

Analyzing the efficacy of implementing journal entries in a secondary math classroom

Sean Mulherin,
Department of Education, University of North Carolina
Chapel Hill, NC

Introduction

The purpose of this case study is to discuss the use of journal entries within a secondary math classroom. I will be talking about this issue from the perspective of a student-teacher. The school in which I am placed is located on the rural-fringe. My course load includes three sections of Honors Math II and two sections of AP Calculus BC. This case will discuss the integration of journal entries within each of these course contexts. Each section averages to about 25 students. As a 1-1 school, every student is issued a google chromebook that is to be taken home with them; they are expected to bring their school computer to class every day. Journal entries are assigned on a weekly basis and submitted through Google Classroom. Students are expected to work individually and may pull resources from their textbook, class notes, and the internet with appropriate citations.

Traditionally, math is thought to be a subject that lacks both creative thinking and expression. Integrating journal entries into the student coursework is done as an effort to push students towards being more creative within the field of mathematics and to apply the lessons covered in the classroom to their lives outside of school. In theory, this will increase the relevance and appreciation of math; both of which play a role in helping students learn. Guiding questions are created in such a way as to try to expose alternative conceptions preemptive to heavily weighted assessments such as a unit test. The prompts are often similar to the lesson's essential question. In my placement classroom, journal entries are predominantly used as a way to summatively assess student comprehension. Since they are assigned on a weekly basis, the entry prompt reflects the lessons covered in the previous week. Later, I will discuss how journal entries can be used as a formative assessment. I will now delve into the main advantages and disadvantages of integrating journal entries within math classrooms.

Advantages

Perhaps the most impactful advantage of the implementation of journaling is the development of mathematical metacognition. For non-STEM subjects like literature and the arts, self-reflection plays an integral role in developing student acuity; however, this is often not the case in math curriculums. Historically, students simply do not know how to write about math,

they often struggle with vocabulary and cannot articulate their thoughts through writing. Initially this was observed in my placement classroom. However, as time went on I saw drastic improvement in organization, vocabulary, level of content, and overall comprehension of the lessons given throughout a unit. Classroom discussions seemed more vibrant; they came to focus on ideas more conceptually than analytically, as students were more interested in the theoretical complexities that make up a concept rather than the computational process used to arrive at the solution.

Alternative conceptions are one of the main reasons students get an answer wrong on a quiz or test. Math teachers are aware of this, which is why we often talk about how important it is to show your work. With work shown, we can see where the student went wrong whether it be due to a simple miscalculation or a systematic misconception. The problem with this strategy is that teachers fail to notice a student's alternative conception until after a high-stakes assessment, often while grading such assessment. The traditional means by which math teachers formatively assess student knowledge often fail to expose any misconceptions they may have. Journal entries have proven to be a great tool for me to find and resolve students' alternative conceptions. It is crucial to prompt questions that are formed in such a way as to unveil any discrepancies within student thinking. Asking open ended questions where there may not be one right answer, asking students to create a pictorial representation of their ideas, and refraining from asking simple yes or no questions are all examples of good parameters to stay within when forming your journal entry prompt.

Math classrooms heavily lack creative expression. There is a stigma around the field mathematics of being cold, drab, and robotic. The way math curriculum has been structured, and the approach mathematicians have taken to portray their field of study has been lackluster. The math that is explored in the classroom and tested on end-of-grade exams lacks relevance and verve; journal entries offer a tool with which teachers can incorporate both mechanisms in their instruction. With journaling, students are encouraged to relate their interests to the lessons covered in class. For example, Sam is a student in one of my AP Calculus BC sections. She expressed her dislike for math at the beginning of the year but is very intrinsically motivated so she never let that prevent her from doing well in the class. Sam loves biology and wishes to

become a biologist when she grows up. Through journaling, Sam has been exploring the interdisciplinary field of biomathematics. At the beginning of the school year, Sam talked about modeling species' carrying capacity using limits. Sam has since written about modeling predator-prey relationships using differentiation and rates of change, lake systems using optimization, and population dynamics using limits and exponential growth. All of which have helped Sam provide context to the lessons covered in class in a rigorous, relevant, and engaging manner; thus, developing her conceptual understanding of the topic.

One last advantage I'll discuss is about the privacy journal entries allow for. Math anxiety is a term that continues to gain traction; it describes the undue feelings of stress and anxiety imposed by solving math problems. Compared to the perceived anxiety levels of all other school subjects, math anxiety is the most prevalent form with approximately 93% of Americans reporting that they have some level of math anxiety (Blazer, 2011). Furthermore, the National Institute of Mental Health has found that 73% of people have a fear of public speaking (Montopoli, 2017). From this, it should not be surprising that many students have a fear of speaking out in math class as it is the intersection of two prominent forms of anxiety. Many students do not feel safe to speak their mind and share their ideas when working through a math problem as a class. This makes it increasingly difficult for teachers to formatively assess student understanding. As a consequence of this issue, teachers either have to impose stress on shy students by calling on them to speak up, or they neglect some students' presence in the classroom and lose the opportunity to hear from their perspectives. This problem is amplified for students who are English language learners (ELL); because English is not their original language, ELLs often lack confidence in speaking in front of a class. Journal entries can mitigate this fear because of its private nature. They allow students to share their thought processes and ideas in a confidential manner; thus, allowing the teacher to gain insight into how students are perceiving the current lesson.

Disadvantages

There are many noticeable advantages to this type of assignment within a math classroom, however a few drawbacks have been observed.

First, this type of assessment thrives only if good feedback is provided to the students. This requires a substantial amount of time for the teacher to spend reading and analyzing journals for misconceptions. With a heavy course load and large number of students, this is often impracticable. Observing my mentor teacher, I have noticed him struggling and at times failing to provide strong feedback. Furthermore, he is consistently behind on grading journals by about a week. Some strategies we have come up with to solve this include: imposing a page limit of two, simplifying the grading rubric (see appendix), and assigning journals biweekly; even so, this remains to be a time consuming assignment for the teacher.

Second, it is likely that students have no experience with this form of assessment within a math context. Student ability to form arguments and communicate to others about math in a professional manner is one of the common core math standards namely, “Construct viable arguments and critique the reasoning of others.” Despite this, students are rarely asked to engage in mathematical discourse and even more, math teachers almost never formally assess student comprehension through discussion. From this, teachers will notice a steep learning curve and much push back from the students; thus, for the first few weeks this assignment is likely to impose a great deal of stress on students. This was observed in my placement classroom. Many of the students in either course went so far as to ask the teacher to disband the journal entry assignments and replace it with more typical math homework (i.e practice problem worksheets). All this is to say, teachers should prepare to be met with a lot of resistance at first. Although my students continue to be critical of this type of assessment, most of them have admitted to its rewarding effects.

Conclusion

Mathematics has a tradition of being mundane and persnickety in that there is often only one correct answer with only one procedure to arrive at that answer. This is a tragic misrepresentation of the field, and one for which standardized testing provided the impetus. Integrating regular journal writing into secondary math pedagogy provides a space in which students develop relevance and creativity. It allows students to debrief and reflect on their

lessons, soaking in the complex ideas and diving deeper into concepts. Therefore, I believe journaling is a great tool that benefits both students and teachers in a math class.

Appendix

Criteria	✓ -	✓	✓ +
Organization	Writing lacks logical organization. It shows some coherence but ideas lack unity. Serious errors.	Writing is coherent and logically organized. Some points remain misplaced and stray from the topic. Transitions evident but not used throughout the essay.	Writing is coherent and logically organized with transitions used between ideas and paragraphs to create coherence. Overall unity of ideas is present.
Level of Content	Shows some thinking and reasoning but most ideas are underdeveloped and unoriginal.	Content indicates original thinking and develops ideas with sufficient and firm evidence.	Student went above and beyond the scope of this class, researching more rigorous underlying concepts & ideas associated with the chosen topic, and was challenged intellectually.
Argumentative Development	Main points lack detailed development. Ideas are vague with little evidence of critical thinking.	Main points well developed with both quality and quantity supporting details. Critical thinking is evident in points.	Main points well developed with high quality and quantity support. Reveals high degree of critical thinking.
Grammar, Mechanics, Style, Format	Student work has 3 or more misspellings and/or grammatical mistakes. Associated vocabulary is either not used or used inappropriately.	Student work has 2 or less misspellings and/or grammatical mistakes. Associated vocabulary is used appropriately, although scarcely.	Student work has 0 misspellings and/or grammatical mistakes. Associated vocabulary is seamlessly used in appropriate contexts.

Table 1. Sample grading rubric for journal entries. I chose to use the ✓+, ✓, ✓- system to expedite the grading process. ✓+ is worth 25 points, ✓ is worth 20 points, ✓- is worth 15 points.

References

- Blazer C. (2011). Strategies for Reducing Math Anxiety. [Accessed December 8, 2019]. 1102. Available from: <https://eric.ed.gov/?id=ED536509>
- Montopoli, J. (2017). Public Speaking and Fear of Brain Freezes. [Accessed December 5, 2019]. Available from: <https://nationalsocialanxietycenter.com/2017/02/20/public-speaking-and-fear-of-brain-freezes/>