USE OF STANDARDS-BASED GRADING TO INCREASE THE TEACHER'S OVERALL UNDERSTANDING OF STUDENT'S LEARNING IN THE SEVENTH GRADE SCIENCE CLASSROOM

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Standards Based Grading (SBG) in the classroom was examined along with the extent to which it would increase students' overall understanding of the materials. As high-stakes testing becomes more prevalent, it has been necessary to begin to look at changing aspects of pedagogy along with assessment to increase achievement. Students were given a survey prior to the treatment/non-treatment cycle and then again when the cycle concluded to detect any change in their attitude once they became more comfortable with the grading system. Students were also given the choice to authentically reflect on their learning and the quality of the reflection was compared to their overall understanding of the materials. Overall students' attitudes about their abilities in relation to the practices with SBG were positive. Students who demonstrated a quality reflection were much more likely to be proficient on the summative assessment when compared to their peers who either did not reflect or completed a poor reflection.

INTRODUCTION AND BACKGROUND

I spent the first few years of my teaching struggling with two questions: how could I make certain that all my students had the opportunity to understand the material I presented, and how could I best help them to articulate their needs as they arose. I believed all students, no matter their background or perceived learning ability, were capable of learning the materials I taught. The challenge I formulated was to figure out how to teach these materials in a way that was efficient, so my students who were advanced did not feel bored or unchallenged, but which allowed students who did not fully understand to express their needs prior to a summative test for all. I came to believe the answer to this challenge might come from a place I had not expected: the way I graded.

Our current grading practices have been around for over a hundred years. It was time, I felt, to evaluate the effectiveness of these practices and to begin to look at different ways to assess learning. I decided I wanted my grades to be informative and not punitive. I was fortunate that the timing of my discovery coincided with my district's desire to find effective, alternative-grading practices. One practice they endorsed early on was standards-based grading or SBG (it may also be referred to as standards-referenced grading).

My action research (AR) focused on the use of Standards Based Grading (SBG) in the classroom and the extent to which it would increase students' overall understanding of the materials. SBG is used to grade students based on their knowledge of a current subject. For each subject area a proficiency scale is provided to the students (Figure 1). Proficiency scales show detailed information about what is required for the

students to master by the end of a given unit. At the end of a unit, students are given a score based on their mastery of the subject. The score was on a zero to four-point scale with three indicating a grade level understanding and a four indicating an advanced understanding of a subject. With this type of grading the student's homework and behavior is not a part of the grade.

Strand: Science		
Topic: Graphing and Measuring Speed		
Grade: 7th Grade		
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught** SP.1. Can accurately read a speed/displacement graph, identifying when the object is stopped, moving at a constant spend or going back to the original position.	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	**The student:** SP.2. Can accurately set up a speed/displacement graph a. Places time on the x-axis and distance on the y-axis. b. Adds a title to the graph **The student exhibits no major errors or omissions.**	
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Recognizes or recalls specific terminology, such as: SpV.1. Distance SpV.2. Time SpV.3. Speed SpV.4. Displacement • Performs basic processes, such as: SpV.5. Accurately measuring time SpV.6. Accurately measuring distance in metric measurements **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.
Score 0.0	**Even with help, no understanding or skill demonstrated.**	

Figure 1. Proficiency Scale for Graphing and Measuring Speed. Formatting from Marzano (2011).

A summative assessment determines a student's grades. Teachers often include frequent formative assessments along the way to insure that students fully understand the topics prior to the summative assessment. For this to work best, I felt it was important for students to begin to reflect on their own level of understanding of a topic. While I believed this system could benefit all students, I also discovered that the most significant

roadblock to implementing this change successfully was student unfamiliarity and discomfort with a measure they did not understand.

I have actively been using standards-based grading in my classroom for over a year. Although initially I was going to devote my Action Research (AR) to an examination of SBG in broad, general terms, I decided quickly that it would be necessary to narrow my focus.

There are several aspects of SBG grading I felt could not be changed during a treatment/non-treatment cycle, elements that are essential to SBG overall. These include:

1. Students are given a grade based on their understanding of a topic.
2. Assignments are used to help build the student's understanding of topics and are not graded.
3. For the most part, behaviors such as late work and effort do not go into the grade.
4. Students are given the information they are required to know prior to the beginning of the unit. This is the only information on which they will be assessed.
5. The focus is on learning and not on grades.

One aspect of SBG I felt comfortable changing was in the area of a student's ability to articulate his or her own understanding.

My AR came to focus on this question: *does standards-based grading (SBG) help to increase overall student learning in the seventh grade science classroom?* This was an important topic to me for three reasons. First, the district I am in has begun to move towards SBG and I wanted to have a greater understanding of the topic prior to full implementation. Second, I wanted a better measure of my students' long-term understanding. Finally, with growing, but still limited experience with SBG, I wanted a

better way to articulate this experience to both my colleagues and district personal. To further focus my research targets, I divided my investigation into a main question and two sub-questions.

The main question asked was: *to what extent will standards-based grading help to increase the teacher's overall understanding of students' learning in the seventh grade classroom?* My first responsibility as a teacher is to ensure all students have the chance to learn all topics. Developing a clear knowledge of each student's understanding of each topic is essential in evaluating how well I meet this responsibility.

The first sub-question is: *is there a correlation between students' attitudes about Standards Based Grading and their overall achievement in summative assessments?* As our district moved towards the use of SBG in the middle school, I wanted to know to what extent the student's understanding of the grading practice would affect their achievement in the class. The knowledge I gained from this question will help the district and me to determine how much time should be dedicated to help the students to better understand SBG.

Finally, I looked at how student self-reporting and self-reflection affected their ability to learn. My final question was: *to what extent does student self-reporting and self-reflection on formative assessments lead to greater success on summative assessments?* Phrased another way, are students who are able to actively and accurately assess and reflect on their own understanding of materials better able to direct their own learning? I believe that this is an important and fundamental question that addresses self-confidence, self-advocacy and personal motivation. To look at this, students were asked to reflect on questions they missed on a test. Within the reflection they had to indicate

where they still struggled and remained uncertain. I then compared their ability to reflect with their actual understanding of the materials. My initial expectation was that as students become more familiar with the proficiency scales and the reflection process, they would be able to better articulate what they know and don't know both prior to and after a test, and then do better on the tests.

My support team consisted of two teachers, my principal, and my father. The teachers chosen to support me are either implementing SBG or have implemented it in the last year. They were chosen because they have a basic understanding of the processes involved, but are working through them as well. One is a science teacher in another grade at my school and the other is a math teacher at another school. Both teachers have been very supportive. The science teacher at my middle school has helped to create proficiency scales for each of my units. In addition, she has helped to answer questions about the process when I got stuck along the way. The math teacher in the other middle school has helped me with the specifics of SBG, because he is navigating this grading system as well. We have also worked together to set-up grading scales as well as setting up our grade books.

I chose my principal-as my final support team member. I am grateful that she has allowed me to try SBG in my classroom, and that she has been ready and able to provide professional input and personal support. Finally, I chose my father as the first editor of my AR. He is a smart man and a careful reader and has always helped me to show my work more clearly.

CONCEPTUAL FRAMEWORK

As high-stakes testing becomes more prevalent, schools have begun to look at changing aspects of their pedagogy to increase achievement. Changes to curriculum and new assessment strategies are not effective if they are not paired with school-wide grading policies that promote learning (Guskey, 2000). There are grading practices that may even cause a decrease in the teacher's understanding of a student's knowledge; Guskey (2000) suggests there are four specific practices, which inhibit learning. All of these pertain to standards-based grading, with the exception of the last, which is the selection of a valedictorian. They are:

1. *Grading on a curve,* where only a few students are allowed to show great success and others are required to get failing grades. This strategy suggests that not all students are capable of achieving topic mastery. In addition, when students are graded on a curve they are norm-referenced, meaning they are graded based on the performance of their peers. Norm-referenced grading places students in competition with each other and does not indicate each student's level of topic mastery. Finally, a curve makes grades difficult to interpret because a C in one class will not mean the same as a C in another.

2. *Using grades as a form of punishment (Guskey 2000).* It has been found this practice does not encourage students. In fact, lower grades tend to discourage students and cause students to refer to the lower grade as meaningless in order to self-protect. In addition, Guskey points out, grades could be used as an extrinsic rewards system, which does not encourage understanding of topics. Finally, many students see an F as a final grade so they are not motivated to learn the missed information. Guskey suggests that if a grade is required, than an I for incomplete should be used in place of the F.

3. *The use of the zero when students do not complete work*. In most cases, the zero does not indicate the students' level of mastery; instead it may be an indicator of behavior. The zero is even more detrimental on a 100-point scale when averages are used (Guskey 2000). As with the F, and I in place of the zero will send the message to the student that completion is still required and allows for full mastery of a topic to be indicated on a grade report.

While Guskey (2000) explained the "don'ts" of grading, I needed additional direction about what I should *do* when I fully implement SBG in my classroom. For this information, I turned to Marzono and Heflebower (2011), who explained SBG strategies that do increase student mastery.

According to Marzano & Heflebower, teachers should use a well-defined scale for each standard the student is to master. This scale should be the same across all standards and could in general look like the one below.

1 - may show success with help

2 - demonstrates an understanding of basic concepts and terms

3 - understands topic at required level

4 - has an advanced understanding of topic

Within the scale, a teacher could have half point marks to indicate partial achievement of the mastery. If a teacher is unable to get rid of the compilation grade, the scores from the four-point scale could be matched with the grade (Marzano & Heflebower, 2011). For example an A could be equivalent to a 4, or an advanced understanding of the topic. This last suggestion is of particular importance to me, because I used a traditional grade reporting system while incorporating SBG in my classroom.

In order to place students on the scale of understanding, they need to be regularly assessed. Marzano and Heflebower (2011) also pointed out that varied assessment techniques are necessary to accommodate a variety of students and to ultimately assure that all students can demonstrate proficiency. For example, as I graded my English Language Learners (ELL) on their mastery of a topic, I needed to find unique ways to allow them to demonstrate their learning as opposed to non-ELL students. Examples of these types of assessments may include probing discussions, unobtrusive assessments, and student generated-assessments (Marzano and Heflebower, 2011).

Frequent use of formative assessments is one of the methods I used in my AR. To gain better insight, I researched both the creation of formative assessments and the types of assessments I could use. Formative assessments are used to guide the teacher and give the students information about where they are in their understanding (Baily & Jakici, 2012). Baily and Jakicic explained that there are four steps to creating and using formative assessments. The first step in implementing formative assessment is to determine what knowledge will be tested. The next step is to decide what defines "proficient". These steps precede the creation of my own proficiency scales. Next is to decide how to respond if students don't understand a topic. This is one of the most important parts of formative assessment if I wanted to show improvement on my summative assessments. Finally, the teacher must determine how students who demonstrate proficiency will get enrichment. Although I felt this important, it was a step I needed to leave for later in the process.

In the model presented by Baily and Jakicic (2012), the formative assessment is balanced to show all levels of proficiency. This is important because a teacher must have

a balanced view of the student's understanding before deciding how to respond (Baily & Jakicic , 2012). The assessment may include different types of probing, although a constructed-response question is helpful. In addition, any construct-response question must have a rubric associated with it so the teacher is able to accurately assess proficiency (Baily & Jakicic, 2012). As I read through this I understood the importance of these criteria, but I was concerned about the length of time it might take. For this reason, I decided to find other types of formative assessments, which would lead to quick but accurate answers and analysis of understanding.

Keely and Eberle (2008) use quick assessment probes to assess student's understanding. Although these are by definition quick, the concepts on which they are formed may be complex. As with Baily and Jakicic above, Keely and Eberle (2008) also explain that an understanding of what needs to be assessed is required prior to creating the assessment. Correspondingly, these probes are concerned with the both the student's understanding and the basis of their knowledge (Keely & Eberle 2008). In addition, Keeley has aligned her probes with national standards and has had peer reviews of the probes prior to release. One example of a probe is a multiple-choice question with a short answer explanation of choice. As I moved forward with formative assessments it was useful to have probes ready to utilize. However, I also understood the validity in assessing my students on all proficiency levels, so I used the types of formative assessments Baily and Jakicic (2012) suggested as well.

Motivation can often be positively associated with goals. One of the larger ideas behind SBG is that people achieve more when goals are clear. This is evident in all aspects of life including sports, weight loss, financial planning and many more. When

SBG is used in the classroom, goals are provided to the students for each standard.

Two types of goals can be examined when looking at grading: performance and mastery. Performance goals in education often refer to a behavior, whereas mastery goals refer to the understanding of the materials. An example of a performance goal would be when a student wants to get all A's. In contrast, a mastery goal occurs when a student wants to become proficient in a certain area. Students achieve more when the goals are mastery goals (Ames and Archer, 1988). Performance goals can be helpful, but only when the importance of mastery goals is stressed (Ames and Archer, 1988). Ames and Archer (1988) found when performance goals were the most important in the classroom, students focused their belief of failure and success on their own abilities. Mastery goals tend to make students believe that the outcome is based on their effort and not ability (Ames and Archer, 1988). In addition, performance goals often promote competition. Students are more successful in classrooms where social comparison is at a minimum; this is achieved best when mastery goals are emphasized (Ames and Archer, 1988). This information helps to reinforce the need to get away from letter grades and work towards mastery goals in my classroom a task I found very difficult to do in the end.

When introducing a significant change into a classroom, a well thought out plan for change may not matter if the key parties are not inclined to accept change. Teachers give varying opinions about standards based grading. Some teachers note the value in helping all students to achieve mastery; while others say that it involves an increased workload for teachers while decreasing the student's motivation (Hanover 2011). Feedback has been found to be an effective way to increase learning and teachers have stated that SBG helped them give more effective feedback (Hanover 2011).

Parents and students are also concerned about SBG and many of them have very strong opinions. One of the larger concerns is that SBG may lower the student's grades, which will then affect the student's ability to get into college (Hanover 2011). Overall a lack of communication about the grading system to students and parents has caused much of their frustration (Hanover 2011). For this reason, I decided it is best to I begin my AR with significant information about SBG given to students and parents. I created a website, which showed all of my proficiency scales, included a frequently asked question site, and had links to research about SBG. In addition, I believed it was it is important to I find ways to continually engage parents and students in conversations about the change and the ideas behind SBG.

The perception of fairness seems to be of utmost importance to students in 7th grade. In a study of elementary and middle school students, researchers found that 84% *(N=114)* percent of the students surveyed stated that SBG was a fair way to practice (Knaak, Kreuz, & Zawlocki, 2012). This study also used surveys to ask parents and teachers their opinions of SBG before, during and after implementation. Parents were asked how well the teacher was able to explain their student's achievement, if they were aware of the standards in the classroom and how comfortable they feel when helping their students with homework. Students were also asked if the grades are fair, if they understand what they are being tested over and if they understand what the teacher expects of them. In addition, they found that after implementing SBG in the classrooms, parents who strongly agreed the teacher could satisfactorily explain why the student received a certain grade rose from 21% *(N=20)* to 33% *(N=30)* (Knaak, Kreuz, & Zawlocki, 2012).

It is crucial to have teacher, parent and student buy-in for change in the classroom to succeed. The "rules of play" must be understood by all involved and fairly applied with frequent reference to them and reminders of how they work for all stakeholders. Measuring stakeholder satisfaction of changed grading criteria over time will be essential for understanding which areas will need additional development.

METHODOLOGY

Data for my AR come from my students in all of my classes. I have analyzed the overall success of each student on the summative assessment along with the success of a couple of sub-groups (Table 1).

Table 1
Class Period Demographics (N = 94)

Class Period	Total Students	Boys	Girls	Behavior Plans	English Language Learners	Minority Students	Special Education
2nd	25	12	13	2	11	12	2
3rd	23	13	10	3	0	3	0
5th	24	13	9	3	1	6	3
6th	22	10	12	0	1	4	0

Harding Middle School has a fairly diverse population for the state of Iowa. Forty percent of students are receive either free or reduced cost lunch and school fees. Twenty six percent (N = 94) of my students are minority including 12 students from the English Language Learners program. I have eight students who have a behavior goal with one student who spends most of his day in a contained classroom. Fifty one percent (N = 94) of my students are males and 49% are females. The student motivation within this group is also varied. Depending on the class I usually have between a 40% - 70% homework

completion rate. In addition, very few of these students take the time to put in additional work studying the concepts outside of the classroom.

The student's science backgrounds also vary greatly. All of the students completed the sixth grade science class with varying degrees of success; students who do not pass science in sixth grade are promoted based on age to seventh grade. In addition, many of them were not taught science while in the elementary schools. High stakes testing in our state concentrate on math, reading and writing, so science is often placed to the side to give emphasis to the other topics.

During the treatment cycle, all units were given a pretest; students were provided with a proficiency scale, and each unit was broken down into teachable chunks. Marzono and Heflebower (2011) suggested that formative assessments, which were associated to a well-designed proficiency scale, needed to be given regularly so students and teachers have a better idea of the student's mastery of a topic throughout the unit. Formative assessments were given and I retaught when necessary. The proficiency scale was given to each student at the beginning of the unit and provided detailed information about what, was included on the summative tests. A level of proficiency was based on the district's required level of learning in each topics. The summative tests were analyzed to see what percentage of students reached a full level of understanding. When at least 80% of students did not reach proficiency, I retaught the lessons to the class as a whole. When 80% of the students were proficient, re-teaching was individualized during extended learning time at the end of the day.

In the beginning of the treatment/non treatment cycles students were provided with a reflection sheet and then taught, through direct instruction about how to reflect.

Each reflection sheet included the following questions: *Code and description of code from the proficiency scale. Did I miss the same code on another test (yes/no)? Did I make the same mistake or a different mistake (yes/no)? Describe the mistake this time. What do I need to do next time I take the test?* (Appendix A) The codes and the descriptions of the codes were taken from the proficiency scales (Figure 1).

Students were taught the proper way to provide meaningful reflection. Specifically, they were told they must be specific when answering the question, "What do I need to do next time I take the test?" For example, students were told answers such as, "Study harder," or "Ask more questions," would not help them to better understand the materials. A better way to answer the question would sound like, "Next time I see a question about mass and falling objects I will understand mass doesn't affect the rate of a falling object, only the air resistance and the gravity."

Another part of the reflection process involved the students finding the correct answers on their own. Prior to this research I would read the correct responses to each of the test answers, but now they were instructed to use their notebooks and binders to find the correct answer. They were allowed to ask for clarification, but I would not help them to find where the answers might be. Once they believed they had the correction, they were allowed, and many times encouraged, to ask me to check their work.

Initially I had planned on having two treatment cycles: one in which students reflected and one in which students did not reflect. However, after direct instructions on the use of the reflections sheets, I found students were asking for them during the non-treatment cycles. The introduction of reflection was so well received with what appeared to be such a positive outcome (students had begun to understand their misconceptions),

that I decided to change my data collection process and either require reflections or make them optional.

Several items were added to the treatment units during my AR (Table 2). Prior to beginning the units, the research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was obtained (Appendix B). Students were given a survey to determine their feelings about SBG (Appendix C). After each teachable portion of the unit, I gave the students a formative assessment. I then analyzed the results of the formative assessment and retaught if necessary. The students then tracked their understanding and were required to reflect on where they were in their learning after each formative assessment.

It was important for me to understand students' perspectives on SBG and the processes associated with SBG. Specifically, I wanted to know if there was an association with their acceptance of the process compared to their achievement in the classroom. In addition, Ames and Archer (1988) explained it is vital for students to begin to see the significance of mastery goals vs. performance goals (getting all A's). Once students can distinguish between the two types of goals they should be able to also separate effort from ability with the use of standards based grading (Ames and Archer, 1988). Each student was given a survey about his or her feelings about SBG (Appendix C) prior to beginning the treatment/non-treatment cycle. Surveys were administered electronically using a Google Form. Students were required to give their student identification number so their test results could be compared with their feelings on SBG; they were instructed their thoughts would not count against them in the class. Once the surveys were

completed I conducted full class interviews so I could expand on patterns I saw in the data. In addition, I asked some individual students to expand on their answers from the surveys. This process was repeated at the end of the treatment/non-treatment cycle to see if the comfort level increased after they became more comfortable with SBG.

Table 2.
Treatment and Nontreatment Characteristics

Non-Treatment Units	Treatment Units
• Give a pretest • Provide students with a proficiency scale, which includes all information to be assessed. • *Students were not required to show evidence of reflection.* • Break each unit into teachable chucks • Teach part of the unit. • Give formative assessment • Students were not required to show evidence of reflection. • Teacher reviews formative assessment responses. • Reteach if necessary • Teach next part of unit. • Give formative assessment • *Students were not required to show evidence of reflection.* • Teacher reviews formative assessment responses. • Reteach if necessary • Give summative assessment	*Before all units:* Give students a survey on their ideas/feelings about standards based grading • Give a pretest • Provide students with a proficiency scale, which includes all information to be assessed. • Students were required to show understanding through reflection • Break each unit into teachable chucks • Teach part of the unit. • Give formative assessment • Students were required to show understanding through reflection • Teacher reviews formative assessment responses. • Reteach if necessary • Teach next part of unit. • Give formative assessment • Students were required to show understanding through reflection • Teacher reviews formative assessment responses. • Reteach if necessary • Give summative assessment
Treatment for subquestion l	Treatment for subquestion ll

Students began the physics unit in January, which included five mini units: Measuring Speed, Falling Objects, Newton's First Law, Newton's Second Law, and Newton's Third Law. For each of these mini units, students had the chance to earn a score between zero and four on a proficiency scale (Appendix D). Four indicated they

had reached a level of understanding above the required understanding for their grade level. A three would indicate grade level understanding, or proficient. Students below grade level would earn a score between one and 2.5 based on their level of proficiency. A score of zero indicated the student had no understanding of the topics. A score between zero to 2.5 indicated a student was not proficient. Each of the scores had a half score indicating a partial level of understanding. For each student their mean score for all units was figured to determine their overall understandings of physics. This occurred over a period of 47 school days (Appendix E).

Finally, I completed a qualitative analysis of formative assessments using student teacher journal entries. After each summative assessment I asked three questions:

1. *Was I able to get an accurate feel for my students' level of understanding prior to the summative assessment and then was I able use this information to adjust my teaching?* I used this question to better understand how the use of the formative assessments affected my own teaching.

2. *Do I see a difference in the results of the three classes? If so, what are these differences?* I used this question to analyze my thoughts about the success of the formative assessment in relation to the different dynamics in the classroom.

3. *Were the students able to articulate their own understanding of the information prior to the summative assessment?* I thought the formative assessments would guide both my teaching and the students' perceptions' of their understanding so I used this to look deeper to see if I could confirm or refute my perception. I then used the information from teacher journal entries in my analysis of my summative assessments. Using this

qualitative data from these entries along with the quantitative results of the tests helped me to provide validity to the analysis of the summative assessment results.

Although not all of my results were what I may have predicted, I was able to learn a significant amount about how my students learn through this AR process.

Table 3
Matrix of Treatments for Standards-based Grading Action Research

Focus Question	Assessment Analysis	Surveys – Students	Reflection after treatment	Student Interview	Literature Review
To what extent standards-based grading (SBG) help to increase overall student learning in the seventh grade science classroom?	X	X	Teacher Journal	X	X
Is there a correlation between students' attitudes about Standards Based Grading and their overall achievement in on summative assessments*?*	X	X		X	X
How will student self-reporting on formative assessments lead to greater success on summative assessments?	X	X	Student Reflection		X

DATA ANALYSIS

Students were given a survey prior to the treatment/non-treatment cycle and then again when the cycle concluded to detect any change in attitude following experience with the grading system. In addition, I used this information to see if student attitudes about standards based grading affected their ability to understand the material. The results of the initial survey are found in Table 4.

Table 4

Pre-treatment Survey Results of Students' Attitudes about Their Abilities in Relation to Standards-based Grading (N= 86)

	I understand what I need to do so I can do well in Ms. Vasquez's class.	I believe I can be successful in this science course.	I know how well I am going to do on the test, before I take the test.	I am aware of the information I need to know before each test.	I think the data sheets we fill out after each test, will help me improve my learning.
Strongly Disagree	2	2	7	3	2
Disagree	2	3	8	1	5
Neutral	6	13	19	12	25
Agree	22	37	29	29	28
Strongly Agree	54	31	23	41	26

Overall students' attitudes about their abilities in relation to SBG were positive. When asked if they knew how to be successful in my class, 80.95% responded in positive ways by choosing agree or strongly agree. In addition, 86.04% of the students believed they could be successful in this class. Of the students who chose a negative response to this question, a couple of them explained it was because they did not feel good about their own abilities (Appendix F). For example, one student said, "I am very distracted and don't get a lot of the things we talk about because I space out and or I just don't get it."

When they were asked if they knew what information would be on the test, all but four students responded in a positive or neutral way. The questions with the lowest positive response were those where the students were asked to use their ability to reflect on their own knowledge prior to a test. Only 62.79% percent of students felt reflection

sheets would help them prior to a test. In addition, only 60.47% of students responded in a positive way when asked if they knew how they were going to do on a test prior to taking the test. Based on this, I believe I may not have done an adequate job of associating the proficiency scale with what was on the tests.

I had assumed that if students saw the codes on the proficiency scale matched up with the codes on the test, they would understand the need to know the information on the proficiency scale. In the future I will find a way to help the students find ways of associating the information on the test with the information provided on the proficiency scales. If they begin to make the association about their understanding of the information on the proficiency scale with what is on the test, they may do a better job of predicting their success on the tests.

In addition, I will need to find a way to help them feel empowered when they take the test. For example, I could show them how to gain control over how well they do on the tests, by looking over the proficiency scales and quizzing themselves. Unfortunately it seems some things might be out of my hands because a couple of the negative responses stated the sheets are not fun, so they don't look at them. One student explained, "They aren't attention grabbing. They are boring."

When examining the comments made by the students I found many of those that conveyed negativity were about the student's personal beliefs about their abilities. When students were asked if they knew how well they would do on a test, all but one of the negative responses were about the student's own ability to study and take tests. The only negative response, which was not about the student's ability, came from a student who had got into trouble prior to taking the survey. This student responded that he would not

do well because the class “isn’t fun”. I also found many of the students referenced the proficiency scale when giving positive responses and also spoke about their own ability to study. (Appendix E).

To answer the question, *what correlation exists between student's attitudes about Standards-based Grading (SBG) and their achievement on summative assessments,* I used a scatter plot to find a correlation between student’s mean attitude score and their overall understanding of the physics units. A mean attitude score was calculated by averaging the survey scores. In the survey, a score of one was strongly negative and a score of five was strongly positive. Their mean unit score was placed on the y-axis with values between 1.5-4. Students were plotted on the graph with their corresponding values (Figure 2). A trend line was added to the data to determine if there was a relationship between the student’s attitudes about SBG and the students’ overall understanding of the materials.

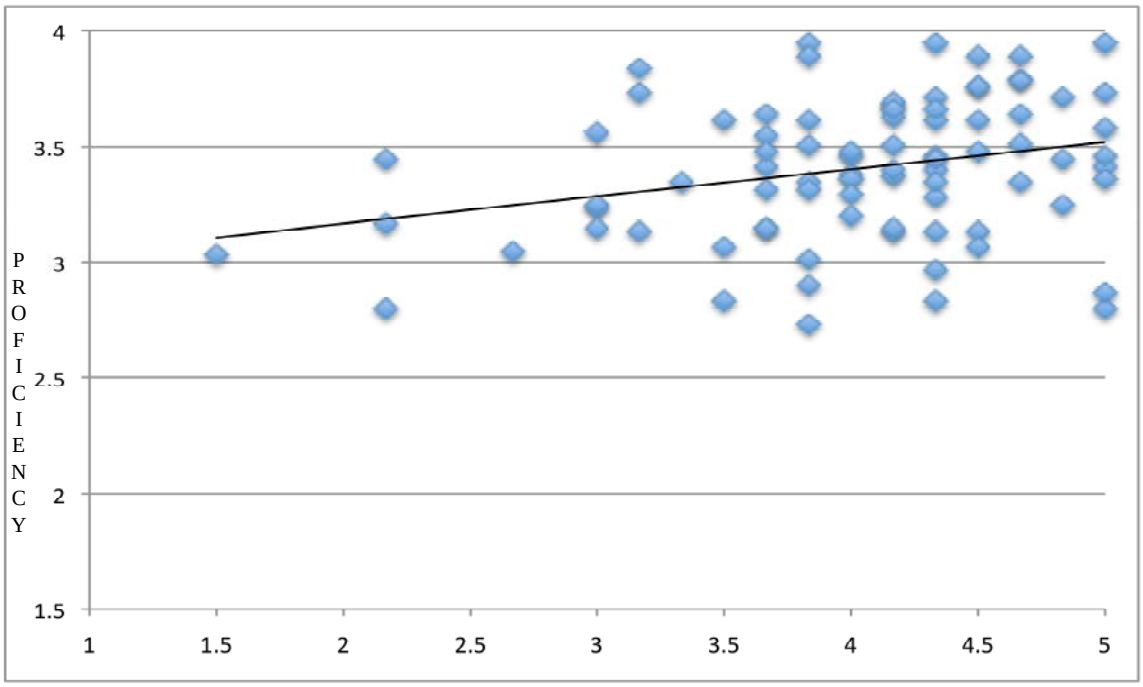

Figure 2. Correlation between Student Attitude about Standards-based Grading and Their Mean Level of Proficiency, *(N*=86*).*

The trend line on the graph shows a slight positive linear slope. As the attitudes of the students become more positive, their tests scores went up. This helps to support the idea that students do better in a class when they understand what is expected of them and would be valuable information for my school district. However, the r^2 value is only 8% indicating the attitude of the students is not necessarily a good predictor of how well the students will do on the tests. In addition to the trend line, the correlation coefficient was figured with an r-value of 0.28. This would also indicate a very weak positive correlation between the students' attitudes and their final understanding of the materials. There may be other factors influencing their final understanding of the materials.

Another aspect of success in the classroom may be the students' belief in their own abilities. Although my survey asked about how my actions influenced their

understanding, several of the students' comments talked about their own confidence in the abilities. For example one student whose overall attitude score was low said, "I'm not very good at this subject and I had to retake a test 3 times even though I try my best." A different student with a more positive attitude score said, "I always try my best and I think I do well on the subject." This shows success in the classroom is often multidimensional.

Once the students completed the treatment cycle, I wanted to see if their attitudes about SBG had changed since they initially took the SBG survey. Each student was again issued the survey and asked to provide comments. Unfortunately this second survey was given directly after a particularly tough test and so the results may have been affected by their scores on the test (Table 5).

Table 5
Post-treatment Survey Results of Students' Attitudes about Their Abilities in Relation to Standards-based Grading (N=74)

	I understand what I need to do so I can do well in Ms. Vasquez's class.	I believe I can be successful in this science course.	I know how well I am going to do on the test, before I take the test.	I am aware of the information I need to know before each test.	I think the data sheets we fill out after each test, will help me improve my learning.
Strongly Disagree	1	0	4	1	2
Disagree	2	4	7	6	9
Neutral	6	13	26	7	14
Agree	23	30	22	26	24
Strongly Agree	42	27	15	34	25

Although the results showed the same overall positive results as the first survey, it showed a decrease in group's attitude score for some of the questions. The two questions that showed the largest decrease in percent of a positive answer were the questions about their ability to be successful in the class and knowing how well they would do on the tests. Compared to the original survey only 77% of the students felt they could be successful in the class, which was a 4 percent drop. The largest drop, however, was in the student's ability to predict how well they would do on the test. Only 50% felt they knew how well they would do on the test prior to finding out their score. This was a 10% drop in the overall percent of students who felt they could do well on the test. To get a better idea of the change in attitudes I decided to look at the number of students who changed from their original answer (Table 6).

Table 6
Number of Students Who Changed Their Responses on the Post survey When Compared to the Pre-survey

Change from Original Answer	I believe I can be successful in this science course.	The data sheets we fill out after each test help me.	I understand how students are graded.	I understand what I need to do so I can do well in Ms. Vasquez's class.	I am aware of what information I need to know before each test.	I know how well I am going to do on the test, before I take the test.
-4	0	2	1	0	2	1
-3	0	2	2	1	1	3
-2	4	5	6	4	2	7
-1	13	12	11	14	14	16
0	40	31	37	40	35	25
1	14	16	13	12	18	14
2	3	5	3	1	3	9
3	0	1	1	1	0	0

The change in the answers varied from question to question. The question with the largest shift in a negative direction was about test performance prediction. Thirty-six percent of students moved their answer on this down one or more points. This is also the area where I had done the least direct instruction. I believe that to improve student response to this question, I would need to create a series of activities to show students how to predict. This thought is supported by the fact that I saw the largest positive movement in the question about the reflections. Almost thirty percent of the students changed their answer to a more positive result. However, I also saw a large percent of students, 28.38% who moved in a negative direction. Reflection takes a lot of work and many students do not enjoy the effort they have to put into it (Appendix G). For example, one student explained, “I sorta understand what I missed with them. I just don't like writing them.” Although not all students found the reflection sheets to be helpful, I wanted to know if they truly were helpful.

I asked the question: *How will student self-reporting and self-reflection on assignments and formative assessments lead to greater success on summative assessments?* The treatment for this question began in January and continued through March. Each of my four classes took part in this research (N = 93). After each formative assessment the students were instructed to record their results and then reflect on the topics they missed using a reflection sheet and data sheet (Appendix A, I, J). A comparison of the number of students achieving proficiency on the topics was then analyzed. In addition, I examined the quality of the reflections with a rubric (Appendix H). Using the rubric I was able to separate the students who accurately completed the reflection from those who did not (Table 7).

Table 7
Accuracy of reflections completed (N = 144)

	Number of reflections	Percent
Reflections completed incorrectly	20	13.89%
Reflections completed correctly	124	79.86%

Overall, I found the results of this part of the study were the most compelling of all aspects of this research. One of the questions I asked myself in my teacher journal was, *Were the students able to articulate their own understanding of the information prior to the summative assessment?* The first time I completed the direct instruction on reflection, I noted:

As I looked around the room I saw light bulbs going off. Students who were once apathetic about their tests results now seem to really understand why they missed the answers. The co-teacher in the room also noticed they students were becoming more engaged in their own understanding. I have great hopes for the outcome of the test after today (1/23 journal entry).

My observations turned out to be correct. The students performed much better on the tests after the reflection. In addition, I also saw a decrease in the number of students who duplicated their errors from one test to the next.

Table 8
Students' Proficiency on Formative and Then Summative Assessment With and Without Reflections (N = 460)

Proficiency	Number of students (Percent)
Proficiency after first attempt	247 (53.70%)
Non-proficient after first attempt	213 (46.30%)
Reflections completed after non-proficient responses on first attempt	144 (83.33%)
Non-proficient responses without a reflection	69 (32.39%)
Proficient on the summative assessment	379 (82.39%)
Non-proficient on the summative assessment	81 (17.61%)

Ninety-two students were given an assessment over five different topics for a total of 460 assessments. Two hundred and forty-seven assessments showed proficiency after the first assessment and 213 were non-proficient after the first assessment. The students who were proficient after the first assessment did not complete a reflection. Of the 213 non-proficient assessments, 32.39% of were retested without a reflection, 9.39% were retested after a poor reflection, and 58.22% of the assessments were retested after a well-written reflection.

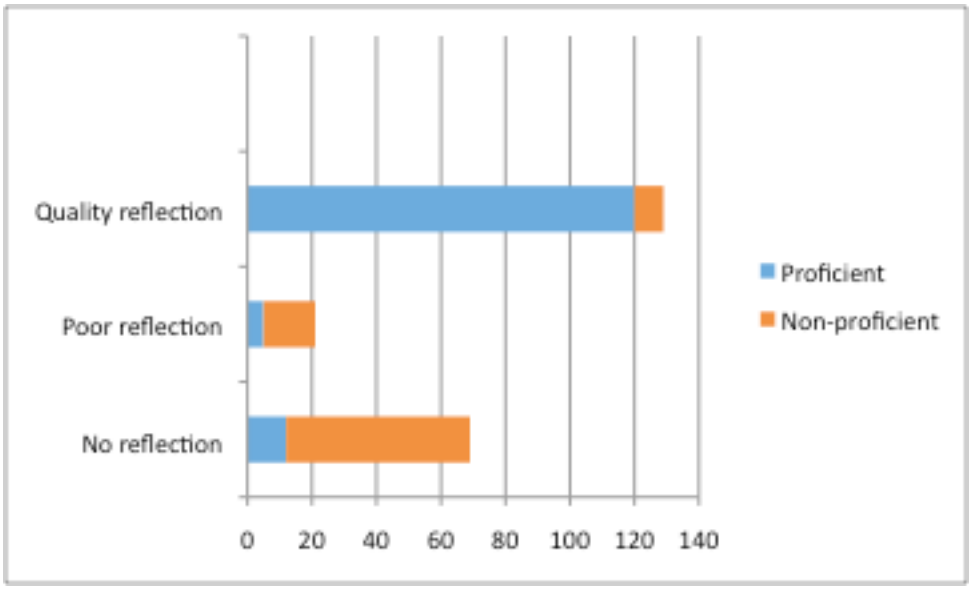

Figure 3. *Proficient and Non-proficient Responses After Students Had the Opportunity to Complete Reflections (N = 213)*

Students who demonstrated a quality reflection were much more likely to be proficient on the summative assessment when compared to their peers who either did not reflect or completed a poor reflection. Of the students who were proficient after being non-proficient on the first test, 87.6% of completed a quality reflection. Ninety-three percent of students who either completed the reflection incorrectly, or did not complete the reflection at all, were non-proficient after the summative assessment. This shows that despite how painful this process may be to students, it is extremely valuable.

In addition to helping students do well on tests, I feel this is one way I have been able to successful differentiate the learning for each student. Throughout my journal I noted how this process felt much more individualized for each student. In the past I stood at the front of the class, read the correct answers, and then hoped the students understood. These reflection sheets have allowed me to individualize conversations with each of my

students based on where they are in their understanding. Although I had an idea about the relationship between a quality reflection and proficiency on a test, I was concerned this would not show the full picture about what occurred in my classroom.

I looked closer at my English Language Learners (ELL), students whose family language is not originally English, to see if they showed the same types of results. I had 12 students who took five assessments each for a total of 60 assessments. Of those assessments 27 showed proficiency after the first assessment -- reflections were not required. Thirty-three assessments required reflection and of those, 24 reflections were completed (Figure 4).

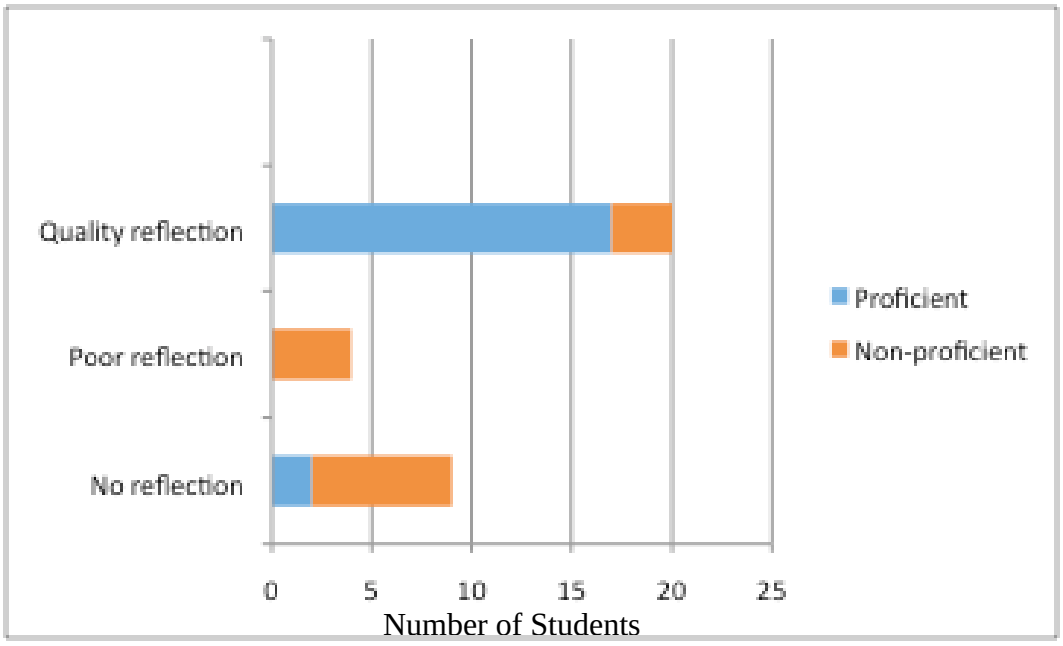

Figure 4. *English Language Learner Assessments After Reflection (N = 33).*

The results of the ELL students were very similar to those of the non-ELL students, but the ELL students actually had a larger percent of students who completed the reflections, 73% when compared to the all of the students, 68%. Fifty-two percent of the students' assessments with a reflection were proficient after the reflection. This is

very similar to the whole group, in which 55% were proficient after a quality reflection. The only and biggest difference between the whole group and the ELL students was that there was a larger percent of ELL students who were non-proficient after a quality reflection -- 9% of the assessments compared to 4% of the whole group. I believe many of my ELL students grew successful because they put in a great deal of effort and want to do well.

I had one student in particular who really seemed to shine in science class after I introduced the reflections sheets. She came to this country just last year. I have been told it can take at least five years in a country before a student is proficient enough in a language to learn specific subject. In the beginning of the year she struggled quite a bit on all of her retakes. When we started doing the reflections, she was able to focus on just the items she missed and then was able to become proficient on the next test. The first time this happened, the girl had a large smile across her face. Now, with the added confidence, she answers questions for other students about the topics.

The final group I wanted to look at was the behavior-development group (BD). I have eight students in my four classes who have behavior plans. The reflection process is difficult and time-consuming, and I wanted to know if my behavior students had the same type of success with the reflection process. I found this sub-group had the most difficulty with the reflections. Most of the BD students did not complete the reflections (Figure 5). When I walked around the room I often heard my BD students stating they wouldn't complete the reflection, because it wasn't fun. The resistance to this process was also reflected in their survey. When asked if the reflections helped them, one student wrote, "I

don't know Why the TEACHERS DONT DO IT. It's her job to tell us the right answer." While another wrote, "I don't think it helps I think that it is just more work to do."

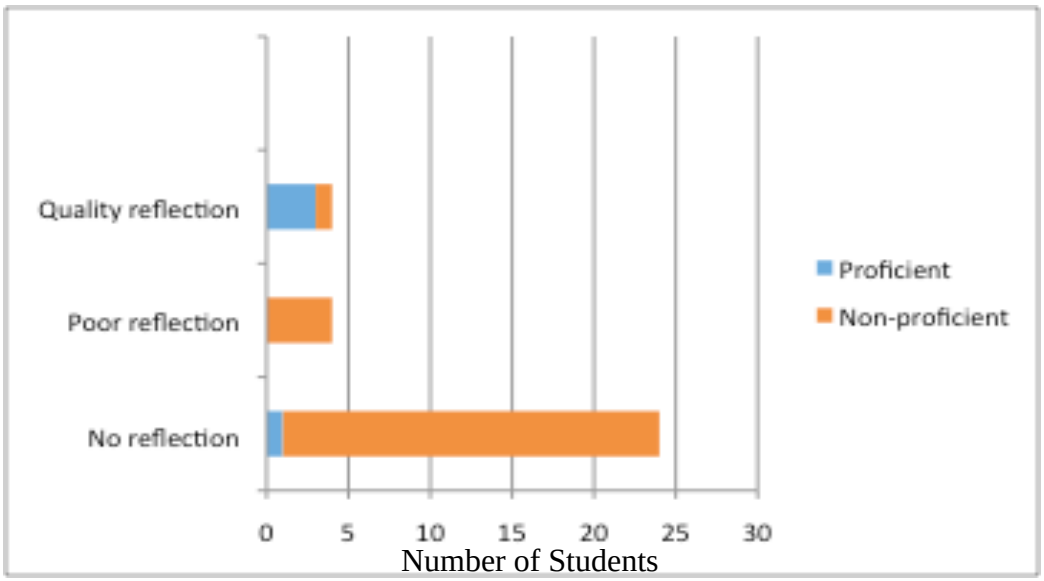

Figure 5. *Behavior Development Students and Reflections Completed After Assessment (N = 32).*

The results of the BD sub-group were not surprising. When given a choice to complete work, many of them chose not do so. Only 13% of the assessments, which required a reflection, had a quality reflections completed (Figure 5). One out of 23 students, who did not complete the reflection, correctly answered the question on the summative assessment (Figure 5). I have found this group of students will do the work if they find enough value in it. It will be a challenge to make reflection exercises a valuable process for them.

INTERPRETATION

Overall the results of this action research were positive. SBG helped me to better understand the specific areas where the students were struggling and it gave me a way to help them see what they still needed to master after the formative assessments. I was also

able to reflect on my teaching strategies and assessments by using the formative assessments to find insufficiencies in my teaching.

Although I thought the students' knowledge about SBG would influence their overall success, I found this to be only marginally true. When examining the correlation I found an r^2 value of only eight percent leading me to conclude student understanding of the processes in SBG was not a good predictor of their success in this class. I was pleased to find 80.95% of my students viewed SBG in a positive light. However, I would like to know if the students who thought of SBG in a positive were more likely to retake tests and complete the reflections, when this is an option. Or, did the student like SBG more after they found success when they completed the reflections and then retook the tests? I would also like to understand why only 60.47% of my students felt they could predict how well they would do on a test prior to taking the test. In other words, why are 40% of my students unable to see the connection between the proficiency scales provided and the tests they take?

Watching students work through the reflective process was the most powerful part of this action research for me. I observed that students became much more articulate when they reflected on their learning. By reflecting on what they didn't understand they seemed much more capable of asking for help in a specific area. Of students who completed the reflective process, 87.9% were proficient on the summative assessment, whereas 93% of students who did not complete the reflection or did not complete it accurately were not successful.

I believe the students' use of the reflections helped me as well. As reflection helped the students pinpoint their misunderstandings, I became more focused with my feedback,

assisting them individually. This is much different than how I used to review tests by standing in front of the room, giving the answers and then hoping for understanding. I believe the individualized feedback they received while completing the reflections also helped them to become successful on the summative assessments.

ELL students appeared to benefit most from SBG. While this group saw similar success on the summative assessments after their reflections when compared to their native English-speaking counterparts, I believe the reflective process provided an important opportunity to them to increase their proficiency in the English Language. Each student in the ELL program is given the Iowa English Language Development Assessment (I-ELDA) once during the year. All of the students in my science classes showed growth in all of the areas of testing, which include speaking, listening, reading and writing. A few of my students showed over two years of growth in some of these areas. It would be interesting to see if students who were not taught how to authentically reflect would show as much growth on the I-ELDA.

Finally, I am particularly intrigued by and eager to follow up on the effect of teaching students to reflect on their own understanding -- about what they know and what they don’t know. This is a potentially low impact activity that could have a complex and positive effect on student self-perception and learning.

VALUE

There were many aspects of this project, which turned out to be quite helpful during my teaching this year and will continue to be helpful in the future. I have found the insights I have gained from this experience will help me to make informed decisions in the classroom. They will guide me toward better-informed and more effective

communication with parents, students and colleagues. Finally and selfishly, I have made professional connections with extraordinary people – scientists and teachers and administrators – who will remain a treasured part of my professional and personal life.

I know many people in my school and in my district will use the information I have learned from this AR. As a member of our district's effective grading committee, I have been a part of an ongoing discussion about the use of SBG in the Cedar Rapids school district. As we move closer to full implementation, I believe it would be beneficial to learn how a student's level of understanding of SBG affects their ability to be successful in the classroom. I believe my findings can be generalized to other classrooms and schools, and I have already begun to share my research within my building. In the last building meeting, I presented my methods of incorporating SBG into my classroom, using the survey information from my students and some of the data keeping tools I have created.

A commitment individually or district-wide to instituting SBG is not trivial and speaks to community core values. At the conclusion of this AR, my experience will help prepare other teachers about what to expect, how much time to devote and where the greatest value can be found in this new system.

One of the most important lessons I have learned is about communication in the classroom. SBG is much more of a foreign concept to my students than I had once realized. I recently asked my students, as a whole class, how many times they would be allowed to retake a test in my class. Hands flew up in the air and many students answered the question numerically. Despite the fact that I had told them they could retake a test as many times as they needed to, many still did not seem to understand this to be true. This

is due in part, I believe, to the fact that I was the only teacher introducing a new approach and my classroom was the only one in which students experienced this change. I was, in effect, an island. Thought I demonstrated SBG and its many facets to my students throughout the year, I was the only one giving the message. I see large changes in the grading system better rolled out as a department or at a grade level.

Teaching students to complete quality reflections is one of the most valuable pieces I take away from this experience. In years prior to using SBG in my classroom I would pass back tests and many students would look at the score, then immediately discard their work? With the new element of reflection, students were required to look at their answers and then decide why they missed them. This reflective attitude allowed almost 88% of my non-proficient students to become proficient. I believe this success sends a strong message to my students that they have the ability to learn even if it takes a little more time. The reflective practice is one I will continue into the future.

Change is difficult – we think we can't do this or that (students, teachers and parents) for reasons that are difficult to describe. This small piece of research with its outcome data tells me that it may not be as difficult as we think. I personally feel empowered to speak with parents and students in a new way, a way that is informed by data and is researched based. Being able to show parents and the students the graphs that show the importance of the reflections has been extremely valuable, allowing discussion to be about data and not outmoded expectations.

Many parents and students were hesitant to embrace a grading system that was so different from what they were used to. Yet the processes that were tested by this research have helped to facilitate discussions with students, parents, and colleagues that have

strengthened relationships and energized many. In the end, I believe additional work needs to be done to explore the benefits and outcomes of this approach, which, I believe holds great promise.

I am currently a member of our district's Effective Grading Committee. Our task is to look at the grading policies in each of our six middle schools and four high schools. One of the grading practices we have been investigating is Standards-Based Grading. My research and surveys have been helpful during the discussion and decision making processes. In addition, the need to fully research the process of SBG along with the need to find research materials has also been a valuable asset to our committee. In addition to the district committee I am on, I also serve on a state committee, which is looking at the policies related to Competency-based Education. The research and experiences from this AR have been helpful with this committee as well.

Finally, one of the most exciting connections I made during this experience was with Dr. Trace Pickering. I met Dr. Pickering when I decided to look into SBG; he was the instructor for a class called Contemporary Education, which addressed grading practices. In this class we were instructed to look at school in a different way and asked to design our perfect classroom, throwing out any preconceived notions we had. One type of education I was particularly intrigued with was problem/project-based programs. SBG is an important element in accurately setting up a problem/project-based classroom. In this type of program students learn through projects and solve community-based problems. Students must also be reflective and self-driven. My work understanding SBG, student motivation, and the reflective process through this AR allowed me to begin to communicate with Dr. Pickering on a regular basis. At the beginning of this year Dr.

Pickering was hired as the Associate Superintendent of our school district in charge of innovative educational practices. Starting next year I will begin a new program with eighth grade students where we will be problem/project-based and I will use several aspects of my research in this program.

The process of using authentic reflection to help guide students in their learning was well supported by my data. The program I will be working in will require students to accurately reflect on their own knowledge since much of their study will be self-guided. I will teach students how to reflect in the beginning of the year so that their self-guided learning progress can be demonstrated. In addition, I will explain how the reflective process can be used to self-advocate for additional assistance and understanding in their project areas.

Although I am generally pleased with the results of this research, there are questions not well answered that I will continue to pursue and variables that I hope can be better controlled in future investigations. I was curious, for instance, about students' ability to predict how well they would do on the test. The results are interesting but I believe more depth can be achieved if there is a way for them to demonstrate their confidence on each test question. In future investigation, I will include a confidence rating with each question to compare it with the individual test results. And though acts of God cannot be controlled, I will pursue changes in the timing of similar research. We had a rough winter and went 13 weeks straight with at least one delay or cancelation of classes per week. The resulting inconsistent schedule made it very difficult for students to remain focused during this time period. Scheduling this or similar projects in fall or spring (or in a Cedar

Rapids school located on Sanibel Island in the Gulf of Mexico at any time of the school year) could reduce or eliminate this problem.

Finally, I am curious about whether I would have had higher satisfaction scores from the students if I had not changed my grading systems alone. Our district decided to allow a few of us to try different grading systems. Most schools had groups of teachers who changed their grading practices together. When I began my research I was the only teacher in our building that chose to switch fully to SBG. Although I did not feel this would put me at a disadvantage, I now believe it has. I was not fully aware of how deeply ingrained grading practice and assumptions are in our society and how difficult it would be for my students to accept such a big change. I often felt like I was re-teaching the process almost daily; I don't believe this would have been the case if other teachers were using the same process. I believe they may have been more accepting if some of their other seven teachers were also using SBG.

REFERENCE CITED

Bailey, K., & Jakicic, C. (2012). Setting the Stage for Common Formative Assessment. In *Common Formative Assessment: A toolkit for professional learning communities at work.* (pp. 13-25). Bloomington, IN: Solution Tree.

Eberle, F. (2008). Using Standards and Cognitive research to inform the design and use of formative assessments: *Assessing student learning* : NSTA

Guskey, T. (2000, December). Grading Policies that Work Against Standards… and How to Fix Them (Research Summary by Thomas Guskey) | Greece Athena Staff Blog. *Greece Athena Staff Blog*. Retrieved April 24, 2013 http://greeceathena.wordpress.com/2012/08/14/grading-policies-that-work-against-standards-and-how-to-fix-them-research-summary-by-thomas-guskey/

Hanover, R. (2012, February). *Effective Grading Practices In The Middle School And High School*. Retrieved April 24, 2013
http://www.freedownloadspdf.net/guide/effective-grading-practices-in-the-middle-school-and-high-school/

Knaack, S., Kreuz, A., & Zawlocki, E. (2012, May). *Using standards-based grading to address students' strengths and weaknesses*. Retrieved December 20, 2013 from http://www.eric.ed.gov/ERICWebPortal/search/detailmini.jsp?ERICExtSearch_SearchValue_0=ED531172

Marzano, R. J., & Heflebower, T. (2011, November). Grades that show what students know. *Educational Leadership:Effective Grading Practices:Grades That Show What Students Know*. Retrieved December 19, 2013 from http://www.ascd.org/publications/educational-leadership/nov11/vol69/num03/Grades-That-Show-What-Students-Know.aspx

APPENDICES

APPENDIX A

STUDENT REFLECTION SHEET

CODE missed **Description of Code**

Did I miss the same question on another assessment?
YES/NO
Describe the mistake:

Did I make the same mistake on this test?
YES/NO
Describe the mistake:

What am I going to do on the next test?

CODE missed **Description of Code**

Did I miss the same question on another assessment?
YES/NO
Describe the mistake:

Did I make the same mistake on this test?
YES/NO
Describe the mistake:

What am I going to do on the next test?

APPENDIX B

APPLICATION FOR EXEMPTION

MONTANA
STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00000165

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Chair: Mark Quinn
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Cheryl Johnson
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MEMORANDUM

TO: Jessica Vasquez and Walter Woolbaugh

FROM: Mark Quinn, Chair Mark Quinn chj

DATE: December 2, 2013

RE: "*Use of Standards-based Grading to Increase the Teacher's Overall Understanding of Student's Learning in the Seventh Grade Classroom*" [JV120213-EX]

The above research, described in your submission of December 2, 2013, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

_X_ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX C

STUDENT SURVEY

ROFICIENCY SCALE FOR GRAPHING AND MEASURING SPEED

For each of the following statements mark whether you Agree, Somewhat Agree, Somewhat Disagree, or Disagree.

	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
I believe I can be successful in this science course				
Please explain your answer.				
I believe I should be required show I know of all the essential content in the science course, even if it takes multiple attempts.				
Please explain your answer.				
The data sheets we fill out after each test, helps me to improve my learning.				
Please explain your answers.				
It is important for *all* students to master skills the district believes are essential.				
Please explain your answers.				
I understand how students are graded in Ms. Vasquez's science class.				
Please explain your answers.				
I understands what is needed to do well in Ms. Vasquez's science class.				
Please explain your answers.				
I am aware of what information I need to know before each test.				
Please explain your answers.				
I know how well I am going to do on the test, before I take the test.				
Please explain your answers.				

APPENDIX D

PROFICIENCY SCALE

Strand: Science		
Topic: Graphing and Measuring Speed		
Grade: 7th Grade		
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught** SP.1. Can accurately read a speed/displacement graph, identifying when the object is stopped, moving at a constant spend or going back to the original position.	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	**The student:** SP.2. Can accurately set up a speed/displacement graph a. Places time on the x-axis and distance on the y-axis. b. Adds a title to the graph **The student exhibits no major errors or omissions.**	
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Recognizes or recalls specific terminology, such as: SpV.1.Distance SpV.2.Time SpV.3.Speed SpV.4.Displacement • Performs basic processes, such as: SpV.5.Accurately measuring time SpV.6.Accurately measuring distance in metric measurements **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.
Score 0.0	**Even with help, no understanding or skill demonstrated.**	

APPENDIX E

TIMELINE OF TREATMENTS

Measuring Speed (Treatment Unit) 12 days	**Falling objects** (Nontreatment Unit) 10 days	**Newton's First Law** (Treatment Unit) 5 days	**Newton's Second Law** (Nontreatment Unit) 15 days	**Newton's Third Law** (Treatment Unit) 5 days
Pretest	Pretest	Pretest	Pretest	Pretest
Provide Students with a proficiency Scale Notes: Measuring speed Labs - Walking Lab - Toys that move Lab	Provide Students with a proficiency Scale Pendulum Lab	Provide Students with a proficiency Scale Newton's First Law Lab	Provide Students with a proficiency Scale Notes over Newton's Second Law - Worksheet activity	Provide Students with a proficiency Scale - Notes over third lab - Worksheet activity
-Formative assessment -Student/teacher reflection -Reteach if necessary	Reflection: Teacher only	-Formative assessment -Student/teacher reflection -Reteach if necessary	Reflection: Teacher only	-Formative assessment -Student/teacher reflection -Reteach if necessary
- Notes: Graphing Speed - Activity	- Virtual Pendulum Lab - Reflective comparison of the results of the two labs	Notes over Newton's First lab	Egg drop lab	- Newton's Third Law Lab
-Formative assessment -Student/teacher reflection -Reteach if necessary		-Formative assessment -Student/teacher reflection -Reteach if necessary		-Formative assessment -Student/teacher reflection -Reteach if necessary
Unit Post-test	Unit Post-test	Unit Post-test	Unit Post-test	Unit Post-test
Unit reflection (Student/Teacher)	Unit reflection – Teacher only	Unit reflection (Student/Teacher)	Unit reflection – Teacher only	Unit reflection (Student/Teacher)

APPENDIX E

PRE-TREATMENT SURVEY COMMENTS

	I understand what I need to do so I can do well in Ms. Vasquez's class.	I believe I can be successful in this science course.	I know how well I am going to do on the test, before I take the test.	I am aware of the information I need to know before each test.	I think the data sheets we fill out after each test, will help me improve my learning.
Strongly Disagree	I don't understand what I need to do too do well in her class, because I don't get the way she teaches or her grades.	I am very distracted and don't get a lot of the things we talk about because I space out and or I just don't get it.	Never, I usually think I will do bad because I don't get a lot of things in that class.	Not usually I never study because I have no clue what to study for in science because we learn different things everyday and its confusing	NO because that is the teachers job to grade papers. Its are (our) job alone to just fill it out.
Disagree	I chose this number because I don't have good grade last trimester in science.	I'm not very good at this subject and I had to retake a test 3 times even though I try my best	I feel like I'm usually going to do well but then when class comes I like blank out but then I remember	If I study I know what is on the test if I don't study then I don't know what is on the test.	Because all it does is tell me what I got wrong
Neutral	Sometimes I understand what we are doing but not all the time.	I feel that I do well in school, but this new method sort of confuses me in a way.	I think I know some but not all.	Well we are supposed to take a look at the sheet to know what will be on the test. Which honestly most of the time I forget to check the sheet.	I think they kind of help because they show us what we need to work on but don't tell us how to do that thing.
Agree	I understand what I need to do to get an A in Ms. Vasquez's class	Because if you listen in class it shouldn't be all that hard.	I already know what I need to know and I know if I do or do not know it.	I do know what I am supposed to study because you tell us what we need to study.	I guess, because I know what I need to improve and look at
Strongly Agree	I understand the grading, why you grade this way,	I chose a 5 because of the fact that I can	Because I know on the amount of studying I do.	She gives us a sheet every time we start a new	It helps, because then I know what I need to redo,

	and most the skills we have been taught.	study, and if I get an answer wrong, I can retake it.		unit to study off of.	and the right answer that it should be is there, so I can try to think of why my answer might have been wrong and why that ones right.

APPENDIX F

POST - TREATMENT SURVEY COMMENTS

	I understand what I need to do so I can do well in Ms. Vasquez's class.	I believe I can be successful in this science course.	I know how well I am going to do on the test, before I take the test.	I am aware of the information I need to know before each test.	I think the data sheets we fill out after each test, will help me improve my learning.
Strongly Disagree	I don't understand	I don't like science	All I know is I'm going to miss at least 3	I do not get the information	They don't tell me anything except for what it I got wrong
Disagree	Pay attention in class and get good grades	I think its really hard for me to understand what's going on and what we are learning and I usually get distracted by something that has nothing to do in science	I hope I do well on every test, and I always think I'm going to do well, but on the last test, I didn't do good at all, and I was very confident in my answers.	I forget things easily and sometimes don't get what we are doing so I do bad on tests. I will work on that.	It does not help me
Neutral	I know what to do	I love science but it's getting harder. Sometimes I can't keep up in what we are doing.	Sometimes I feel confident and ready but other times I feel confused, frustrated, and worried.	Once I study for something it slips my mind very easily. I have a hard time remember stuff for school (tests, worksheets, and homework)	Because I know there importance but still they take a lot of effort
Agree	I know I need to study and pay attention in class, in order to remember things for tests, homework, and questions that you give me.	I chose this as my reason because science confuses me sometimes, but once I hear a fact a few times, it gets etched into my brain, and I remember	I don't know exactly how I will do, because it depends on what I studied and how well I understand it.	I'm aware because its on the colored sheet but I never read it because its really confusing or I just forget its there and so then I don't look at it	I remember things better with the reflection sheets and without them I feel I would have very low test scores.

		the fact			
Strongly Agree	I understand that I need to learn from my mistakes and make improvements from what I already know.	I have not only learned new theories and topics but I have added on to my previous knowledge. I feel like I have a lot of knowledge about this topic.	I said this because it all depends on how long you study so if I did not study then I know that I will not do very good on the test, but if I do study then I know I will do pretty well.	I said this because I study the information over and over again until I know what I need to know.	When Ms. Vasquez tells us to stray away from saying," Study more" or whatnot, and actually write down what you will do next time, it helps us actually learn from it because we all know we won't study harder.

APPENDIX G

REFLECTION RUBRIC

Level of Reflection:
NOT PROFICIENT
PROFICIENT

N – No reflection needed because it was correct on the first test.
NW – No reflection needed because it was correct on the first test,
0 – Student did not complete a reflection
0C – Student did not complete the reflection
1 – Reflection was completed, but did not include specific information to correct thinking. May have included information like, “study harder,” or “look at notes.” Or reflection completed, but not correct.
1C - Reflection was completed, but did not include specific information to correct thinking. May have included information like, “study harder,” or “look at notes.” Or reflection completed, but not correct.
2 - Reflection completed accurately, but not approved by the teacher prior to the retest.
2W - Reflection completed accurately, but not approved by the teacher prior to the retest.
3 - Reflection completed and approved by the teacher prior to the retest.
3W - Reflection completed and approved by the teacher prior to the retest.

APPENDIX H

STUDENT DATA SHEET

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1		4		Score 3.0					Score 2.0										
2		ME.1	3	ME.2	ME.3	ME.4	ME.5	2	ME.6	ME.7	ME.8	ME.9	ME.10	ME.11	ME.12	ME.13	ME.14	ME.15	
3		Conv.	Check if done	Meas. Mass	Meas. Length	Corr. Unit	Meas. Volume	Check if done	liter	meter	gram	mass	volume	TBB	GC	Meter stick	length	meniscus	
4	Pre-test																		
5	Quiz 1																		
6	Quiz 2																		
7	Quiz 3																		
8	Quiz 4																		
9																			
10	Quiz 1 - Reflection				my score is:				Quiz 2 - Reflection						my score is:				
11																			
12	What did I miss?								What did I miss?										
13																			
14																			
15																			
16	Why did I miss them?								Why did I miss them?										
17																			
18																			
19																			
20																			
21	What am I going to do differently next time?								What am I going to do differently next time?										
22																			
23																			
24																			
25																			
26	Quiz 3 - Reflection				my score is:				Quiz 4 - Reflection						my score is:				
27																			
28	What did I miss?								What did I miss?										
29																			
30																			
31																			
32	Why did I miss them?								Why did I miss them?										
33																			
34																			
35																			
36																			
37	What am I going to do differently next time?								What am I going to do differently next time?										
38																			
39																			
40																			
41																			
42																			
43																			

APPENDIX I

STUDENT TEST AND REFLECTION EXAMPLE

Name: [redacted]

$s = \frac{d}{t}$

P.2 4/9/14

SLE 1 – Test Prep

Trial	Distance (cm)	Time (s)	Speed (cm/s)
1	100	1.33	133 cm/s ✓
2	100	1.59	159 cm/s ✓
3	100	1.47	147 cm/s ✓

Fill in the missing speeds above.

What is a bike doing if it is accelerating?

If a bike is accelerating, it is speeding up (0)

If a car drives down the road at a steady 25 miles/hour, what is its acceleration?

0 miles/hours (0)

Provide three units of speed:

centimeters ✓ (0)
meters
millimeters

Answer the following with True or False, and then explain why it is true or false *and give an example*.

1 True (FM1.3) If an **object's speed** is ***increasing***, there must be a force acting on that object.

Explain: If an object's speed is increasing, there has to be a force on it because if there was no force, it would be at a steady speed. (0)

Example: If a car is accelerating, it has to have friction pushing it to keep it at a different or same speed.

2 False (FM1.1) **All** forces can be seen.

Explain: Gravity can't be seen, and pushing can be, (0)

Example: If there is water pushing an object that can be seen, if wind is pushing an object it can't be seen

3 False (FM1.6) IF there is NO force acting on an object it **can only** be stopped.

Explain: If a car is moving with no force acting on it it won't speed up. (0)

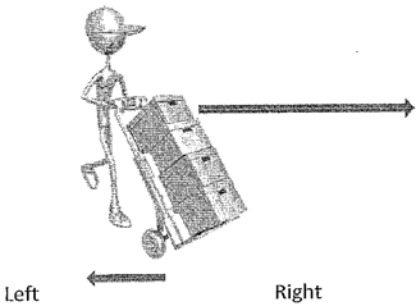
Example: If a bike was moving, it wouldn't accelerate because of friction pushing on it.

4 True (FM1.2) When a book is resting on a table, there are still forces acting on the book.

Explain: If a book is resting on a table, gravity is the force acting on it, Gravity keeps the book from floating away. Another force is the table because it keeps it from falling down. (0)

Speed	FM1.1	FM1.2	FM1.3	FM1.4	FM1.5	FM1.6

SLE 2 – Test Prep



Is the object in the picture moving? How do you know?
The object is moving because the arrow pushing right is bigger.

If so, which direction?
TO the right of the object

Are the forces balanced or unbalanced? How do you know? They're Unbalanced because the two arrows are different sizes and different forces

Name the force that is pushing towards the LEFT.
Friction is the push going towards the left arrow

(FM1.5) What will happen to the *speed* of the object if the force going to the LEFT increases?
The object's speed will become slower because of friction

Vocabulary Check:

(FM1V.4) A balanced force occurs when all forces acting on an object are **equal** and you have a net zero net force. The object will either be not moving or be moving at a steady pace in the same direction.

(FM1V.3) A unbalanced force occurs when all forces are **not equal** so the object is either changing speed or direction.

(FM1V.2) motion is the action or process of an object moving.

(FM1V.6) friction is the force that is caused when two objects rub against each other.

(FM1V.7) An object's resistance to change in motion is called Inertia. This increases as mass increases.

(FM1V.1) A force is a push or pull and is measured in (FM1V.5) Newtons, which is a unit.

(FM2.7) Mass is the amount of matter in an object.

(FM2.6) When an object is changing speed or direction it is acceleration.

(FM2.5) The combined forces acting on an object is called the resistance.

Unit Check:

(FM2.8) The unit of **mass** is Kilograms.

(FM2.9) The unit of **acceleration** is Meters/Second ✓.

(FM2.10) The unit of **force** is Newtons.

Newton's Second Law

(FM2.11) What causes an object to move?

Force

(FM2.2 & 4) Which needs **more** force to accelerate, an object with large mass, or an object with a little mass.

an object with a little mass

Which would accelerate faster, an object with more force or less force? Explain

an object with more force because it is pushed or pulled harder and will go faster

(FM2.3) A cat has a mass of 2.62kg. Jumps off a counter with an acceleration of 9.8m/s/s. How much force will it hit the ground with?

25.676 N

$F = Ma$

$F = 2.62\,kg \cdot 9.8\,m/s^2$

$F = 25.676\,N$

A model rocket is accelerating at 2 m/s/s and has a mass of 0.5kg. What force was needed accelerate the model rocket?

1 N

$F = Ma$

$F = 0.5\,kg \cdot 2\,m/s^2$

$F = 1\,N$

Optional

(FM2.1) Half the people on the team decided not to pull the airplane. The combined force of those left is 4500 N, while the airplane's mass is still 30,000 kg. What will be the acceleration?

✓

Another model rocket is accelerating at a rate of 3 m/s2 with a force of 1 N. What is the mass of the rocket?

✓

[redacted]

Reflection

Code	Description of code:
FM2.9	understands the unit for acceleration is m/s/s or m/s^2 (meters, seconds)
Did I miss the same code on another test? YES / NO	**Why did I miss the item on the other test?**
Did I make the same mistake or a different mistake? YES / NO	**Describe the mistake this time:** I forgot to do units of acceleration and I did the questions thout the units of acceleration.
What do I need to do next time I take the test?	I need to make sure that I know to usse units of acceleration (m/s^2)

Code	Description of code:
	Units of Speed
Did I miss the same code on another test? YES / NO	**Why did I miss the item on the other test?**
Did I make the same mistake or a different mistake? YES / NO	**Describe the mistake this time:** I didn't include a unit of time.
What do I need to do next time I take the test?	I need to give examples with a unit of time like km/hrs mi/sec m/min

Code	Description of code:
	Distance/time
Did I miss the same code on another test? YES / NO	Why did I miss the item on the other test?
Did I make the same mistake or a different mistake? YES / NO	Describe the mistake this time: I multiplied instead of dividing
What do I need to do next time I take the test? B	(A) 75.192969 cm/s (B) 62.893081 cm/s (C) 63.0272 cm/s

Code	Description of code:
Did I miss the same code on another test? YES / NO	Why did I miss the item on the other test?
Did I make the same mistake or a different mistake? YES / NO	Describe the mistake this time:
What do I need to do next time I take the test?	