USING SELF-ASSESSMENT RUBRICS IN SCIENCE

by

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of the requirements for the degree

of

Master of Science

in

Science Education

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DEDICATION

This paper is dedicated to my parents and extended family. Their continuous support and love made it possible for me to complete this project.

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ABSTRACT

This study evaluated the use of self-assessment rubrics to encourage and motivate students in learning physical science. Students used rubrics, discussion questions, and exit slips to assess their understanding of the content learned. Rubrics were used ln alternating phases for students to self-assess on the unit objective. Confidence levels were measured with surveys, discussion questions, and interviews. The results from January-April 2019 indicated an increase in students advancing in the levels on the rubric. The use of self-assessment rubrics indicated a growth in students' confidence and desire to self-reflect on science concepts.

INTRODUCTION AND BACKGROUND

The use of self-assessments is important and needed in education. In the past, I used teaching methods to get students to memorize information and reproduce it on a test or quiz. With self-assessment, I chose to make a shift with my students into applying higher-order thinking skills through the use of rubrics. This has been a challenge because I had to change my assessments and the way I teach. Trying to get my students to self-reflect has been a long process. The use of self-assessment rubrics allows students to demonstrate skills and use realistic approaches to solve problems. This technique allows teachers to observe students applying what they have learned about science topics through comprehension, and it shows the gaps in students' knowledge. It also allows teachers to see growth in "…students' conceptual understandings that result from instruction" (Angelo, T. & Cross, K., p. 197). Using rubrics for self-reflection allows students to think beyond just memorizing facts and to use previous knowledge to make connections.

I teach at Virginia High School located in Virginia, Minnesota. According to the Minnesota State High School League, our school has a 7-12 enrollment of approximately 422 students (MSHSL.com, 2019). The class I used for the implementation of self-assessment rubrics is called ninth grade Introduction to Physics and covered six units. The six units were motion and force, waves, work, distance and displacement, power, and energy. Thirty five percent of the students are open-enrolled and travel 20 minutes to get to school. Forty eight percent of students receive free or reduced lunch (L. Perkovich, personal communication, May 21, 2019). The region has suffered a huge loss in

employment since the 1980s, with the decrease in iron ore mining operations. The employment numbers at the main taconite mine went from 3,400 to 1,500 miners over the past 10 years (taconite.org, 2018).

There is often a struggle when trying to teach students to self-reflect. Many want to be told the answers instantly. I made a self-assessment rubric to help familiarize students with the process of self-reflection for several science units. Students have some experience with different self-assessment rubrics in other content areas other than the science classroom, and they know what elements are needed to make a reflection.

Self-assessment can encourage and motivate students to inspect their own learning, helping them to see the level of understanding they are at for each unit in science. Using self-assessment pushes for more student-centered learning, which makes students set goals and create steps to conquer them. Students find relevance in the physical science world through self-assessment, which allows them to practice the skills needed to self-reflect and branch into other areas of learning. Motivation in students aged 14-15 can be minimal if the assessment does not foster engagement or allow for self-expression. When assessing their own work, students will develop better judgement skills so they can see what is needed for quality work.

Students who employ self-assessment strategies tend to be more self-governing. They want to succeed, and the strategies may help them prevail through difficult assignments or projects. Students are building confidence in their work and enjoy the progress they have made. They will be more willing to use inquiry skills and be open to answering harder conceptual questions.

These all lead to the primary research question of this study: What are the effects of self-assessment rubrics on student motivation, engagement, and learning in physical science? My sub-questions based off the main focus questions were created as follows:

1. What are the effects of self-assessment rubrics on a student's overall performance at the end of each unit?
2. Do self-assessment rubrics promote greater self-efficacy?

CONCEPTUAL FRAMEWORK

Self-assessment is a way for students to reflect on the information they have learned. Taking the time to check if they have mastered the objective for each unit is a challenge for most students. One study modeled different levels of self-assessment that helped students transition into using them. Having students start comparing their work with classmates was the first step in getting them to reflect. Once students had been practicing with simple self-reflection, they started using rubrics to make sure they can judge their work against standards (Brown & Harris, 2014).

Getting students to use self-assessment requires them to be motivated and want to achieve a higher level of learning. Having students participate in this type of assessment allows them to master a goal and to reflect on personal growth. One study was conducted using self-assessment at different levels of education and was based on the Constructivist Learning Theory. The study started with classes that do not use self-assessment and ended with ones that use it daily. Research into the Constructivist Learning Theory showed that students and teachers need to tap into skills and previous knowledge to be able to make their reflection count. This theory can help identify a teaching strategy that

needs improvement and could benefit from self-assessment. This theory states that learning is active and is based on personal experience. The learner brings past personal experiences to the table and cultural factors to a situation. These experiences will influence the way a student will respond to an assessment (McMillan & Hearn, 2008).

Creating a grading and reporting practice that truly reflects a student's learning is challenging. It encourages the teacher to confront the current grading systems that may have been in place for centuries. Instead of keeping on the traditional path, it advocates for educators to research and try new methods (Gruskey, 2015). Creating new self-assessments will allow students to see that the information they are learning is relevant. The assessments can be simple reflection questions or standard based rubrics. Students that have higher self-efficacy and monitor their own goals or growth tend to demonstrate higher performance throughout the course. Self-assessment rubrics set clear expectations for goals or objectives students are trying to master (McMillan & Hearn, 2008).

Keeping students inspired to continue their education in science courses can be time-consuming. There are many preconceived notions that science is about memorizing facts and passing tests. Science should be about using inquiry skills and exploring information learned in class. Also, the topics in middle school science tend to be trivial and laborious (Lyons, 2006). By creating new and appealing self-assessments, teachers can give new life to topics that tend to be uninteresting to students. This brings back the point that students need to be motivated.

Students expect to be rewarded for everything. They have grown up in a society that uses an overabundance of rewards for minor accomplishments. In lecture form of the

thesis of Daniel Pink's book *Drive*, he argues that human motivation is largely intrinsic, and that the aspects of this motivation can be divided into autonomy, mastery, and purpose. It stated that using the traditional rewards verses consequences is not the best system to persuade people to complete a task. Students need to be able to reflect on and realize that if they want to achieve a goal, it should be done for that reason. It allows them to see personal growth and gives them skills to use in the future. His main point concerning motivation was having purpose (Pink, 2009).

A good self-assessment will encourage students to discover how much growth they have made during the unit. This self-learning could then be used by students in academics and future jobs. To make sure that the self-assessment rubric is effective, it needs to contain certain characteristics. First, the rubric needs four to five main defined points that will be assessed in the unit or project. Some points could be long in-depth objectives, while others could be one word. Secondly, there should be subcategories that contain descriptions of what the main points are. This allows students to see what is going to measured. Next, there is a set amount of points assigned for each section and students will be able to reflect on what it takes to achieve that score. Lastly, there needs to be a place for comments and questions that students have generated. This will allow the teacher to offer guidance and support the student in self-reflection. In a study conducted to look at how self-reflection can be used in classrooms by teachers, the research showed it would make teachers more conscious about the assessments they give their students (Machera, 2017).

It is important what type of self-assessment is going to be used for each unit. Some are simple discussion posts, exit slips, or practice problems. While others are standard based rubrics that fit each project. Some standards are easier to master and reflect on than others. Each assessment will have to be built around the unit objective. This can be done by creating a base rubric that can be manipulated or changed to match each unit. Keeping the proficiency scale unified throughout each unit will give students a goal to reach by the end (Gruskey, 2015).

For self-assessment rubrics to promote student learning, it must be purposeful and useful to the students. It will need to engage the intended audience and be used as a tool for collecting data to help with measuring student's growth. Self-assessment rubrics are tools to make the teacher the facilitator of the material and to adjust the pace of the unit being taught. Self-reflection done by the student directs the overall impact the material has on the student. Overall, self-assessment is an effective strategy to promote higher retention skills and academic achievement (McMillan & Hearn, 2008).

Self-assessment is a teaching strategy that allows students to use inquiry skills and to build self-reflection practices that will benefit them through life. Self-reflection allows students to relate their prior knowledge to new concepts. It allows for students to network with others and to use those skills to help improve their education. On the teachers' end, building rubrics for each unit requires advance planning and to routinely reflecting on what strategies are working.

METHODOLOGY

The purpose of this study was to determine if using self-assessment rubrics at the end of a unit would improve student's overall grade and performance and if it would positively increase the students' attitude towards science. The study was conducted on three classes of ninth grade Introduction to Physics at Virginia High School. During treatment, six self-assessment rubrics were used. During non-treatment phases standard assessments were used. The Introduction to Physics course is a requirement for all ninth-grade students to take. 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 maintained (Appendix A).

The Self-Assessment Rubric was made to be manipulated for use in each science unit (Appendix B). The state standard was given to the students at the beginning of each unit. Under the main objective were the benchmarks that the students would complete by the end of a unit. For each benchmark, students rated themselves on a scale of zero-four. Each rating coincides with a set performance scale that students used to judge their performance for the applicable topic. A rating of zero-one means students felt that they have no understanding about the current objective. Selecting a two means that they could identify vocabulary words and acquired some information about the topic. Being at three means students know the information enough to pass the test. Reaching a four means that students know the information and could teach the topic to classmates. After the unit was presented, short assessments were completed, and before the final assessment for the unit, the students broke into their partner groups, which consisted of two or three students.

They went through the rubric handout. The first rubrics were a struggle to get through and many students tended to rate themselves either too high or too low.

Pre and Post Assessment Surveys were given to all students in multiple settings. Most of the students chose to fill out the nonmandatory surveys. The Pre and Post Assessment Surveys used the Likert scale rating of strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). The Likert scale was given a numerical scale to help with analyzing the results. The scale was 1-4 representing SD-SA, respectively. The Pre-Assessment Survey questions were related to the student's comfort level in science class and how confident they felt using Self-Assessment Rubrics (Appendix C). The Post-Assessment Survey gauged the student's attitudes towards the Self-Assessment Rubric (Appendix D). Open ended questions were asked to see what impact the rubric had on the overall growth in science students had.

All treatment classes were interviewed. Students were put randomly into groups of three to work on their rubrics. Two groups of three from each section were picked randomly to interview (N=18). The interviews were conducted one-on-one and it was explained to them that the purpose was to gather information for an action research project. The Pre and Post Assessment interview included five questions. All the questions were content-specific pertaining to Self-Assessment Rubric and how the students felt in the class (Appendix E). The data was analyzed for themes and used as evidence to support the claim that self-assessments improve student's overall performance. Observations and teacher reflections were recorded each weekly within lesson plans. This allowed for the progress of the treatment and nontreatment groups to be documented.

Formative assessments were given to both groups in the form of Exit Slips and online discussion posts (Appendix F). This allowed results to be compared to teacher reflections. Table 1 summarizes the data sources collected in the study.

Table 1
Data Triangulation Matrix

Focus Question	Data Source 1	Data Source 2	Data Source 3
Primary Question: What are the effects of self-assessment rubrics on student motivation, engagement, and learning in physical science?	Teacher observations and journaling	Student Pre and Post Assessment Surveys	Pre and Post Student Interviews
Secondary Question: What are the effects of self-assessment rubrics on a student's overall performance at the end of each unit?	Teacher constructed formative assessments	Student Pre and Post Assessment Surveys	Self-Assessment Rubrics
Secondary Question: Do self-assessment rubrics promote greater self-efficacy?	Student Pre and Post Assessment Surveys	Self-Assessment Rubrics	Pre and Post Student Interviews

DATA AND ANALYSIS

The results of the Pre-Assessment Survey indicated that 91% of Introduction to Physics students agreed or strongly agreed that they felt confident and comfortable in self-accessing after each unit (N= 59) (Table 2). When asked how comfortable they were in using a rubric to self-assess, only 52% of the same students agreed or strongly agreed.

However, 89% of the students thought that learning about and using self-assessments would show them the benefit of self-reflection. One student responded, “This will hopefully help me organize my thoughts before we move to the next chapter.”

Table 2
Pre-Assessment Survey Results

	Pre-Assessment (%) Strongly Agree and Agree	Pre-Assessment (%) Disagree and Strongly Disagree
Comfortable in the science classroom	98	2
Science classroom environment promotes learning	70	30
Comfortable expressing my opinion or questions in class or small groups	88	12
Confident and comfortable in what it takes to use a self-assessment	89	11
Confident and comfortable in my ability to self-assess after each unit	91	9
Confident and comfortable in using a rubric to self-assess	52	48
Self-assessment shows me the benefit of reflection on my work	89	11

Seventy-two percent of the students interviewed with the pre-assessment questions knew what a self-assessment was (N=18) (Table 3). Thirty-three percent of those students said they have used self-assessment techniques in other courses this year. In response to the question about how they feel about science this year, one student stated

that, “The online discussions have been more beneficial than worksheets. I hope this new rubric does not mean more work.”

Table 3
Pre-Assessment Interview Questions Results

	Pre-Assessment Interview Questions (%) Yes	Pre-Assessment Interview Questions (%) No
Do you know what self-assessment is?	72	28
Do you use self-assessment in other courses this year?	33	67

After using the rubric with the first treatment unit on motion and force, 49% of students rated themselves at a level three, which is proficient (Figure 1). One student stated, “I am a fast learner and I do make some mistakes here and there, but I try to correct them.” A student that was at level two responded that, “I’m always stuck on some points and I need help to explain them.” Rubrics from the second through fourth treatment units indicated an increase of students performing at levels three and four. Unit three rubric results indicated a 7% increase on students in level three compared to rubric 2. Unit four rubric had a 7% increase in level four and a 7% decrease in level two. Level three and one stayed the same.

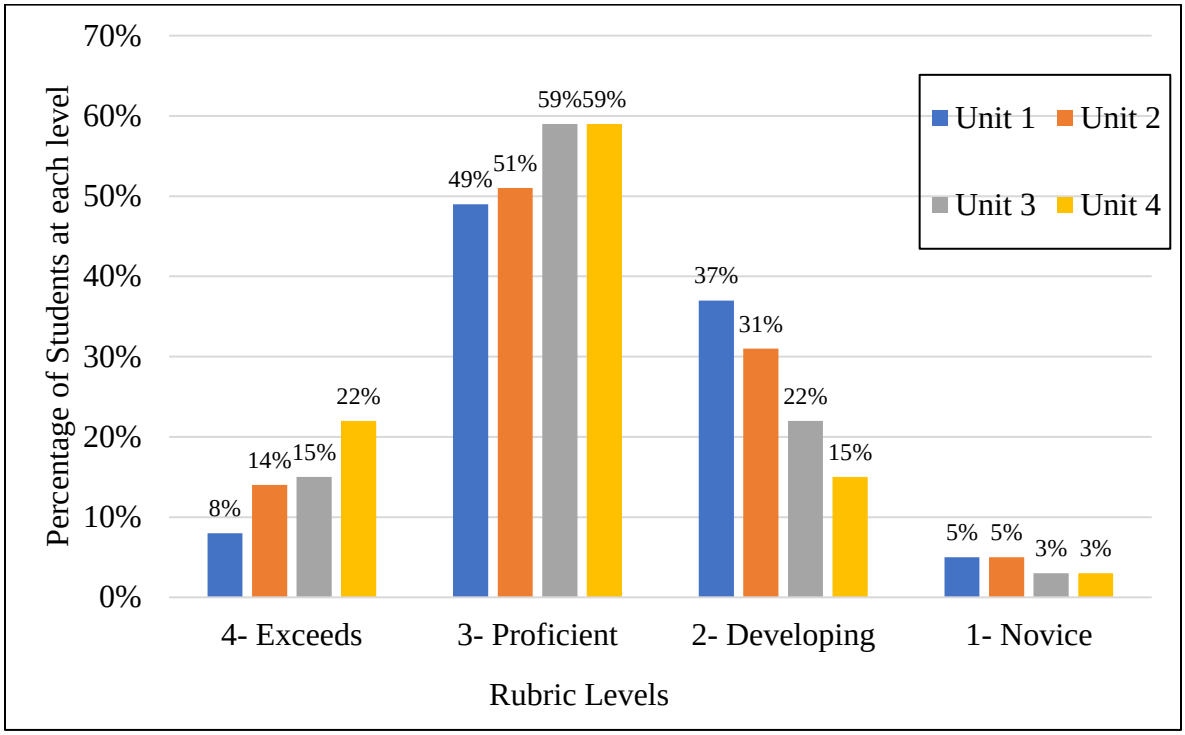

Figure 1. Student self-assessment rubric scores unit 1-4, (*N*=59).
Note: Rubric level scores: 4= Exceeds- I can do it without mistakes. I can help others, 3= Proficient- I can do it by myself! I make little mistakes, 2= Developing- Sometimes I need help. I am starting to understand, 1= Novice- I can't do it by myself. I don't understand yet. Unit 1- Motion and Force, Unit 2- Waves, Unit 3- Work, and Unit 4- Distance and Displacement

The results from the fifth rubric interestingly showed a decline in students in levels three and four (Figure 2). The average class scores from the online discussion question posts also indicated a decrease in comprehension. All six treatment units had discussion questions worth a total of 15 points and only 40% of students scored a passing grade (Figure 3). One student stated that, "This unit was just harder. I had issues with some of the math and did not feel ready to teach others."

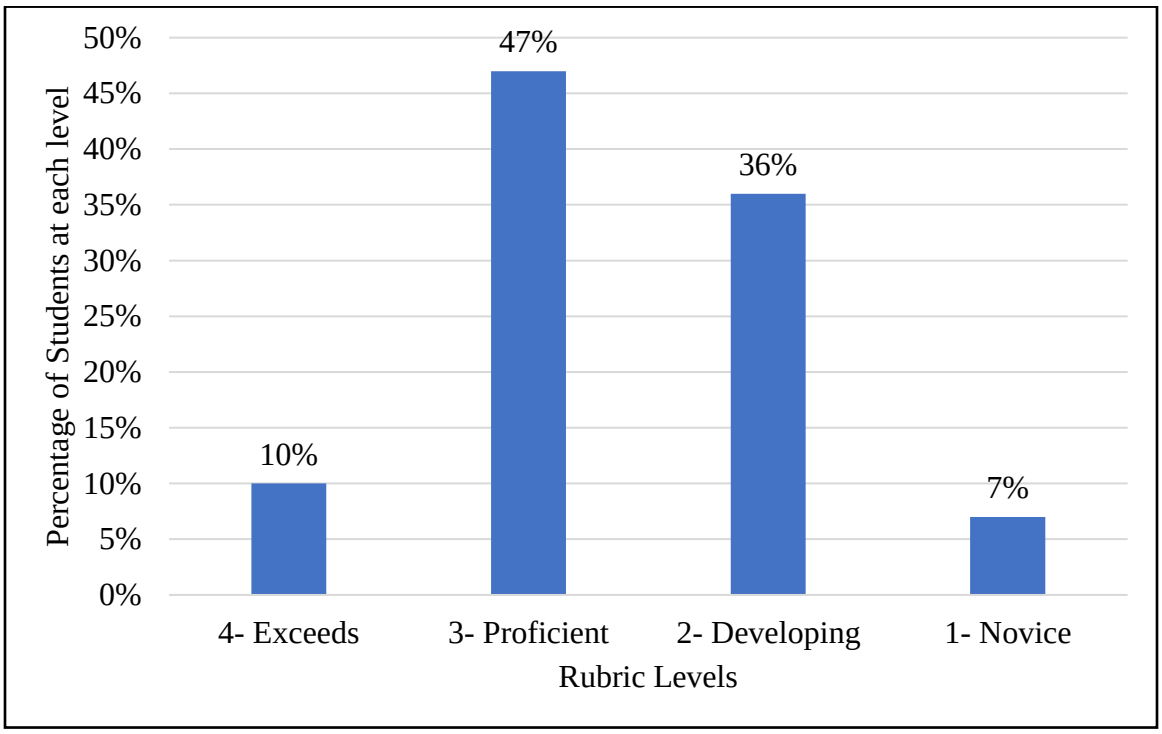

Figure 2. Student self-assessment rubric scores Unit 5- Power, (*N*=59).

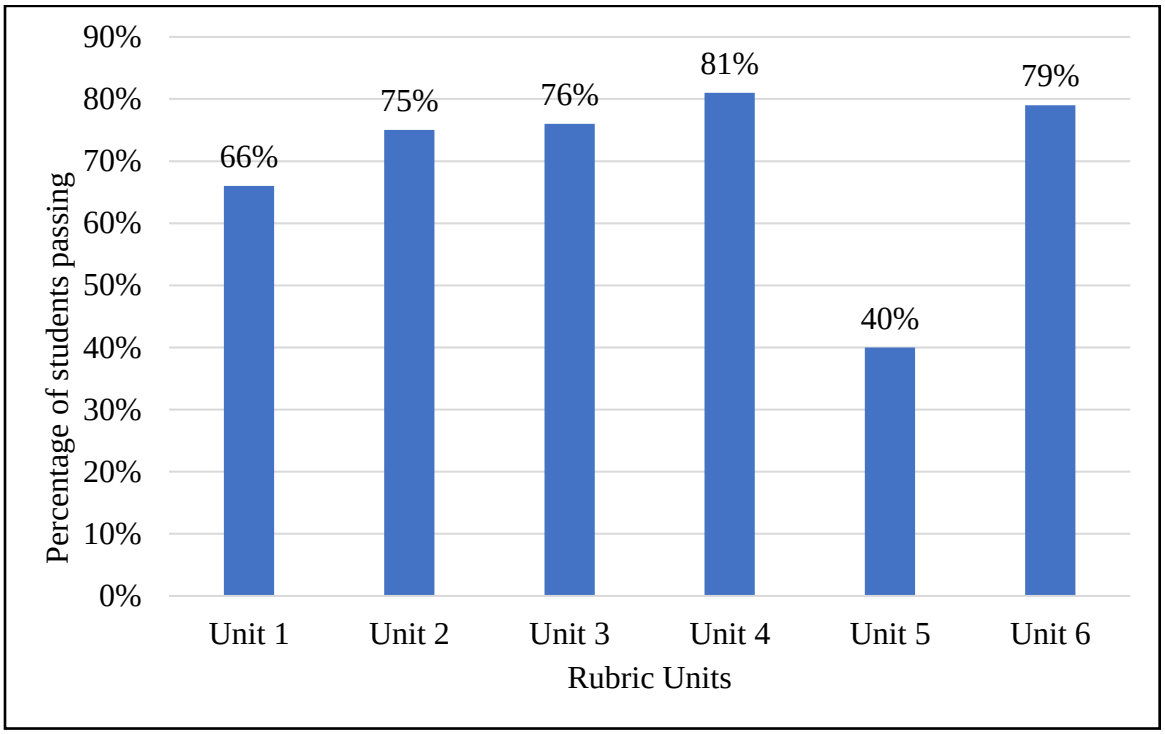

Figure 3. Students' on-line discussion points passing scores, (*N*=59).
Note. Passing score was at a 60% and higher or 9 out of 15 points.

The results from the sixth rubric indicated a 18% increase on students in level four (Figure 4). One student wrote, “I continuously help my peers with their work and explain the proper steps. I excel on test and projects throughout the semester.” Another student expressed, “I don’t like to take my time on ANY work. I know this rubric is supposed to make me stop and think, but I am still going to rush. I do still rate myself on a level 3 closer to 4 because I help other students on the on-line discussion questions.”

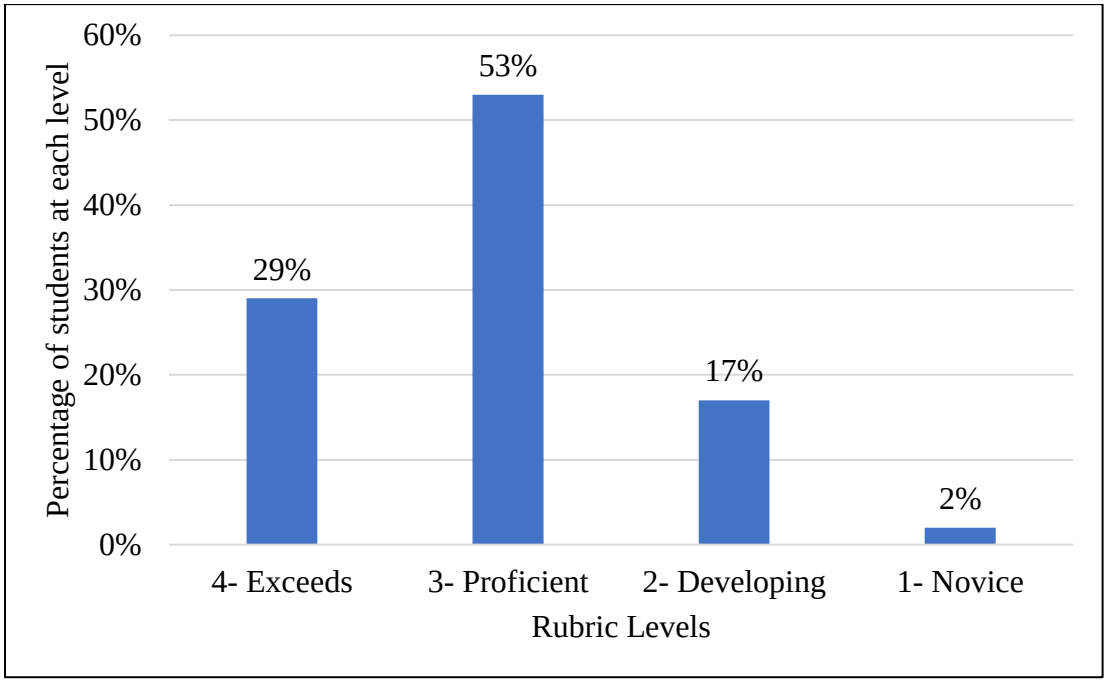

Figure 4. Student self-assessment rubric scores Unit 6- Energy, (*N*=59).

The results from the Post-Assessment Survey indicated that 88% of students agreed or strongly agreed that they worked hard on the rubric and maintained high standards for themselves unit (Table 4). Ninety-one percent of students agreed or strongly agreed that they were highly motivated to complete the self-assessment rubrics for each unit. One student said, “I try really hard in this class because I enjoy it.” Twenty-five

percent of students disagreed or strongly disagreed that they did not spend enough time to do quality work on the rubrics.

Table 4
Post-Assessment Survey Results

	Pre-Assessment (%) Strongly Agree and Agree	Pre-Assessment (%) Disagree and Strongly Disagree
Worked as hard as I could have on the self-assessment rubric	88	12
Set and maintained high standards for myself	88	12
Highly motivated to complete self-assessment rubric	91	9
Spent enough time on the rubric to do quality work	75	25
Tried not to procrastinate when doing my self-reflection	90	10
Comfortable asking questions when I needed help	99	1

Ninety-five percent of students interviewed after the use of the rubrics for the six units, indicated that they could use this assessment tool and teach others about it (Table 5). The results showed that 87% of students boosted their confidence and comfort in the class by using the rubric. One student stated, “I help them find what level they are at and might be able to help them reach the next one.”

Table 5
Post-Assessment Interview Questions Results

	Pre-Assessment Interview Questions (%) Yes	Pre-Assessment Interview Questions (%) No
Did you find parts of the rubric confusing?	93	7
Does this type of assessment boost your confidence and comfort in the class?	87	13
Could you teach other students to use this assessment tool?	95	5

INTERPRETATION AND CONCLUSION

This study supported that using self-assessment rubrics will improve students' overall grade, performance, and attitude towards science. The rubrics used after each treatment unit also showed growth for students in self-reflection. The rubrics helped students focus on obtaining the unit objective. Prior to using the rubrics, the average passing scores for the on-line discussion questions averaged 51%.

The post-assessment surveys and interviews reflected that growth was increased within the confidence students had in the science classroom. Students had better reflective entries on the discussion questions toward the end of the treatment. Even when the content was more challenging, students were able to indicate in detail where they needed help.

I saw more positive attitudes when students came to class. When asked to complete the questions for the end of the unit, even when not being asked to complete the rubric, students would take their time and concentrate on the task. One student shared,

“Even though we do not use these rubrics in other classes, I am learning to slow down my approach on explaining big ideas on exams.”

Self-reflection is a way to show personal growth and allows students to express their emotions. Overall, this study granted freedom for students to communicate their successes, struggles, and work on higher order thinking skills. At the end of the study, most students did not need to a prompt to complete the discussion questions. I noticed more self-motivation and individual engagement to finish the assessments for each unit. I always stressed that the students needed to advocate for themselves and their learning. I believe this skill will help them in their future courses.

VALUE

The implementation of self-assessment rubrics into my classroom is a technique that I will continue to use. These reflections empowered students to become self-aware of their learning and to take ownership. This allowed them to become more responsible in and out of the classroom. I wanted to challenge my students and not just give them more busy work. The rubric offered students a tool to identify new knowledge and self-growth in the science classroom.

Due to the time constraint for this project, I would start it in the fall so students could build on the skill of self-reflecting for the entire school year. The period for data collection did show improvement, but I would like to have more numbers to compare. Due to weather issues and school closings, I did miss spending time on some units. I also started teaching a College in School class this year and I spent more time preparing for that.

This classroom research project made me concentrate on what assessment and discussion questions I would give to my students. I focused my time on writing the unit around the main objective and branching out to the benchmarks the students would be accomplishing. I would develop my discussion questions for the end of the unit on being more open ended to prompt personal reflection. The reflections helped steer my teaching and planning to be conscious of connections my students make and how diverse their thinking is.

My goals are to start weekly reflections so my students can express any concerns they are having with the content they are learning. I want students to communicate what parts of the material really resonated with them and how this can impact their lives outside of the classroom. I have learned that students want an outlet for their struggles in science content and that is why I will continue to use self-assessment rubrics.

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APPENDICES

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

MONTANA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD
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MEMORANDUM

TO: Elizabeth Suihkonen and John Graves

FROM: Mark Quinn Mark Quinn CJ
Chair, Institutional Review Board for the Protection of Human Subjects

DATE: November 7, 2018

RE: *"The Impact of Self-Assessment Rubrics on Students' Overall Performance in Science" [ES110718-EX]*

The above research, described in your submission of November 7, 2018 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 B

BASE SELF-ASSESSMENT RUBRIC

Unit:_____ Name:_____

Dates:_____

Student Self-Assessment Rubric

4
Exceeds
I can do it without mistakes.
I can help others.

3
Proficient
I can do it by myself!
I make little mistakes.

2
Developing
Sometimes I need help.
I am starting to understand.

1
Novice
I can't do it by myself.
I don't understand yet.

For this unit, I am at number _____ because:

What help do I need from Ms. Suihkonen?

APPENDIX C

PRE-ASSESSMENT SURVEY

PRE-ASSESSMENT SURVEY

Being able to self-assess is an important skill. This allows you to make improvements in areas where you struggle.

Note: This is a voluntary survey to gauge your feelings about self-assessments in school. Participation is not required, and this is not graded. Thank you for your time in this research.

1. I feel comfortable in the science classroom
    a. Strongly Agree
    b. Agree
    c. Disagree
    d. Strongly Disagree
2. The science classroom environment promotes learning
    a. Strongly Agree
    b. Agree
    c. Disagree
    d. Strongly Disagree
3. I feel comfortable expressing my opinion or questions in class or small groups
    a. Strongly Agree
    b. Agree
    c. Disagree
    d. Strongly Disagree
4. I feel confident and comfortable in what it takes to use a self-assessment

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

5. I feel confident and comfortable in my ability to self-assess after each unit

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

6. I feel confident and comfortable in using a rubric to self-assess

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

7. When I use the base self-assessment rubric, I try to

a. Be honest and grade myself accurately.

b. Choose the number my classmates do.

c. Choose a middle number so I don't have to challenge myself.

8. Learning about and using self-assessment shows me the benefit of reflection on my work

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

APPENDIX D

POST-ASSESSMENT SURVEY

POST-ASSESSMENT SURVEY

Being able to self-assess is an important skill. This allows you to make improvements in areas where you struggle.

Note: This is a voluntary survey to gauge your feelings about self-assessments in school. Participation is not required, and this is not graded. Thank you for your time in this research.

1. I worked as hard as I could have on the self-assessment rubric
    e. Strongly Agree
    f. Agree
    g. Disagree
    h. Strongly Disagree
2. I set and maintained high standards for myself
    a. Strongly Agree
    b. Agree
    c. Disagree
    d. Strongly Disagree
3. I was highly motivated to complete the self-assessment rubric
    a. Strongly Agree
    b. Agree
    c. Disagree
    d. Strongly Disagree
4. I spent enough time on the rubric to do quality work

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

5. I tried not to procrastinate when doing my self-reflection

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

6. I felt comfortable asking questions when I needed help

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

7. Did you review your work for possible errors? Yes or No? Why?

8. Is your work something you are proud of? Would you be willing to share it with others? Yes or No? Why?

APPENDIX E

PRE- AND POST- INTERVIEW QUESTIONS

INTERVIEW QUESTIONS

PRE-ASSESSMENT

1. Do you know what self-assessment is? Explain.

2. Do you use self-assessment in other courses this year? How does the teacher grade them?

3. When you use self-assessment, does it seem to help with the understanding and applying of the classes content? Explain.

4. How many times are you asked to self-reflect during a school week, Monday-Friday?

5. How do you feel about your science class this year?

Any other thoughts or comments?

POST-ASSESSMENT

1. How do you feel about using the self-assessment rubric? Explain.

2. Did you find parts of the rubric confusing? Yes or No. Which parts. Explain.

3. Does there need to be more specific questions on the rubric? Write a new question.

4. Does this type of self-assessment boost your confidence and comfort in the class? Yes or No. Explain.

5. Could you teach other students to use this assessment tool? How would you do so?

Any other thoughts or comments?

APPENDIX F

SAMPLE EXIT SLIPS AND DISCUSSION POSTS

Discussion Questions for student reflection

1. What objective or essential question did you learn about this week?
2. What activities helped you to learn?
3. What activities did you find engaging?
4. What questions or comments do you have for Ms. Suihkonen?

Sample Exit Slips

1. Using the work equation, solve the problems below:
    a) If 150 Joules of work is needed to move a box 10 meters, what force was used?

    b) _____ is done when an object moves through a distance because of a _____acting upon the object.

    c) When calculating work, you should use the formula: work = force X

    d) Any questions or points that caused confusion?