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Implementing and managing self assessment procedures

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IMPLEMENTING AND MANAGING SELF ASSESSMENT PROCEDURES

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ABSTRACT

This study tests the hypothesis that implementing, managing and enhancing self-assessment procedures may improve learning. One hundred and fifty seven (157) financial math students in a high school with a predominantly at-risk population were divided randomly into an experimental group (self assessment and reflection) and a control group (traditional practice work). The experimental group performed significantly better than the control group ($p \approx 0.02$). The experimental group increased their scores from an average of 5.3 out of 18 correct on the pre-test to an average of 11 out of 18 correct on the final quiz. The control group increased their scores from an average of 4.5 out of 18 correct on the pre-test to an average of 8 out of 18 correct on the final quiz. We include a review of the literature related to the use of self assessment and a description of the procedures we used and how we developed them.

INTRODUCTION

Today, teachers expect students to play a more active role in their own learning with the hope that they will develop life-long skills and the ability to evaluate their own work (Boud, 1997). With this in mind, the present study is intended to inform educators of various methods of promoting self-assessment. There are many possible strategies. We provide guidance regarding what a classroom that incorporates self-assessment and student reflection should look like.

Chapter One is a review of the theoretical background for the use of self assessment as a means of learning. By understanding the purpose and the differences between assessment *of, for* and *as* learning, we lay a foundation for an understanding of student self assessment as a form of metacognition. The chapter explains why we should expect that students who reflect and make judgments on their work will perform better and shows the use and importance assessment *as* learning.

Chapter Two turns to more practical concerns. The chapter identifies the advantages of as well as the obstacles to implementing self and peer assessment practices. Also, we clarify how self and peer assessment can support the goals of the Common Core Standards. In many cases, self and peer assessing can be difficult to implement, we review practical support for self-evaluation from several authors.

Chapter Three describes my experiences trying to motivate, implement and manage self-assessment among my own students. I describe the problems and challenges I faced and describe how, after much trial and error through various experiments, I finally found a way to get students to assess their own work.

Chapter Four describes the tools, methods, procedures and results of the experiment. I divided each of six classes into experimental and control groups. There were 157 students all

together, randomly assigned. All the students did a graded pre-assignment, engaged in the lesson and then did a graded post-assignment and then took a quiz. The difference between the experimental subjects and the controls was that the experimental spent 25 minutes engaged in a directed self assessment activity before doing the post-assignment. The controls spent the 25 minutes working additional practice problems, but were not asked to self assess. The chapter reports the results of the quiz, with the grade on the pre-assignment used to adjust for differences in initial ability.

Chapter Five concludes with interpretation from the data and suggestions for further study.

CHAPTER 1. BACKGROUND AND LITERATURE REVIEW ON ASSESSMENT

The present chapter focuses on the theory underlying the use of assessment as a means of learning. By understanding the various purposes and forms of assessment, we will lay a foundation for rest of this thesis. Self and peer assessment can be understood as a means of promoting metacognition. Students who reflect and make judgments on their work are engaging in metacognition in a way that is beneficial for learning. We will also discuss the use and importance of "assessment-*as*-learning," as realized in self and peer assessment.

1-1 Assessment Of, For and As Learning

Learning is an "interactive process by which learners try to make sense of new information and integrate it into what they already know" (Earl, 2003& Earl& Katz 2006, p.5). To measure learning, an assessment is needed to measure what a student knows. Assessment is based on data collected from students that serves as evidence of learning.

Assessment practices can be in three forms: assessment *for* learning (formative), assessment *of* learning (summative), or assessment *as* learning (systematic) (Earl & Katz,2006). Stiggins and coauthors (2006) explain the difference between assessment *for* and *of* learning as follows:

> Assessment *of* learning are those assessments that happen after learning is supposed to have occurred to determine if it did. They are used to make statements of student learning status at a point in time to those outside the classroom, as when making student referrals or making decisions about programs. For example, state assessments, local standardize test and college admissions test are external examples of assessment of learning, while a assigning a grades on a student report card represent internal examination.
>
> Assessment *for* learning happen while learning is still underway. These are the assessments that we conduct throughout teaching and learning to diagnose student needs, plan our next step of instruction, provide students with feedback they can use to improve

> the quality of their work and help students see and feel in control of their journey to success (p. 31).

Assessment *as* learning is assessment that is interwoven with learning activities and that engages students in the assessment of their own learning as a means of increasing learning. It is characterized by "students reflecting on their own learning and making adjustments so that they achieve deeper understanding" (Afflerbach,2002and Earl&Katz,2006, p.41). Earl & Katz (2006) characterize assessment *as* learning as

> ... a process of developing and supporting metacognition for students. Assessment as learning focuses on the role of the student as the critical connector between assessment and learning. When students are active, engaged, and critical assessors, they make sense of information, relate it to prior knowledge, and use it for new learning. This is the regulatory process in metacognition. It occurs when students monitor their own learning and use the feedback from this monitoring to make adjustments, adaptations, and even major changes in what they understand (p. 13).

Assessment *for* learning, assessment *as* learning, and assessment *of* learning are all significant yet different. If we want to enhance learning for all students, Earl& Katz (2006,p. 14) suggest "the roles of assessment *for* learning and assessment *as* learning take on a much higher profiles than assessment *of* learning". Traditionally, teachers have focused on assessment *of* learning to measure learning after the task or test, using the information to make judgments about students' performances, and reporting these judgments to others. (Earl& Katz ,2006). Teachers traditionally have also been using assessment *for* learning when they put "diagnostic processes, formative assessment, and feedback at various stages in the teaching and learning process, though it was often informal and implicit" (p. 16).

Systematic assessment *as* learning, where students become critical analysts of their own learning, has been rare (Earl&Katz,2006). Although some teachers have incorporated self-assessment into their programs, few have systematically or explicitly used assessment to develop

students' capacity to evaluate and adapt their own learning (Earl &Katz, 2006). For our study, we will discuss assessment *as* learning more than assessment *for* learning.

Although some methods have come to be associated with assessment during instruction and learning, and others with assessment at the end of a unit or term, there are a variety of methods that can be used for all three purposes: *of, for* and *as*. Earl & Katz (2006, p.16) states "teachers should clarify the purpose of assessment and then select the method that best serves the purpose in the particular context". Although the methods have been organized by function—gathering information, interpreting information, keeping records, and communicating—there are indeed interrelationships among them, and it is important to note that some methods belong in multiple categories (Earl & Katz, 2006).

Dr. Lorna Earl and Dr. Steven Katz from Aporia Consulting, in collaboration with the Western and Northern Canadian Protocol for Collaboration in Education (WNCP) assessment team created a list of assessment tool kit for assessing, *of, for* and *as* learning. Teachers ask the questions "Why am I assessing?", "What am I assessing?", "What assessment method should I use?", "How can I ensure quality in this assessment process?"(p. 17).

1-2 Metacognition

Metacognition is "thinking about thinking" (Costa). Students who reflect upon their own work, and make judgments about it to guide further work are using metacognition. Metacognition also refers to the judgments an individual makes on the basis of self-knowledge, for example knowledge of past errors or personal habits. Bransford et.al. (1999) viewed self-evaluation a part of the metacognitive process. The metacognitive approach is used when students can draw conclusions about their own work, set goals, keep records, use aids or cuing devices to check for understanding. (Bransford et.al., 1999).

There is incomplete evidence about the degree to which very young students are able to use metacognition. Young students possess knowledge, but how old or how mature they must be for metacognition to occur is not clear (Car, 1996). Even students who are clearly capable of metacognition may not use if for a number of possible reasons. Students who are working the "procedural steps" with a focus on completion may not be thinking about their own thoughts, nor connecting their work to the concepts and thinking critically (Car, 1996, p. 93). According to Boud (1997), it is believed that students resist critiquing themselves for the following reasons: the cultural climate of the course, a poor student-teacher relationship, or contradictions between what is being taught and what students believe. However the fact that there may be obstacles clearly does not mean that it should be ignored.

What strategies can be used to promote metacognition? Sadler (2006, p.14) suggested that teachers should be responsible "to download [their] evaluative knowledge so that students eventually become independent of the teacher and intelligently engage and monitor their own development". Earl (2006, p. 17) suggested using metacognitive strategies such as the following. Students may:

- describe their own learning, with the goal of determining its extent, outlining next steps and reporting progress;
- employ a checklist that includes criteria used to gauge and guide learning;
- use rubrics, i.e., scoring tools, to determine the quality of learning;
- write reflective journals that include comments and conclusions on how their learning is going;
- engage in self-assessment, reflecting on their own work and using meaningful criteria to determine learning gains;
- cooperate in peer-assessment, reflecting on their peers' work and using meaningful criteria to evaluate it.

Self and peer assessment are metacognitive strategies that help students develop an awareness of what worked and what needs to improve. The benefit of self-evaluation as a metacognitive approach is to engage students into their own learning and develop lasting skills of critiquing their learning (Black & Wiliam, 1998(a); Wolf, 1991; Sadler, 2006). Kulm (1994), who wrote several books on mathematics assessment tools, encourages having students develop the "metacognitive ability for self-checking" (p.73). Students who can evaluate their own thoughts and learning systems are more likely to solve math problems (Kulm, 1994).

1-3 Self and Peer Assessment

Often times the teacher is the primary assessor, but metacognition theory shows that students can assess themselves profitably (assessment *as* learning). Self-assessment could be explained as the ability to critique and make decisions about one's own thinking, procedures and abilities as a means of improving learning (Noonan & Duncan, 2005; Black & Wiliam, 1998(b)). Peer assessment requires students to make judgments in the form of feedback to their peers on a specific process, problem or performance based on a standard or a solution guide (Boud & Falchikov, 2007). For students who have grasped the concept of how to give proper feedback for learning, peer assessment provides an added dimension to formative assessment in the classroom as students are evaluated in their own words by someone other than a teacher. Sadler (1998) described self and peer assessment as a process that shifts the responsibility of learning to the learner or learners themselves.

Here are a few examples of peer assessment procedures from Kagan's (2009) book on cooperative learning. The application in a given classroom would depend on the maturity level of the students and the subject matter.

- Think-Pair-Share - The teacher poses a question to the class. The students think about their response, and then students' pair with partners to talk over their ideas. Finally, pairs share their ideas with the class.

- Rally table - Students work in pairs within their teams. Students take turns completing a task and analyzing the solutions.

- Showdown - Each student writes his answer on his individual response board. When everyone in the group is ready, the leader says "Showdown" and team members compare and discuss their answers.

There are several popular and supposedly highly effective instructional strategies grounded in student self assessment that an ever-increasing number of educators are putting to work in their classrooms. One involves the use of rubrics. Rubrics, when used correctly and for the right reasons, can be very powerful self-assessment tools. A rubric is defined "a document that lists criteria and describes varying levels of quality, from excellent to poor, for a specific assignment" (Andrade, 2008, p.2). Students are invited to become highly involved in the learning process when rubrics are used as a tool for providing meaningful feedback that leads to improvement of products and skills.

Another approach to self assessment uses student-led interviews with accompanying student portfolios. This provides an excellent opportunity for students to play an active part in their own learning. "When student-led conferences are coupled with the use of portfolios, students assume more responsibility for their learning and see connections among and between their learning in and outside of school" (Conderman, Ikan & Hatcher, 2000, p. l). Student-led conferences are an alternative to the more traditional parent-teacher conference. They meet the desire of many schools to involve students in directing their own learning (Hackmann, 1996). Student-led conferences encourage students to state and share their own learning goals, rather than the goals that teachers have for students, which may or may not be important to the student (Aseltine, 1993 as cited in Conderman, Ikan & Hatcher, 2000). The portfolio component enables

students to showcase their work. When students purposefully choose artifacts to demonstrate progress made toward personal learning goals, they are taking ownership of their learning, and this is the very type of practice that student-engaged learning stands upon.

In order for students to direct their own learning, assessment *as* learning closes the gap that joins what a student knows and what a student needs to know (Earl& Katz, 2006). When students use self or peer assessment and the feedback from this monitoring to make changes and adjustments in what they understand, they are using a metacognitive strategy to make sense out of missing information, relate it to prior knowledge and use it for new learning. This chapter has shown the use and importance of assessment *as* learning as implemented in self and peer assessment methods.

CHAPTER 2. SELF AND PEER ASSESSMENT THEORY, PRACTICE AND PROCEDURES

The present chapter provides experimental support and practical advice for using self and peer assessment. We identify the advantages of self and peer assessment practices and review some of the known obstacles. We show how a rubric for self and peer assessment can be used as a learning tool, and we suggest how self and peer assessment can support the goals of the Common Core Standards. Although there is much research on self-assessment, there is little practical advice about how to use the findings of experiments to design self and peer assessment procedures within the classroom. In many cases, self and peer assessing can be difficult to implement, yet a few authors, such as Rolheiser, Ross, Andrade, Zimmerman and Stiggins give valuable suggestions.

2-1 What Self and Peer Assessment Might Be Able To Offer, and The Obstacles To Its Use.

Teacher feedback to students is important, but self and peer assessment can do some of the work. Black, Harrison, Lee, Marshall, and Williams (2004) listed many options for teacher feedback to students. These include: asking questions, grading assignments, commenting on written work without grading and peer and self-assessment work. Peer and self-assessment is most important because it enables a student to make their own decision about their own or their peers' approach to solving problems. When a teacher assigns activities for self and peer assessment, this causes students to discover things and draw conclusions about their own work. Students in theory create a positive learning environment and are empowered to reflect (Noonan & Duncan, 2005).

Sadler & Good (2006) listed many advantages to self and peer assessment. If self and peer assessment are effectively implemented, there are several advantages. Logistically, student grading could save teacher time and provide quicker feedback (Boud 1989, and Sadler and Good, 2006). Pedagogically, it provides students an opportunity to analyze their work and make changes (Bloom & Krathwohl, 1956; Boud, 1989). Metacognitively, it develops the learning skill of evaluating their own work (Sadler & Good, 2006). Affectively, it changes students' perspectives and improves the learning environment (Sadler & Good, 2006).

Self and peer assessment tends not to be used in STEM. Although teachers have expressed concerns about self and peer assessment, it has been shown by a few studies that it can aid students learning. A study by Noonan and Duncan (2005) explored how often 118 teachers used peer and self-assessment. Thirty-two (32) of the 118 were math and science teachers. Of these, 14 reported 'no use', 12 reported 'little use' and 6 reported some use. The data showed that math and science teachers rarely used self/peer assessment in their lessons and used it less than teachers in other content areas. The authors commented that "such little use in math and science could show that there are many concerns about the relative merits of training students to use a rubric, the amount of time and energy needed to prepare assessment tools, and the strategies or skills needed to engage a body of students in the self and peer assessment process" (Noonan & Duncan, 2005, p.6).

Study about the best methods of implementation is needed. If used well, self and peer assessment may motivate, increase self-efficacy and establish a routine of on-going self-reflection, all of which help students become long-term learners. Sadler and Good (2006) showed that self assessment can improve student learning, but they advise that more study is needed in the area to determine if one procedure is better than the other. Clearly, it is important

to study how to implement, manage and enhance procedures for self and peer assessment. Most teachers would agree that this might be challenging, but it could be a means to meet learning goals (Black & Wiliam, 1998a). Teachers need to be concerned with implementing, managing and enhancing the procedures for self and peer assessment.

There are obstacles to implementation. Black, Harrison, Marshall and Williams (2004) received reports from teachers of low-performing and low-motivated students. They concluded that "self-assessment will happen only if teachers help their students, particularly the low achievers, to develop the skill. This can take time and practice" (p.14). One teacher said:

> The kids are not skilled in what I am trying to get them to do. I think the process is more effective long term. If you invest time in it, it will pay off big dividends, this process of getting the students to be more independent in the way that they learn and to take the responsibility themselves. (Black, et. al ,p.14)

But, if appropriate methods are found, good results can be expected. When students (and teachers) become comfortable with a continuous cycle of feedback and adjustment, learning becomes more efficient and students begin to internalize the process of standing outside their own learning and considering it against a range of criteria, not just the teacher's judgment about quality or accuracy (Earl& Katz, 2006).

2-2 Self and Peer Assessment Will Support The Goals Of The Common Core Standards

The Partnership for Assessment of Readiness for College and Careers (PARCC) and the Common Core Standards (CCSS)(2012) are defining and clarifying new expectations in public schools. The PARCC tests are expected to focus on applying skills, concepts, and understandings to solve multi-step problems requiring abstract reasoning, precision, perseverance, and strategic use of tools. They will require students to demonstrate the Common Core Standards of Mathematical Practices, listed in the Common Core website as follows:

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

In the work of this thesis, our emphasis is mathematical practice number three that "construct viable arguments and critique the reasoning of others".

Currently, many students who have difficulties with mathematical problem-solving fail due to the lack of reflection on their "cognitive process" either before or during problem solving (Car,1996, p.92). This thesis is testing the hypothesis that self and peer assess can be an important tool to meeting the expectation of CCSS. In the year 2013, students who create viable arguments when critiquing themselves and others will have an advantage in meeting the expectations of mathematical practice number three.

When PARCC tests are implemented, students will be assessed four times each year on mathematical thinking strategies in the form of opened-ended or constructed-response items. Open-ended math problems require a written response that can involve "formulating hypotheses, explaining mathematical situations, writing directions, creating new related problems or making generalizations" (Stenmark 1989 and Kulm 1994, p.42). Mathematical Practices Standard 3 from the Common Core website will require that students:

- "justify their conclusions, communicate them to others, and respond to the arguments of others;"
- "distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is;"

- attend to "arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments."

Open-end questions geared to Standard 3 will require students to self and peer assess. The kind of questions that will be asked are likely to require students to accustom themselves to on-going reflection, self- or peer evaluation and revision of responses. These are all components of self and peer assessment.

If teachers promote self and peer assessment, then students will be at an advantage in being able to set up problems and solve them (Car,1996). Skills developed through self and peer assessment will be valuable. Higher education researchers believe that a student's best chance of enhancing his learning to reach expectations like those in the common core is to self-assess (Boud, 2007).

Those who complain that self and peer assessment take too much time to prepare, implement and deliver need to understand the proven benefits of self and peer assessing when the proper methods are used. Boud and Falchikov (2007, p.133) has shown the benefits of self and peer assessment in adult education and higher education that has proven to:

- enhance reflection (e.g., Alverno College, 2001),
- create autonomy and independence (e.g., Beaman, 1998),
- self-efficacy (e.g., Bangert, 1991),
- increase responsibility (e.g., Dochy,1999),
- reduce math anxiety (e.g., Bangert,1991), and
- increase confidence in problem-solving (e.g., Lapham & Webster, 1999).

Self and peer assessing are the best option to meeting the goals of PARCC and Common Core standards because it allows students to focus, make judgments and revise the reasoning of

others and themselves. Self and peer assessing is the best option for kids to take ownership of their ability to set-up, solve, justify and correct math problems. If self and peer assessment is not used, students will continue to be unchallenged to reason, analyze and evaluate their own work and the work of others.

2-3 Questions Concerning The Use Of A Rubric When Self and Peer Assessing

A rubric for self-assessment would be defined as a scoring tool to measure and identify the quality of work based on a standard (Andrade, 2008). Kulm (1994) asserted that students can increase their awareness and insight of open-ended problems if they assist with developing scoring rubrics and evaluating their own work using a rubric. However, rubrics can be ineffective when the scoring criteria are too general (Andrade,2008). Popham (2006), in reporting a writing experiment about donating blood, listed what an effective rubric for self assessment should include. It must be based on a description of the important steps; it needs a numbering system; it needs to be able to detect logical reasoning. In this section, I will discuss how a rubric can be used to self assess, the steps used in developing a rubric for self-assessment, how to improve the quality of student rating, and what key components are needed for student to self assess with a rubric.

How can a rubric be used to self-assess? Stiggins, Arter, Chappuis and Chappuis (2006, p.231-240). created seven strategies for using a rubric as an instructional tool. A rubric can be used:

1. to provide a clear and understandable vision of the learning target;
2. to use examples and models of strong and weak work;
3. to encourage consistent and insightful feedback;
4. to teach students to self-assess and set goals;

5. to design lessons to focus on one aspect of quality at a time;
6. to teach students focused revision;
7. to engage students in self-reflection, and let them keep track of and share their learning.

What are the steps used to develop a rubric for self-assessment? Stiggins, Arter, Chappuis and Chappuis (2006, p.235) created six steps for rubric development:

1. determine what information is most important to the student;
2. gather samples of students work;
3. classify what is good, average or poor work;
4. find traits that characterize work of different levels;
5. create "models" for each level to be used as examples;
6. iterate the process to improve.

How can one improve the quality of rubrics for self assessment? A concern when using a rubric to self and peer assess is the reliability of ratings (Newstead & Dennis, 1994). Teachers worry about students inflating their grades (Ross et al., 2002) or not taking the self-assessment seriously when it does not count for a grade (Ross, 2006). Peer assessing with multiple people on a given product can be more reliable than a single marker (Mathews, 1994), (Magin, 1993, 2001). Stefani (1994) investigated the self assessment process using 87 students in laboratory reports. The conclusion was that when teachers and students are involved in creating the assessment tool and mark together, there is reasonable agreement. Another option is training. When training was provided, seventy percent of peer assessors felt more confident in participating in the activity (Sluijsmans, 2001). On the other hand, although teachers are concerned about the reliability of rubrics for self and peer assessment, Ross and others (2002) who surveyed students in grades five through eleven found that those surveyed responded

favorably to self assessment. Students felt, "it is beneficial to self-assess because they get to go over and correct their mistakes" (Ross et al, 2002, p. 56). To conclude, reliability is an area where improvement is likely to be needed, but are other issues that are worth attention.

Stefani (1994) and Cowan (1988) argue that the benefits of self-assessment are so great that we should not be concerned about reliability. We should be concerned about students taking responsibility for their own learning Heron's (1981; 1988). Heron (1988) conducted a study with 131 second-year marketing students. He found that self and peer assessment could lead to more autonomy in a course using problem-based learning. Higher performers were consistent in marking, but lower performers, showed inconsistency, possibly cancelling the benefits of self and peer assessment. Self and peer assessment can be a tool that enhances learning.

The value of self-assessment depends on classroom environment and student-motivation. Class management will be important to improving the quality of using a rubric to self-assess. It will be the teachers' responsibility to support the goals of the lesson. Self and peer assessment will keep students motivated to learn (Nicholls, 1983 and Carr,1996). The teacher will have to play an important role in managing the classroom environment and motivating students to self and peer assess with a rubric. If self and peer assessment are for students to assess their own or their peers' learning, then the students views on the task and culture of the classroom will have to change to motivation to learn (Carr, 1996). I believe that self-and peer-assessing with secondary students can work if the teacher can manage and motivate students with well-planned procedures.

The teacher's goal should be to use motivation to create a classroom culture that expects success, to change students' views of math, to manage classroom structures and procedures, and to focus students' attention on goals (Carr, 1996). When teachers motivate, it helps students

become self-learners. A teacher's ability to motivate the classroom with these components will encourage students to take responsibility for their own learning. The more students are self-regulated to learn on their own, the more likely students will become future learners (Corno & Rohrkempen, 1985 and Carr 1996).

The research says that the level of problem must be chosen with care. In order for motivation to occur, it is important for the teacher to create a task or problem that is not too low and not too high in level of difficulty for students (Nichiolls, 1983). Posing problems of moderate level helps teachers monitor the outcomes and enables all students to work. The teacher must be able to monitor the range of difficulty of problems without destroying the confidence of student to do a problem on their own (Vygotsky, 1986). When a class culture is engaged and monitored for learning, students can take responsibility for their own learning by self and peer assessing.

Student-motivation, a well-managed learning environment and appropriate level of task are important factors that should not be ignored by the teacher when self- and peer-assessing with a rubric. These factors help students to learn independently. Black and Wiliam (1998, p. 11) explained "when anyone is trying to learn, feedback about the effort has three elements: recognition of the desired goal, evidence about present position, and some understanding of a way to close the gap between the two." When students are trained to close the gaps within their learning through self and peer assessing, they are practicing metacognitive skills of self-reflection, self-analysis, re-interpretation and reorganization of knowledge. It is important for students to relating new knowledge to what they know by making sense of what is learned. This happens best when students are engaged in evaluating themselves (Costa,1989). Students who use the skills of self and peer assessing make adjustments, adaptations, and even major changes

in their thinking (Earl& Katz, 2006,p.41). When these skills become well developed, students will become more confident in directing their own learning while the teacher is more of a coach than a task-master.

2-4 The Literature Review: Self and Peer Assessment Theory, Practice and Procedures

The following studies show that self- and peer-assessment can work, provided that students are motivated, engaged and concerned about their own learning. Each study has reported favorable results of self-evaluation. The studies reviewed here have been restricted to classroom settings of primary and secondary education in science and math courses.

Klenowski (1995) conducted a qualitative study on the use of self-evaluation processes of secondary students in England and Australia. Both teachers and students in this study found self-evaluation useful and reported that it increased student motivation and that students became more aware of their mistakes as a result.

Maqsud and Pillai (1991) found that South African high school students who were asked to self-assess for a semester outperformed students who did not self-assess.

Several authors reported that primary school students who received self-evaluation training over a period of several weeks in a specific subject area performed better in mathematics (Fontana & Fernandez, 1994) than their counterparts who were not trained in self-evaluation.

Researchers do not appear to have a final verdict on rubric use for self and peer-assessment as a learning tool. These are the few studies on this, but those that have been done show positive effects. Noon and Duncan (2005) surveyed fifty-four teachers on their use of self- and peer assessment. They found that teachers prefer using self-assessment in the context of group work or to assess projects and presentations. These authors agree in theory that self and peer assessment are “important components” of formative assessment within groups. They

increase student participation in the learning process, promote self-efficacy and increase social interaction and feedback, but only when students focus on the process of thinking and not on the end product. The authors recommended, "More research is needed to better understand the use of peer and self-assessment in particular courses or school subjects" (p. 1).

Another notable study was conducted by Andrade, Wang, Du, and Akawi (2009). They studied the relation between long- and short-term rubric use (including self-assessment) and self-efficacy. The study involved 268 elementary and middle school students in writing classes. Although average self-efficacy ratings of both treatment and control groups increased over time, the authors reported a greater increase in self-efficacy of girls in the treatment group (using rubrics to check their work) than in the control group. The effect of the rubrics on self-efficacy of boys appeared to be statistically insignificant. To explain these results, the authors relied on research on attribution theory stating: "[G]irls tend to be more concerned with mastering a writing task than do boys, who, on average, tend to be more concerned with showing someone else that they are capable. Our findings regarding the differences in increases in self-efficacy after self-assessment may reflect these different achievement goals: Girls may derive more satisfaction and confidence from self-generated evidence of progress on a writing assignment than do boys, who seek confirmation of progress from others, including perhaps their teachers and peers" (Andrade, et al., 2009, p. 296).

Jonsson and Svingby (2007) reviewed the literature to see how rubrics were used. They looked at seventy-five reports of using a rubric. Only eight of the 75 concerned self- and peer-assessment. The eight reports concerned teachers using self- and peer- assessments within the classroom. The studies showed that rubrics could improve students' understanding of the

objectives. This confirms that there are few reports of using a rubric to self and peer assess as a learning tool.

Schirmer, Bailey, and Fitzgerald (1999) report on a year-long experiment with deaf children in the fifth and seven grades. Assessment rubrics were used as a teaching strategy. Significant improvements in the quality of students' compositions were observed. The evaluation used both quantitative and qualitative measures. The quantitative analysis indicated that use of the rubric as a teaching strategy significantly improved writing with respect to topic, content, story development and organization.

The study by Sadler and Good (2006) examine the benefits of self and peer assessing within a few science classes. The researchers compared teacher-assigned grades to grades awarded either by students to themselves or by their peers. Students in four middle school classrooms were trained to grade with the help of a scoring rubric. A very high correlation between students and their teacher was obtained (.91–.94). An important finding was that the students who scored their own tests using the rubric, improved dramatically. The authors conclude that both self and peer grading may be used to save teachers' time on grading, and also that self-grading appears to result in increased student learning, whereas peer-grading does not. The authors suggested that to "make student grading optimal, [one should] train the students, use blind grades, use incentives and check for accuracy" (Sadler and Good, 2006, p.25).

Hafner and Hafner (2003) used assessments of oral presentations to estimate the reliability of a rubric for self- and peer assessment purposes. When supported by a rubric, the students showed much agreement in their ranking of the presentations.

Cho et al. (2006) argue that peer reviewing of writing may be a way to create more writing opportunities in college and university settings, but observes that the validity and

reliability of peer-generated grades are a major concern. Their analysis suggests that the aggregated ratings of at least four peers are both highly reliable and as valid as instructor ratings.

Ross, Hoganoam-Gray and Rolheiser (2002) who experimented self-assessment for learning in a middle school found that one treatment group outperformed those who did not self-assess. The results suggest that self-evaluation can affect learning.

Although few, these studies indicate that rubrics might be valuable in supporting student self- and peer assessment. Some studies also show that students actually internalize the criteria, making them their own, and use them while self-assessing (Andrade, 1999b; Piscitello, 2001).

2-5 Theory Of Implementing Self and Peer Assessment

Self–evaluation, self-assessment and self-regulation are often used interchangeably to refer to "a student's ability to make a judgment on their own work based on a standard" (Rolheiser & Ross, 1998). Noonan and Duncan (2005) conducted research on self- and peer-assessment in high schools and found "little evidence of teachers use of self- and peer-assessment as a form of classroom assessment" (Noonan, 2005, p.1). This is partly due to the difficulty of collecting data (Hotard, 2010). Sadler & Good (2007) stated "little attempt is made in the literature review to discuss the reasons for a particular (self-assessment) design and the choice of measure, or to determine the error associated with a particular method"(p. 4). Although some researchers have offered suggestions for implementing rubrics and self-assessment as a learning tool, more research in implementing procedures is needed because managing the classroom environment and inspiring each generation of students are continuously changing. Therefore, it is of great interest to explore procedures for self-evaluation or self-assessment in secondary education.

An overview of the procedures described in the following sources will be discussed:

- Rolheiser, C. & Ross (1998) “Process Theoretical Model Behind Self-Evaluation”;
- Rolheiser, C. & Ross, J. (1998) Four Stage Model for Teaching Self-Evaluation;
- Zimmerman (2002, p.67) “ Self-Regulation Model for Homework Completion”;
- Stiggin’s et al. (2006, p.231-240) “Seven Strategies for Using Rubrics as Instructional Tools in the Classroom”; and
- Andrade (2008) “Steps for Rubric-Referenced Student Self-Assessment”.

Rolheiser (1998) explains how self-evaluation contributes to learning. She proposes a cycle that includes the following steps: (1) negotiate the goal for the learner, (2) encourage effort, (3) mix effort and goal with the learner sense of achievement, (4) self-evaluate, (5) self-judge of where do the student stand when meeting the goal, (6) self-react by allowing the learner to give an opinion of their work and (7) establish self-confidence. Rolheiser (1998) states, her process may have positive or negative effects depending on how the teacher is involved in the process.

Rolheiser, C. & Ross, J.(1998) interviewed a series of teachers on cooperative learning methods and created a four stage model for teaching students to self-evaluate. Stage One is to set goals and discuss grading criteria for self-evaluating. In Stage Two, students learn how to apply the material to their work. By examining examples and practicing how to classify, students take ownership of the process. In Stage Three students receive feedback on their self-evaluation either by a peer or by a teacher. Stage four requires students to create goals and action plans with teachers help. When the four stages are implemented, the authors claim, students can feel comfortable with self-evaluation. The process highlights expectations and gives students a voice, and feedback enables students to improve the quality of their work.

Zimmerman (2002) was interested in how self-regulation affected homework completion. He proposed four phases for self-regulation: the forethought phase, the performance phase, the

self-reflection phase and the repeat phase. The phases were designed to help students monitor themselves and seek help from peers with homework. At the completion of the homework, students were asked to evaluate themselves on the standards that the homework addressed. If the students were not pleased with their findings, then they would repeat the process.

Stiggins et al. (2006, p.231-240) created seven strategies that teachers might use with rubrics as instructional tools in the classroom. They can be summarized as follows:

1. Provide a clear and understandable vision of the learning target;
2. Use examples and models of strong and weak work;
3. Continue to provide regular descriptive feedback;
4. Train students to self-assess and set goals;
5. Design lessons to focus on one aspect of the standard at a time;
6. Teach students to revise their work;
7. Engage students in self-reflection by letting them keep track of and share their learning.

Andrade (2008) listed three basic steps of rubric–referenced student self-assessment. His steps required students to practice continuously over time. This was shown in an experimental study to enhance students' writing and to increase the overall grades of elementary and middle-school students (Andrade, Du, and Wang, 2007). The first step sets a clear expectation by showing students the rubric before issuing the assignment. The second step is to conduct the self-assessment by circling key phrases in the rubric and on the assignment. In the last step, students revise their work by identifying and correcting their mistakes.

As our review shows, strategies for self-assessment may be time consuming or hard to manage. Teachers are always concerned with efficiency. Therefore, it is important to test and modify each strategy over one or two days. The previously discussed procedures can be used as

a template to develop a method that is customized for a teachers' situation. With the exception of Andrade (2008), all the procedures have not been tested experimentally.

The procedures, strategies and methods mentioned are tools for further research. These procedures must be investigated to determine if they impact learning or provide a better way to self or peer assess while using a rubric. The effectiveness or ineffectiveness of one procedure compared to others could be explored.

CHAPTER 3. MOTIVATION AND PRELIMINARY STUDIES

This chapter describes my experiences trying to motivate, implement and manage self-assessment with my own students. I address the problems and challenges faced when implementing self and peer assessment procedures. I will describe how I devised a plan to get students to self-assess. And, after much trial and error through various experiments, I found a procedure that seemed to work.

3-1 The Problem

I teach in an urban high school in Baton Rouge. Over eighty percent of our students are on free or reduced lunch. Ninety-eight percent are minority students, most being African-American or Hispanic. The state of Louisiana has created a school performance system that grades public schools based on standardized test scores, attendance and graduation rates. In the 2011-2012 school year, my school's score was 65.2, which means we are labeled "academically unacceptable" and categorized as a "D level" school. Our school goal is to reach a performance score of 75.0 by the end of the next year and eventually move to the state goal of 120.

I teach several math courses. One of these is called "Financial Math." It is an accredited math course that counts towards graduation that is offered to juniors and seniors who do not take the college-readiness course, "Advanced Math." In 2011-2012, I taught eighty-one students in three sections, with twenty-nine in the first, twenty-three in the second and twenty-nine in the third. All students within these classes needed some form of support for learning or else they would withdraw. Twenty had some form of official accommodation for special leaning needs.

For students with official accommodations, the state recommends various interventions, such as grouping, use of guided questions and math organizers, and breaking down practice

problems. The interventions are vital to supporting students. I tried to support students by using word walls to remind them of vocabulary. These accommodations helped students to some extent, but I was not satisfied with the results. Even with this support, students were not meeting the mark with respect to competence in problem solving on their own.

My students remained unmotivated and indifferent within the class, especially when challenged at the limits of their capacity. They would not attempt problems that challenged them in reading, interpreting, following numerous steps, analyzing, making judgments or drawing conclusions—the tools needed to demonstrate competence in problem solving. Some of my students had trouble reading problems or translating problems into basic math. As a result of these knowledge gaps, students often submitted incomplete or low-quality work.

In addition to students struggling with the class expectations, students were often not in attendance or were distracted when participating. Unexcused absences required the teacher to track the location of students during instructional time. Students' behavior was problematic and suspensions were very high within my class. Additional distractions came from the school in the form of field trips, senior skip days, special events and graduation activities. A broken rhythm of instruction distracts students and interferes with building knowledge. All these things became an extra weight on the students and teacher.

The problems all go back to two sources: motivation and foundational skills (e.g., reading and basic math). I became aware of this issue when several reading assignments were submitted incomplete. I found that teaching literacy strategies and word walls needed to be routine within the class. To expect students to comprehend and answer with quality constructed-response questions without reviewing vocabulary is like asking someone to play basketball on a fifty foot

goal. Timing, management and review of basic skills become just as important as getting students to work on open-ended problems.

3-2 The Plan

The strategy that I finally adopted was the result of a long process of trial and error. It involves working on word problems from the course using a guide that doubles as a rubric for self- and peer-assessment. When joined with a step-by-step guide, the rubrics are not just a scoring tool but they help students understand what they are doing and why. The rubrics become a multi-faceted tool that can do many tasks all at once. They motive, get people to work together, get them thinking critically, guide them and provide literacy support. By using these tools, skills were developed at many levels all at once. The plan addresses and resolves the problems of motivation and knowledge gaps. At the top level, it leads students to self-assess. At the middle level, it takes care of course content. At the base, it builds vocabulary and reading skills.

Inspiring students is not an easy task, but I have found that external and internal motivation can increase interest within a task. External rewards, such as special recognition, candy, stickers and in exceptional cases even dollar coins were given to students who completed and turned in good work. This can get expensive. When students completed literacy assignment using the guide and assessed themselves, they were given stickers of completion. The student who had the highest gains received a dollar coin. All others would receive some form of recognition for completing the process.

Internal motivation was encouraged through the self and peer assessment process. The teacher's goal must be to respond as quickly as possible to student questions and concerns. This will keep the task or assignment moving along without delays. If a student has the right amount

of support to guide them through a task, he or she will remain motivated, even when difficult problems occur. Students like to receive immediate feedback on their work, and when teachers respond quickly, the process continues to flow and leads to increases in students' internal motivation.

3-3 Experimentation and Implementation

I tried several methods that took too long to implement. At the beginning of November, after many failed attempts to use constructed response problems, I tried using Ross's method (Ross, 1988). His process begins by developing a rubric with the students and goes on to training them to apply it, revising it, using it for self-evaluation, and providing teacher-feedback after grading. Unfortunately, even this didn't work. The process simply took too much time, and we never got past the first step. Ross's process assumes that students want to self- and peer assess, but if they have never done anything like this, they are at a loss. I tried to develop a rubric with the students, but it took two days of instruction. Training students took a whole day of instruction, and even after training, they were lost.

It was my goal to identify the source of my obstacles and to find a technique that would use instructional time efficiently. The first challenge I posed for myself was to find out why it was a challenge to get kids to make sense of the word problems. Using feedback techniques during the task instead of after the task (as prescribed by Ross) helped me understand the issues that my students were facing. A feedback form was created to find out what the problem was. As students raised their hands during the task, the teacher would prompt students to ask questions about the word problem. The students identified one or several choices:

1. I do not understand this word.
2. I do not understand what I read or what the question is asking.

3. I do not understand how to set up the problem.

4. I have a mental block

I found that over sixty percent of my students had trouble with the vocabulary. And, twenty- one percent requested help with solving. Less than eighteen percent had trouble with comprehending the problem. The instant feedback helped students identify the concerns of literacy, application, and reasoning required to complete the constructed response. The results showed that literacy and vocabulary were the major issues to be solved. This work led me to devise what I call the "Whole-Class Evaluation Feedback Form" which is designed for a teacher to use while students work. It gives immediate feedback and encourages students to keep working. This solved my first challenge.

The second challenge was to create a math organizer and rubric to breakdown the word problem into guided steps. Organizing a guide that goes along with the rubric and the constructed response was time consuming but not pointless. My students needed the extra assistance, especially in really large classes. This resulted in the Step-by-Step Guides, which support students who are stuck in an area.

The third challenge was to get students to see the value of self-and peer-assessing. When students are not motivated to self or peer assess, it becomes a waste of instructional time. Students who do not see the process as a learning moment turn their attention elsewhere. I noticed, however, that students would cooperate when immediate external rewards (for example, candy instead of grades) were used to keep them on track, even if they did not yet grasp the purpose. When they were able to focus, they could get more involved in critiquing their work. At first, training a student to self-assess was time consuming. However, the training time was reduced when feedback was provided during the task. This gradually led students to identify,

analyze their problems and make correlations between the constructed response and the rubric. Students learned to use the rubric to examine difficult solutions. One student replied, “I used to skip the word problems because I never saw it again. Now, if I try, I see where I went wrong”. In time, students came to see the benefit of self and peer assessing.

The whole process took a lot of experimentation, observation, thought and revision to find a procedure that used the available time in an efficient manner to address the problems that were most urgent. Of the seven strategies that we reviewed, Stiggins’ (2006) provided the greatest support, yet even his recommendations did not consider the time and motivation issues that arise in urban settings with at-risk (i.e., high free/reduced lunch) populations. My experience is that by combining some of his strategies and rearranging others, it is possible to increase interest, to reduce time and provide effective instruction.

After much trial and error, I felt that I had all the tools needed to get kids motivated to self- and peer- assess without losing much instructional time. My procedures for self-assessment practices with a rubric included:

1. Aligning the step-by-step guide with the rubric and the constructed response;
2. Allowing students to use the step-by-step guide as they practice the constructed response;
3. Gathering feedback during the task using a whole class tally feedback sheet;
4. Training students to self or peer assess using the whole class feedback sheet and the rubric;
5. Establishing an environment where students understood that self or peer assessment was an important part of the classroom process;
6. Encouraging students to self-reflect.

Using this format, I wanted to test my procedure to determine if self-assess and reflection impact learning when solving constructed response. In the following chapter, I will describe the specific procedures used in an experimental trial and will report on the results.

Students should be able to guide themselves and correct their own mistakes. The plan would allow students to compare their work to the teacher and their peers. When students make judgments by using a rubric, they can determine the quality of work. This in turn can lead to correction and reflection of students reasoning. The plan to self and peer assess while using a rubric as guide was expected to help students to comprehend the word problem, to fill in gaps of knowledge, to help manage themselves and to reflect on the quality of their work.

Of course, all these considerations took shape slowly during the period of exploration and trial and error. The specifics of the product and the procedures for using it will be described below in chapter four.

CHAPTER 4. EXPERIMENTAL STUDY

This chapter will discuss the tools, method, procedures and results of the experiment. The subjects were one hundred and fifty-seven African-American and Hispanic students, whom I taught over the course of eight months in a financial math course. In the experiment, students were randomly assigned to experimental and control groups. Both groups participated in three days of lessons, with a final quiz on the fourth day. The experimental group engaged in specific self-assessment activities during day two, while the control groups did other kinds of work during the self-assessment time.

Each lesson included several parts in addition to the period of self-assessment: a pre-practice assignment with a guide, acquiring feedback from the whole class, rubric training, post-assignment with a guide and the final quiz. These materials were needed to collect data and to support students during the process. The lesson reports the design, implementation and results of the experimental study below.

4-1 Method

This section will discuss the method, the lesson design and the rating system. Over the course of four days, nine steps were used to conduct the experiment. The students in six different classes were randomly selected and divided into two groups. Each class had an experimental group and a control group.

The first day, all students were introduced the lesson and vocabulary. Students began the day by solving an opening ACT problem and connecting with the vocabulary words using a literacy strategy. After the opening twelve minutes, all students were given a constructed response problem along with guided steps to work individually. During this time, the teacher walked around the room conducting a whole class evaluation to receive immediate feedback

from students. The whole class evaluation form is used to address difficult areas and introduce the rubric. The class ended by addressing the problems and concerns of the students during the pre-practice.

Table 4.1. Overview Of The Lesson Sequence For Experimental and Control Groups**.**

Step	Day	Description	Minutes
1	1	Introduction to the Lesson	12
2	1	Pre-Practice w/ Guide	25
3	1	Question & Answers	8
4	2	Lesson	20
5	2	Experiment & Control	25
6	3	Post- Practice	25
7	3	Group Discussion	20
8	4	Quiz	25
9	4	Transition to Next Lesson	20

The second day began by dividing the class into treatment and control group. Student names were picked from a paper bag to determine the group assignments. After this, the teacher and students worked a model problem for understanding, explanation and application, and then the students worked individually or with the teacher or with peers throughout. Up to this point, both groups were treated the same. Next, the experimental group received their pre- assignment, a rubric, a guide with the answers and a self–reflection sheet Figure 3. Students in the control group worked on additional problems with their peers and the teacher. Students who had questions about self-assessing were given directions by the teacher. Each pre-assignment was covered with a plastic sleeve to insure that students did not tamper with the pre assignment. After the students who self-assessed finished rating themselves, they were given the following directives to complete on each question:

a. Rate your effort using the rubric.

b. Determine where did you go wrong?

c. Explain what have you learned?

On the third day, all students were given a post-practice with a guide, which was the same as the pre-assignment. Afterwards, the teacher led a discussion with the whole class to continue teaching the lesson. On the fourth and final day, students were quizzed with the same constructed response without the guide. Students completed the assignment. Additional details about the activities are in the lesson plan reproduced in Table 4.2.

Three teachers worked on the grading of the papers (pre-assignment, post-assignment and quiz). The first teacher was responsible for rating the first two questions using the rubric and guide with answers. The second teacher rated the last two questions, reading the short answers and evaluating the students' responses. This system was used to reduce bias and increase the reliability of grading. Neither of these teachers knew which group the paper belonged to. The third teacher confirmed the ratings of the first two and recorded the scores in a spreadsheet.

The classroom was managed by using a reward system and the whole class evaluation procedure. Students were forewarned of the difficulties and frustration of being left alone. All, students were rewarded with candy or chips for maximum effort. Also, students were given the opportunity express their frustration using the whole class evaluation form while students' pre practice, post-practice and quiz. The Whole Class Evaluation Form, Figure 7**,** is a great way to receive immediate feedback and to reduce the anxiety of individual practice. My students like being able to express their feelings during a challenging practice or quiz. The Whole Class Evaluation Form will allow my students to respond to their fears in a nonthreatening way.

Table 4.2 Lesson Plan

Day 1 Lesson Plan Overview **45 minutes**

The goal of the lessons for the week are to explore and discover the mortgage lending system costs the of a mortgage loans. Students will incorporate housing costs which must fit into their long-term financial plans. Students will understand how to calculate closing costs of a mortgage loan, real estate taxes, finance and operating costs associated with home ownership. The objective of each lesson, students can compute various mortgage amounts and monthly payments. Students will be required to analyze the data using a pre practice tool along with a guide. Students will self- asses using a rubric and a guide with answers to self-reflect

2 minutes

ACT problem (1)

5 minutes

Connecting with the Vocabulary Words:
Mortgage Loans, financed, total pay back, and interest charged

5 minutes

Opener (Using the vocabulary)

A young couple is considering buying a new home with a selling cost of $168,000. A 20 percent down payment is required, and the rest will be financed through a mortgage company.

a. Think! What information must you know to calculate the mortgage loan amount to be financed?
b. When you calculated, you found the mortgage to be financed was $134,400. What questions would you want to ask the loan agent to ensure the correct calculations?
c. Often loans are 100% to 400% over the selling cost, why do you think this is the case?
d. Use Mental Math to calculate

25 minutes

Pre-Practice with Guide
The teacher will use the whole class evaluation form to receive immediate feedback from all students who are pre-practice with the guide.

8 minutes

Closure. After the all students are finished, the WCEF form will be used to discuss the constructed response problems in the area of vocabulary, reading comprehension, solving, mental block and question styles. The WCEF form was used to introduce the rubric.

Day 2 Lesson Plan Overview **45 minutes**

(Table 4.2 continued)

4 minutes

Check for Understanding. Review the objective and determine if the student computed mortgage amount by checking each other work. These students worked additional problems with their peers.

4 minutes

Model. I Do [Teacher]

A couple agrees to a 2/5 down payment on a new ranch home, which has a selling price of $98,750. They will finance the rest through a mortgage with a bank.

a. What is the amount of the down payment?
b. What is the amount of the mortgage loan?

4 minutes

Explanation. You Do [student]

c. Is there another way to calculate 2/5 of a down payment of the selling price?
d. Show a neighbor near you at least two ways to calculate the down payment.

4 minutes

Applying. We Do [student then teacher]

e. What steps could you create?
f. If you were writing how to solve the problem to your neighbor?

4 minutes

Training. How to use the guide with the rubric.

25 minutes

Experimental Group.

Students who were randomly selected to self-assess used a rubric with a guide to review their work. After half of the students rated themselves, they were given a reflection sheet to analyze their work for mistakes. Then students were asked to compare their answers to rate themselves with the guide and rubric. Students were asked to find their error and explain why they made their mistakes. Lastly, they wrote in words what have they learned about each question.

Control Group

Students will work together in peer groups to solve problem

Solving the Problem for the Control Group Activity Mortgage Loan Cost

Stinky Julie reached an agreement with a realtor to buy a house for $138,500. She made a down payment of 10% and will finance the remainder. She could finance the mortgage in one of two ways: Homework Mortgage at 6.5% for 25 years or Friendly Home loan at 5.5% for 20 years.

a. Which mortgage results in a larger amount of interest paid?
b. How much greater? *Find the down payment then subtract the down payment from the*

(Table 4.2 continued)
selling price.

Given :
Monthly Mortgage = Amount of Mortgage/$1,000 * Monthly Payment Rate for a $1,000 Loan
Total Pay Back = Monthly Payment* Number of Payments
Total Interest Charged =Amount Paid - Amount of Mortgage

Exploration: Ask students, what have you discovered?
I want my students to know: The most interest would be paid if she financed at Homeworks Mortgage. The difference is that the Friendly Homeloans loan is repaid five years sooner and costs $45,595.40 less in interest.

Day 3 Lesson Plan Overview 45 minutes

3 minute
Timed ACT Prep Problem 2

25 minutes
All students Post Practice With Guide

12 minutes
Evaluate & Create: [Group Discussion]
Students will evaluate a sample constructive response problem. Students will look for the mistakes and determine how are the values obtained by using a rubric with answers. Afterwards the student will practice rating the sample constructive response problem.

1. If you compare two loan options; such as, the selling price and time of payoff is the same, but the APR is different, which option would be best? Why? Create an example problem and justify your reasoning.
2. If you compare two loan options; such as, the selling price and the APR is the same, but the time of payoff is different, which option would be best? Why? Create an example problem and justify your reasoning.
3. Tricky! If you compare two loan options; such as, the selling price is the same, but option one has an higher monthly payment but shorter pay-off than option two. Which could be the better option? Why? Create an example problem and justify your reasoning for the option you choose.

5 minute
Closure and Elaboration

4. What have you learned? Write a paragraph about what you learned about today lesson.

Day 4 Lesson Plan Overview 45 minute

25 minutes
Quiz All students are expected to complete the quiz without the guide.

20 minutes
Early Finishers. Students are finishing their prior assignments.

4-2 Results

A scatter plot and a line graph (Figures 1 and 2) were created to compare the students who self-assessed with those who did not.

Figure 1 (page 41) compares the pre-assignment scores to the final quiz scores by plotting each student at the position of his or her pre-assessment score (*x*-axis) and final quiz score (*y*-axis). The green circles represent the students who did not self-assess and reflect. The red crosses are the students who did self-assess and reflect. The means and regression lines for each group are also shown in this figure. The control group increased their scores from an average of 4.5 out of 18 correct on the pre-test to an average of 8 out of 18 correct on the final quiz. The experimental group increased their scores from an average of 5.3 out of 18 correct on the pre-test to an average of 11 out of 18 correct on the final quiz. It is apparent that the experimental group did better than the control group on the pretest despite the random assignment. This means that from the outset, the two groups were not equivalent. The experimental group included more students than the control group who scored very high (9, 10 or 11) on the pre-assessment. On the final quiz, the experimental group increased its lead over the control group. The difference between the slopes of the regression lines is significant ($P = 0.02$, determined by a random permutation test as described below). Later, we will examine whether the performance difference between the groups could be accounted for entirely by the outliers.

In Table 3 and Figure 2, we compare the final quiz score means for the experimental and control groups at each pre-assessment level. It appears that group-by-group, the students who did not self-assess and reflect had lower averages lower than those who did.

Table 4.3. Comparison of groups defined by pre-assessment scores.

Pre-Assessment score	1	2	3	4	5	6	7	8	9	10	11
Final Quiz Average (Experimental)	7.2	10.4	8.0	10.5	10.9	10.3	9.3	12.7	16.7	18	18
Final Quiz Average (Control)	5.8	8.5	6.9	7.6	8.2	10.0	8.1	9.1	--	--	11.5
Number of students (Experimental)	6	7	10	11	9	11	4	10	3	3	4
Number of students (Control)	5	12	12	16	10	6	7	9	0	0	2

The line graph in Figure 2 plots the group average scores on the final quiz against the pre-assessment scores (1 thru 11 out of a possible 18). For example, the experimental students who scored one point on the pre-test averaged 7.2 on the final quiz. The numbers within each disk indicate the number of students in the groups defined by pre-assessment score. The graph shows that groups who self-assessed and reflected out-performed the control groups at every level.

We tested to see if the observed advantage of the experimental group could be attributed to chance or to the outliers. We removed the outliers (i.e., all students scoring 9 or more on the pre-assessment) from the data set. After this, the mean of the trimmed experimental group was 10.1 and the mean of the trimmed control group was 8.0. We used *Mathematica* to randomly reassign experimental and control status within each pre-assessment-level group and then computed the means the faux-experimental and faux-control groups. In 10,000 trials, a difference greater than 2 was observed 5 times. The probability of a difference like the one we observed in our trimmed data occurring by chance is less than 1%. Our findings are significant.

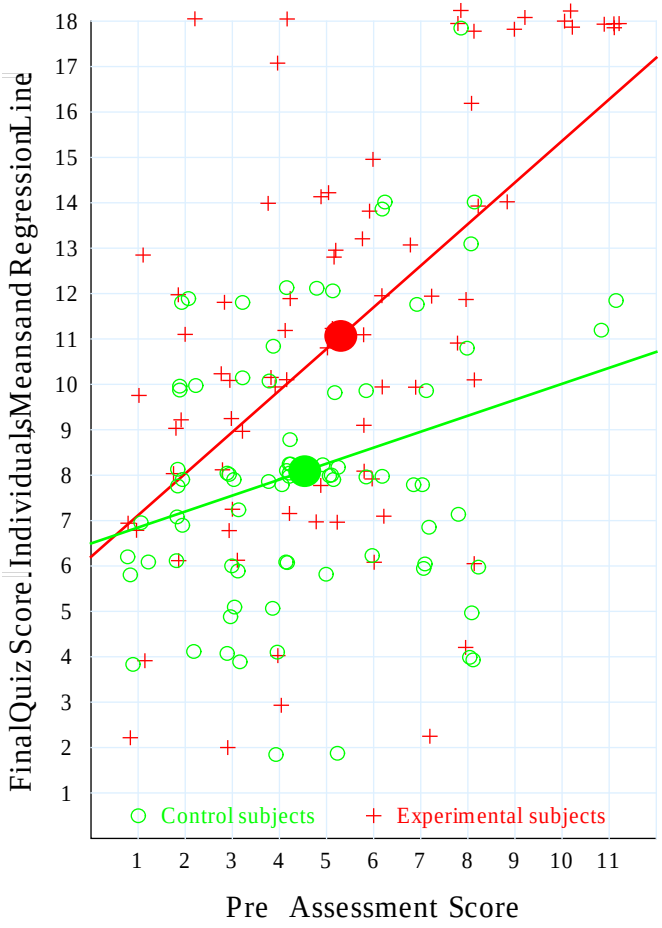

Figure 1. Scatter Plot. Each student was plotted at the position of his/her pre-assessment score and final quiz score. Regression lines and data means are also plotted.

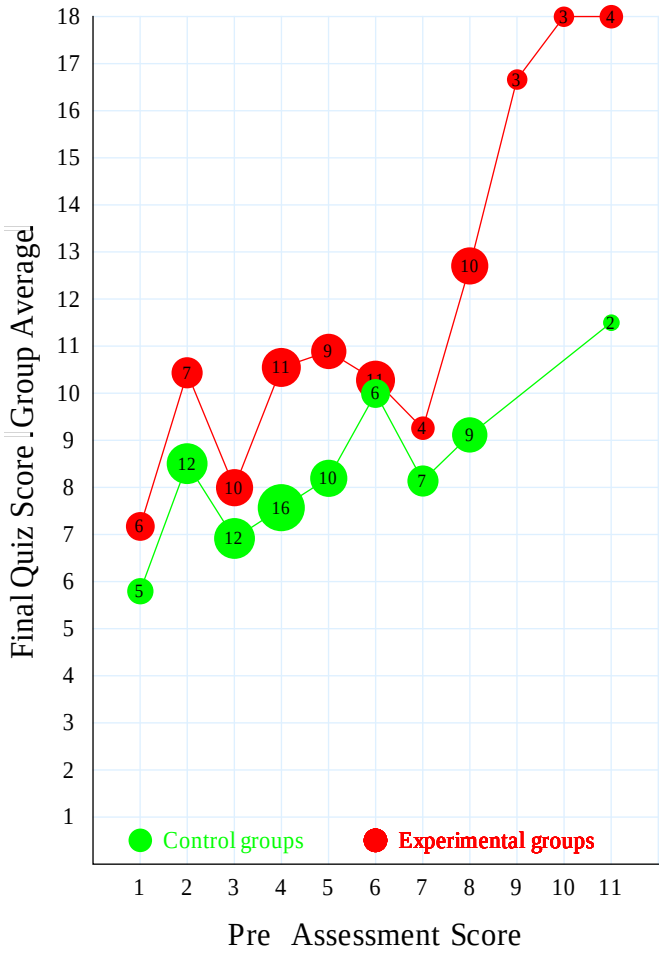

Figure 2. Group Average Plot. Students were grouped by pre-assessment score, and the final quiz averages for each group were plotted. Figures in disks show number of students.

CHAPTER 5. CONCLUSION

This study took place in several financial math classes for 11th and 12th grade students from at-risk populations. Students who were asked to self-assess and reflect on their work performed significantly better on a quiz involving constructed response items than students who were asked to do additional practice work. Self assessment and reflection led to greater learning gains than working more problems.

The experiment employed a carefully designed sequence of learning activities. .I thought deeply about how students think and process information, and I created special classroom materials. My goal was to provide opportunities for students to correct themselves and face their fears of making mistakes. I hoped that self-assessment and reflection would increase the expectation of success for both the teacher and the students at all levels of learning. The positive results that I obtained are surely related to this extensive planning. Self-assessment in another setting might not be as effective.

There are a few things that might be done differently if the experiment is ever repeated. First, one might divide students based on their current academic performance instead of randomly selecting students from a paper bag. By selecting students this way, one could avoid an excess of high-performing outliers in one group. Second, the study might be carried on for a longer period of time with several tests (but this might be difficult without interfering with the usual pacing of the lessons). Finally, one might use a higher level of questions. This could give more insight into students' thinking. I suggest for future study that researchers might create experiments using Kagan Structures. These provide a format for self-assessing and peer-assessing that teachers have been able to implement. They could test any one of those structures to see what kind of effect it has on learning.

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APPENDIX

Reflection Sheet

Question 1

a. Compare your answer to the answer on the rubric and rate your effort.

b. Where did you go wrong?

c. What have you learned?

Question 2

a. Compare your answer to the answer on the rubric and rate your effort.

b. Where did you go wrong?

c. What have you learned?

Question 3

a. Compare your answer to the answer on the rubric and rate your effort.

b. Where did you go wrong?

c. What have you learned?

Question 4

a. Compare your answer to the answer on the rubric and rate your effort.

b. Where did you go wrong?

c. What have you learned?

Figure 3 Reflection Sheet

Experiment___ Mortgage Rates Comparisons Name:_____ Period____

Tracy and Allen Bonehead have applied for a $200,000 loan at an annual interest rate of 7.50 percent. The loan is for a period of 20 years and will be paid in equal monthly payments that include interest.

Monthly Payment for a $1,000 Loan

Interest Rate	Length of Loan in Years		
	20	25	30
6.50%	$7.46	$6.75	$6.32
7.00%	$7.75	$7.07	$6.65
7.50%	$8.06	$7.39	$6.99
8.00%	$8.36	$7.72	$7.34
8.50%	$8.68	$8.05	$7.69

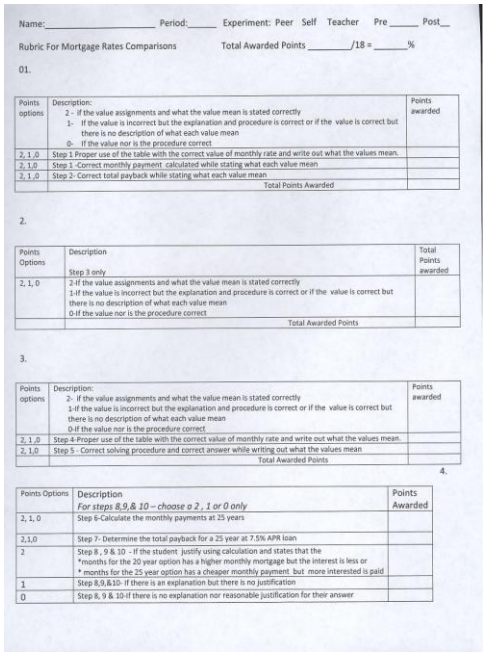
1) How much in total will they pay back to the bank during the 20 years?

2) How much interest will they pay, in total over the 20 years?

3) If the interest rate goes done to 6.50% in 20 years, how much can they borrow and still have the same monthly payment?

4) If they borrow the same amount, but go to a 25 year loan at the same APR; which option would you choose: 20 year at 7.5% APR or 25 year at 7.5% APR? Explain and Justify your answer.

Figure 4 Final Quiz



Name:_____ Period:_____ Experiment: Peer Self Teacher Pre _____ Post__

Rubric For Mortgage Rates Comparisons Total Awarded Points _____/18 = _____%

01.

Points options	Description: 2 - If the value assignments and what the value mean is stated correctly 1- If the value is incorrect but the explanation and procedure is correct or if the value is correct but there is no description of what each value mean 0- If the value nor is the procedure correct	Points awarded
2, 1 ,0	Step 1 Proper use of the table with the correct value of monthly rate and write out what the values mean.	
2, 1,0	Step 1 -Correct monthly payment calculated while stating what each value mean	
2, 1 ,0	Step 2- Correct total payback while stating what each value mean	
	Total Points Awarded	

2.

Points Options	Description Step 3 only	Total Points awarded
2, 1, 0	2-If the value assignments and what the value mean is stated correctly 1-If the value is incorrect but the explanation and procedure is correct or if the value is correct but there is no description of what each value mean 0-If the value nor is the procedure correct	
	Total Awarded Points	

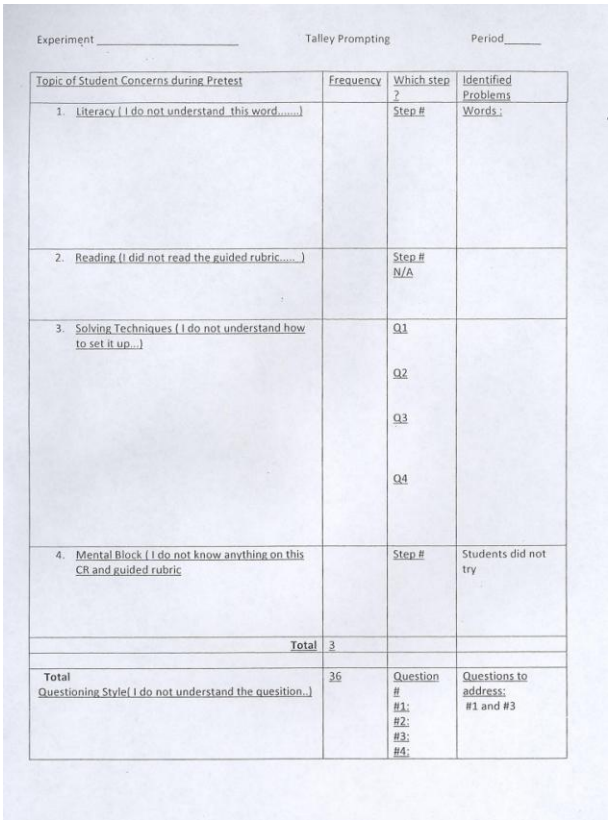
3.

Points options	Description: 2- If the value assignments and what the value mean is stated correctly 1-If the value is incorrect but the explanation and procedure is correct or if the value is correct but there is no description of what each value mean 0-If the value nor is the procedure correct	Points awarded
2, 1 ,0	Step 4-Proper use of the table with the correct value of monthly rate and write out what the values mean.	
2, 1,0	Step 5 - Correct solving procedure and correct answer while writing out what the values mean	
	Total Awarded Points	

4.

Points Options	Description *For steps 8,9,& 10 – choose a 2 , 1 or 0 only*	Points Awarded
2, 1, 0	Step 6-Calculate the monthly payments at 25 years	
2,1,0	Step 7- Determine the total payback for a 25 year at 7.5% APR loan	
2	Step 8 , 9 & 10 - If the student justify using calculation and states that the *months for the 20 year option has a higher monthly mortgage but the interest is less or * months for the 25 year option has a cheaper monthly payment but more interested is paid	
1	Step 8,9,&10- If there is an explanation but there is no justification	
0	Step 8, 9 & 10-If there is no explanation nor reasonable justification for their answer	

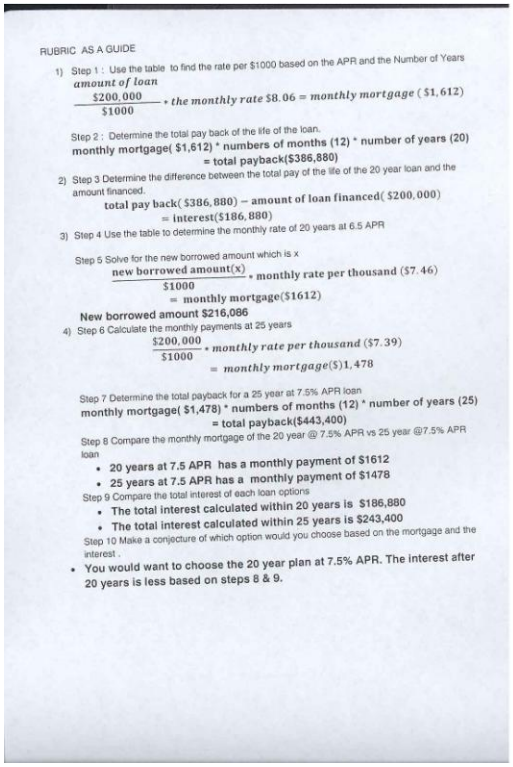
Figure 5 Rubric



Experiment _____ Talley Prompting Period_____

Topic of Student Concerns during Pretest	Frequency	Which step ?	Identified Problems
1. Literacy (I do not understand this word.....)		Step #	Words :
2. Reading (I did not read the guided rubric.....)		Step # N/A	
3. Solving Techniques (I do not understand how to set it up...)		Q1 Q2 Q3 Q4	
4. Mental Block (I do not know anything on this CR and guided rubric		Step #	Students did not try
Total	3		
Total Questioning Style(I do not understand the quesition..)	36	Question # #1: #2: #3: #4:	Questions to address: #1 and #3

Figure 6 Whole Class Evaluation Form



RUBRIC AS A GUIDE

1) Step 1 : Use the table to find the rate per $1000 based on the APR and the Number of Years

$$\frac{amount\ of\ loan}{\$1000} * the\ monthly\ rate\ \$8.06 = monthly\ mortgage\ (\$1,612)$$

Step 2 : Determine the total pay back of the life of the loan.

monthly mortgage($1,612) * numbers of months (12) * number of years (20)
= total payback($386,880)

2) Step 3 Determine the difference between the total pay of the life of the 20 year loan and the amount financed.

$$\text{total pay back}(\$386,880) - \text{amount of loan financed}(\$200,000)$$
$$= \text{interest}(\$186,880)$$

3) Step 4 Use the table to determine the monthly rate of 20 years at 6.5 APR

Step 5 Solve for the new borrowed amount which is x

$$\frac{\text{new borrowed amount}(x)}{\$1000} * \text{monthly rate per thousand}\ (\$7.46)$$
$$= \text{monthly mortgage}(\$1612)$$

New borrowed amount $216,086

4) Step 6 Calculate the monthly payments at 25 years

$$\frac{\$200,000}{\$1000} * monthly\ rate\ per\ thousand\ (\$7.39)$$
$$= monthly\ mortgage(\$)1,478$$

Step 7 Determine the total payback for a 25 year at 7.5% APR loan

monthly mortgage($1,478) * numbers of months (12) * number of years (25)
= total payback($443,400)

Step 8 Compare the monthly mortgage of the 20 year @ 7.5% APR vs 25 year @7.5% APR loan

- **20 years at 7.5 APR has a monthly payment of $1612**
- **25 years at 7.5 APR has a monthly payment of $1478**

Step 9 Compare the total interest of each loan options

- **The total interest calculated within 20 years is $186,880**
- **The total interest calculated within 25 years is $243,400**

Step 10 Make a conjecture of which option would you choose based on the mortgage and the interest .

- **You would want to choose the 20 year plan at 7.5% APR. The interest after 20 years is less based on steps 8 & 9.**

Figure 7 Guided Steps with Answers

Application for Exemption from Institutional Oversight

Institutional Review Board
Dr. Robert Mathews, Chair
131 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.5983
irb@lsu.edu
lsu.edu/irb

Unless qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research/ projects using living humans as subjects, or samples, or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

-- Applicant,Please fill out the application in its entirety and include the completed application as well as parts A-F, listed below, when submitting to the IRB. Once the application is completed, please submit two copies of the completed application to the IRB Office or to a member of the Human Subjects Screening Committee. Members of this committee can be found at http://research.lsu.edu/CompliancePoliciesProcedures/InstitutionalReviewBoard%28IRB%29/item24737.html

-- A Complete Application Includes All of the Following:

(A) Two copies of this completed form and two copies of parts B thru F.
(B) A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1&2)
(C) Copies of all instruments to be used.
*If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.
(D) The consent form that you will use in the study (see part 3 for more information.)
(E) Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB. Training link: (http://phrp.nihtraining.com/users/login.php)
(F) IRB Security of Data Agreement: (http://research.lsu.edu/files/item26774.pdf)

1) Principal Investigator: Terry Armstrong **Rank:** Graduate Student

Dept: MNS **Ph:** 3377945614 **E-mail:** tarmstrong@ebrschools.org

2) Co Investigator(s): please include department, rank, phone and e-mail for each
*If student, please identify and name supervising professor in this space

IRB# E7034 LSU Proposal #
✓ Complete Application
✓ Human Subjects Training

3) Project Title: Implementing, Managing and Enhancing Self and Peer Assessment Procedures

Study Exempted By:
Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-8692 | www.lsu.edu/irb
Exemption Expires: 10/24/2015

4) Proposal? (yes or no) NO **If Yes, LSU Proposal Number**

Also, if YES, either ◯ **This application completely matches the scope of work in the grant**
OR ◯ **More IRB Applications will be filed later**

5) Subject pool (e.g. Psychology students)

*Circle any **"vulnerable populations" to be used**: (children <18; the mentally impaired, pregnant women, the ages, other). Projects with incarcerated persons cannot be exempted.

6) PI Signature Terry A Armstrong **Date** 9/23/12 (no per signatures)

** **I certify my responses are accurate and complete.** If the project scope or design is later changes, I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

Screening Committee Action: Exempted ✓ Not Exempted ____ Category/Paragraph 1
Signed Consent Waived?: Yes (No)
Reviewer Mathews **Signature** [signature] **Date** 10/25/12

VITA

Terry Armstrong is a Financial Math teacher at Belaire High School in Baton Rouge, Louisiana. A native of Lafayette, Louisiana, he is a graduate of Acadiana High School.

Earning a Bachelor of Science Degree in Mathematics in December 2002, Mr. Armstrong completed his collegiate studies at McNeese State University. While at McNeese, he was homecoming king and earned academic honors. He holds a State of Louisiana Teaching Certificate of Highly Qualified Status. His certification studies came from University of Louisiana at Lafayette.

Mr. Armstrong has been active in many roles in the East Baton Rouge Parish School System. He has taught various Secondary Mathematics courses at Istrouma High School and at Belaire High School. It is Mr. Armstrong's hope to find new procedures and methods to influence inner city students to love mathematics.