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E-Journals: Reflections and Communication Improve Learning Outcomes

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Abstract. This report describes how journaling and email were used to benefit both the teacher and her students on a college campus in Georgia. The report outlines how decisions were made about the content of the journals, submission deadline considerations, and concerns about the e-journal process. Benefits to the teacher/professor are enumerated and discussed as are benefits to the students. E-journaling has been a successful experiment, which, seemingly, has improved the education process for these students and others as well.

Keywords: Journaling, Communication, Student Success

I. Introduction.

Journaling is not a new phenomenon; it is used very successfully in a plethora of situations. It comes as no surprise that the National Council of Teachers of Mathematics (NCTM) has long recommended journaling in the teaching and learning of mathematics (NCTM, 1989, 2000). The Communication (process) Standard, in particular, recommends journaling for the following reasons:

1) Journaling helps students organize and consolidate mathematical thinking through communication.
2) Journaling helps students to communicate mathematical thinking coherently and clearly to peers, teachers, and others.
3) Journaling helps students to use the language of mathematics to express mathematical ideas precisely. (NCTM, 2000, p. 268*)*
4) Journaling affords students opportunities for using new vocabulary or notation and for reflecting on their understanding of mathematics.

Mathematics is a precise language full of abstract symbols and notation that have no meaning without careful consideration of their purpose. Thus, if students are to communicate mathematically and use mathematics in a productive way, they must find meaningful understandings for the symbols and notation associated with the language of mathematics. The act of communication contributes strongly to connecting intuitive ideas about mathematics to the abstract symbols and notation that constitute the language of mathematics. Very often communication sharpens the understandings that students have about the language of mathematics and the mathematics itself.

The understandings of the language of mathematics are two-fold. The first is the myriad symbols with their applications and the vocabulary that we use to stand for mathematical ideas and concepts. Attaining familiarity with this aspect of the language is often daunting in itself. The second, of course, is understanding the concepts and bringing meaning to their applications. Building clear understandings of mathematics is one of the goals of the mathematics classroom, and communication is a fundamental tool of the classroom where students are asked to think,

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reason, and "express results of their thinking orally and in writing" (NCTM, 2000, p. 268). This type of communication can foster a classroom environment that encourages students to explore and refine their knowledge of the language of mathematics.

Such a classroom environment is desirable at all grade levels and is even beneficial in the college or university classroom. Those teachers who provide opportunities for students to communicate about mathematics cultivate a supportive, non-threatening environment that can deepen the understandings that students need to make mathematics meaningful and to connect informal ideas about mathematics to the symbols and notation in the language of mathematics.

II. E – journal Experiment.

In the courses that I teach, which are freshman mathematics (e.g., mathematical modeling/college algebra) and the critical content for elementary education majors, the students bring with them an undercurrent of attitudes about mathematics that tend to hinder their success. Students often come into these courses with very little confidence in their mathematical abilities. Therefore, one of my instructional goals is to encourage better attitudes toward the study of mathematics and, consequently, improve student success, and the use of journals has contributed to meeting that goal.

Williams and Wynne (2000) stated that journal writing allowed students to clarify their mathematical thinking by explaining their ideas about mathematics concepts. Williams and Wynne recommended a three-part approach to journaling: decide what the students write, decide when the students write and how long, and decide the writing format. Williams and Wynne worked with high school mathematics classes to develop their approach to journaling. To tailor their recommendations to the university venue, I chose to use email for the journals because it was convenient for both student and me because each of us could choose the time to complete the composition of or response to the e-journal.

In *Principles and Standards of School Mathematics*, NCTM states that teachers can help students reflect on their learning by asking the students to "write commentaries on what they learned in a lesson or a series of lessons and what remains unclear to them." (p. 272) This statement guided the formulation of what and when the students would write, the first and second recommendations of Williams and Wynne. I designed the e—journals to be in the form of reflections that addressed the following three questions:

1) What mathematics did I learn this week?
2) What was easy and why?
3) What was difficult and why?

The second recommendation of Williams and Wynne was decide *when* the students write and how long. I decided that the activity could be accomplished outside of class, thus, not using valuable instruction time in the classroom, and students could choose a time to write the journals. Because of the differences in student populations and class meeting schedules, I asked my students to send the email by midnight of the second day after the last class, (e.g. the Monday-Wednesday classes by midnight on Friday). I set this time deadline because the university population is quite different from that of a high school. Many of the students in my classes are non-traditional students who go directly to work and would be unable to submit an e-journal by 5 PM. Also, I have found it beneficial for students to "mull over" the content of the week before writing their journals. This period before the deadline gives them time to work on homework and identify with what concepts or parts of concepts they are still struggling. The length of the reflections was to consist of fifty words or more. I decided that fifty words would be a minimum

if students were truly reflecting on their learning. This approach seemed more reasonable than setting a time limit since the students choose the time that is convenient to them. Lastly, Williams and Wynne recommended that the teacher decide the format of the journal. This aspect of their recommendations was a natural outgrowth of what the students would write, based on the questions for reflection that I designed for my students, with the additional stipulation that the writing use complete sentences.

III. Benefits to Teachers/Professors.

Students who conscientiously reflect on their learning provide benefits not only to themselves but also to the teacher/professor. I have found that three basic benefits for the professor arise from student reflections. The first benefit is the correction of misconceptions. As students communicate what mathematics they have learned, many times the narrative they use will highlight a misunderstood mathematics term or concept. This misconception can be identified for the student and corrected immediately via reply email and, hopefully, get the student back on track. The timeframe that I use for replying to reflections is before the next class meeting. This timeframe is more likely to accomplish the desired outcomes (improved student learning and self-confidence and assisting the teacher/professor with planning).

The second benefit that I have perceived is directly related to planning instruction of the course content. When several students in the same class report difficulties with the same concept, then I know that particular concept needs to be attacked from another direction to aid students' understanding of the concept. This approach to planning instruction promotes a dynamic classroom based on student needs.

Finally, the third benefit has to do with student success. Once students become accustomed to the e-journaling process and how they can be helped by speedy replies and suggestions for correct thinking, they are less reluctant to contact the teacher/professor with questions at other times not related to journaling. I am very diligent about checking email to answer student questions when a test/quiz/graded homework is scheduled for or is to be turned in the next class meeting. This "conversation" provides even more opportunities to help students deepen their understanding of mathematics and promote student success.

IV. Benefits to Students.

Students (pseudonyms were used to identify each student quote.) involved in e-journaling report personal benefits that enhance the learning experience. Identifying strengths and weaknesses and focusing study time were explicitly cited by Amy and Casey:

> …the reflections, what a powerful tool to make us "think" about what we've learned, tell [the professor] about it, and evaluate where we need to go… (Amy, in-service middle grades teacher)

> I have benefited greatly from doing the weekly reflections…[they] make me think about the math that I did that week…[it] shows me where my weaknesses lie. It helps me see where I need to focus more study time…in order to succeed in math I must go to class, review my notes, and reflect to identify my weaknesses. I love the weekly reflections; it is a wonderful tool to help me with mathematics. (Casey, early childhood major)

A lack of confidence in mathematics abilities is very often an attribute the professor must deal with in certain student populations. Lora, Sarah, and Matthew report that the reflections actually build confidence in their mathematics knowledge and abilities:

> By completing the reflections every week, I have found that I am better able to assess my math skills on my own…This knowledge gives me a better sense of confidence in my mathematics abilities. Math has never been my best subject, so the reflections encourage me when I see that I really am learning the material… (Lora, mathematical modeling student)

> The reflection website has been very helpful to me since spring semester…I need to be able to explain in English the concept that I learned instead of using numbers. This helps me put the information in simple terms to show that I understand it and can explain it to another person…My favorite question is the one where I explain what I've learned. It is so rewarding to me when I have grasped a concept and I can explain it in my reflection.(Sarah, early childhood major)

> …this weekly procedure is hardly a sacrifice; it's a medium for me not only to communicate my thoughts [to the professor], but also to communicate my thoughts with myself. Math has always been a big scary, lonely place where numbers fly around in my head. By "talking" about these numbers and definitions, I'm able to grasp math as a whole much more easily. (Matthew, mathematical modeling student)

A third benefit that students nearly always report is the immediate feedback that is possible via email. They cite the "clearing up" of misconceptions, affirmation of correct thinking, and the "clarifying, supportive, and encouraging" communication between student and professor.

> [The professor] always responds to our reflections, often clearing up a misconception. I love the weekly reflections; it is a wonderful tool to help me with mathematics. (Casey, early childhood major)

> I am able to let my professor know immediately when I realize that I do not understand something, and my questions are answered almost as soon as they arise. (Lora, mathematical modeling student)

> When I put down the concept I am struggling with, the professor always replies with an example, suggestion, or a question that clarifies my confusion. She helps me understand where my misconception is and explains the concept…(Sarah, early childhood major)

> In addition to clarification of thought in definition, the communication aspect between student and professor is heightened in this medium…I can be assured of a response from [the professor] either clarifying, supportive, or both! This pleases me not only because of the answers to questions but also the encouraging words and support, which I find invaluable. (Matthew, mathematical modeling)

Finally, many students report that the reflections help them "see" the mathematics from a different perspective that allows for better understanding and contributes to their success as mathematics students. April says it very well:

> I am a firm believer that reflections help me better understand mathematics. To write a reflection, I must go through my notes and find key points and think about the importance of them and understand how they fit into the big picture. Often times, I may not realize how things fit together and what is important until expressing these ideas via reflections. Also, I have to remember specific points, reflect on them, and form them into my memory to express them as a reflection. The reflections keep the information fresh in my mind and help me better understand the concepts. (April, mathematical modeling student)

V. Concerns and Cautions.

With every strategy we devise in our endeavors to better educate students in mathematics or any other discipline, there are always concerns and tradeoffs that must be considered. Implementing e-journals is not immune to the arena of concerns. I have currently identified three major concerns.

The first concern involves the amount of time to respond to student e-journals. It is somewhat time consuming to compose and write thoughtful responses to student journals, and if a professor attempts to integrate e-journals for all students, this time factor may be prohibitive. The second concern involves dealing with computer/internet provider downtime. Policies have to be thoughtfully considered in these circumstances because students very often do not have any control of when these circumstances occur nor can the professor actually verify that the problem really existed. The third concern involves the group of students who will abuse the opportunity in one of two ways that I have identified to date. The first abuse is the inevitable "gripe session" journal where the student constantly criticizes what has been done by the professor in teaching the concepts of the week, with no thoughtful suggestions to improve the situation. Of course, the professor controls the privilege to delete the journal or withhold credit for the journal, but, unfortunately, one still has to listen to the "griping." The second abuse is the student who just does as little as possible in the journaling process to qualify as a journal. In those instances, I have found that stated policies address the problem very well.

In conclusion, e-journaling has been a successful experiment with my students. The process has proven beneficial to both the teacher and the students in several ways that, seemingly, has improved the education process for these students and others as well. E-journaling appears to disarm many misconceptions before they lead to more serious problems with other concepts, to provide opportunity for a dynamic classroom based on student needs, and to build students' confidence in mathematics abilities that results in better student success.

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