Task design for improving students’ engagement in mathematics learning

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Abstract. This article analysed the importance of task design as one of the instruments in the learning and its application in several studies. Through task design, students engage in learning caused them enthusiastically in expressing ideas, opinion or knowledge of them. Thus, the teacher was able to gain an idea of knowledge belonging to students. By using this information, teachers are able to develop the thinking ability of students.

1. Introduction
Learning mathematics currently is directed at the dominance of the activity of the students. They explore, collaborate, rediscover the formula, and build an understanding of the concept with their own language. These activities are carried out to meet the learning objectives of mathematics that is making mathematics as a means of critical thinking, survival tools, cooperative learning and capable of expressing his opinion of his own.

Teachers have an important role in learning mathematics, but not as the sole source of student learning. They are tasked to facilitate and manage the students to keep learning in accordance with the learning objectives to be accomplished. Therefore, teachers are no longer just delivering learning with oral, but also capable of designing tasks that can involve students in learning.

Tasks which used in learning mathematics are not just a form of exercise problem for the coaching numeracy skill of students. Instead, those are able to develop the thinking ability of students. The ability to think is expected like problem-solving, reasoning, representation, communication or connection. With the task of learning that accommodates such things, then through those tasks can improve and hone students’ thinking ability. To be able to devise such a task, there are things that still need to be noticed by the teacher. When the students struggling with the task later, do not let them lose the element of education or pedagogy in learning mathematics.

This article will explain things that can be accomplished through task design. There are 1) for closing gap between the goal of teacher and student activity, 2) a tool of decentering, 3) generalizing pattern, 4) honing a concept and 5) means of collaboration

2. Methods
2.1. Task Design
The task of learning mathematics is meant as anything that teachers use to display mathematics so that students are actively engaged in learning or to ask students to do something. Tasks can also be meant any students decide to do by him in certain situations [1]. So that through the assignment can result in activities that give the opportunity for students to learn math concepts, ideas, strategies, and also to use and develop mathematical thinking and doing inventions [1]. Thus, the task is an intermediate used in
the mathematics teaching-learning activities so that students gain experience and understanding of mathematics.

As a learning tool, the task is the instrument of cognitive processes to gain knowledge. Adherents of Vygotsky even assess a tool of learning, e.g., student worksheets; can become the tools of Psychology within the context of a growing culture of social interaction through the zone of proximal development and the process of internalization. The involvement of students in learning mathematics that enable the majority of sensory will provide a strong link between the activities of the students with learning activities itself.

In a class initially using lecture, question and answer happen later and ends with awarding the assignment to the students. But the task is not just accidental events and only one time in learning. The task is part of a sequence of learning activities that can help students to understand the material. Thus a task should have a clear arrangement. The arrangement can be either a similar Problem but the use of numbers ranging from simple to complex, questions or problems that developed with more complex and increased variable also resulting solution which requires a lot of stages, or Starts from a simple concept into a more sophisticated and complex. The importance of the order in the task that shows the order of difficulty, this becomes the focus of attention on the lesson study as well as Realistic Mathematics Education.

Thus, learning includes selecting, modify, designing, composing, arranging, observing and evaluating tasks. This role is often given in textbooks, student worksheets, module or other sources that are designed by someone else, not the teachers themselves. As a result, sometimes between the tasks of the resource and referrals from teachers not aligned. However, the use of the task from another source does not become the issue. It's just that when emerging questions from students relating to assignments from other sources, the teacher must be responded even can anticipate things that pertain to the task.

The tasks are arranged must notice the ability of the students. Better yet, if the task can accommodate differences in learning styles of students. Because the task or task order is indeed designed and administered so that students can acquire mathematical knowledge and honed their mathematical thinking ability. However, teachers should be aware of the student's responses regarding the task. It is possible that students complete tasks are given due regard the important thing for them is the task finish. If it happens then the student not getting mathematical knowledge, even less honed their mathematical thinking ability. This can occur, particularly for the younger students also underachieving because teacher helping them complete the tasks so that those students concerned are not left behind by his friends. Thus, the teachers strived to give different tasks to different students to facilitate learning.

2.2. Task Desaign for Closing the Gap Between the Goal of Teacher and Student Activity

The fundamental principles that are used in the design of the task for closing the gap between the goal of teacher and student activity, using the principles expressed by Alf Coles and Laurinda Brown [2]. The first three principles are used to cover the gap between the goals of a teacher with student activity. While the next four is the special way which is applied by Coles and Brown to get the desired math activities in their research. The principles are as follows:

- Present at least two conflicting examples, if possible in the form of pictures, and then collect responses
- Ask students to give an opinion on the similarities and differences between the conflicting examples or pose questions.
- Introduced the term and the granting of notation based on statements of students
- Start the covered activity can be accompanied by learning new skills
- Have challenge prepared for students if there were no questions coming
- Opportunities for the teacher to teach further new skills and for students to train their skills in different contexts.
- Gives students the opportunity to notice the pattern, make a conjecture and work on proof them

The principle of first to third is linked to the inactive views in knowing and learning with their emphasis on the difference in the example given. By using at least two examples (principle 1) and ask
for the opinion of the students about the similarities and differences (principle 2), will support students in sharing the distinctions and through sharing this will create a new distinguishing as well as learning from the perspective of the inactive. Terminology and notation were introduced to distinguish name that made students (principle 3) supports a new way of looking. Usage examples (principle 1) intended to capture a variety of possibilities, including images, animations, and procedures.

Whereas the principle of four to seven relates to the work of Caleb Gattegno (Coles & Brown, 2016). Closing activities may involve something visible or affordable and give students something to do or discussed (principle 4). Having challenges (principle 5) and the opportunity to teach skills in different contexts (principle 6) associated with extraction capabilities of teachers. When teachers use something with different objectives and contexts are different, the skills can be honed and potential to survive without tradition. As delivered by Tall that the Crystal structure of mathematical concepts make the students make the necessary connections if they are able to make distinguishing in mathematical context [2]. Principle 7 comes from the view that mathematics is essentially about relationships, so it certainly refers to the pattern and a possible conjecture no matter what material is covered [2].

It can be concluded that to achieve the learning objectives of mathematics, teachers choose or design tasks and sorts the task, then select the appropriate media for the presentation of the task. Therefore the students can communicate the result, design pedagogy and relate the opportunities to make it happen in the task, determine the difficulty level of the task for students including how adjustment for them and to anticipate the process of assessing student learning. Each of this ruling influenced the understanding of math teachers. It is preceded by the relevant assessment of teachers over the readiness of students, experience or creativity or access the teacher against teacher, hopes the top source of student involvement, the commitment of digitally learning associate teachers to student life and awareness as well as the willingness of teachers to apply the appropriate pedagogy.

Task design uses the 7 principles previously mentioned. Through this design task, the teacher trying to involve students in the learning activities, and it is managed. Students who have been involved in the study took out what they think about a given task. When the students pulled out their thoughts about a given task, the teacher knew what was in the minds of his disciples, making it easier for the teacher to direct the students to the concept that was intended. Nevertheless, the involvement of students preferred. So the selection of the material presented in the task more on that make students interested and active in the learning, though it is not included in the curriculum is essential. However, with the active involvement of students and time of learning, then it is hoped they can enthusiastically direct at the intended concept.

In practice, there are some students who developed his mind based on the given task, for example, initially the teacher presents the number of integers in the form of a concept, but students can develop it in the form of fractions, decimal, or without regular referrals from teachers. With the involvement of students in learning mathematical reasoning, then triggers the students, so as to develop the student's way of thinking about the mathematical material studied. Students also make distinctions and questions without the need to be asked. Then the students have done inquiry or discovery through his involvement, not just because it is a task that has been arranged. The purpose of this research on task design in support of mathematical thinking and teach skills in a meaningful context for students that allows immediate applied these new skills [2].

2.3. Task Design as a Tool of Decentering

Decentering introduced Piaget (1955) is an activity to characterize the actions of the observers who tried to understand the perspective of different individuals. Similar to the activity of the Coles & Brown, in this case else teacher trying to steer students in the intended thing after finding out what is in the mind of the student. What is in the minds of students considered a teacher as the first model of the concept that will be studied. Then the teacher by asking questions that dig will be directed to the second model or a formal model. Teacher argued that is not the student's answer is right or wrong, but rather the meaning of a concept that can be understood. There is no misconception, misconceptions is a conception
that for some reason, the teacher does not want students to use it. In other words, the misconception is the initial data for teachers to develop a model of the next level.

To be able to do so, the teacher should be able to ask questions that can bring the students understand what they're doing. The giving task continued by questioning students about thinking for the display of the task. It should be noted, that the teacher's role was to develop the thinking ability of students, don't get stuck to direct the procedures or steps solving problems students. So the first level of the briefing, informal, to the second level, formal models, depending on the perspective of the teacher to think their students [3]

2.4. Task Design in Generalizing Pattern
A study was done by Rivera and Becker in using task design for generating activity of generalized patterns. This is based on previous studies suggesting that children and adults have a natural disposition towards generalizing patterns. Then Rivera and Becker use this research to uncover the tendency of students in making the pattern.

This research uses a task with the following arrangement. Originally a teacher submits an image sequence to 4 pieces (4 stage) then students are asked to specify the pattern. The next task, students are given a picture to phase one; the students further forward it myself until the fourth stage. Students use the figures to determine the pattern of each.

The results of the study show that in making generalizing patterns students tend to use a linear formula involving addition and multiplication. A small portion of students who used the formula not in generating a linear pattern, and there's still that makes the images on the next stage without having a specific pattern [4]. So to develop the ability to generalize patterns, granting make students actively create images and determining the pattern of its own. It is more engaging students compared to merely provide a picture and ask students to determine the pattern.

2.5. Task Design for Honing a Concept
One of the mathematical content that needs to be controlled by the student according to the National Council of Teachers of the Mathematics (NCTM) is the geometry. Research using task design aimed to observe the student's work in making a ceramic pattern by using the reflection of a given format.

Students are expected to be able to complete the task given by the use of the concept of a perpendicular bisector. It turns out that only a small portion of students who use those concepts to solve problems. Most of the students do a reflection by using the process of folding and flipping [5]. After getting the data through a task that has been given, the students got the direction of the teacher to be able to use the concept is meant to complete the pattern ceramics by using reflection. Through task design, teachers can document and identify various sources of knowledge of students is reflected from his mathematical work. Thus, teachers can find out opportunities to be able to develop the thinking ability of students.

2.6. Task Design as a Means collaboration
Task design is not the dominance of teachers only. Researchers, mathematicians can also contribute to task design. Learning design team consisting of 3 teachers and author of designing learning with an early form of problem-solving in the context of the outbreak. Students complete the task independently and submit the results. The team checked the answers students and creates a new task by modifying the first task. The team made a list of predictions of the difficulty students in completing new tasks and the anticipation questions advice and referrals. Once ready, teachers give new tasks to be done in a group. During the activity, the teacher has twice conducted discussions with the students. The first to review the results of one of the groups, the second session of the panel, such as by asking two groups. After the study is completed, the team returned, having discussions to study the learning process in the classroom.

The task provides a starting point for teachers and students in the attachment class activities [6]. This design task relating not only to the activity of the students but also for people like teachers who have a
variety of different education also researchers or experts, as teachers brought the task as an instrument that can be used in the practice of learning.

3. Conclusions
Task design has a role in the learning of mathematics; one of them is the bridge between students and teachers to be able to achieve learning objectives. The task may be released through the workings of mathematics students, which varies, so teachers have preliminary data to direct students to the learning objectives in accordance with the initial perception of the students. Some task design expressed include discussions between students and teachers to get confirmation of what the students think about the mathematical tasks related to their working on. The task of making the design not only by the teacher can be from other experts, textbooks or materials that can be downloaded. Even collaboration in any task design is possible to get a variety of views in anticipation of learning.

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