

# STRATEGIES FOR SUPPORTING THE PRACTICE OF REFLECTION IN ONLINE LEARNING

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## Our Roles

- We both work at The Math Forum @ Drexel, which focuses on math problem solving in K-12.
- We both teach in the Mathematics Learning and Teaching online graduate program.
- Val teaches three core courses focused on student thinking and feedback, as well as the capstone research course.
- Annie teaches three electives about strategic use of *The Geometer's Sketchpad* software in the middle and high school classroom.

## Why Reflection?

- 'active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends'

(Dewey, 1933, p. 118).

## Dewey's Criteria for Reflection

1. Reflection is a meaning-making process that moves a learner from one experience into the next with deeper understanding of its relationships with and connections to other experiences and ideas. It is the thread that makes continuity of learning possible, and ensures the progress of the individual and, ultimately, society. It is a means to essentially moral ends.
2. Reflection is a systematic, rigorous, disciplined way of thinking, with its roots in scientific inquiry.
3. Reflection needs to happen in community, in interaction with others.
4. Reflection requires attitudes that value the personal and intellectual growth of oneself and of others.

(As distilled by Rodgers in *Defining Reflection: Another look at John Dewey and Reflection*, 2002)

## What does learning look like?

- Learning is Social
  - Goal #1: Create a learning community
  - Goal #2: Create activities that can be completed asynchronously, but can be used as shared learning experiences.

## Goal 1: Learning Community

- Introductions – seems obvious, but make them interesting & respond to them
- Regular meaningful peer-to-peer feedback
- Assignments that draw on their own practices and experiences
- Announcements that draw on specific student work & meaningful peer-to-peer interactions

## Goal 2: Asynchronous Activities as Shared Experiences

- Meaningful assignments (related to their practice) that can be revised
  - ▣ Revision creates opportunities for reflection
- Structure for peer-to-peer feedback
  - ▣ “I notice, I wonder”
  - ▣ Clear guidelines for what kind of feedback to give to peers
  - ▣ Clear guidelines for how to use that feedback & how to show how you’ve used it

What our courses and assignments look like

## Sample Course Module Structure

1. Do two or three Geometer's Sketchpad activities written for middle and high school students.
2. Post work plus 5-minute screen-capture movie (video and audio) of the parts that were exciting, interesting, challenging, surprising, etc.
3. Look at peers' videos and work and comment on at least two (those posted above and below you).
4. Revise your original work and reflect on your learning.

## Examples of Meaningful Assignments

- Working to solve a problem and explaining all your thinking
- Constructing feedback given a student's work
- Developing a research question
- Outline for a literature review

## What do our instructions to students look like?

## Structure for Peer Feedback

### 1) Describe their noticings as:

- ▣ noticings about “things you can measure,”
- ▣ noticings about “things you can count,”
- ▣ noticings that included calculations,
- ▣ noticings that introduced information not given in the scenario,
- ▣ noticings about relationships between quantities (measured things or counted things).

### 2) Discuss their solutions as:

- ▣ what noticings were used in the solution,
- ▣ can you describe the strategy—maybe label it,
- ▣ what more would you like to know or ask of the author

## Guidelines for Using Feedback in Revisions

- Revise your initial post based on your reading of both your classmates' solutions and the comments that were made.
  - If you were not able to generate a complete solution, now is a good time to try to do so.
  - Add any noticings that you missed on the first reading to your list. Pay attention to whether you missed 'counting', 'measuring' or 'relationship' noticings—'counting' and 'measuring' are not enough.
  - Next, consider how could you use these added noticings to enhance your solution.
  - If you were able to solve the problem, think about the method you chose and its relationship to your "noticings." Think about how you might approach or solve the problem differently based on different things you notice about the problem.

## Reflecting on Feedback

By now you should have received by email three mentor replies to your *Seven Congruent Rectangles* solution. Reflect on the value of the comments you received. Here are some specific questions to guide your reflection, but feel free to address questions of your own as well.

- Were the suggestions helpful?
- Was the language helpful and clear?
- How did you feel reading criticisms of your submissions?
- What significance does your reaction to the mentor's comments have for your experience of mathematics?

## Revision/Reflection Assignment

- You'll revise the activities that you already did and do a little writing.

The text of your discussion post should outline all of the following to some degree:

- what you revised. If you did not revise anything because you didn't need to, say so.
- which parts you are feeling good about now and what most helped you come to that understanding (might have been someone else's video, or a comment on the Work discussion, or a combination of things).
- what Geometer's Sketchpad seems to bring to the exploration, and how it might change people's experiences with these topics/concepts
- any specific questions you have that you would like help with
- anything else you are still wondering about

What does the student work look like?

## Student Reflection Example

- I didn't revise anything in the manually probing sketch, I think I got those questions and steps correct the first time.

I didn't revise anything major in the automatically probing sketch. I just added a little more to my description in Q8.

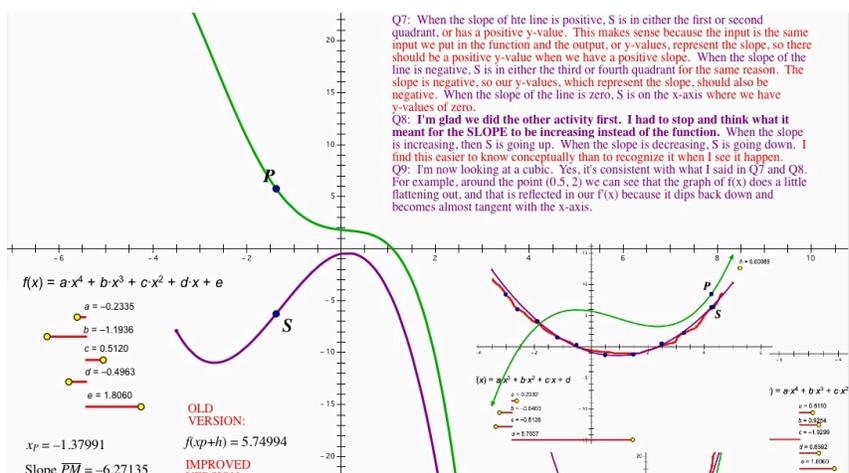
Yay! I was successfully able to un-hide my tangent line in the first page of the slope field activity! **Thanks for the tip, Annie.** Looking at Q3 again, I was having trouble figuring out what I wanted to say. **I had first said that it was increasing, but I think I can say more.** It looks like there is a constant increasing slope to all of the lines, which means that the slope is always increasing in the original. I think I'd have a hard time answering if I didn't have calculus knowledge already, but because I do, I know that the derivative of an upward facing parabola is a line with an increasing slope. So, since we have a constant, increasing slope, I'm going to predict that our antiderivative is an upward facing parabola. **I now understand what was supposed to happen in the explore more for this activity, but it doesn't seem** like we'll be graded on it so I didn't change it in my sketch. I think the fact that they wrote it as  $dy/dx$  in the instructions threw me off there.

The uses of annotation to record reflections and improvements

## Posting Reflections in Blackboard

- what you revised mathematically **my revisions appear in red**. I updated portions of my previous answers for the ones I had not fully answered the questions asked.
- what you changed Sketchpad-wise that wasn't working and now is **I had to re-do the creation of the tangent line portion for the manual probing because it was altered when the automatic probing used the same file, took a screen capture and included it. Also included the new file in case you wanted to check hide/show objects.**
- which parts you are feeling good about now feeling good about **the field of slopes activity. It was not working correctly the first time I worked on the activity – then I somehow saved over that file and had to re-do the activity. The second time following the steps 1-13 produced the correct result. I also figured out how to change the color of the marker tool – I had not been able to figure this one out – now I know to change the color after it is drawn by selecting the drawing box and then changing the color.**
- what specific questions you have that you would like help with (note in your subject line if you have burning questions) **good for now**
- anything else you are still wondering about **just wondering what Module 6 brings ☺**

## Clarifying Revisions in Sketches



## Posting Revisions in Word

Hi Joanna,

I really enjoyed reading your solution! You did well interpreting this problem. Your strategy of first finding a rate in meters per second (11.7) that was equivalent to the rate of 25 miles per hour was creative and utilized a great deal of logical reasoning. ~~By dividing the 1500 meter distance by your determined rate of 11.17 meters per second supplied you with a travel time of 2 minutes and 14.3 seconds. You were then able to determine that anyone with a travel time less than this time (meaning they were faster) was in violation of the speed limit regulation and might be arrested.~~ *(I am deleting this sentence as I am doing the student's thinking for her. I am walking her through the calculations as I understood them rather than having her explain them to me).*

~~I'm wondering if you could add more detail to your explanation as if you were explaining your strategy to another student.~~ *I am deleting this sentence. As a teacher, when I am evaluating my students' clarity of their explanation of their work, I may use this as a measuring tool for myself but it may not be particularly inviting of a comment for a student to revise their work).* **It took me some time however to figure out exactly what you did to come up with your solution.** *(I had originally made this statement to the approver but placed this in the revision because the student needs to know that her explanation of how she completed the problem was very difficult to follow).* I wonder if you could tell me more about how you used the information in the problem to figure out what calculations to do. *(This sentence replaced the sentences in the first paragraph where I told the student what I thought she had done to figure out the calculations).*

## Using Word's "Track Changes"

I was curious about a few things when I looked at your solution. You first started with 10 adults going on the trip. ~~Was there a reason that you started out with 10 adults?~~ **Based on your findings with 10 adults, why did you decrease the number of adults that went on the trip?**

Now that you have an idea of what the solution is, ~~do you think that there might be another way that you could try this problem or even check your solution?~~

~~Thanks again for sharing your ideas on this problem. I look forward to reading your revision!~~

Sincerely,  
Erin

Erin 3/18/14 8:31 PM

**Comment [1]:** I was curious what made her pick 10. I want to know if there was a reason or if she just picked a random number. I also wanted to see why she didn't start with zero and work her way up.

Erin 3/18/14 8:31 PM

**Comment [2]:** I think she can be more explicit about her results and why she changed the values that she did.

Erin 3/18/14 8:30 PM

**Comment [3]:** I thought this would be a way to see if Kristin might be able to use a more formal method, as opposed to guess and check, to solve the problem now that she knows the answer and has a process. I also thought that this could serve as a reflection piece for her submission.

Erin 3/18/14 8:32 PM

**Comment [4]:** I made sure to only include 3 questions (2 about her solution and one extension/reflection) to increase the likelihood that she would respond.

What do students think of these learning experiences?

## Evidence of a Learning Community

- I feel like I learned a lot this module by reviewing the videos and sketches of my classmates. I like seeing how we interpret the problems differently, and I like seeing how others answer the questions. I really like watching their videos to hear how fluently they can speak about the math. I feel like I am really benefitting from listening to the videos of others and hearing how they are explaining the topics that are giving me difficulty.

## Evidence of a Learning Community

- It is in the discussion boards where I feel I am learning the most. Seeing the thoughts of others, give me some insight and also other thoughts for reflection. On the other hand seeing the responses to my own posts provides feedback to myself so I can gauge where I am at and where my thinking is or maybe needs to go.

## Peer-to-Peer Feedback Example

- I am at the same spot as you are in trying to remember terms and vocab 😊 It's been too long. I agree that it would be really helpful for students to be able to see the line as opposed to trying to imagine it. The biggest thing that I have noticed is that I am able to make visual connections that I have never been able to make before.

I was interested in your thoughts about positive, negative, and zero. I didn't think through how that would affect student thinking, which is clearly the biggest idea. After listening to your thoughts, I realize that I did do that when trying to predict my traces. I think Annie had marked off in an intro sketch where changes happened to draw her trace, but I hadn't used it until this week. Thinking about when something is positive, negative or zero splits the problem so that it is more bite-sized and less confusing for students to understand. Great thoughts!

## Peer-to-Peer Feedback Example

- “I hadn’t even really thought about the absence of algebra or, really, arithmetic in general but, now that you mention it, I find that very interesting. I am definitely gaining much more of a conceptual understanding than I had when I was working on my undergrad. Also, I really like your point about how we are using the trace to show the approximate derivative of the entire function. It really makes me appreciate the technology that we have and much potential there is for its use in mathematics education.”

## Student Reflection Example

- As part of a midterm writing assignment to reflect on the structure of the course: “To be honest I have dealt with this [Do → Discuss → Reflect] structure for several courses now and it wasn’t until this assignment where it really hit me when we could discuss it that I realized the importance and significant in any educational setting.”

## From Course Evaluation

- What did you like best about the course?  
“Being able to work through activities and then discuss with classmates any difficulties we encountered. The podcasts are always a help when presenting your accomplishments or struggles. Your classes always seem to bring the classmates close together. You have the ability to build a community of learning that I do not always feel in other classes.”

## Summary

- Reflection is a critical element of learning.
- Students need structure to help reflection be meaningful.
- Revision must be built into the course structure.
- Opportunities for reflection help us better understand our students' growth as learners.
- Reflection is a form of differentiation.

## Contact Us

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- Drexel e-Learning Conference, March 2014