

Problem-based learning and 21st-century skills: Are they compatible?

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Abstract

Rapid changes in the 21st century require students to have not only theoretical knowledge but also high order thinking skills and communicative skills. Arguing that problem-based learning can be a good alternative for improving 21st-century skills, the present study will elaborate on the characteristics, syntax, strengths, and challenges faced in implementing problem-based learning in the classroom. Library research was employed to choose the references for supporting the arguments. Relevant articles were chosen from reputable international journals through Google Scholar, limiting the publication's date from 2015 – 2020, with keywords related to problem-based learning and developing 21st -Century skills. The results reveal that the problems proposed in problem-based learning must be real-life-based and require problem-solving skills. The syntax of the implementation can be adjusted based on the needs of teachers and students. Although problem-based learning might be intricate, suitable strategies can be employed to obtain maximum benefits from this approach. In short, problem-based learning is an appropriate teaching approach to be implemented to meet the needs of the 21st century.

Keywords: 21st-century skills; higher-order skills; problem-based learning

INTRODUCTION

The development of the industry in the 21st century has influenced the development of other sectors. As predicted by Naisbitt and Aburdene in the 1990s; and then confirmed by Diamandis and Kottler in 2012, the exponential development of technology is inevitable (Diamandis & Kotler, 2012; Naisbitt & Aburdene, 1990). This development brings radical changes that shift learning goals from the mastery of skills toward expertise with awareness toward nature and the rich differences of our global society (Puspawati et al., 2021; Trilling & Fadel, 2009). It is the age where cognitive development alone will no longer suffice for our students' survival as a future workforce. They need to have good moral quality (Lickona, 1991; Lickona, 2004; Blangsinga et al., 2021; Senawati, et al., 2021; Suwastini et al., 2018; Suwastini et al., 2021; Utami et al., 2020)

in order to be able to build good characters and awareness toward social and environmental issues (Hutapea & Suwastini, 2019; Mahayanti et al., 2020; Suwastini et al., 2020; Suwastini et al., 2020; Suwastini et al., 2020; Suwastini et al., 2020; Suwastini et al., 2018; Suwastini et al., 2020). The conventional teaching method where students are demanded to remember and recall information without being required to understand its relevance and application in everyday life (Munawaroh, 2020), is no longer compatible with the 21st-century learners' needs. The 21st-century skills demand students to have essential skills that include 6C skills and work habits, where technology is an integral medium (Anazifa & Djukri, 2017; Ariantini et al., 2021; Artini et al., 2020; Cahyani et al., 2021; Citrawati et al., 2021; Dantes et al., 2019; Dantes et al., 2017; Ersani et al., 2021; Puspitasari et al., 2021; Utami et al., 2021).

Trilling and Fadel (2009) argue that students have to be exposed to activities that allow them to obtain 21st-century skills, such as creativity, collaboration, critical thinking skills, problem-solving, communication, and innovation, which will prepare them to be the highest-paid workforce in the coming years. Teachers have crucial roles to increase students' knowledge, skills, and attitude to compete in their future lives. Thus, a strategy in teaching that can engage students, provide them with the opportunity to speak spontaneously, fluently, and correctly and improve their 21st skill is needed (Anazifa & Djukri, 2017; Aygün & Yavuz, 2020; Bashori, 2017; Dwiyantri & Suwastini, 2021; Listiani et al., 2021; Setyawan et al., 2020; Suwastini et al., 2021; Suwastini et al., 2021; Wijaya et al., 2021). One of the teaching approaches that are considered to contribute to developing these skills is problem-based learning. Trilling and Fadel (2009) consider problem-based learning appropriate to be implemented in this century since it focuses students on solving complex real-world problems while working in small groups to gather information and find solutions.

Nevertheless, divided arguments regarding problem-based learning are found. Some studies found the strengths of problem-based learning for enhancing students' 21st-century skills (Anazifa & Djukri, 2017; Bashith & Amin, 2017; Duff, 2008; Ghufon & Ermawati, 2018; Hadi & Izzah, 2018; Iswandari et al., 2017; Lapuz & Fulgencio, 2020; Keong & Mohammed, 2015; Munawaroh, 2020; Yuberti et al., 2019). On the other hand, some studies found the complexity and challenges in implementing problem-based learning (Blundell & Berardi, 2016; Ceker & Ozdamli, 2016; Ghufon & Ermawati, 2018; Iswandari et al., 2017; Kassem, 2018; Miner-Romanoff, Rae, & Zakrzewki, 2019). Regarding these diverging opinions, the present study will explore the compatibility of problem-based learning to develop the 21st Century skills by describing its characteristics, elaborating the syntax of its implementation, investigating its compatibility with the 21st context, and reviewing the challenges of its implementation.

METHOD

This study was library research in which articles related to the study's topic were reviewed and interpreted (George, 2008). Figure 1 below displays the step-by-step procedure of George's library research, which is modeled upon its adaptation by Ariantini et al. (2021) into the qualitative design. The articles reviewed as the study data were published in 2015 – 2020 to represent the state-

of-the-art research in the use of problem-based learning. Google Scholar was the primary application used for browsing the articles used as the sources of data in the present study. The keywords used in the Google Scholar search engine were characteristics of problem-based learning, implementing problem-based learning in language learning, problem-based learning for critical thinking, problem-based learning for 6C skills, problem-based learning for 21st-century skills, strengths of problem-based learning, and weaknesses of problem-based learning.

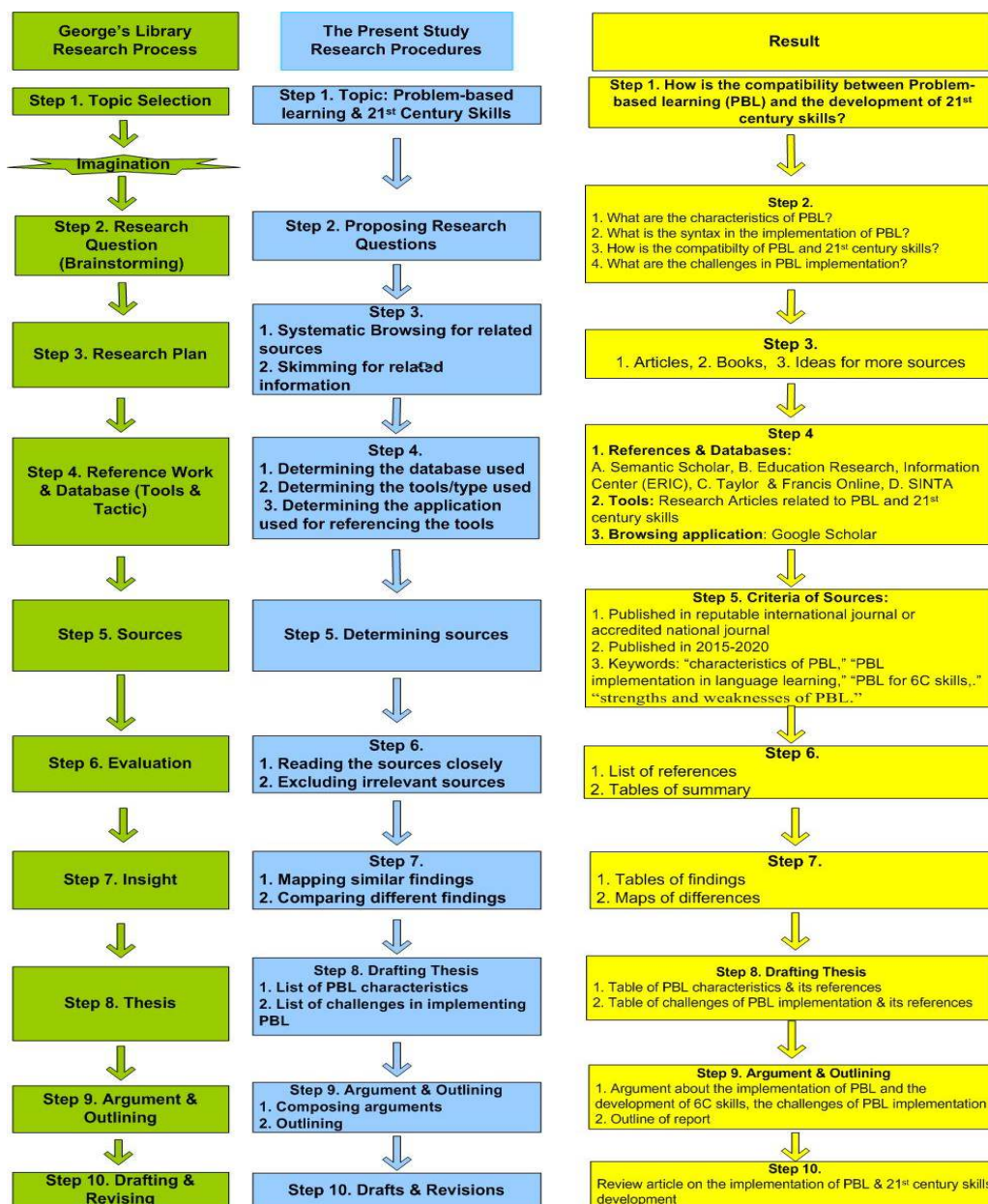


Figure 1. Library Research Procedure. (Source: George, 2008: pp. 66)

Figure 1. George's library research adaptation

From the process, forty articles were selected. However, ten articles were excluded during the inclusion/exclusion process because they showed limited relevance to the present study. After the inclusion/exclusion process, 30 articles were selected to be reviewed in this study, mainly from reputable international journals indexed by Scopus or Web of Science and from accredited national journals indexed by Science and Technology Index (SINTA). The results of the review were mapped to answer the present study's research question. This mapping was then used to propose arguments, which were presented as the present article.

RESULTS AND DISCUSSION

Problem-based learning is not a novel object of research. Various researchers have observed and discussed problem-based learning from different dimensions. However, this study focused on defining the characteristics of problem-based learning, the syntax of problem-based learning, the strengths of problem-based learning that contribute to 21st-century skills, and the challenges that may occur in the process of implementing problem-based learning.

Characteristics of problem-based learning

Various attempts have aimed at defining problem-based learning (Miner-Romanoff et al., 2019). Lapuz & Fulgencio (2020) define problem-based learning as a teaching approach that proposes problems to engage and stimulate students to learn and gain knowledge of a particular subject actively. Problem-based learning is a pedagogical approach that puts students at the center of learning by allowing them to experience open-ended problem-solving activities (Ali, 2019; Dolmans et al., 2016; Ghufroon & Ermawati, 2018). In this case, the students must use their high-order thinking skills (HOTS) (Ghufroon & Ermawati, 2018). The objectives of problem-based learning are to help the students relate their learning and future life, maintain their motivation, and make them responsible (Ansarian et al., 2016).

Problem-based learning is considered to be a practical approach due to its characteristics. In problem-based learning, the activity is dominated by including problems to be solved as problem-based learning aims to prepare students to solve real-life problems (Ansarian et al., 2016). This teaching approach is different from the traditional teaching method because it focuses not only on the theory of the subjects but also on meaningful learning. Furthermore, problem-based learning helps the learning process be encouraging, engaging, and contextual (Ali, 2019). Although the stimulus is the use of problems, problem-based learning develops students' problem-solving skills and other skills, especially 21st-century skills and attributes. Problem-based learning allows students to discover their problems and finding alternative solutions to solve them (Hadi & Izzah, 2018).

In a class that implements problem-based learning, rather than directly being given learning materials, students are given authentic problems as their starting point to learn, which then will be discussed in groups, encouraging them to creatively and critically collect information and data to solve problems (Anazifa & Djukri, 2017; Bashith & Amin, 2017). For Lin (2015), the problem is not only the starting point; it is the centerpiece of the learning process. In this

case, the problems are used to guide students' learning process. The problems can be designed as various situations, so they are not limited to the content of the materials, quiz, or test. Consequently, the more students solve the problems, the more significant opportunity to learn they get. Since the learning process occurs during the problem-solving process, it is necessary for teachers to determine the types and levels of the problem to match the needs and the students' level. In problem-based learning, the characteristics of the problems most teachers must determine are meaningful and real-life-based. Students are demanded to integrate their knowledge and skills simultaneously through self-directed learning to make them take the role of the owner of the situation (Ali, 2019; Isrokijah, 2015).

Due to the learning activities' characteristics, problem-based learning requires teachers' and students' different roles compared to their roles in traditional classrooms (Wilder, 2015). Teachers play the facilitators' role that helps students identify what they need to know and the resources needed to obtain as the learning process is student-centered (Ansarian et al., 2016; Mansor et al., 2015; Keong & Mohammed, 2015; Zuhriyah, 2017). Along the process, students are given a chance to take ownership of their learning process (Wilder, 2015). Consequently, instead of providing information directly for the students, the teachers allow students to gather information and knowledge by themselves. It will provide students with the opportunity to strengthen their self-learning experience as they can transfer their skills to real-life situations (Mansor et al., 2015). Teachers also play a role in designing the learning environment, creating problems, and facilitating group sessions (Tawfik & Lilly, 2015). It then allows students to learn, relearn, and unlearn during the activities.

In conclusion, problem-based learning may be a complicated teaching method to implement if teachers and students are not accustomed to using their high-order thinking skills. However, considering the positive contributions obtained from problem-based learning, it deserves to be applied. Teachers are required to consider the characteristics of problems in problem-based learning as well as their essences. It is also necessary to align the students' characteristics and levels with the level of the problems. In other words, teachers are supposed to have higher-order thinking skills and sufficient communicative skills before they implement the method in the classroom. Therefore, the significant advantages of problem-based learning can be achieved by both teachers and students.

Syntax of problem-based learning

Although problems solving is the essence of the learning process, there are several ways to implement problem-based learning. Due to its flexibility, teachers may determine the syntax to be applied and modify it as needed, as long as problem-based learning's central values are maintained. Generally, teachers start the teaching and learning process by proposing a problem at the beginning of the learning process to collect and integrate new knowledge (Lin, 2015). Ill-structured problems are intended to develop students' critical thinking and problem-solving skills. Furthermore, collaborative group work is also the essence of problem-based learning. Each group can consist of 4-5 students working together to find solutions (Dastgeer & Afzal, 2015). Teachers

do not lecture students about what they have to learn. Instead, the teaching and learning activity will center the problem (Lin, 2015). Teachers only play a role as a guide; meanwhile, all the students perform all the tasks (Dastgeer & Afzal, 2015). Nevertheless, previous researchers and educators have set the syntax of problem-based learning, and some of them are as follows.

Hadi & Izzah (2018) explain five phases of the syntax of problem-based learning. In the first phase, teachers need to consider the main objective of the learning and the complexity of the problems with conflicting solutions with no correct answer. Furthermore, during the lesson investigation, students are stimulated to ask questions critically and seek information. Teachers are allowed to assist students, but they must be encouraged to work in small groups. After students are given time to discuss, they can communicate their ideas in the analysis and explanation phase. It is crucial to allow students to deliver their ideas openly and freely. In the second phase, collaboration skills among students are required to be developed. This phase demands teachers to assist the students in investigating the problems and how they will report them. In the third phase, students, with the help of teachers, determine the method of investigation. The investigation method will be chosen by taking into consideration the characteristics of the problems and the solutions. In the fourth phase, the investigation is conducted by recording the learning process that focuses on the problematic situation and proposed solution. It may be in written or spoken form. In the last phase, teachers invite and help students analyze and evaluate their thinking processes and investigative skills. It is crucial to make students reflect on their learning process.

In a study conducted by Chiou (2019), there are six steps of problem-based learning proposed. Firstly, students are divided between working in small groups. Each student has a role in the group, such as the leader, note-taker, or member. Secondly, teachers propose an open-ended problem and invite all groups to find solutions critically. Thirdly, each student is required to propose their opinion and the solution in their groups creatively. The leader should take note of the opinion proposed. Fourthly, all group members have to discuss to seek the appropriate solution for the problem collaboratively. Fifthly, the teacher assists the students in overcoming obstacles they face in the process. Lastly, each representative of the group is invited to present and communicate their solution.

Based on the explanation of the syntax of problem-based learning proposed, similar patterns are found. In the beginning, the type of problems is crucial to be determined by teachers. This process will be continued by the teachers' preference whether to start their strategy with individual work or directly invite students to work in groups collaboratively. Moreover, teachers are found to have similar roles in all syntaxes, namely as the facilitators for the students. In short, teachers may adjust and follow any syntax of problem-based learning to match the needs of the students while maintaining the essence of problem-based learning. Including humanity or enviro working in groups, collaborative discussion regarding students' faces in their daily lives can improve their awareness and compassion. Moreover, assigning students projects after discussion will boost their creativity, especially when the projects require their computational skills to produce something. Thus, it is safe to say

that the syntax of implementing problem-based learning is appropriate to enhance students' 21st-century skills.

Strengthening 21st-century skills through implementing problem-based learning

Numerous studies on the implementation of problem-based learning were found. Most of the studies reveal that problem-based learning significantly affects students' language skills and their 21st-century skills. Problem-based learning also improves language skills, such as listening, reading, speaking, and writing (Lin, 2017; Keong & Mohammed, 2015). It is considered suitable to enhance skills needed in this century because it allows students to practice communication, work together, and collaborate to solve authentic and complicated problems (Iswandari et al., 2017; Kassem, 2018).

Problem-based learning can improve students' language speaking skills, especially in terms of pronunciation, vocabulary, fluency, and grammar (Keong & Mohammed, 2015). It is because students are required to speak and discuss during the process of learning. Moreover, there are various strengths that can be obtained by students. As concluded by Ghufron & Ermawati (2018), the strengths are in terms of increasing students' confidence and motivation, triggering them to actively speak, exploring their critical thinking, and increasing their positive attitude toward learning. Furthermore, since the students have to interpret what they perceive individually, various strengths can improve long-term memory (Lin, 2015). Thus, it will strengthen their self-learning, so they can transfer their skills to real-life situations (Mansor et al., 2015). These are the qualities needed in the teaching and learning process in the 21st century.

Furthermore, Yuberti et al. (2019) examined the problem-based learning model's effect on students' problem-solving skills. The study was a quasi-experimental research design with a non-equivalent control group design. Two classes consisted of 70 students ranging from 15-16 years old in SMA N 2 Bandar Lampung taken as samples. The results showed that the implementation of problem-based learning has a significant effect on improving students' problem-solving skills, communication skills, confidence, and understanding of the lessons. In this case, it is proven that problem-based learning positively impacts students as it makes them understand the lessons both practically and conceptually.

Munawaroh (2020) explains the benefits of problem-based learning regarding students' skills development in a more recent study. These skills are referred to as questioning, thinking, and problem-solving skills alongside conducting autonomous and independent learning. Besides, students may obtain both theoretical and practical understanding of certain information. Problem-based learning allows students to discover their problems and finding an alternative solution to solve them (Hadi & Izzah, 2018). It will train students to be ready to face the future academic and professional challenges future in life.

These findings are in line with the findings of Lapuz & Fulgencio (2020). Students were found to have a sufficient level of critical thinking before problem-based learning was implemented in their study. However, after the treatment was given, the students' critical thinking level was found to be improved above

average. It shows that a significant difference exists in the pre-test and post-test of the students.

From the three studies above, it can be seen that problem-based learning improves students' understanding of a particular subject and their language skills. It is due to the reason that students are required to use English only in delivering their ideas. As the problems were authentic and relatable, students enjoyed the learning process and showed significant improvement from the pre-test until the post-test. In all of the studies above, students' 21st century is also tapped and stimulated. All of those are to ease students in their future life.

Furthermore, in implementing problem-based learning, various topics can be included to enhance 21st-century skills. For example, students' compassion and environmental education can also be improved through problem-based learning by including topics and vocabularies related to the classroom environment (Iswandari et al., 2017). Teachers can raise current issues of humanity or the environment that students are familiar with or the issues they have never heard before. Moreover, it can be about social issues and other current 21st themes, such as personal and public hygiene, global climate change, sustainable energy, global business, and how they are affected by technology and also by nature. In this case, all of the other skills will be integrated. Students will be forced to assess the problems critically. When the topics about current social issues are included, students' awareness of gender equality, economic gaps, racial discrimination, religious conflicts, and many more can be improved, raising their compassion toward each other.

Besides, their communication skills are needed when discussing and delivering their ideas (Lin, 2015; Mansor et al., 2015). Students must think creatively and out of the box to gain more perspectives in solving the problems. Their collaboration skills will also improve when put in a small group to work on the problems (Dolmans et al., 2016). They have to collaboratively work throughout the process, namely clarifying and defining the problem, proposing solutions, and identifying learning gaps in regards to the problem (Wilder, 2015). Moreover, their creativity and computational skills can be enhanced. Teachers can assign students to create posters related to the results of their discussion in overcoming humanity and environmental issues (Iswandari et al., 2017). As a result, throughout the implementation of problem-based learning, students' 21st-century skills are trained.

Challenges in implementing problem-based learning

Apart from its good values and strengths, Ceker & Ozdamli (2016) consider the difficulties that may become obstacles in implementing problem-based learning. These difficulties are faced both by teachers and students. Students may need extra time to solve problematic issues, especially when the problem requires high-order thinking skills to which students are not accustomed. Furthermore, learning done in groups or individuals may make students complete their work slower or faster than the allocated time. As for teachers, they are demanded to provide more comprehensive sources and materials. Besides, problem-based learning may not be applicable in all classes; thus, defining the dimension of learning differently is necessary. From this study, the difficulties require both teachers and students to be ready and understand the mechanism of problem-based learning to gain its benefits.

In addition, in their study, Blundell & Berardi (2016) assert that problem-based learning may be complex and difficult to be applied with confidence and efficacy. Teachers may be overwhelmed in applying effective problem-based learning. In line with their study, Miner-Romanoff et al. (2019) concluded the challenges of problem-based learning. These challenges are caused mainly by the mechanism of problem-based learning and the readiness of both teachers and students, such as the unwillingness of teachers to have less control, the absence of traditional testing and grading system, the discomfort in group work, the misconception of learning process and application, and the lack of comprehensive perspective to solve the problems. Also, teachers play a role as facilitators and supervisors. If students are found to be discouraged and passive, teachers are expected to motivate and engage them.

Furthermore, Mansor et al. (2015) consider that there are four challenges in implementing problem-based learning. Firstly, as for the students, they will be struggling to decide what is essential to learn. Secondly, all materials required in the curriculum may not be covered all by the teachers. Thirdly, teachers' preparation requires much time. Lastly, it is difficult for teachers to be accustomed to acting as a facilitator.

In this case, teachers should be aware that the goals of problem-based learning are not only to acquire content but also to develop higher-order thinking skills, communication skills, and collaboration skills (Wilder, 2015). However, in developing those skills, teachers need to consider the problems used since they relate to the students' interest in engaging in the learning process (Tawfik & Lilly, 2015). In their study, Tawfik & Lilly (2015) found that the types of problems included in problem-based learning influenced students' interest and motivation. Students were found to be more engaged when they could relate to the problems. Thus, in other words, including real-world problems is to motivate the students to learn (Lin, 2015). If teachers want to make the teaching and learning process more exciting and relatable, films that include environmental awareness and character education, such as *Finding Dory* or *Zootopia* (Suwastini et al., 2020; Suwastini et al., 2018; Suwastini et al., 2020), as the topic of discussions. Implementing problem-based learning is not guaranteed to be successful when it is only implemented once. Students should be accustomed to being exposed to problem-based learning to develop problem-solving strategies and disciplinary knowledge bases (Lin, 2015). The more they are exposed, the more they are trained.

Other challenges that may occur are students' confusion, longer duration to prepare, time to train teachers, management, group division, and accustoming students to new approaches (Ghufron & Ermawati, 2018; Kasseem, 2018). It is understandable that many teachers, especially those new to implementing problem-based learning, face difficulties. It is because students' HOTS is stimulated by contextual problems (Iswandari et al., 2017). In this case, teachers themselves should possess HOTS too. Teachers and students should be well-trained and immersed in the problem-based learning process. Moreover, implementing problem-based learning also requires administrators and other school staff (Wilder, 2015). Teachers' ability to scaffold students to learn and motivate, support, and guide them is crucial in determining play-based learning success (Kokotsaki et al., 2016). Besides, problem-based learning activities become less structured because students are demanded to find their way to

solve the problems (Mansor et al., 2015). Students need to be guided through their learning and problem-based processes (Ansarian et al., 2016).

Furthermore, Kokotsaki et al. (2016) conducted a literature study reviewing the challenges in implementing problem-based learning. The study suggested six keys recommendations that will be helpful for the success of the problem-based learning implementation. These recommendations include guiding and supporting students, supporting teachers' needs, providing practical group work for students, balancing instructions with students' needs, emphasizing reflection assessment, and allowing students choice and autonomy (Kokotsaki et al., 2016). There should be a learning reflection that allows students to connect their learning experience and problem-solving goals. This reflection will help students infer, find gaps, and transfer their problem-solving skills to adapt to new situations (Ansarian et al., 2016).

In other words, teachers are also required to have 21st-century skills to train students skills. As teachers own the skills, it would be easier for them to adjust to teaching the students. Moreover, teachers must choose and construct problems carefully to motivate students to speak (Keong & Mohammed, 2015). It is vital to know students' levels and ensure the problems proposed is not too easy or too difficult for them. It is also crucial to always remind students that learning a language is about grammar and how to use it to communicate and deliver messages (Iswandari et al., 2017). Consequently, teachers can boost students' confidence to speak up about their ideas and opinion without making them afraid to be judged when making mistakes.

CONCLUSION

Based on the review, it is revealed that problem-based learning is beneficial to be implemented. Problem-based learning is seen as a complex teaching method that combines students' critical thinking, problem-solving, social, and communicative skills. As the essence of problem-based learning is the use of 'problem' in the learning process, teachers are demanded to determine the level of problems discussed in the classroom. In implementing problem-based learning, teachers are given the flexibility to follow which syntax meets their needs. Furthermore, the data obtained from the previous researchers prove that problem-based learning can be implemented both to improve students' language skills and 21st-century skills. In this case, Problem-based learning is also able to improve students' micro-and macro-language skills. Future research is expected to review more studies from different parts of the world and different levels of education to compare the efficiency of problem-based learning in enhancing skills needed in the 21st century.

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