

Assessment *for* Learning in Saskatchewan Mathematics Classes

by Murray Guest

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As the phrase ‘assessment *for* learning’ (AFL) is used more and more in Saskatchewan, some math teachers find themselves wondering how their practice conforms to its precepts, whether they are behind the times and if their practice is to be found wanting. In some people’s minds, AFL seems to be better suited to the humanities or perhaps even the sciences, but it doesn’t fit well with mathematics. This article looks at what I believe to be the practice of many math teachers and compares that practice to the precepts of AFL. I am confident that math teachers have many teaching practices that follow AFL recommendations and that AFL is suited to student improvement in mathematics. There are areas of change to be addressed, but math teachers are well positioned with regard to AFL.

Assessment *for* learning involves using assessment in the classroom to increase learning and raise pupils’ achievement. AFL is based on the idea that students will improve most if they understand the goals of their learning, where they are in relation to them and how these goals can be achieved. This approach to education is based on decades of research from many sources. The results of the research are not in dispute. Assessment *for* learning is a research-based theory of learning and teaching which has many components, all of which have been shown to improve student learning. These components include providing clear learning targets, exemplars of student work and continuous, high quality feedback. It also includes opportunities for students to revise their work based on the feedback they receive, and the provision for alternative proof of knowledge. It is anticipated that teachers using AFL will use the information gathered from student assessment to alter their teaching to identify student strengths and address needs identified from the assessment process.

The ‘assessment’ part of assessment *for* learning refers to the gathering of information regarding student understanding and using it to support student and/or teacher practice, rather than matching a number to that information. Evaluation comes after assessment *for* learning and is best – and most accurate – when not based on all assessments taken during the school year. Assessment can be more formal (using tests, writing samples or student projects to collect information regarding student understanding) or it can be less formal (using observations of a student working at math, or a conversation regarding the current assignment, or a one-question quiz at the end of class to check student understanding of the day’s work).

Math teachers have used some of the precepts of AFL before AFL was named. Math assignments with an available answer key allow students to self-assess their knowledge to obtain one form of continuous feedback. When teachers of mathematics walk around checking work and talking to students, they are providing feedback to students as well as gathering information regarding

student understanding of math concepts. Handing back a piece of student work with corrections and written ideas for improvement can also offer students high quality feedback. These types of assessment *for* learning have been done for years in math classes. However, it is important to do this with explicit intent and that is sometimes missing in the minds of the students.

Students must be aware of the reasons for having this feedback and also be aware of how to use this feedback to help their learning. Those we would traditionally consider good students are able to do this on their own without much prompting by the teacher, but struggling students are often unable to translate teacher feedback into better performance. I have regular quizzes in my classes, as many of us do. The change I made in my practice is to make it explicit to my students that the point of the quizzes is to have students check to see what they know and don't know about the area they will be tested in. To increase the likelihood that this is the only message students are given regarding quizzes, I offer no marks for the quiz. The students are practicing, and I don't give a mark for practice. Therefore, the only changes I made to conform to AFL are that I removed marks from my quizzes and I discussed the reasons for the quizzes with my students.

Similarly, homework is practice. The point of doing homework is to gain automaticity with the material and to identify problems in student understanding of material. It is still practice and should not be assigned a mark. I justify this by asking how often I was marked based on a practice drive as I learned to handle a car or if I was judged as I refined my skills on the volleyball court. Once students understand the reasons for assigned practice and see that it works, they do it without complaint. Those who don't will learn of its value through trial and error. I still check homework so I can identify problems with student understanding, but that checking re-enforces the message I want to send regarding homework. It is useful in our goal of understanding math better, rather than something used to gather marks.

I also have students go through their own work using a list of standards they need to meet for the unit, which I provide for them. Then they are expected to write about what they do well and what they struggle with and why they believe that is the case. This process supports student understanding of where they are with respect to math standards as well as meeting some of the province's requirements regarding communicating about mathematics. The process is collaborative, student centered, and by students' own admission, useful.

For years, math teachers have shown the responsiveness that is a hallmark of AFL. When we look at the results of a mid-unit quiz, or know, through teacher-student interaction that a large portion of the class doesn't understand a concept, we spend more time with it and re-teach concepts. We spend individual time with certain students who we see, through informal assessment, need extra help to understand a concept. Math teachers already explain a concept in many different ways using visual aids, manipulatives and real world examples. When a student asks a math teacher for help, that is a self-assessment the student makes and our response is collaboration with the student to help them understand the math concept they struggled with.

An area where math teachers may want to adjust their practice is in making explicit all of the learning targets they have for students and being consistent in keeping to that learning target. Only recently I've begun writing clearly on the board what I hope the students will understand by the end of the class. An example would be: "Today you will be able to find the reference angle for any given angle, and you will find the exact value of a trig function using reference angles." This allows students to know exactly what is expected of them from the beginning of the class. I was surprised that many of my students did not know what I wanted them to know at the end of a class. By being very explicit about my expectations, students better understood the purpose of each activity.

A final area of change involves evidence of learning, which can take many forms. The traditional form for math teachers is the unit test and the comprehensive final. They offer students a chance to show off what they know by working a set of problems in a set amount of time. Alternatives do exist. Students can write regarding their understanding of various mathematical techniques – explaining how and why specific techniques work, with a discussion of their strengths and weaknesses. Students can also devise or strengthen existing questions, with an accompanying explanation of why the work done reflects an understanding of concepts. They can work through real-world questions, either alone or in a group, grappling with the messy nature of problems that are not 'cooked' for the classroom. Although they are considered time-consuming, student interviews can give a very good picture of student understanding and don't have to be awkward. They can be short and focus on a single concept.

For example, I like to talk to my students individually regarding the expansion of a squared binomial like $(x-3)^2$. The reason for this is that many students choose to use their own rule to 'distribute the square' and end up with either $(x-3)^2 = x^2 - 9$ or $(x-3)^2 = x^2 + 9$.

I might follow up on their answers by asking them about the statement $(5-3)^2 = 5^2 - 3^2 = 16$ as a parallel example or ask them to compare the factored form of $x^2 - 9$ to $(x-3)^2$ and explain where they see differences. If they answer my initial question with $(x-3)^2 = x^2 - 6x + 9$, I might ask why it isn't $x^2 + 9$ or ask them to explain their work in English rather than the language of mathematics. By tailoring the follow-up questions to allow students to explain their thinking and struggle with inconsistencies, I get a better insight into their thinking and the student gets a chance to re-arrange their own understanding of math concepts. Math teachers have done this, both at the board in larger groups and individually, for years and years. The difference is that I am explicitly trying to assess the misconception of the student, whatever that might be, and then engage the student in a way in which he or she rearranges the concepts. I can convert this into short notes to follow up on and be more confident in my insights into the quality of understanding held by my student.

By opening the door to alternate ways of showing understanding, we as teachers can also invite our own students to devise acceptable ways of demonstrating proof of learning that we may not have thought of ourselves. By rearranging our work, we can spend more time assessing our students and responding to the understanding they show, and less time defining the form student understanding must take.

This article holds that math teachers have been leaders, in some cases without knowing it, in the use of assessment *for* learning. While we still have some challenges to address, we have less to apologize for than some people would suppose.