Using Portfolios In The Mathematics Classroom

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ABSTRACT

Students, particularly freshman, are often unorganized and come to college with poor study skills. It is important for each instructor to encourage each student in a first semester college mathematics class to maintain a system of organization. I used a portfolio to formally assess their organization of all major graded events, homework and board sheets. This also provided a forum for students to make corrections on previous work, reflect periodically about their progress in the course and discuss their best work throughout the semester. This paper explores the use of a portfolio from this perspective in a mathematics classroom. There are many designs of a portfolio, which are not limited to our perspective. We offer some suggestions to enhance this project if your goals are not simply organization and reflection.

INTRODUCTION

The mission of the department of mathematical sciences at West Point is “To educate and develop cadets and faculty to have the competence and confidence to be effective problem solvers in a rapidly changing world.”\(^1\) These goals are similar to many other mathematics departments, but the trouble is how to actually help our students achieve these goals inside the classroom. In the core mathematics sequence, we encourage students to use a formal problem solving process. For example, the Polya problem solving process\(^2\) was used in the 2007-2008 academic year and gives the steps in “How to Solve it”:

1. Understand the Problem
2. Devise a plan
3. Carry out the plan
4. Look Back
While these steps seem straightforward and perhaps even an obvious method to solving complex problems, I have found most students have substantial trouble with Understanding the Problem and Looking Back.

In order to understand a problem, we must determine the question we are attempting to answer. Most students tend to do this well. I think they are taught early with the use of word problems to find the question being asked. However, after they understand the question itself, they have trouble finding and using the necessary information to answer that question. They need to organize the information given so that they can synthesize it to create their plan. When students fail to organize the material often the resulting plan is poor or unsubstantiated. I thought that it would be beneficial for students to organize not only problems to solve, but also their coursework to solve the problem of learning the material. I would like my students to be able to organize the information of the course, so that they can better synthesize the pieces and see how it relates to understanding the course objectives. Accentuating the importance of organization will make them better problem solvers.

The process of looking back is often forgotten at the end of a problem solving process. Students think that when they get an answer, it must be right because they followed a prescribed set of steps so the problem must be complete. However, most answers actually leave more questions like, Does this answer make sense? or Can it be improved? Students do not look back on their answers for a single question and often fail to look back even with feedback. Many instructors complain that students get their grade and, whether good or bad, just move on to the next activity. However, we, as instructors, often forget to discuss that failure and mistakes are part of the learning process. I chose to encourage students to rework problems by making this a component of their course grade. In addition, I also asked students to write reflective essays on
their progress throughout the semester, usually once in each block of instruction, to chart their own progress, see Appendix A for examples. This allows them to review their own study habits and hopefully use this insight to improve on their skills.

There has been significant research particularly at the K-12 grades that suggest that a portfolio increase problem solving skills, understanding of patterns and relationships found in mathematics, and communication of mathematical concepts.\textsuperscript{3} I have chosen to implement the portfolio into a first semester freshman classroom in the hopes to reach those objectives, and ultimately the mission of the department through organization and reflection.

**BACKGROUND**

A portfolio is a composite of student work. It allows the student and instructor to see an overview of the student’s capabilities and growth rather than the snapshots of it on each assignment. Having the actual examples of the students work as evidence of their progress gives a better assessment of their performance rather than a collection of numbers for each assignment. A portfolio is an opportunity for students to develop their self-assessment skills with examples to refer to. Overall, a portfolio needs to be structured with a particular purpose in mind. The purpose of this portfolio was to keep the students organized and ask them to reflect often on their learning throughout the course. For several examples of alternate implementation of portfolios see \textsuperscript{4}, \textsuperscript{5} or \textsuperscript{6}.

There are several pitfalls to using a portfolio in the classroom. If specific guidance is not given to students, most students will include only their best work in a portfolio. If the goal is to look at a student’s attempts at a variety of learning methods, then ask students for an example of several different categories. If the goal is to improve their communication skills then perhaps the portfolio only includes writing assignments and presentations and not problem sets. I thought
the best use of a portfolio is displayed by the two simple questions that Pam Knight asked her class, “What would show their effort and learning in (math)? What activities have been most meaningful?” If possible, allowing the students develop the criteria as Knight did would give them a larger investment in the purpose and credibility of the portfolio. However, if a more specific goal is desired, then a predetermined set of requirements may be necessary.

Another caution to using portfolios is that the class is only going to get as much out as the instructor is willing to put in. The instructor must continually remind the students that each assignment is a potential candidate for their portfolio, so care should be taken in completing each assignment. Also, feedback is particularly vital for the improvement of the portfolio throughout the semester. This requires time to read through and comment on each portfolio and possibly extra time to conference with a student about their selections. However, if proper care and time is given toward the portfolio, then it can be a great assessment of a student’s learning for both the instructor and more importantly the student.

**METHODOLOGY**

Three sections of MA 103 were asked at different times to keep a portfolio of their work; one section was responsible for maintaining a portfolio throughout the entire semester and the other two sections each maintained it for only one block of instruction. I used the semester long portfolio to help see the progress of the class throughout the semester and the other two as control groups to see if the portfolio caused a significant change in their performance during that one block.

The semester long class was given guidance at the beginning of the semester about the exact requirements for their portfolio submission with grading guidance; this is attached in Appendix B. Setting the criteria for the portfolio during the first week of class was extremely
important to the success of this project. Many students were unfamiliar with this technique so we often discussed what items would be good to go into the project. I had mentioned keeping a portfolio in the other two sections, but did not give them specific guidance until the block of material they were going to be assessed on. In hindsight, I wish I had posted the guidance, so they knew specifically what my expectations were rather than laying it out late in the semester.

As part of their portfolio, I asked them to keep all of their board sheets in their portfolio with most of the problems attempted each day. At the end of each day, I mentioned that their board sheet should be attempted to completion and then entered into their portfolio. This kept the portfolio in mind throughout the semester.

Organization of the portfolio materials was left to the students. Many students already have a method of organizing their notebooks, so I did not want my portfolio guidance to conflict with any good study habits. For disorganized students, perhaps more guidance would have been helpful.

A major component of their portfolio grade was making corrections to graded events. As I had mentioned earlier, mistakes and failure are part of our learning process, so it cannot be emphasized enough that ignoring incorrect answers will not help us grow.

Each submission included a section of “Best Work”, they could define this in any way they wanted. I suggested that it may be an illustration of improvement or an especially good assignment, because they spent time on it and really understood the material.

Each section was asked to complete the reflection essays outlined in Appendix A, even if they were not responsible for a portfolio during that block. The section with a semester long portfolio submitted their reflections with their portfolio and I asked that they use specific
examples from their portfolio as needed to support their analysis. This same guidance was given to the Block 4 section for the end of semester essay.

In order to evaluate the effectiveness of their portfolio, I used several metrics of assessments. I had my own in class observations each day, particularly between sections that were working on a portfolio against those that were not. I used several anonymous surveys throughout the semester to find the students’ impressions of the portfolio. I often informally asked students during additional instruction in my office or before class about their portfolio. They freely offered up their impression of its effectiveness for their own learning. Although these were not formal interviews, I found that they answered the questions I would have asked in an interview. I had two instructors substitute for me during the semester in each of the sections, so I was able to interview them about their impression of the class and the potential contribution of the portfolio to the learning environment. I also used the end of semester feedback to analyze the use of the portfolio for the student. I was hoping to gauge if the student felt that the goal of the portfolio was achieved. Every instructor hopes that any classroom activity results in a deeper level of learning, which hopefully equate to their grade in the course, so that was certainly analyzed as well.

RESULTS

By asking students to attempt the board sheets each day, I thought it would encourage them to make daily steps at a semester long goal. I found that this did happen. The section which maintained a portfolio throughout the semester was more independent in the classroom. They knew each day they were going to work on a board sheet that would need to be added to their portfolio. So each day, they just wanted to start working on the board sheet. I noticed that students often saved their questions until they were working in small groups. This
caused me to answer the same question several times, where as I would only answer it once in
the other sections that had more discussion. The same observation was made by instructors that
substituted for my class twice that semester. The substitute for the semester long portfolio
discussed the topic of the day for about 10 minutes and then the students went right to board
work. In the other two sections, the discussion lasted about 30-40 minutes. I think students were
responding to the requirements I placed on them for the portfolio. However, I was encouraged
by how well they worked in groups and took ownership of the material.

I thought keeping a notebook or binder organized was an easy for students. However, as
the course of the semester went along, graded events went missing and their method for filing
was to set it inside the cover of their portfolio rather than fastening it securely inside. However,
students seemed to understand that a large component of the portfolio was organization as
exemplified in the end of course survey question 1 results given in Figure 1.

Question 1: The portfolio is a helpful organizational tool. (Agreement question)

<table>
<thead>
<tr>
<th>Agreement Level</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree  [5]</td>
<td>17</td>
<td>(32%)</td>
</tr>
<tr>
<td>Agree [4]</td>
<td>19</td>
<td>(36%)</td>
</tr>
<tr>
<td>Neutral [3]</td>
<td>10</td>
<td>(19%)</td>
</tr>
<tr>
<td>Disagree [2]</td>
<td>4</td>
<td>(8%)</td>
</tr>
<tr>
<td>Strongly Disagree [1]</td>
<td>3</td>
<td>(6%)</td>
</tr>
<tr>
<td>(no response)</td>
<td>0</td>
<td>(0%)</td>
</tr>
</tbody>
</table>

Figure 1: Responses to Question 1

This shows that the target audience also believes it to be an effective tool for organization, so
those that used it were organized. This was one of the objectives of the project.
The requirement to correct graded events was routinely overlooked by students. They did not make the effort to review their mistakes and use this tool to learn from. It was disappointing that even the best students did not make an attempt to correct their few errors. I was encouraged that several of my struggling students did make corrections on old materials. Several commented when turning in the portfolio, that they felt better prepared for the term end exam, because of that correction requirement. Perhaps to counteract the general inconsistency of corrections, I would make that requirement worth more in the future. So, although many did not make the corrections, they did the other requirements, so the overall grades of the portfolio seem relatively high. The results of the portfolio grades for each section are listed below in Table 1.

<table>
<thead>
<tr>
<th>Section</th>
<th>Portfolio Grades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
<td>86.68</td>
</tr>
<tr>
<td>Block 3</td>
<td>84.77</td>
</tr>
<tr>
<td>Block 4</td>
<td>91.88</td>
</tr>
</tbody>
</table>

Table 1: Portfolio grades

The reflections were intended to give students a better understanding of their approach to the class and steps they can take to be successful. I found that all students knew what they should do to be successful, but few were actually following through on it. The major distinction in the reflections was between classes that used the portfolio for the assignment and those that did not. The ones that submitted their reflections with their portfolio often pointed out specific results of steps they took or failed to take. For example, “I failed WPR 1, because I did not confirm my understanding of the material with a tutor. However, for Writ 2, I did quite well because the company tutor spent several hours with me the week of Writ 2.” On the other hand, students that submitted a reflection essay without a portfolio made general statements with few
specifics. For example, they would say they go to tutoring or “need to go to tutoring”, but with no specific justification to support the statement.

The reflections also attempted to showcase the progress and growth of the students over the semester. Although only one section had the portfolio during the entire semester, the other two sections compiled key documents from the entire semester in their one submission. Since their submissions were each in the second half of the course, there is a potential to show growth. I used another end of course feedback question 2 to understand the students’ perspectives on this component. The results are shown in Figure 2.

Question 2: The portfolio displayed my growth throughout the semester.

<table>
<thead>
<tr>
<th>Response</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree [5]</td>
<td>8 (15%)</td>
</tr>
<tr>
<td>Agree [4]</td>
<td>25 (47%)</td>
</tr>
<tr>
<td>Neutral [3]</td>
<td>12 (23%)</td>
</tr>
<tr>
<td>Disagree [2]</td>
<td>5 (9%)</td>
</tr>
<tr>
<td>Strongly Disagree [1]</td>
<td>3 (6%)</td>
</tr>
<tr>
<td>(no response)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Figure 2: Responses to Question 2

From my perspective, I felt as though the portfolio gave me an understanding of their learning throughout the course, because I can reference all the material and their mistakes directly. Many of these portfolios did show growth, particularly in their writing and explanations of mathematics. On the first homework assignment, every solution was given as a number with maybe units. However, by the end the students were writing the result as a sentence explaining the result in the context of the problem. Since technology is often used to solve a problem, they were also explaining their mathematics used by the computer rather than attaching code to a
homework assignment. These improvements showed the mathematical process we are hoping to see in our students each semester.

The goal was to assess whether the additional organization and reflection of a portfolio affected their performance in the course. Table 2 shows the exam grades and final averages for each section of the course and each block of material.

<table>
<thead>
<tr>
<th>Portfolio Section</th>
<th>Final Ave</th>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
<th>Block 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
<td>81.43</td>
<td><strong>74.42</strong></td>
<td><strong>79.91</strong></td>
<td><strong>76.56</strong></td>
<td><strong>82.85</strong></td>
</tr>
<tr>
<td>Block 3</td>
<td>78.98</td>
<td>70.51</td>
<td>71.91</td>
<td><strong>81.96</strong></td>
<td>77.5</td>
</tr>
<tr>
<td>Block 4</td>
<td>83.92</td>
<td>63.76</td>
<td>88.7</td>
<td>88.87</td>
<td><strong>84.3</strong></td>
</tr>
</tbody>
</table>

Table 2: Course Averages for each WPR and Final Grades

We can see from Table 2 that the section that kept a portfolio for Block 3 did significantly better in that block of material. Also notice that the other two sections did not significantly improve on that exam, so it was not just an easier exam. This suggests that Block 3 did benefit from the portfolio. Overall, the students in the Block 3 section did not perform as well in the course. This may suggest that these students were not keeping themselves organized or reworking mistakes as they did in Block 3. There does not appear to be any improvement shown by Block 4 from the portfolio. Many of these students have good note taking and organizational skills. So, I was not surprised to not see a significant change in their grade. The semester long portfolio section seemed to improve as the semester went along and it is unclear to me if this improvement was due to the portfolio.

**DISCUSSION**

The general feedback from the students suggests they appreciate the organization required of them, but they did not plan to duplicate this system in the future. I noticed that the
students that most enjoyed the portfolio were the ones that were generally organized anyway. They saw it simply as an extension of the good habits they have already developed.

I believe a portfolio is a great way to remove the focus of the classroom on testing and correct answers. By highlighting their thought process and self-assessment as more important than correctness, it sends a clear message that the goal of this course is to learn from our mistakes. There were many times that students included their best work section only graded events where they earned a good grade. However, I did have students mention the tremendous improvements they were making in the course and gave examples that reflected this fact. There were also a few students that gave an in depth analysis of their semester in MA 103 as a compilation of their portfolio. They saw the larger picture of the goals of the course and noticed how the portfolio was in line with those goals.

As suggested by the performance of the Block 3 section, students with poor organizational skills or that are math anxious achieve more through a portfolio. This allows them to showcase their potential rather than grades that only emphasize their lack of achievement. Several of the students with math anxiety found the portfolio system helpful in their learning. They liked that some of their grade was based on writing and organization rather than mathematics. One student even commented that “I really like the portfolio, because it is the only way I will see a perfect score in this course.”

While many found it useful, most said they would probably not include the elements in future courses when asked on the end of course feedback question number three. The results are shown in Figure 3 below.

Question 3: I am considering using a portfolio again in other courses.
Figure 3: Responses to Question 3

Ultimately, we are trying to create problem solvers. Analyzing how we think about problems is a key element in achieving this mission. A portfolio combines reflective thought in designing the portfolio submission as well as reflective essays on growth in the course. This sends a message that solving problems is more than just working through steps, but revisiting those choices to determine if we would make the same ones again.

CONCLUSIONS

The portfolio design was meant to increase student organization and reflection of work. I believe these goals were achieved and many saw the usefulness of it. In order to improve on the organization component, I would have the students include a table of contents. Many students mixed their events together in chronological order, but that made it hard to find. The added structure would help them to find the materials quicker and help me to navigate their portfolio.

I would like to find time to peer evaluate the portfolios in class. I think this reflective step with another student’s portfolio would help students assess their own. This would have given more personal investment by the students to the project and ultimately produced a better portfolio. I used peer assessment with writing exercises and found it successful. This step would be great after the students had made an initial decision about their submission, so that they can
have a second opinion on their evaluation. However, the course has a tight calendar that does not allow for such days. I think this is a critical element that limited this portfolio design.

If I had chosen this assessment technique for a course without administrative restrictions, I think I would have structured the components of the portfolio differently as well. I would like to have several categories of assessment rather than just best work. I think it would be helpful to have a section of worst work, examples of growth, writing samples, and a section containing examples of applications they found beyond the classroom. However, the ability to structure assignments that give the portfolio more breadth was limited by the requirements for the course. The course already includes two major projects, four exams and two quizzes. The portfolio geared assignments needed to be scheduled around these events, so that the students could adequately compile their documents.

In order to understand students’ view of the portfolio, I will end with the results to a free response question on the course end feedback. It is clear that this was a successful project in the students’ eyes, which makes it successful to me. I have included a sampling of the responses below.

Question 4: Please provide additional comments about the use of a portfolio this semester.

POSITIVE COMMENTS:

1. The portfolio was a good morale booster for when I did not feel as if I had learned the material. Organization and was also a "take away" from the portfolio. But on the other hand, it was also a morale killer because I had a lot of unfinished work in my portfolio, mainly in class worksheets, that did not look too good on me or to me.
2. Well the one block that I did a portfolio for I received a 95% on the WPR so it definitely
did something. I already do it for Chemistry and History so it wasn't that new to me as far
as organization.

3. A portfolio allows easy review of previous topics because everything is usually organized
in chronological order.

4. It was a good setup that I am going to be able to use in preparation for the Term End
Exams.

5. It helped me gather my assignments and have them in order and neat so they were more
easily accessible when I needed them.

6. It forces you to do the work and learn the material.

7. The portfolio not only organized all of my work, but it also provided a very useful study
guide.

NEGATIVE COMMENTS:

1. I felt it was a waste of time and energy. It required me to gather all of my work and
correct things of the past that I did not want to look at again. I have not looked at it since
it came back, I will never use it again.

2. I really just wasn't a big fan of the whole portfolio idea. I think organization can be
accomplished without a "portfolio," but the overall purpose of keeping students organized
is a good idea.

3. It was not vital because we did not use it throughout the semester.

NEUTRAL COMMENTS:
1. I already keep an organized notebook, if you call that a portfolio then yes I will keep one, and they are very helpful.

2. I was able to stay organized without the use of a portfolio. Possibly recommend it instead of enforcing it.
APPENDIX A

First Day of Class Essay

1. What do you know about this course and what do you expect to get out of this course?
2. How do you expect your instructor to help you meet your objectives for the course?
3. What will you do to meet your objectives for the course?

End of First Block of Instruction Essay

1. Submit your original essay with this reflection essay. You MUST have a cover sheet.
2. Reread your initial statement essay.
3. Reflect over the last block. Did you follow through on those ideas? What did you do? Why didn't you do it?
4. What are you going to continue to do?
5. List one improvement you can make over the next block. Be specific on what the goal is and how you are going to achieve it.
6. Do you think your WPR grade is a reflection of your efforts in Block I? Why or why not?

End of Semester Essay

1. Explain how you have grown mathematically this semester.
2. What skills or knowledge are you taking with you from MA 103 to MA 104?
3. During reorganization week next year, you will be the team leader for a cadet of the class of 2013. What would you tell an interested plebe MA 103 is all about? Be specific, because they are really curious.
In the past, I have felt as though grading assignments individually is like seeing snapshots of my students during the semester. This semester, I would like to see the feature-length film of your progression in this course. We will be keeping a portfolio in this class to provide that view. In addition to highlighting your growth, it will serve as an opportunity for you to work on your organizational skills, self-assessment and reflection.

Overview

1. Neatness: Your binder needs to be in order and neat. This means material from September should appear before October, unless it is in your "My best work" section. This means that the pages should not be folded, crumpled, nor stained. This means that the pages should not be falling out of the binder.

2. Completeness: Your binder contains many items, including your best work, board problems, graded homework, reflection essays and exams. In addition to being in order, these items should be fully completed (attempted). This should not be difficult if you have been keeping up with your assignments daily.

3. Organization: Generally open to interpretation but at a minimum you should include some mechanism to separate all of the above information and a method to quickly find and retrieve information.

4. Beginning of semester reflection essay should be the first page of your binder.

Grading

Your portfolio will be assessed three times during this semester.

Date turn in time points

19 Sep (WPR 1) in class 30 points

24 Oct (Friday) in class 40 points

25 Nov (WPR 2) Dean's Hour 50 points

On 19 Sep, you will not include a section of your best work, but the second two submissions will. This section is a chance to put your best foot forward and should include a short paragraph explaining why you feel these items reflect your best work.
A (90% - 100%)
1. I included all graded homework and made corrections to at least 90% of the incorrect problems.
2. I included all board sheets and attempted to complete all problems.
3. I included all major graded events and made corrections to 100% of the incorrect problems.
4. My reflections indicate that I have developed a deeper conceptual understanding of the material.

B (80% - 89%)
1. I included all graded homework and made corrections to at least 80% of the incorrect problems.
2. I included at least 80% board sheets and attempted to complete all problems.
3. I included all major graded events and made corrections to at least 80% of the incorrect problems.
4. My reflections indicate that I have a good grasp/understanding of the material.

C (70% - 79%)
1. I included all graded homework and made corrections to at least 70% of the incorrect problems.
2. I included at least 70% board sheets and attempted to complete all problems.
3. I included all major graded events and made corrections to at least 70% of the incorrect problems.
4. My reflections indicate that I have a rote recitation of the material with a conceptual foundation to build upon.

D (65% - 69%)
1. I included all graded homework and made corrections to at least 65% of the incorrect problems.
2. I included at least 65% board sheets and attempted to complete all problems.
3. I included all major graded events and made corrections to at least 65% of the incorrect problems.
4. My reflections indicate that I have a marginal conceptual understanding of the material.

F (0% - 65%)
1. I included all graded homework but made little effort to correct the incorrect problems.
2. I included about half of the board sheets and attempted to complete most of the problems.
3. I included all major graded events and made little effort to correct the incorrect problems.
4. My reflections demonstrate elementary understanding of the material.
APPENDIX C

MA 103 Mathematics Portfolio        Fall 2008

In other sections, I have used a portfolio to see the progress of the students throughout the semester. I have seen many great benefits to doing this project. We will keep a portfolio in this course for Block 3 (or 4)

Overview

1. Neatness: Your binder needs to be in order and neat. This means material from September should appear before October, unless it is in your "My best work" section. This means that the pages should not be folded, crumpled, nor stained. This means that the pages should not be falling out of the binder.
2. Completeness: Your binder contains many items, including your best work, board problems, graded homework, reflection essays and exams. In addition to being in order, these items should be fully completed (attempted). This should not be difficult if you have been keeping up with your assignments daily.
3. Organization: Generally open to interpretation but at a minimum you should include some mechanism to separate all of the above information and a method to quickly find and retrieve information.
4. Beginning of semester reflection essay should be the first page of your binder.

Grading

Your portfolio will be assessed at the end of Block 3 (or 4) on 4 Nov (25 Nov) for 50 instructor points. You will include a section of your best work. This section is a chance to put your best foot forward and show include a short paragraph explaining why you feel these items reflect your best work.
A (90% - 100%)
1. I included all graded homework and made corrections to at least 90% of the incorrect problems.
2. I included all board sheets and attempted to complete all problems.
3. I included all major graded events and made corrections to 100% of the incorrect problems.
4. My reflections indicate that I have developed a deeper conceptual understanding of the material.

B (80% - 89%)
1. I included all graded homework and made corrections to at least 80% of the incorrect problems.
2. I included at least 80% board sheets and attempted to complete all problems.
3. I included all major graded events and made corrections to at least 80% of the incorrect problems.
4. My reflections indicate that I have a good grasp/understanding of the material.

C (70% - 79%)
1. I included all graded homework and made corrections to at least 70% of the incorrect problems.
2. I included at least 70% board sheets and attempted to complete all problems.
3. I included all major graded events and made corrections to at least 70% of the incorrect problems.
4. My reflections indicate that I have a rote recitation of the material with a conceptual foundation to build upon.

D (65% - 69%)
1. I included all graded homework and made corrections to at least 65% of the incorrect problems.
2. I included at least 65% board sheets and attempted to complete all problems.
3. I included all major graded events and made corrections to at least 65% of the incorrect problems.
4. My reflections indicate that I have a marginal conceptual understanding of the material.

F (0% - 65%)
1. I included all graded homework but made little effort to correct the incorrect problems.
2. I included about half of the board sheets and attempted to complete most of the problems.
3. I included all major graded events and made little effort to correct the incorrect problems.
4. My reflections demonstrate elementary understanding of the material.
REFERENCES

8 Excerpt from a student’s reflective essay submitted for the End of Course Reflective Essay.
9 Excerpt from a student’s reflective essay after Block 1.