Applying the Planning-Experience-Reflection Pedagogy to the Classroom

Signature Pedagogy Research

Education 378

Emily Ude

Manhattan College

Abstract

Problem solving plays a very essential role in mathematics. A primary goal of learning mathematics is to build new knowledge, solve problems that arise in mathematics and other contexts, apply and adapt a variety of appropriate strategies, and monitor and reflect on the process of problem solving. Teachers play an essential role of this development in students. Teachers that create a comfortable classroom environment and apply the “planning-experience-pedagogy” are effective in the development of independent, critical thinkers. This problem solving pedagogy allows students to explore, inquire, and reflect on problems both independently, and in small and large group discussions. The planning-experience-pedagogy is especially helpful in teaching mathematics and is effective in the expansion and deepening of students’ understanding of problems, problem solving, and inquiry.

*Keywords*: teaching, mathematics, problem solving, education, pedagogy

Mathematics plays a key role in how individuals deal with various aspects of life. According to Sherman & Richardson (2014), “A lack of sufficient mathematical skill and understanding will affect one’s ability to make critically important educational, life, and career decisions.” Today, many students continue to struggle in mathematics and become distanced learners as they confront obstacles in engagement. Problem solving is a central concept in school mathematics and is important as a way of doing, learning, and teaching mathematics. Instructional programs must be created to enable all students to build new mathematical knowledge and therefore, it is imperative that we understand what effective mathematics teaching looks like. Such programs should allow students to build new knowledge, solve problems that arise in mathematics and other contexts, apply and adapt a variety of appropriate strategies, and monitor and reflect on the process of problem solving (Chapman, 2008). To achieve this, teachers must create a welcoming environment that makes all students feel comfortable to question and explore their own math identities and incorporate the “planning-experience-reflection” problem-solving pedagogy.

Teachers have an important role in guiding students’ mathematical development. Research studies show that effective teachers facilitate learning by truly caring about their students’ engagement. They create an environment that allows students to develop their individual mathematical and cultural identities. Teachers must set high yet realistic expectations to enhance students’ capacity to think, reason, communicate, reflect upon, and critique their own practice. Students will strive in an environment that they are comfortable in and feel a sense of togetherness (Anthony & Walshaw, 2009). Teachers must ensure that all students feel included by respecting and valuing mathematics and the cultures that each student brings to the classroom. Effective teachers are aware of each individual student’s different needs that result from different home situations, different languages, and different capabilities. According to Anthony & Walshaw (2009), “The positive attitude that develops from a secure learning environment raises students’ comfort level, enlarges their knowledge base, and gives them greater confidence in their capacity to learn and make sense of mathematics.” Developing such a classroom environment is essential in promoting individual thinking, questioning, and intellectual risk taking for the learners (Anthony & Walshaw, 2009).

Problem solving ability is enhanced when students have opportunities to solve problems themselves and to see problems being solved (Chapman, 2008). The planning-experience-reflection pedagogy is an approach that instructs students to individually explore and respond to a problem, interact in a pair or group to discuss their findings, present different solutions, and discuss the different conclusions as a class. This problem solving pedagogy provides students with opportunities to begin to struggle with issues of facilitating students’ problem solving and to make their struggle an open and reflective activity used as an opportunity to improve their practice.

Each individual student learns differently from one another and has his or her own way of thinking. All of these students are also at different academic levels and have a wide range of background knowledge in mathematics. Before we can expect students to make sense of mathematical ideas, they need an understanding of the mathematical language used in the classroom. “A key task for the teacher is to foster the use, as well as the understanding, of appropriate mathematical terms and expressions.” (Anthony & Walshaw, 2009) The teacher must take into account the students’ informal understandings of the mathematical language in use. For example, words such as “less than”, “more”, “maybe”, and “half” can have quite different meanings for each student outside of the classroom setting. Teachers face particular challenges in multilingual classrooms or while working with English Language Learners (ELLs). Words such as “absolute value”, “standard deviation”, and “very likely” often lack an equivalent term in the students’ home language and make it even more difficult for these students to merely comprehend what they are being asked in the problem. Research shows that the student’s inability to comprehend the English language leads to anxiety and a lack of motivation to learn mathematics. This makes it especially important for learners to feel comfortable in the classroom environment and grasp an understanding of what is being asked in the problem prior to looking for a solution.

Once the teacher has introduced the problem in a way that sets the context and the vocabulary so that the problem is understandable to all, the students are given the opportunity to work independently on the problem. This allows the students to focus on individual self-reflection of problems and problem solving to create awareness of their own conceptions and knowledge. Students need time to think and work quietly by themselves, away from the varied and sometimes conflicting perspectives of other students (Sfard & Kieran, 2001). Allowing the students a few minutes to gather their own thoughts and strategies will lead to a more productive experience when the students are put into groups. For example, if students are not given time to work independently and are instructed to break into groups immediately after presenting the math problem, the students will be more likely to agree with the first strategy that is suggested within the group. Students will then become more dependent on the individual who offered the idea and are unlikely to present any other possible strategies to solve the problem.

After that students are given the time to think about problem independently, the students are broken up into pairs or groups by the teacher’s discretion. “When groups are mixed in relation to academic achievement, insights are provided at varying levels within the group, and these insights tend to enhance overall understandings” (Anthony & Walshaw, 2009). Group or partner arrangements are useful not only for enhancing engagement but also for exchanging and testing ideas and generating a higher level of thinking. Small group environments promote students to make inferences and learn how to engage in mathematical argumentation and validation. Community work on problems also makes the process of problem solving less frustrating for students. Group work allows the students to see the ways in which their peers did the mathematics, and showed them that problems can be solved in more than one way. (Chapman, 2008)

After students have independently made acquisitions about the problem, discussed and reflected to determine a solution with their group, the students will then present their findings to the class. One at a time, the groups are instructed to present their solutions on the board by having one of the students go to the board to show their solution. While the students present their solution on the board, the teacher simultaneously records their method of solution on chart paper that is taped to the board. The chart, created by the teacher, “helps the students to record their reasoning while also producing a permanent record of the solution that could be posted next to the other solutions that subsequent pairs proposed” (Suurtamm & Vézina). For example:

**On the board**  **What was said**

2625 + 75 = 3000 🡪 3000 + 2000 = 5000 “2625 plus 75 is 3000”

“3000 plus 2000 is 5000”

5000 + 300 = 5300 🡪 5300 + 3000 = 8300 “5000 plus 300 is 8300”

Therefore, the answer is 5675

The visual presentation of the students’ work and the teachers’ representation of the work that is being explained allows students to discuss the different strategies and solutions. This method of instruction stimulates an open class discussion in which all students are given the opportunity to participate and are included in the verification of the solution and respond when there are errors or misunderstandings. This procedure continues until each group has been given the opportunity to present their solution on the blackboard. “The whole class would then look at the variety of solutions posted on the pieces of chart paper with the teacher leading the discussion about the similarities and differences of the various ways that students solved the problem.” (Suurtamm& Vézina) This method of presenting group work is helpful in including all of the students on the different ways to solve the problems. This also allows the teacher to help students see the value in learning from errors and by recognizing that a strategy can be valid even though the answer could be incorrect.

To conclude the problem-solving activity, the teacher facilitates a class discussion to reflect on the outcomes and clarify any misunderstandings. Whole class discussion provides for broader interpretations and a forum for students to ask any final questions.

Teachers have an important role to play in this discussion. Effective teachers must focus attention on efficient ways of recording, invite students to listen to and respect one another’s solutions and evaluate different viewpoints (Anthony & Walshaw, 2009). In all forms of classroom organization it is the teacher’s responsibility to listen, to monitor student participation, and to facilitate the discussion. Class discussion is a very essential piece for teaching and learning, students provide teachers with information about what they know and what they need to learn.

The planning-experience-reflection pedagogy is an effective way for teachers to plan mathematics lessons that allow students to build on their existing abilities, interest, and experiences. “In planning for learning, effective teachers put students’ current knowledge and interests at the center of their instructional decision making” (Anthony & Walshaw, 2009). This teaching pedagogy is especially useful in mathematics and is very effective in expanding and deepening the students’ understanding of problems, problem solving, and inquiry.

Resources

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