physics learning interesting and easy to be understood by increasing students' interest and motivation [74], flexibility [75], and the effectiveness in physics learning [54]. According to Satrianawati, the activities carried out by students every day cannot be separated from the influence of technology. Technology in learning will help the students' to understand physics, present data or information, and make it easier to interpret data and get information. Students are familiar with the use of technology, especially computers and cellphones. By using both, they will become more enthusiastic in finding and studying physics. Study materials can also vary, not only in the form of words, but also in other variations such as text, audio, video, film, and animation.

The hybrid learning can facilitate teachers and be beneficial for students because the learning can be done anywhere and anytime [76]. Learning will not be limited by space and time because learning can be done anywhere, not necessarily in the classroom. Even at home, the learning process can still take place as long as a good internet connection is available. Learning can also be done and accessed at any time, be it day or night so that the students could have more time to think critically and to solve physics problems [77]. Students apply critical thinking to obtain plans and alternatives to find solutions [78].

Through the hybrid learning model, teachers can facilitate problem-solving abilities to find information [66]. because the abilities to solve physics problems is a cognitive aspect that students need to possess [79]. Teachers need to prepare content [80], teaching materials [81], and guide students in physics problem-solving [38]. Students tend to find it easier to find concepts than applying the concepts in various problems [53]. They should be able to understand and apply concepts to produce solutions in physics learning [43]. They should be able to understand and apply concepts to produce solutions in physics learning [25].

Teachers are expected to make maximum use of internet technology and facilities in the hybrid learning model [82]. Through a hybrid learning model, technology and the internet can facilitate students to obtain information and knowledge not only from face-to-face learning but also from learning outside the classroom [83]. By utilizing technology and the internet, teachers can use the platform as a medium of learning, such as homework, questions, discussions, and weekly quizzes [84]. To support the statements by [85], [86], utilizing media is an obligation in learning, especially physics learning. Several media and platforms have been used by previous researchers in problem-solving abilities, namely web-based learning where students can interact through a chatroom, email, discussion forums, can do assignments, and can answer questions [62]. The Quipper School can connect the teachers and students via an online network [87]. E-scaffolding can help students to understand the concept and find the best solution in solving physics problems [15]. Furthermore, through Edmodo, students will be independent in physics learning isika [88].

By applying the hybrid learning model on problem-solving abilities in physics learning, teachers will no longer find difficulties. Students will also have problem-solving abilities in physics learning because when they face difficulty in solving problems they can get feedback from teachers during face-to-face learning or

online learning. the students will also have more time to solve problems because the learning can be done anywhere and anytime, as long as they have an internet connection

4. Conclussion

Helping students to solve problems in physics learning is something that needs to be done by teachers through the hybrid learning model by combining face-to-face learning and online learning (technology and networks). Hybrid learning can help in solving physics problems. Hybrid learning can also be used as a solution in learning when certain situations occur like now (Covid-19 pandemic). The learning can still be done virtually. Therefore, hybrid learning needs to be supported in today's education world and it is necessary to provide training for teachers to apply the hybrid learning model in physics learning.

5. Recommendation

Helping students to solve problems in physics learning is a form of teachers' empathy [89]. It also shows that the teachers are qualified [90] and has high emotional intelligence [91]. Hybrid learning can be used as an innovation in all situations. Covid-19 forces all activities to be carried out from home by utilizing technology and the internet. Face-to-face learning can be done virtually through interactive video and audio. It is also important for teachers to adapt to the face-to-face and online learning (hybrid learning) [92] to help solve physics problems.

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