Assessment Modifications in a High School Mathematics Course

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With the current situation regarding the Covid-19 pandemic, each school's circumstances are different as the 2020-2021 school year begins. This situation presents a need to quickly and efficiently modify how assessment, both formative and summative, will occur to ensure students are able to master critical content within a course.

In this paper, we share one teacher's account of how formative assessment strategies in a geometry class can be modified in response to an educational need. Five specific assessment strategies adapted to fit in an online learning environment that can be used in the trigonometry unit of a geometry class, or other content areas, will be discussed. The first author teaches both an algebra and a geometry course at a public high school in the Midwest. For the last two years, the first author had the opportunity to teach geometry to students in an alternative education program. These experiences have encouraged the first author to integrate a hands-on, problem-based learning approach to teaching in the classroom.

Formative assessment is an essential element in education that serves as a checkpoint to determine what students are learning and if educators are teaching effectively. The use of assessment helps provide structure and direction to both lessons and classroom interventions.

Prior to the school closures, assessment in the first author's classroom occurred through quizzes and tests, circulating the room listening to conversations, questioning students, and allowing students to write in order to reflect on their learning. Through the conversations with students while constantly circulating around the classroom, one can paint a fairly accurate picture of which students understood the main ideas from the day's lesson and which students needed more support when leaving the classroom. Analyzing quizzes and tests, listening to students, providing feedback, and reading what students have written are all valuable ways to determine a student's level of understanding. However, with the barriers educators are facing in regard to remote learning, it is more important than ever to determine how to modify and implement assessment strategies. As these barriers and obstacles are analyzed, equitable teaching practices must be considered. In NCTM's *Principles to Action* (2014), equity means, "ensuring that all students have access to high-quality curriculum, instruction, and the supports that they need to be successful—applies to all settings" (2014, p. 63). Some school districts have addressed the equity issue with distance learning by providing hot spots for internet access in all school parking lots. The school district where the first author teaches in has made this option available for students who do not have internet access at home in an effort to make learning more equitable and accessible during the closure.

Last year, the first author taught geometry using the CPM Mathematics curriculum (Dietiker and Kassarjian 2013), which uses problem-based learning and presents the trigonometry unit in a way that is new to many teachers, including the first author. Students begin the unit by

investigating slope ratios and slope angles in right triangles. Then, students move into finding missing legs of a right triangle by identifying the slope angle and using slope ratios. From this exploration, students can understand the tangent ratio in a deep, conceptual way. Application problems are introduced after students become comfortable with using and applying tangent, sine, cosine, and inverse trigonometric functions. The book, *Mathematics: Formative Assessment; 75 Practical Strategies for Linking Assessment, Instruction, and Learning* written by Page Keeley and Cheryl Rose Tobey (2011) offers many formative assessment strategies that helped the first author to develop a plan for assessment that can be modified to fit the needs of learners in a remote/distance learning situation. There are five formative assessment strategies from the book that can be integrated into the trigonometry unit that would work in both an online and in-person format. These strategies include Learning Goal Inventory, Muddiest Point, Two-Minute Paper, Comments-Only Marking, and Strategy Harvest.

To begin the unit, the first author plans to give the students a Learning Goal Inventory (LGI). In the above-mentioned book, Keeley and Tobey (2011) define an LGI as, "a set of questions that relate to an identified learning goal in a unit of instruction. Students are asked to "inventory" the extent to which they feel they have prior knowledge about the learning goal" (2011, p. 119). Utilizing a Learning Goal Inventory allows a teacher to recognize what concepts and terms students are familiar with and what content might be new for students. In an online environment, providing students with an LGI on a document that one can type into and submit would be easy to do. Muddiest Point could be used in the following lesson to allow students to reflect on their understanding of using slope ratios and slope angles to find missing sides of right triangles. "*Muddiest Point* is a commonly used, quick monitoring technique in which students are asked to take a few minutes to jot down what the most difficult or confusing part of a lesson for them was" (Keeley and Tobey, 2011, p. 132). When a teacher reads their students' responses, they will be able to gain insight about where students are in their understanding of the concept and reach out to provide intervention or clarification on misconceptions. It is important for students to identify areas that are not clear in this lesson since it will be the foundation of what is to come. Like the LGI, Muddiest Point could be turned in as a typed document or easily integrated into the end of a Classroom Activity made with Desmos Activity Builder. Another student reflective assessment strategy is the Two-Minute Paper. Likewise, this assessment strategy can be utilized through typing in a document or as part of a Desmos Classroom Activity. "*Two-Minute Paper* is a quick and simple way to collect feedback from students about their learning at the end of a lesson or other learning experience. Students are given two minutes to respond to a predetermined prompt in writing" (Keeley and Tobey, 2011, p. 204). In this unit, the Two-Minute Paper strategy could be used to have students write about question prompts regarding sine, cosine, tangent, or the inverse trig functions. With the use of this strategy, students have a brief amount of time to solidify their understanding in a concise manner, especially when students are in an online environment and cannot get immediate feedback from the teacher.

Comments-Only Marking and Strategy Harvest are two strategies that move away from reflective assessment and focus more on content. Comments-Only Marking would be a great method to use when students turn in work and are looking to receive feedback from their

teacher. "*Comments-Only Marking* is a way to provide feedback to students that research has shown is more effective in getting students to use feedback to improve their work…Making comments only is nonjudgmental…When a grade is not essential" (Keeley and Tobey, 2011, p. 66). Comments-Only Marking is a way to be intentional in providing feedback to students, especially in an asynchronous remote learning environment when it is more difficult to have one-on-one conversations with students. Strategy Harvest occurs when "students complete a problem-solving task and then circulate among their peers to find students who used a strategy different from theirs to solve the problem…A *Strategy Harvest* provides an opportunity for students to examine others' processes and compare them to their own" (Keeley and Tobey, 2011, p. 171). While implementing the Strategy Harvest in an online learning environment presents obstacles, it is something that is possible to do. Students could utilize Flipgrid to make a short video explaining their strategy to solve a problem and post it to the class forum. Next, students can watch each other's videos and gather strategies that are different from theirs and analyze how others have approached and solved a problem. The Strategy Harvest provides students with an opportunity to share, justify, explain their work, and critique the work of others.

While the focus of these assessment strategies is used with the trigonometry unit in a geometry class, all of these can be applied to other disciplines. Teachers of all grade levels and content areas provide learning goals and learning targets to give their students direction as to where they are going within a unit. This makes it possible to incorporate a Learning Goal Inventory into any unit. Likewise, reflection, justification, and critical thinking occur in other courses as well; Muddiest Point, Two-Minute Paper, Comments-Only Marking, and Strategy Harvest are all viable assessment strategies to use in various content areas.

Assessing student understanding is a crucial element of the learning process. Many different educational settings will occur this school year: in-person, online (asynchronous or synchronous), or a mixture of both. Finally, the following statement is something to reflect on as teachers consider how to respond to the assessment needs in a virtual learning format. "Assessment should be more than merely a test at the end of instruction to see how students perform under special conditions, rather, it should be an integral part of instruction that informs and guides teachers as they make instructional decisions. Assessment should not merely be done *to* students; rather, it should also be done *for* students, to guide and enhance their learning" (NCTM 1995, p. 22). Even in these unique educational circumstances, educators cannot let the practice of assessing students fall to the wayside.

References

Dietiker, L. and M. Kassarjian. 2013. *Core Connections: Geometry*. Sacramento, CA: CPM Educational Program.

Keeley, P. D., and C. R. Tobey. 2011. *Mathematics Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning*. Thousand Oaks, CA: Corwin Press.

NCTM. 1995. "The Assessment Principle." *Assessment Standards for School Mathematics,* 22-24.

NCTM. 2014. *Principles to Action: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

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