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Reveals Learning Problem Posing Mathematics In Primary School

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Abstract
Background. Math class, especially in primary school, has always been a "big monster" for many students. Teachers are also having difficulties in delivering in the classroom. However, there are some options available for addressing these problems.
Aims. This chapter offers problem-based learning and project-based learning as its solutions. Both solutions are explained briefly yet clearly, including their "how-to" and their barriers.
Methods: Problem-based learning and project-based learning are employed as teaching methods that engage students in real-world problems, creating a personally meaningful experience.
Conclusion. some barriers in implementing both of the solution options. They are: (1) role changing of teachers from knowledge resource into facilitator, (2) lack of experience for teachers, (3) good resource availability, (4) support from stakeholders, (5) technology support, and (6) careful teaching plan. However, all of them can still be solved based on each solution. While the barriers can be overcome in the learning process, there are also some critical considerations that teachers should be aware of when solving math class problems.

Keywords: Math, Problem-Based Learning, Project-Based Learning, Classroom

INTRODUCTION

Math, as one of the "big monsters" in most primary schools, especially in Indonesia, has always been an interesting problem to be solved. As many teachers and researchers attempt to understand why most students struggle with math and lack interest in the subject, new issues have arisen recently.

Many education researchers think that math should be taught as real-life problems rather than just being taught "as is". For example, dilemmas among teachers in teaching math

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can lead to confusion while delivering lessons to the children (Ball, 1993). It also stated that teachers should make math more interesting from the kids' point of view. At the same time, teachers should also maintain the curriculum's basic framework and fulfill the targets set by the school.

It also stated that teachers create value and make math valuable for kids, thereby making them more interested in the learning process. The teacher should incorporate this value, making it an excellent foundation for teaching math to children. For example, how can we teach students and convince them that with math, they can achieve better performance in buying snacks from the local store inside the school? It can also be taught that students can help themselves in arranging their pocket money more efficiently.

Math in many levels of education has become a big problem in the social environment, too. For example, a student who is more interested in math will be considered a clever and intelligent student, while another who is less interested will be considered the opposite. However, research has already proven that math ability does not have a relation with math anxiety. This means that students who do not have a significant interest in math do not always have less math ability than others (Wigfield & Meece, 1988).

Math also becomes a problem in other fields, such as the gender gap assumption (Guiso, Monte, Sapienza, & Zingales, 2008). Some researchers believe and have evidence that women are creating a gap in math anxiety learning across the world. However, this gap is already closing bit by bit while many math teachers nowadays are women.

Thus, it has become another problem that can be solved using a strategy. The strategy proposed in this chapter merely inspires math teacher to increase their knowledge about the learning process and reveal the real problems in class. Hopefully, it can also serve as a trigger for other researchers to propose alternative strategies for similar problems.

LITERATURE REVIEW

Problem-Based Learning

One of the most effective strategies in pedagogical science is using real-life problems in class to help students level up their anxiety through specific class material. Especially for math, which is already recognized as a significant problem, with difficulty in learning, and is often considered boring material. While real-life problems, which are brought into the learning process, can help students relate their theory to their own real-life problems, thus

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increasing their enthusiasm in the learning process.

Some researchers refer to this approach as problem-based learning. Problem-based learning can be defined as a teaching method that enables students to solve open-ended problems in groups, thereby driving motivation in the learning process (Nilson, 2010). It also stated that problem-based learning can point students to real-life problems and prompt them to create reasoning and defend their own solutions (Illinois CITL, n.d.).

This approach can be one of the problem-posing options that many math teachers, especially those in elementary or primary school, find beneficial. While students can be encouraged to address real-life problems, work in groups, and defend their reasoning, rather than just providing exact answers on exam papers.

On the other hand, math teacher nowadays are also being forced to use recent technology in their teaching process. This can be helpful, or it can be a failure of the teacher, and/or the students may still lack readiness in implementing it. Whatever technology is being implemented, teachers should have a better understanding that classroom technology merely helps the teaching process, not replaces it.

Problem-based learning can also be referred to as project-based learning, which leads students into small groups and encourages them to collaborate and cooperate. While project-based learning differs slightly from problem-based learning, it can still incorporate real-life problems into the learning and teaching process (Fearnside, 2004).

Problem-based learning in math teaching can be applied easily using story mode and real-life problems. For example, math teachers often use a marble story or a fruit story to introduce the concepts of addition, subtraction, or multiplication in class. While students also mostly ignore the story since they cannot relate it to real-world problems, it will change students' minds, showing them that math is not just pushing them away from reality and is not useless to them. This is one of the primary challenges for math teachers worldwide.

Then, why should we repeat the same mistakes in this case, when we can transform the learning process into something more useful for students and turn math into a more positive experience for them? Problem-based learning can be an alternative approach to addressing difficulties in the math teaching process. However, it needs some enhancement in its implementation.

Problem-based learning requires learning goals that are supported by a conducive environment that stimulates and engages students in real-life problems (Savery & Duffy,

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1996). It means that the teacher should simulate real-life problems for students, allowing them to imagine and become involved in the environment. This can be particularly helpful if the teacher has access to good support in information technology, such as internet access or other e-learning tools.

Problem-based learning has also been proven effective in higher education and K-12 settings, including elementary or primary schools (Midla & Coryell, 2010). It is believed that problem-based learning came first in the 1950s in the medical school environment. While it is credited in Canada in the early 1970s, other medical schools tried to follow the strategy from the USA to Australia.

Problem-based learning has several characteristics that should be considered to enhance the learning process of students (Midla & Coryell, 2010). The first step should start by revealing problems, not just the lies from teachers. It means that students can create problems related to the math course material, or the teacher can also facilitate problems that will be solved during the class. Therefore, there will be reciprocal relationships between emerging knowledge and the problems themselves. The teacher should maintain this relationship as a facilitator.

The second characteristic of problem-based learning is that it must result in self-directed learners, so students must be able to access their own assessments and also the course material during the learning process. This characteristic can be held using proper e-learning and technology support from the school. While some schools cannot access the internet and e-learning, this characteristic can also be achieved by using a small library inside the classroom, which the teacher maintains.

The third characteristic is self-reflection, which means that students should be able to monitor their own understanding of the course material while they attempt to solve problems. The teacher must support this characteristic, so students can be encouraged to continue searching for the best answer when solving problems. It can also be taught to students how to stay motivated while facing failures in their learning journey.

This strategy should become effective if teachers understand and continually strive to enhance students' involvement during the learning process. Most teachers simply let students do their problem-solving while their own hands seemed "handcuffed" by their incorrect perception of student-centered learning.

Student-centered learning, which stems from problem-based learning, should be

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engaging and foster a better learning environment with the teacher serving as its facilitator. Students will not be able to create it by themselves, since the teacher is the creator and facilitator before it all begins. A facilitator in this context should encourage students to challenge their creative thinking for problem-solving (Savery & Duffy, 1996). Thus, the facilitator role will continuously ask students, "What is the meaning of it?" or "Is there anything else?" These questions will pose a challenge for students, prompting them to continue searching for alternative answers to their problems.

These kinds of questions will prompt them to employ various problem-solving techniques or methods (Hmelo-Silver & Barrows, 2006). Eventually, students will create their own roles and take on their own problems, and the final result is that they become self-directed learners. This is not as straightforward as it may seem; however, it can be an effective alternative teaching strategy in math. For example, while 1 + 1 + 1 = 3, the teacher, as a facilitator, can prompt students to create alternative ways to solve it. For example, 1 + 2 = 3 can also be another answer for the problem. However, this answer can not be instantly revealed to students; the teacher, as a facilitator, must deliver an introduction for it. Teachers should be able to explain the basics of adding numbers before attempting to engage students as self-directed learners.

While problem-based learning is commonly done in groups, the previous example can serve as a good example of problem-solving. Meanwhile, some students will answer the first option, and others can choose the second option. It means that teachers should be able to maximize their performance as facilitators and become a wise third party, rather than acting as a judge for them. If this situation can occur, students should feel that they have improved their performance in math class, and they will have a different perspective on the learning process. It means that one of the main problems in the math course for elementary or primary school has already been solved conceptually. While teachers as facilitators merely become challengers for students by continually asking them and triggering broader learning experiences. It should also be supported by technology, such as e-learning, to create a better learning environment and encourage students to become self-directed learners. On the other hand, e- learning in math courses is not always a key factor in the learning process (Berkowitz et al., 2016). Since that technology should be aligned with a learning strategy, the proper e-learning for problem-based learning should also become aligned. For example, an e-learning developer must also understand how problem-based learning is executed, so it will not

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become just another course repository and multiple-choice exam for students. This alignment must be created before the class is conducted and the problem-based learning strategy is implemented.

On the other hand, as mentioned in Figure 1, problem-based learning must also provide good course material resources so that students can access them during the problem-solving journey (Torp & Sage, 2002). It should also provide tools and software to support real-life problem-solving, such as a word processor, a spreadsheet, and others (Fukuzawa & Cahn, 2019; Hallinger & Bridges, 2007).

Another barrier to implementing problem-based learning in elementary school math courses is classroom organization (Fearnside, 2004). While some countries, such as Indonesia, already have established procedures and a list of topics, it will be a challenging task for teachers to implement them. Another barrier is that some teachers consider problem-based learning to be time-consuming rather than the standard learning process (Azer, 2001). Thus, some of them will attempt to integrate problem-based learning with conventional teaching methods to create a timely learning process.

It also stated that a lack of experience from teachers will be another barrier for problem-based learning (Clark, 2015). Thus, they will not be able to easily relate real-life problems to the course material. It also becomes difficult for teachers to design proper real-life problems and initiate classroom activities (Torp & Sage, 2002). While these barriers exist, schools should facilitate senior teachers as mentors for junior ones, allowing them to collaborate on implementing problem-based learning.

Project-Based Learning

Project-based learning, which can be defined as a method of teaching that engages students in real-world problems and creates a personally meaningful project (PBLWorks, n.d.-b). Project-based learning is considered similar to problem-based learning (Blumenfeld et al., 1991; Kurzel & Rath, 2007), while others view it as a successor. However, this strategy is considered a more radical change in teaching method rather than problem-based learning (Schoology, n.d.).

Some research that implements classroom technology in the math teaching process stated that it can be helpful under certain conditions. For example, the usage of AI (artificial intelligence) can be very helpful in creating smart quiz for students (Clark, 2015). It also

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stated that this strategy will optimize usage of technology while it opens opportunity in collaborating with other colleagues (Intel® Teach Program, 2012).

Project based learning is not problem based learning, since that project based learning should create full project for students from beginning (Miller, n.d.). While it can be implemented in many fields, math course can also adopt this strategy in increasing math anxiety for students in elementary school.

However, some obstacles and barriers already wait for this strategy implementation. For instance, students should be involved in project planning in order to get their attention and motivation in finishing the project during learning process (Miller, n.d.; PBLWorks, n.d.- a). Getting project initiated also means that teacher will prepare students in learning profoundly and thinking critically during project process (Ark, 2018). So, students should be able understand how project will be done in the first place.

Another obstacle is that commonly students are out of boundary from their own project (Scarbrough et al., 2004). It means that project should be defined and planned carefully before classroom begin. Because out of boundary effect from project based learning will impact undefined purpose and difficulties for teacher in facilitating students project. For example, while math course in elementary school having the project in helping school canteen counting its profit, project should stay in that problem, not extending it in counting stocks, purchasing activity or other activity outside the project boundary. This boundary keeper should not be burdened merely to the teachers, but also should be kept by students who already pointed as group leader.

This strategy implementation also intended in tackle most common problem in math class of elementary school. Since that many students already become afraid of math by their environment, parents or society, this project based learning should have created better point of view for students in math learning process. However, other obstacle in implementing this strategy is almost the same with problem based learning, since that project based learning will change learning process in extreme way, some stakeholder will try to resist the changes (Lathram, Bob, & Vander Ark, 2016). So, it will need proper preparation before project based learning becoming real in classroom.

Some researchers already create helpful hints and guidelines in order to ease teacher for their preparation in conducting project based learning. Such as HQPBL or high quality project based learning which already proposing new framework in implementing it (High

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Quality Project Based Learning, 2017). This framework propose that students should have intellectual challenge and its accomplishment during learning process and critically thinking in investigating problems.

Project based learning should also having project that fits with students local culture so their solution can impact their environment (Ark, 2018; High Quality Project Based Learning, 2017). This will create authenticity in students' project, so students will get more motivation in finishing their project and also teacher can be easily give understanding to stakeholders, including parent and community. For example, if teacher give project for math class that calculating farmers field lifetime and its soil degree in environment of village which full of field, it will create authenticity for students'
project and also create value added to community.

Project based learning can also integrate with technology, just like problem based learning did. It means that technology should be integrated in project based learning process, such as its presentation, its note using technology and it become part of content project (Moursund, 1999). Technology should also be facility for students in gaining their experience for problem solving process.

DISCUSSION

Based upon previous explanation, obviously math class problem in elementary school is false perception from community about math which resulted lack of math anxiety from students. While math teachers is demanding to create better learning process, there are at least two options for it. First of all is using problem based learning which can lead students into real life problems and connect math class within. Second option is using project based learning which is similar with problem based learning, but this option considered as more advance compared to problem based learning.

Problem based learning has been proven can increase students' anxiety about certain topics, however, it needs support from community and parents, also technology. While technology in problem based learning not merely come as e-learning, it also should contain repository and resources which supports students in solving problems given. Thus, it will need more financial support and better planning for teacher in order to implement this option completely.

However, without technology support, problem based learning in math class still can

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be implemented based upon teachers' readiness and their understanding about problem based learning. Because of role changing for teachers, from knowledge source into facilitator, thus problem based learning implementation really demanding their readiness in planning the class and become good facilitator. On the other hand, various answers from students should be faced gradually as constructivist does. This manner could be problems for some math teachers in "old generation" who usually demanding fixed answers from their students. Thus, open minded perspective also needed in implementing this option.

Second option is implementing project based learning which need more resources and more careful planning before it all begin. This option really need better understanding and more exhausted explanation for students. While bigger resources are needed rather than problem based learning, this option also should be done by more experience teacher. However, some research's already have good evidence that this strategy come with better result for math anxiety.

Both of options also having some barriers such as classroom organization for math which commonly already being listed in certain topics, so it is difficult to change into problem based learning or even project based learning. It also having constraint from lack of experience from teachers which are not capable in handling students using both options. Thus, it will need more training and explanation to overcome these barriers.

Other barriers are lack support from stakeholder and technology support. Stakeholder which consist of parents and community rarely understand about the implementation of problem based learning, moreover project based learning. Thus, it should be explained carefully to them before any options is taken for students. Because of many parents still believe that fixed list topic is the best way in teaching math, so they will need understanding of implementation of problem based learning also project based learning.

On the other hand, community support also needed in implementing both options. While this support becomes a barrier, it can turn into support if teachers and the school can convince the community and bring problems and projects to support them. For example, bringing students into community problems, such as calculating farm fields, or small and micro industries. It could be difficult for some teachers, but it could be the best solution in order to get the support and overcome all barriers..

CONLCUSION

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Math class problems in elementary school are common problems for most math teachers. Some problems include: (1) math anxiety, (2) "big monster" paradigm among parents and community about math, and (3) conventional teaching method in math. However, we can still create a better learning process for students using two similar options, which are: (1) problem-based learning and (2) project-based learning.

On the other hand, there are also some barriers in implementing both of the solution options. They are: (1) role changing of teachers from knowledge resource into facilitator, (2) lack of experience for teachers, (3) good resource availability, (4) support from stakeholders, (5) technology support, and (6) careful teaching plan. However, all of them still can be solved based on each solution.

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