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Using Rubrics to Communicate Unit Learning Goals to 6th Grade Science Students

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UNIT RUBRICS IN MIDDLE SCHOOL

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Abstract

The purpose of this research study is to determine if the use of unit rubrics will increase student academic achievement and motivation. One hundred and nine 6th grade science students from a diverse low income Southern California School participated in the study. The research compared two three-week units of study, an Earthquake Unit and a Volcano Unit. The Earthquake Unit served as the control where no rubric was provided to the students. The Volcano Unit was the experimental unit where students were provided a rubric that communicated the learning goals for the entire unit. Each unit was a 3-week unit and was taught using lectures, note taking, reflective writing, drawings and labs. The motivation surveys for each unit were taken the day before the unit test was given to the students. The motivation surveys and unit test scores were compared between the Earthquake and Volcano Unit to demonstrate an increase in student motivation and achievement with the use of rubrics during the Volcano Unit. Using quantitative analysis, the results revealed no significant increase in student achievement and motivation with the use of a unit rubric. This research study was only performed for a single three-week unit. In order to observe the full effect of the use of unit rubrics students should be exposed rubrics throughout the year. Therefore, the students and teachers are familiar with aligned assignments and assessments based on the rubric learning goals for each unit.

KEYWORDS: academic achievement, efficacy, learning goals, motivation, rubrics
Chapter One: Unit Rubrics in Middle School

In middle school students travel to different classrooms everyday and have different teachers. Each teacher has different expectations, rules, and assessments within their classrooms. Based on personal experience, teacher instruction can sometimes be unclear in the classroom and can cause students to be confused on what they were suppose to learn that day. The students are then left to infer what is important to learn each day in each class. To help students understand what is expected from them each day, teachers can clearly state the learning goals for the current unit of study. Educators can deliver clear learning expectations in many ways. For example, teachers can post up learning objectives on the board, have students recite learning goals that are displayed, or provide students with a learning goal rubric. No matter what the teacher strategy is the main goal is to deliver clear expectations to the students to promote learning. In this research study rubrics are used to deliver learning expectations for my students for an entire unit. This thesis introduction includes the purpose the study, a preview of literature review, the methodology, the significance of the research study, and definitions of the key terms.

Purpose of Research

The purpose of this research study is to determine if the use of unit rubrics will increase academic achievement and motivation. The research question is: How does the use of rubrics in 6th grade science classes increase student motivation and academic achievement? The study will look at student motivation and academic achievement independent from one another to determine the effects of rubrics within
two middle school science units. Student motivation will be measured using Likert surveys and academic achievement will be measured with formative and summative assessments.

**Preview Literature**

The effect of using unit rubrics on student academic achievement and motivation is the focus of this research study. Research on academic achievement, motivation, and rubrics has been collected to provide insight and support for this research study.

Academic achievements may increase within students if students are provided the opportunity for self-assessment (Kitsantas, Reisner, and Doster, 2004). Students will be aware of what knowledge they learned and what they still need to learn in order to improve academically. Another factor that can increase student academic achievement is through providing specific feedback that guides students on what they can specifically do to improve academically (Marzano, 2006). Simply showing students a score does not communicate what the student can do to improve that score. Therefore, low scores may actually become discouraging to student academic achievement.

Motivation is also an important factor in student achievement. For this research study, efficacy is the type of motivation that is focused on. Efficacy refers to a person's belief about their skills of performance (Bandura & Schunk, 1981). If a student has a high level of efficacy about their ability to perform a specific task, the
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higher the probability is for success. This research study measures if student efficacy increases with the use of unit rubrics.

A rubric is one tool teachers can use to clearly communicate learning expectations within a classroom (Ross, 2006). With the use of rubrics, students can visually see what they need to accomplish. Students can monitor or self-assess their learning progress with the use of rubrics. The closer a student gets to reaching their learning goals on the rubric the more motivated they may become as an individual in completing tasks and performing well on assignments (Graham & Weiner, 1996). Students may increase their motivation or self-efficacy because will be able to see growth in their learning each day.

Rubrics can also be used to provide specific feedback to the students. Teachers can communicate with the student on what they specifically need to work on to improve. The rubric can be referred to while feedback is being provided. The teacher is not just providing students with just a “grade”. The students will be scored based on the rubric for all assignments, therefore the student know what they need to work on to improve (Mertler, 2001). Feedback on assignments will provide guidance to students for improvement, not simply a score that is open for interpretation and provides no directions to the student. Specific feedback can be communicate clearly because the rubric will have all the learning goals listed out for unit. The teacher can simply refer to the rubric to direct students on what they need to review.

Rubrics are essential tools to clearly communicating expectations to students. Students have the opportunity to assess their own learning. Teachers are able to
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provide specific feedback to help students improve their work. Overall, the use of rubrics should increase student academic achievement and motivation.

Preview Methodology

Two units of study will be taught for this research study, Earthquakes and Volcanoes. Earthquakes will be taught in a three-week unit with no rubric. The Earthquake unit will be taught with the following activities: lectures, note taking, reflective writing, drawing and labs. The second unit on Volcanoes will follow the same format with instruction including lectures, note taking, reflective writing, drawings and labs. The difference with the second unit of instruction is that a rubric will be used to communicate learning goals throughout the three-weeks. At the end of each unit and before the summative assessment, the students will be given an survey on their motivation and their understandings of the expectations. The survey will be optional to the students and no names or test scores will be attached to the surveys. The survey will use a Likert scale, ranging from one to four. After the survey, the students will then take the summative assessment to determine their academic achievement.

Significance of Research

The unit rubrics used in the study will clearly list what learning goals must be accomplished in a particular unit. Since students will have a clear understanding of what is expected for them to learn throughout the entire unit, teachers and students can gain and provide feedback on the learning process. The feedback can help students realize what they are doing well and what they need to work on to improve.
The feedback gained from rubrics can also help teachers understand what needs to be re-taught in class before they move on. Students can also be given time to self-assess on their learning for different assignments or projects. This research study will demonstrate to educators that clearly communicating expectations their students at the beginning of a lesson will increase students' academic achievement and motivation.

The use of a rubric for an entire unit will also allow teachers to align the assessments to the academic learning goals, which are on the California State Standards. Every assignment and assessment will be connected to a learning expectation, therefore, decreasing the chance of assessing students on information not clearly taught in class. Overall, this can help teacher with their unit plans and connecting assessments to learning goals, ensuring specific learning goals are being taught in class. Aligning lessons to the State Standards can be a challenging task to teachers, but creating a clear list on a rubric of what needs to be covered will also help teachers stay focused on what needs to be taught.

Summary of Chapter One

There are several strategies teachers use to increase student motivation and academic achievement. However, the primary focus for this study is the use of rubrics. The rubrics will provide clear learning goals to the students. Students will then learn better when goals are clearly stated because they can check their understanding by using the rubric as a “checklist” (McMilan & Hearn, 2008). The students will know what the purpose is for each activity and assignment that is linked back to the unit rubric. Therefore, rubrics may motivate students to achieve
academically because they can assess their learning progress. In chapter two, research on motivation, achievement and rubrics will be reviewed.

**Definition of Key Terms**

Key terms used through the research study may have many definitions and meaning to the reader. The key terms will be listed with definitions for them to be understood within the context of the research study.

**Academic Achievement**

Academic achievement is how well the student does in school. This study will look specifically at their performance in their 6th grade science class for two specific units, the Earthquake and Volcano units. Formative and summative assessment scores for each unit will be used to determine the 6th grade students’ academic achievement results for this research study.

**Efficacy**

Efficacy is a type of motivation that specifically refers to a person’s belief about their capabilities of performing well on tasks (Bandura & Schunk, 1981). Efficacy will be measured with a survey. There are two sets of efficacy surveys. One survey will measure student efficacy after the unit where no rubric was provided. The second survey will be given at the end of a unit where a rubric was provided to the students. Both surveys are given to students before the summative unit assessment.
Motivation

Motivation refers to the "...beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). Motivation will be analyzed by the results from the efficacy surveys for each unit of study.

Rubrics

"A rubric is a scoring tool that list the criteria" for assignments (Goodrich, 1997, p. 1). During this research study, the term rubric will refer to a graphic organizer that contains a list of learning goals that will be covered throughout an entire unit.

Unit

A unit refers to a complete set of lessons on a specific topic. The two units (Earthquakes and Volcanoes) for the study are about three weeks long each.
Chapter Two: Literature Review

Rubrics can be a tool to influence student motivation and academic achievement (Ross, 2006). Rubrics help communicate clear learning goals to the students. Therefore students know what they are expected to learn each day. Clear expectations communicated in a classroom will improve students' motivation and academic growth (Ross, 2006). In this chapter I will review key research on academic achievement, student motivation, and how rubrics can be useful tool to address both.

Academic Achievement

Academic achievement is how well students perform in school. For this research study, student formative and summative scores are used to determine students' academic levels. A variety of factors can increase student achievement. One strategy that increases student achievement is through the process of self-assessment. Kitsantas, Reisner and Doster (2004) suggest that self-assessment and achievement are positively correlated. Students that go through the process of self-assessing their knowledge or assignments will improve academically.

A second strategy that increases academic achievement is through feedback. However, not all types of feedback increase achievement. In order for achievement to be positively affected, the feedback needs to be efficient. Feedback needs to be specific and guides students on what needs to be learned in order to improve academically (Marzano, 2006). Students that just see a score on an assignment or assessment does not express what can be done in order to improve their learning; this
actually may discourage students from improving (Atkinson, 1964). Feedback should encourage students at all levels to improve academically. This can be done if feedback guides student learning and expresses that students can improve.

**Motivation**

Motivation is an important component to student academic achievement. If students believe they can accomplish a task their motivation will increase and will be willing to take on more challenging tasks (Eccles & Wigfield, 2002). Motivation is one factor that is reviewed in this research study.

Based on Atkinson’s Theory of Achievement Motivation there are three factors to consider: motive for success, probability that one will be successful at a task or an assignment, and the incentive value of success (Graham, & Weiner, 1996). All of these variables differ from student to student. For example, some students may be intrinsically motivated, they are engaged in the activity because they are personally interested in the material. Other students may be extrinsically motivated, engaged in activity for other reasons like rewards (Esscles & Wigfield, 2002). Since rubrics can be used as an external factor to motivate students, students may be more motivated to learn more of the material listed on the rubric because they can physically “check off” what they have learned. Therefore, students will see tasks being accomplished from their efforts.

For this research study the type of motivation it focuses on is students’ level of efficacy, which refers to a person’s belief about their capabilities of performing well (Bandura & Schunk, 1981). Efficacy is a type of motivation that focuses on the
probability of an individual succeeding on an assignment based on Atkinson’s Theory of Achievement Motivation. The higher the level of efficacy, belief they can accomplish a specific task, the higher probability of success (Schunk, 1983). The more students believe they can accomplish tasks more improvement in academic achievement will occur.

**Rubrics as Tool for Academic Achievement & Student Motivation**

This research study uses rubrics to: allow student to self-assess their learning progress and allows teachers to provide specific feedback to students to encourage learning. These two factors are important factors to increasing student motivation and academic achievement.

**Self-Assessment**

Using rubrics provides students with the opportunity to self assess their own work for an assignment and knowledge gained during the unit. The students will know what they need to accomplish and learn before submitting an assignment or taking an assessment. They may even be able to determine their own score using the unit rubric.

**Value of Self-Assessment on Academic Achievement.** Students can be given the opportunity to monitor their progress, set goals, and reflect on their performance. In order for self-assessments to be effective, students must go through a process. First, students need to identify the learning and performance strategies they want to work on. Second, students provide and receive feedback on their progress. Third,
students review their progress and determine the next steps for improvement (McMillan & Hearn, 2008).

Having students self-assess their own learning progress is a crucial component in students’ academic growth and motivation (Ross, 2006). Self-assessments allow students to digest all the information they learned about their learning progress towards specific learning goals. Students can evaluate their achievements, what they still need to improve, and a new plan towards further improvement (McMillan & Hearn, 2008). It is important to provide the opportunity for students to learn the metacognitive skill of analyzing their own work and determining what they did well on and what they need to improve on. Teachers are an important role in helping students learn, practice and perfect these skills. Rubrics is a tool that can help students self-assess their learning progress because the expectations are clear and broken down into simpler steps.

Students self-assessing their knowledge is beneficial because they will gain better understanding of what students are suppose to do for assignments because criteria is clearly listed (Ross, 2006). Students can monitor what they have learned or accomplished and they will have a better idea of what they need to learn or accomplish.

Another benefit to self-assessing their own work or progress is that students know what they need to do in order to improve their work (Ross, 2006). The rubric serves as their guide and students can determine their score even before submitted for
grading. The rubric will always serve as their answer whenever they question what they need to do in order to increase their academic achievement.

One difficulty with student self-assessments is that some students may lack skill on analyzing their own work and understanding what the final product should look like (Noonan & Duncan, 2005). The rubric is available for students to help them check their work and progress; however, some students may still be unsure of what is exactly expected for each goal listed on the rubric. Students may have difficulties connecting assignments to the rubric. Students need to be guided at first in order to model how to self-assess their work correctly.

**Value of Self-Assessment on Motivation.** Students that are given the opportunity to self-assess their learning can positively increase their motivation as well. Kitsantas, Reisner, and Doster (2004) state that students that increase academically through the process of self-assessment also produce higher levels of efficacy, belief they can accomplish a task. Self-assessment enables students to identify what they accomplished and what they still need to accomplish. They are not just handed a score, which lacks details instruction on how to improve. The students can also assess their own work and have an idea of what they score will be by self-assessing. Therefore, if they are not content with the self-assessment score they can work on the activity to obtain a better score.

Self-assessment opportunities can be a powerful skill to students. Self-assessments empower students to be more involved in their learning process (Noonan & Duncan, 2005). Students are able to identify their own strengths and weaknesses
through self-assessment and can construct a plan on how to improve. This creates a positive learning environment because students are now focused on what they can do to improve their scores.

Overall, self-assessment contributes to students’ efficacy levels. Students that perceive themselves as successful during the current tasks they are assessing the more likely they will believe they will be successful in future tasks (Bandura, 1997). Therefore, self-assessment can improve student motivation.

**Feedback**

Rubrics provide the opportunity for specific feedback to be communicated to the students. Students will know what they need to work on to improve their own learning based on the specific gained with the use of rubrics. Feedback can be in a simple informal verbal form or formally communicated to students in writing while referring to what students need to specifically work on based on the rubric.

**Value of Feedback on Academic Achievement.** Feedback is a vital part in students determining their progress towards a specific learning goal. Providing feedback during the learning process and not only after instruction will inform students what they need to work on to progress in their learning (McMillan & Hearn, 2008). Formative assessments allow students to determine what they have accomplished and what they still need to accomplish, which can enhance student motivation and achievement.

Rubrics provide students with specific feedback on their performance (Mertler, 2001). When rubrics are written to address certain learning goals, feedback can refer
to a specific learning goal a student can focus on improving. Students will know exactly what they need to do to improve, which provides the opportunity for students to improve academically. The guesswork on what needs to be done for an assignment will no longer exist. The communication about assessment scores will be easier to understand between the student, teacher and parents.

Value of Feedback on Motivation. Providing feedback to students can motivate students if the feedback allows students to improve their learning (Marzano, 2006). Feedback that says, “Good Job” or “Needs work” is too vague to effectively communicate to students what they can do to improve. Marzano states that the feedback provided from educators needs to be specific, so students know exactly what they need to work on to improve their learning (2006). If scores are the only type of feedback provided to students, some students may decline in motivation because they only see themselves as a “failure.” Scores do not express any accomplishments the student obtained and it does not clearly state what they need to do in order to improve. Therefore, the process of learning stops when they receive their score.

Using Rubrics in My Classroom

The Shelter Instruction Observation Protocol (SIOP) method recommends content objectives be communicated to the students at the beginning of each lesson (Echevarria, Vogt & Short, 2007). This strategy allows all students, especially students learning English, to understand what is expected from them to learn each
day. Teachers can post the content objective on the board or on a hand out, the main idea is that the students have a clear understanding of the teacher’s expectations.

Based from the SIOP model of communicating learning objective for lessons, this research study focuses on communicating learning goals for a unit. The learning goals will be provided to students at the beginning of each unit for students to preview. Each learning goal will be covered during certain lessons in the unit. Students will also have time to reflect on their progress and write personal goals for the unit as well. For this study, learning expectations will be communicated to students in the form of a rubric. The rubric will contain all learning goals students are expected to learn an entire unit.

A rubric will be used to help guide the students towards their academic goal. Some students want to do well in school and care about their grades. A few students may not have the incentive to do well in school due to personal reasons. However, the use of a rubric that provides students with a clear understanding of what they should be learning will hopefully have them realizing that they can accomplish academic goals if they put forth the effort. Therefore, the use of rubrics will potentially increase students’ personal beliefs that they can accomplish academic tasks.

In order for students to self-assess their progress on personal learning goals and for teachers to provide effective feedback; clear learning targets are necessary. Clear criteria allows student to identify what they need to work on and what they have already accomplished during their self-monitoring stage (Bruce, 2001). Rubrics
are also scoring guides for assignments or assessments (Mertler, 2001). With the clear learning goals, feedback can be specific and can reference a specific learning target.

However, rubrics should not just simply list expectations and the corresponding grade with those expectations because students do no perform at all the same levels. Rubrics should differentiate the different achievement levels to promote learning as a process (Bruce, 2001). Not all students learn at the same rate and perform at the same level. Therefore, rubrics can be designed to communicate learning goals for different readiness levels. Rubrics should also contain learning goals that follow the state content standards (Marzano, 2006). Rubrics should teach material essential to the state curriculum and aligning learning goals to state standards is one way on accomplishing that task. The rubrics for this research study are aligned to the standards for 6th grade science curriculum and are separated into different levels of learning.

For this unit of study, the Volcano Unit rubric contains learning goals that are aligned to the standard and are differentiated based on levels of learning. According to Robert Marzano (2006) there are four major categories in a standards based grading rubric: advanced, proficient, basic and below basic. The rubric for the Volcano Unit are designed to rate each students learning on using these categories, however the rubric is separated into four levels, 0 – 4. The numbers communicate their level of learning for the unit. On the rubric for this study, a “0” represents no work collected from the student, a “1” represents “below basic”, a “2” represents
“basic” and a “3” represents “proficient” and a “4” represents “advanced”. In order for assessments to follow this scale, a rubric must be designed that separates the “basic” simpler concepts from the “proficient” more complex concepts.

The rubric’s scale creates a continuum that expresses distinct levels of knowledge and skill regarding the topic of Volcanoes. On the volcano unit rubric there will be basic knowledge, level 2 requirements that the students must learn in order to earn a basic score of at least a “2”. For student to reach the “proficient” level, students must apply concepts from the basic learning goals “2” to reach the level “3” learning targets. The level “4” learning target has students apply the content out of the context of the unit, for example real life connections and experiences.

Levels 2, 3 and 4 contain different content required to complete each level, however, levels 0 and 1 do not. A level score of “1” indicates a student cannot independently; demonstrate competence of the level 2 content. A “0” indicates a student cannot, even with help, demonstrate competence or skill in any level (Marzano, 2006). All assignments and assessments are broken down into these levels and scored using the scale from 0-4 within the Volcano Unit.

Summary of Chapter

This research study focuses on the effect of unit rubrics on student academic achievement and motivation. Student academic achievement may increase because of the opportunity to self-assess their learning progress using a rubric. The students will also be able to receive feedback that specifies what they need to do in order to improve their learning. The rubric can be used to refer to specific learning a goal a
student needs to focus on and review to perform better on an assignment or assessment. When students are provided the tools in order to succeed and students experience success in learning, student motivation to perform well may also increase. Rubric are the essential tools in increasing student academic achievement and motivation.
Chapter Three: Methodology

Student motivation and learning can be effected in a variety of ways. The focus of this research looks at how Unit Rubrics can help motivate 6th grade students to excel academically in science. Rubrics are a great tool for assessments because expectations are clear. Having clear expectations articulated throughout a unit allows constructive feedback to be provided to help students improve academically. Rubrics also allow students to reflect on their progress throughout a unit and develop strategies for themselves that will help them progress throughout the unit. Within this chapter the design, participants, instruments, procedures and analysis about the research study will be discussed. The research questions that will guide the research study are:

- How do rubrics affect student motivation throughout a unit?
- How rubrics affect student academic achievement?

Design

The study employed quantitative research methodologies. Two 6th grade science units were taught, one unit was not provided a unit rubric and one unit was provided a unit rubric to guide student-learning expectations. Motivation survey responses and unit assessments for the Earthquake and Volcano Units were collected, analyzed and compared between the two units. The purpose of this study is to determine if there is an increase in motivation and achievement with the use of a unit rubric.
Participants

The classroom for this research study is located in a kindergarten through eighth grade school in the Southern California Inland Region. The population of students within the school are 2% African American, 1% American Indian, 1% Asian, 69% Latino, 25% White, 0.4% Pacific Islander/Filipino and 1.6% no response. In addition, approximately 58% low socioeconomic status students that receive free and reduced lunches. The location of the research study is in a 6th grade science classroom, totaling to 109 students. Within the students participating in the study, 59 are females and 50 are males. Twenty of the students receive special education services. Twenty-four of the students are English Language Learners, with levels ranging from English Language Development Level 3 to the redesignated level. All students in the 6th grade science classes, split into 4 sections, will participate in the two units of study because the research will be part of the regular education curriculum.

Instruments

The first unit of study for this research was on Earthquakes. The 6th grade Science California State Content Standards regarding teaching Earthquakes are the following:

- “Students know that earthquakes are sudden motions along breaks in the crust called faults” (California State Standard, Grade 6, Standard, 1d, pp. 86-87).
- “Students know how to determine the epicenter of an earthquake and know that the effects of an earthquake on any region vary, depending on the size of
the earthquake, the distance of the region from the epicenter, the local
geology, and the type of construction in the region” (California State
Standard, Grade 6, Standard, 1g, pp. 86-87).

The second unit of study is on Volcanoes. The 6th grade Science California State
Content

Standards for teaching Volcanoes are the following:

- “Volcanoes and fissures are locations where magma reaches the surface.”
  (California State Standard, Grade 6, Standard, 1d -1f, pp. 86-87)
- “Students know how to explain major features of California geology
  (including mountains, faults, volcanoes) in terms of plate tectonics.”
  (California State Standard, Grade 6, Standard, 1f, pp. 86-87)

In addition to using the California State Standards to establish learning goals these
instruments were also used in the research study: Volcano unit rubric, Earthquake an
Volcano unit surveys, and formative and summative assessments for the Earthquake
and Volcano unit.

**Rubric**

The unit rubric (see Appendix C) was specifically created to inform students
of the learning goals for the Volcano unit. It covered the structure of a volcano,
location of volcanoes, and different types of volcanoes that can be formed based on
the different locations. The rubrics ranged from 0 to 4, however the rubrics main
levels of learning were level 2 and level 3. According to Robert Marzano, students
should be assessed on these two levels: knowledge and reasoning (2006). Level 2
represents the “knowledge” based material and level 3 concepts represent the “reasoning” based material. Knowledge based learning, level 2, contains content that students must learn to reach a proficient level of learning for the unit. The reasoning, level 3 learning, contains content that allows students to apply the knowledge obtained from level 3. This allows students to separate material that they need to learn, level 2, and what material is considered advanced learning, level 3. If a student scored a “1” on the rubric the student requires help to demonstrate knowledge at the different levels. If a student scored a “4” on the rubric the student has demonstrated independent learning of the level 2 and 3 material and can connect the content to outside resources or experiences.

Survey

The motivation survey students were given to students before the unit test for each unit was modified from the Morgan-Jinks Student Efficacy Scale (1994). The surveys (See Appendix A and B) were implemented before the tests for each unit and measure efficacy levels. The Earthquake Survey (See Appendix A) was given before the Earthquake unit test and the Volcano Survey was given before the Volcano unit test. The surveys were measured using a Likert scale ranging from one to four. The survey responses were: (1) really disagree; (2) kind of disagree; (3) kind of agree; and (4) really agree. The Higher score on the motivation surveys show that students are willing to put forth more effort towards their assignments and assessments. The Volcano Survey has two additional questions were added (see Appendix B): “Clear expectations in the rubric made me work harder” and “I will do better on the Volcano
unit test than the Earthquake unit test.” These two questions are specific to the effectiveness use of rubrics during the unit.

The Morgan-Jinks Student Efficacy Scale (MJSES) was used for this research study mainly because the surveys focused on student efficacy related to school success (2004). The questions and the scale were written in student friendly terminology. Therefore, students were less confused about the questions and were comfortable with the survey choices. The MJSES had undergone development to ensure validity and reliability using the DeVellis’s (1991) Scale Development. The MJSES was also positively correlated with academic achievement (2004). Therefore, using the MJSES can help make the connection between motivation and academic achievement analysis within this research study.

Assessments

The two assessments given were quizzes and unit tests. Quizzes were given in the middle of the unit. The assessments for each unit, Earthquakes and Volcanoes, consisted of 30 multiple-choice questions. The questions were separated into level 2 and level 3 type questions. Students had to earn a specific amount of correct responses to earn a specific level of understanding score. The level of understanding scores range from 1 to 4. The multiple-choice only go up to the level 3, but the students were given a bonus level 4 free response questions to answer. The level 4 question allows students to apply the material taught to real-life situations. The unique scoring policy for this unit requires each assessment is modified to fit the level
of understanding scoring method. Therefore, all the questions on the assessments were rephrased by the researcher to make the survey more accessible to middle school students.

The motivation survey students are asked to take before the unit test for each unit was modified from the 1994 Morgan-Jinks Student Efficacy Scale (See Appendix A). The survey questions focus on student efficacy levels. Higher score on the motivation surveys show that students are willing to put forth more effort towards their assignments and assessments. The Volcano Survey has two additional questions were added (see Appendix B): “Clear expectations in the rubric made me work harder” and “I will do better on the Volcano unit test than the Earthquake unit test.” These two questions are specific the effective use of rubrics during the unit.

**Procedures**

During this research study, there were six major steps:

1. Taught an Earthquake Unit for three weeks.
2. Students took a formative assessment quiz on the Earthquake Unit at the midpoint of the unit.
3. Students took an Earthquake survey on motivation at then end of the unit the day before the unit test.
4. Students took the summative assessment unit test on the Earthquake Unit.
5. Taught a Volcano Unit for three weeks. The unit rubric was provided at the beginning of the unit allowing students to refer to the rubric throughout the unit.
6. Students took a formative assessment quiz on the Volcano Unit at the midpoint of the unit.

7. Students took a Volcano survey on motivation at then end of the unit the day before the unit test.

8. Students took the summative assessment unit test on the Volcano Unit.

Teaching the Earthquake Unit

A three-week sixth grade unit on Earthquakes was taught to students without providing students with a rubric. However, the unit still taught the content standards required for 6th grade science students. There was just no rubric created to communicate the learning goals to the students. During the unit, the following activities were included: lectures, not taking, reflective writing and thinking, drawings and labs.

Earthquake Survey on Motivation

At the end of the Earthquake unit but before the summative unit test, the students took an anonymous survey (see Appendix A). The survey included an assortment of Likert scale questions, ranging from 1 to 4, to determine the students' perception of their learning and motivation for learning about Earthquakes. All the student responses were calculated for the mean for each survey question. Students' grades were not affected by their participation or lack of participation in the survey.

Earthquake Unit Assessments

Students were given a formative and summative assessment on Earthquakes. The formative assessment (See Appendix D) was given in the middle of the unit to
allow students to check their current level of understanding. The summative assessment (See Appendix E) was the unit test given on the last day of the unit to measure students’ final understanding of Earthquakes. The formative and summative assessment scores for all the students were calculated for the mean and the mode. These calculations were analyzed for the research study, not individual student scores. The formative and summative assessments were compared to each other and the survey responses as well.

**Teaching the Volcano Unit**

A three-week sixth grade unit on Volcanoes was taught to students while providing students with a rubric that clarifies the learning goals and outcomes for the unit. At the beginning of the unit, we went over the learning goals. This was the first time the students have worked with a unit rubric. During the unit, the following activities were included: lectures, not taking, reflective writing and thinking, drawings and labs.

**Volcano Survey on Motivation**

At the end of the Volcano unit but before the summative unit test, the students took an anonymous survey (see Appendix B). The survey included an assortment of Likert scale questions, ranging from 1 to 4, to determine the students’ perception of their learning and motivation for learning about Volcanoes. All the student responses were calculated for the mean for each survey question. Students’ grades were not affected by their participation or lack of participation in the survey.
Volcano Unit Test

Students were given a formative and summative assessment on Volcanoes. The formative assessment (see Appendix F) was given in the middle of the unit to allow students to check their current level of understanding. The summative assessment (see Appendix G) was the unit test given on the last day of the unit to measure students' final understanding of Volcanoes. The formative and summative assessment scores for all the students were calculated for the mean and the mode. These calculations were analyzed for the research study, not individual student scores. The formative and summative assessments were compared to each other and the survey responses as well. The final assessment scores for all the students were calculated for the mean. These calculations were analyzed for the research study, not individual student scores.

Thesis Analysis

There were two types of data collected and analyzed: motivation surveys and assessments. One piece of data that was analyzed was the student motivation surveys from the Earthquake and Volcano unit. The responses for each question were calculated for the mean and mode. The Earthquake and Volcano motivation survey responses were compared to one another and analyzed to determine if student efficacy increased after the Volcano Unit, which had rubrics provided to students.

The second piece of data analyzed was student test scores. No individual scores were used for analysis; the scores' mean and mode for each quiz and unit test were calculated. The Earthquake and Volcano Unit test score averages were
compared to one another. The scores were analyzed to determine if student academic achievement increased with the use of rubrics during the Volcano Unit.

Summary of Chapter

This research study was a quantitative study that analyzed student motivation responses and unit test scores for the Earthquake and Volcano Unit. There were 109 students involved in the study and they enrolled in 6th grade science. The Earthquake Unit served as the control where no rubric was provided to the students. The Volcano Unit was the experimental unit where students were provided a rubric that communicated the learning goals for the entire unit. Each unit was a 3-week unit and was taught using lectures, note taking, reflective writing, drawings and labs. The motivation surveys for each unit were taken the day before the unit test was given to the students. The motivation surveys and unit test scores were compared between the Earthquake and Volcano Unit to demonstrate an increase in student motivation and achievement with the use of rubrics during the Volcano Unit.
Chapter Four: Data Analysis

Students are expected to learn a lot of material throughout a unit. Rubrics help breakdown what they are expected to learn throughout a unit. During this research study rubrics are used to determine if they increase student motivation and academic achievement. The research questions for the study are:

- How do rubrics affect student academic achievement?
- How do unit rubrics affect student motivation?

Within this chapter, data from the formative assessment quizzes, survey responses and unit tests are provided for the Earthquake Unit and Volcano Unit. The Earthquake Unit did not provide a rubric for the students that clarified the learning goals for the unit. However, the Volcano Unit did provide a rubric for the students. The median, most frequent number, and mean, average, were calculated for quizzes, surveys and unit tests in this chapter. Individual scores for each set of data were not collected or analyzed. The survey responses did not affect the students' assessments scores. All three pieces of data are analyzed and compared with one another to determine how rubrics affect student motivation and academic achievement. Within this chapter, data will be presented about Earthquake and Volcano Unit surveys and assessments, followed by the data analysis section.

Data Presentation

The data collected for this study contains quiz scores, survey responses and unit test scores for the Earthquake and Volcano Units. Quizzes were given to
students midway through the unit. The survey was given to students the day before the unit tests. Finally, the unit test was given to students on the last day of the unit.

This section of the chapter will have the median and mode displayed for the two assessments, quizzes and unit tests. Survey response means will also be displayed for each unit. The results obtained will help determine the effect of unit rubrics on motivation and academic achievement.

Earthquake Unit

The Earthquake unit is a three-week unit taught to students where no rubric was provided to students that clearly communicated the learning goals for this unit. The unit still covered the content standards required for 6th grade science students. During the unit, the following activities were included: lectures, not taking, reflective writing and thinking, drawings and labs.

Table 1 displays the mean and the mode for the 109 students that took the Earthquake Quiz and Test. The quiz was given to student halfway through the unit for students to check for their current level of understanding on Earthquakes (See Appendix D). The test was given to students on the last day of the unit (See Appendix E). The assessments were created in order to incorporated the levels, ranging from 0 (really disagree) to 4 (really agree). The quiz and test covered these California State Science Standards:

- “Students know that earthquakes are sudden motions along breaks in the crust called faults” (California State Standard, Grade 6, Standard, 1d, pp. 86-87).
"Students know how to determine the epicenter of an earthquake and know that the effects of an earthquake on any region vary, depending on the size of the earthquake, the distance of the region from the epicenter, the local geology, and the type of construction in the region" (California State Standard, Grade 6, Standard, 1g, pp. 86-87).

Table 1

Earthquake Assessment Results for 109 6th Grade Science Students

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Mean</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake Quiz</td>
<td>1.68</td>
<td>1.50</td>
</tr>
<tr>
<td>Earthquake Test</td>
<td>2.03</td>
<td>1.50</td>
</tr>
</tbody>
</table>

The Earthquake Quiz and Test were created and scored using a scoring range from 0 to 4. The questions were separated from basic knowledge questions (Level 2) to reasoning and skill questions (Level 3) and an advanced question (Level 4). A score of (0) shows no learning of material even with assistance; a (1) shows minimal learning of the knowledge based concepts (Level 2 questions); a score of a (2) demonstrates learning of the knowledge based concepts; a score of a (3) expresses the student proficiently understands the concept of Earthquakes from the knowledge based questions and reasoning questions. Based on the results displayed in Table 1, the students increased the mean calculation from the Earthquake Quiz to the Test. However, the mode for each assessment remained at a 1.5.
Table 2 displays the mean and mode for the 106 students that took the survey. Three students were absent the day the surveys were provided to students. To insure students had enough time to complete the unit test in one class period, the Earthquake Survey was given to students the day before the test. The survey was on a Likert scale and the response options were: (1) really disagree; (2) kind or disagree; (3) kind of agree; and (4) really agree. Individual student names were not connected to any survey taken and their participation did not affect their assessment scores.
Table 2

_Earthquake Survey Results for 103 6th Grade Science Students_

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I work hard in school.</td>
<td>3.11</td>
<td>3</td>
</tr>
<tr>
<td>2. I feel like I have little control of my grades.</td>
<td>2.37</td>
<td>3</td>
</tr>
<tr>
<td>3. I worry that I am not very good in school.</td>
<td>2.56</td>
<td>3</td>
</tr>
<tr>
<td>4. It doesn’t matter how much effort I put in my school work because I get</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>the same grade whether I try hard or not.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I feel good about my ability to do school work.</td>
<td>3.20</td>
<td>4</td>
</tr>
<tr>
<td>6. I understood my assignments for this unit.</td>
<td>3.16</td>
<td>3</td>
</tr>
<tr>
<td>7. I understood what I was expected to do for each assignment for this unit</td>
<td>3.03</td>
<td>3</td>
</tr>
<tr>
<td>8. The assignments helped me understand the material for this unit.</td>
<td>3.17</td>
<td>3</td>
</tr>
<tr>
<td>9. I worked harder on the assignments than most of my classmates did for</td>
<td>2.67</td>
<td>3</td>
</tr>
<tr>
<td>this unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I will do well on this unit’s test.</td>
<td>3.15</td>
<td>3</td>
</tr>
</tbody>
</table>
UNIT RUBRICS IN MIDDLE SCHOOL

The Earthquake Survey was on a Likert scale and the response options were: (1) really disagree; (2) kind or disagree; (3) kind of agree; and (4) really agree. One hundred and six sixth grade science students' responses were calculated for the mean and mode for each question on the survey. Individual student names were not connected to any survey taken and their participation did not affect their assessment scores.

Volcano Unit

The Volcano Unit is a three-week unit taught to students where a unit rubric was provided to students that clearly communicated the learning goals for this unit. The unit rubric learning goals were based from the content standards required for 6th grade science students. The students were given the rubric and guided through reading the rubric on the first day of the Volcano Unit. The rubric was also referred to several times during the unit. During the unit, the following activities were included: lectures, not taking, reflective writing and thinking, drawings and labs. All and assessments were assignments were aligned to the rubric learning goals.

Table 3 displays the mean and the mode for the 109 students that took the Volcano Quiz and Test. The quiz was given to student halfway through the unit for students to check for their current level of understanding on Volcanoes (See Appendix F). The test was given to students on the last day of the unit (See Appendix G). The assessments were also created in order to incorporated the rubric levels, ranging from 0 to 4. Each question written covered a specific Volcano Rubric.
expectation and was labeled on the exam. The quiz and test covered these California State Science Standards:

- "Students know evidence of plate tectonics is derived from the fit of the continents; the location of volcanoes" (California State Standard, Grade 6, Standard, 1a, pp. 86-87).
- "Students know major geologic events, such as volcanic eruptions, result from plate motions" (California State Standard, Grade 6, Standard, 1e, pp. 86-87).
- "Students know how to explain major features of California geology (including volcanoes) in terms of plate tectonics" (California State Standard, Grade 6, Standard, 1f, pp. 86-87).

Table 3

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Mean</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volcano Quiz</td>
<td>2.11</td>
<td>2.50</td>
</tr>
<tr>
<td>Volcano Test</td>
<td>1.79</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Similar to the Earthquake Quiz and Test, the Volcano Unit assessments were also created and scored using a scoring range from 0 to 4. The questions were separated from basic knowledge questions (Level 2) to reasoning and skill questions (Level 3) and an advanced question (Level 4). A score of (0) shows no learning of material even with assistance; a (1) shows minimal learning of the knowledge based
concepts (Level 2 questions); a score of a (2) demonstrates learning of the knowledge based concepts; a score of a (3) expresses the student proficiently understands the concept about Volcanoes from the knowledge based questions and reasoning questions. The main differences between the Earthquake and Volcano Unit was that the Volcano Unit provided students with a unit rubric at the beginning of the unit to communicate with students the learning goals. The Earthquake Unit did not provide a rubric to communicate learning goals to the students. Based on the results displayed in Table 3, the students decreased the mean and mode calculation from the Volcano Quiz to the Test.

Table 4 displays the mean and mode for the 104 students that took the Volcano Survey. Five students were absent the day the surveys were provided to students. The survey was given to the students prior the Volcano Test on the same day.
Table 4

*Volcano Survey Results for 104 6th Grade Science Students*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I work hard in school.</td>
<td>3.24</td>
<td>3</td>
</tr>
<tr>
<td>2. I feel like I have little control of my grades.</td>
<td>2.46</td>
<td>3</td>
</tr>
<tr>
<td>3. I worry that I am not very good in school.</td>
<td>2.70</td>
<td>3</td>
</tr>
<tr>
<td>4. It doesn’t matter how much effort I put in my school work because I get the same grade whether I try hard or not.</td>
<td>2.04</td>
<td>1</td>
</tr>
<tr>
<td>5. I feel good about my ability to do school work.</td>
<td>3.16</td>
<td>3</td>
</tr>
<tr>
<td>6. I understood my assignments for this unit.</td>
<td>3.06</td>
<td>3</td>
</tr>
<tr>
<td>7. I understood what I was expected to do for each assignment for this unit</td>
<td>3.07</td>
<td>3</td>
</tr>
<tr>
<td>8. Clear expectations for each assignment made me work harder towards a my specific goal.</td>
<td>2.90</td>
<td>3</td>
</tr>
<tr>
<td>9. The assignments helped me understand the material for this unit.</td>
<td>3.07</td>
<td>3</td>
</tr>
<tr>
<td>10. I worked harder on the assignments than most of my classmates did for this unit</td>
<td>2.51</td>
<td>3</td>
</tr>
<tr>
<td>11. I will do well on this unit’s test.</td>
<td>3.19</td>
<td>3</td>
</tr>
<tr>
<td>12. I will do better on this unit’s test than last unit’s.</td>
<td>3.18</td>
<td>3</td>
</tr>
</tbody>
</table>
The Volcano Survey was on a Likert scale and the response options were: (1) really disagree; (2) kind or disagree; (3) kind of agree; and (4) really agree. One hundred and four sixth grade science students’ responses were calculated for the mean and mode for each question on the survey. Individual student names were not connected to any survey taken and their participation did not affect their assessment scores.

**Interpretation of Data**

The mean and mode of the Earthquake Unit Test and Volcano Unit Test were calculated to determine if student academic achievement increased with the use of unit rubrics during the Volcano unit. For the Earthquake Unit Test the mean was 2.03 and mode was 1.50. For the Volcano Unit Test the mean was 1.79 and the mode was 1.50. Based on the results there was no significant increase in student academic achievement when a unit rubric was provided during the Volcano Unit. Rubrics were expected to be a tool to increase academic achievement through self-assessment (Ross, 2006) and providing specific feedback (Marzano, 2006). The results did not support the use of rubrics increase student academic achievement.

The unit quizzes were used to determine student achievement with the units of study. During the Earthquake Unit the mean increased from 1.68 to 2.03 from the quiz to the test; however, the mode remained the same at 1.50. This shows that there was a slight increase in student achievement during the Earthquake Unit, where no rubric was provided. During the Volcano Unit, the mean decreased from 2.11 to 1.79 and the mode decreased from 2.50 to 1.50 from the quiz to the unit test. However,
when comparing the mean and mode for quiz scores, academic achievement did increase. This may have occurred because the quiz covered material that was simpler and easier for students to comprehend than the latter half of the unit. Overall, student academic achievement did not increase with the use of the unit rubrics during the Volcano Unit. The results with in the unit assessments also did not show support for rubrics increasing student academic achievement.

The Earthquake and Volcano Surveys were used to measure the effect of rubrics on student motivation. The Earthquake and Volcano Surveys contained ten questions that were the same, except the Volcano survey included two additional questions:

- "Clear expectations for each assignment made me work harder towards a my specific goal."
- "I will do better on this unit’s test than last unit’s."

Rubrics were expected to increase student motivation through self-assessment (Kitsantas, Reisner, and Doster, 2004) and feedback (Marzano, 2006). However, the responses for the ten questions that were the same displayed no significant change in student motivation. Therefore, the results did not support the research of rubrics increasing student academic achievement and motivation.

The two additional questions on the Volcano Survey expressed that students’ mainly agreed (2.90) that the expectations for each assignment were clear and made them work hard towards the goal. Students also agreed (3.18) that that they were going to do better on the Volcano Unit Test than the Earthquake Unit Test.
Even though students did not perform better on the Volcano Unit Test than on the Earthquake Unit Test, the students believed they were going to do better on the Volcano Unit Test. Therefore, student efficacy or motivation did improve during the Volcano Unit than in the Earthquake Unit with the use of the unit rubric in the research study. However, based on Schunk’s research (1983) on efficacy, if student have high levels of efficacy they have a higher probability of success. Schunk’s research (1983) was not supported in this research study.

**Summary of Chapter**

Multiple unit assessments were used to measure the effect of a unit rubric on student academic achievement. Based on the data collected and analyzed student achievement did not increase with the use of a unit rubric. Unit surveys were used in order to measure the effect of a unit rubric on student motivation. The survey questionnaire did not show significant increase in the questions that were the same on the Earthquake and Volcano Surveys. However, the additional questions on the Volcano questions did demonstrate that students felt the lesson expectations were clear and helped them complete assignments to reach their goal and their level of efficacy for their performance on the Volcano Unit Test was high.
Chapter Five: Recommendations

The focus of this research looks at how Unit Rubrics can help motivate 6th grade students to excel academically in science. Rubrics provide clear expectations to the students and help communicate specific feedback to the students (Mertler, 2001; Ross, 2006). The research questions that this study focuses on are:

- How rubrics affect student academic achievement?
- How do rubrics affect student motivation throughout a unit?

During this research study, there were two units of study. The first unit focused on Earthquakes and no unit rubric was provided to students. The second unit of study was on Volcanoes, and students were provided with a unit rubric at the beginning of the unit. Student quizzes and unit tests were collected and calculated for the mean and mode for data analysis. Survey responses from the students were also collected and calculated for the mean and used for data analysis as well. The results for the study employed quantitative research methodologies. Within this chapter there will be: a findings summary, interpretation of findings, finding within the context, implications of the study, limitations of study, and future direction of research study.

Summary of Findings and Interpretations

The purpose of this research study was to determine the effect of rubrics on student academic achievement and motivation. There were one hundred and nine 6th grade science students in this study. The school the students attended consisted of a diverse low-income population in a Southern California school. The students were in their regular classroom setting with their regular science teacher. The research study
UNIT RUBRICS IN MIDDLE SCHOOL

consisted of two three-week units, and Earthquake Unit and Volcano Unit. The material for each unit followed the California State Standards and was taught using lectures, note taking, reflective writing, drawing and labeling. The Earthquake Unit was the control, where no rubric was provided to the students. The Volcano Unit was the experimental unit where a rubric that communicated the learning goals for the unit was provided to the students. In the middle of each unit, the students took a quiz, and on the last day of each unit, the students took a unit test to measure academic achievement. Student motivation was measured the day before the unit test by giving the students a motivation survey. The results from the assessments and the survey were calculated for the mean and the mode. The results where then compared between the Earthquake Unit and Volcano Unit to determine if rubrics increase academic achievement and motivation.

Research revealed that rubrics could have a positive impact on student academic achievement and motivation. Rubrics were expected to show an increase in academic achievement through self-assessment (Ross, 2006) and providing specific feedback (Marzano, 2006). Rubrics were also expected to demonstrate an increase in student motivation with the use of self-assessment (Kitsantas, Reisner, and Doster, 2004) and providing specific feedback (Marzano, 2006).

The results from the research study did not support the previous research on rubrics increasing student academic achievement and motivation. The mean and mode for the unit test scores between the Earthquake Unit and Volcano Unit showed a decrease in the scores. Therefore, this did not support that the use of rubrics
increase student academic achievement. The volcano quiz assessment and the
Volcano Unit Test scores also revealed decrease scores within the experimental unit
where a rubric was provided. The results again do not support that rubrics have a
positive effect on student academic achievement in this research study. The survey
responses did not show a significant increase in student motivation with the use of
rubrics either.

The results obtained from this research study may have been influenced by the
uniqueness of the school. The school is currently transitioning into incorporating
learning goals into the classroom. At other school sites and districts, learning goals
have been incorporated and used regularly with their students. This may have
affected the participants in this research study because they have not been exposed to
learning goals on a regular basis and may not be mentally prepared to comprehend the
purpose of communicating learning goals. Therefore, when the students were
provided a unit rubric that listed the learning goals for the entire unit, the students
may have been overwhelmed and did not comprehend the purpose of the unit rubric.
The rubrics where then not used to its full potential during the research study. The
students were not able to properly self-assess their learning progress throughout the
Volcano Unit. They were also not able to fully comprehend the feedback provided
referring to the rubric because of their unfamiliarity with the learning goals on a
rubric. The students were not readily exposed to using learning goals in the
classroom on a regular basis, which may have caused the ineffective use of the
rubrics during this research study.
Implications

Rubrics are an effective tool that does allow the opportunity for students to self-assess their work and learning (Ross, 2006). Rubrics also allow teachers to provide specific feedback to students to communicate what the students can do to improve (Marzano, 2006). However, in order to benefit the most from the use of rubrics, rubrics must be used in the classroom consistently.

Consistently using rubrics in the classroom will allow student to be comfortable using rubrics. Then rubrics can become effective and increase student academic achievement and motivation because student will be able to regularly monitor their progress and teachers will be able to communicate specific feedback frequently. Only allowing students to use rubrics a few times does not provide adequate time for students and teacher to become accustomed to the use of rubrics. Therefore, the rubrics will not be effective in student learning.

Rubrics should also be aligned to the state standards. Therefore, the teachers, parents, students and administration know the goals on the rubric follow the state curriculum goals as well. The use of standard aligned rubrics may also increase student state test scores and well increase student overall learning in the classroom.

Limitation of Study

One limitation to the study is that there are 109 different sixth graders with different backgrounds in their knowledge of Earthquakes and Volcanoes. Not all 109 students had the same fifth grade teacher. Therefore, the units being taught on Earthquakes and Volcanoes may be review or new to the student.
A second limitation is the different levels of personal interest of Earthquakes and Volcanoes. For the study I picked units that might gain a similar interest level for each topic, however some students may favor one topic versus the other. The students’ different levels of interests for each topic may affect their motivation during the unit in fulfilling activities and taking the assessments.

A third limitation is that some students may be absent during the units of study. The absences will cause students to have to review material on their own time and they will not get the same exposure to the material like the rest of the students. Students may also be absent on the days surveys are given or when the final assessment is given. The student will have to make it up on a different day than the rest of the students.

A final limitation to the study is the use of only a Likert scale to measure student motivation. A Likert scale does not allow students to express their personal thoughts about the survey questions. Therefore, the students can no explain their responses to the raters. Another limitation to using a Likert scale survey is that the interpretation of the scale may be different for every person. Even if the responses specifically state “1” means really disagree, “2” means disagree, “3” means agree, and “4” means really agree, the responses may mean something different to each individual taking the survey.

Future Direction

This research study was only implemented for a week period. Students may not have had enough time to work with the rubric and familiarize themselves to using
unit rubrics. Teachers may also not refer to the rubric often because it is not part of their routine. For future studies, implementation should be throughout the whole year. This allows teachers and students to practice using unit rubrics.

For future implementation, the same methodology may be followed, where the unit rubrics are provided at the beginning of the rubric, referred to throughout the unit and assessed at the end of the unit. Students may be asked to reflect on their learning after assignments and may peer edit their work more often since unit rubrics will be part of the routine curriculum throughout the year.

Summary of Chapter

Rubrics can be an effective tool in an educators “tool box” because rubrics clearly communicate learning expectations to the students. Students are also able to be active participants in their learning because they can be given the opportunity to monitor their learning through self-assessing their work with the use of rubrics. Educators can also guide students better by providing specifically communicating to students what they can do to improve by simply referring to a rubric. Students would no longer have to “guess” on what they have to correct in order to improve. With clear expectations and detailed feedback, students are bound to academically succeed and become more motivated to perform well in school because school will no longer be a “guessing game”. However, in order for rubrics to be the most beneficial, rubrics must be consistently used in the classroom. Educators will need to take the time to create standard aligned rubrics, design lessons and assessments that follow the rubric, allow time for students to self-assess, and revise work to demonstrate
improvement. Using rubrics properly in class to be the most effective does require a lot of work, however; the gain in student learning and motivation is priceless.
References


## Earthquakes Survey

<table>
<thead>
<tr>
<th>Statement</th>
<th>Really Disagree</th>
<th>Kind of Disagree</th>
<th>Kind of Agree</th>
<th>Really Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I work hard in school.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. I feel like I have little control of my grades.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. I worry that I am not very good in school.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. It doesn’t matter how much effort I put in my school work because I get the same grade whether I try hard or not.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. I feel good about my ability to do school work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. I understood my assignments for this unit.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. I understood what I was expected to do for each assignment for this unit.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. The assignments helped me understand the material for this unit.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. I worked harder on the assignments than most of my classmates did for this unit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. I will do well on this unit’s test.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
## Volcano Survey

<table>
<thead>
<tr>
<th>Statement</th>
<th>Really Disagree</th>
<th>Kind of Disagree</th>
<th>Kind of Agree</th>
<th>Really Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I work hard in school.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. I feel like I have little control of my grades.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. I worry that I am not very good in school.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. It doesn’t matter how much effort I put in my school work because I get the same grade whether I try hard or not.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. I feel good about my ability to do school work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. I understood my assignments for this unit.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. I understood what I was expected to do for each assignment for this unit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. Clear expectations for each assignment made me work harder towards a my specific goal</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. The assignments helped me understand the material for this unit.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. I worked harder on the assignments than most of my classmates did for this unit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. I will do well on this unit’s test.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12. I will do better on this unit’s test than last unit’s.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
## Appendix C
### Volcano Unit Rubric

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>4</th>
<th>In addition to Level 3.0 performance, the student provides further insight by making connections with other components of the real world, other units, or themselves that go beyond what was taught in class.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.5</td>
<td>In addition to Level 3.0 performance, the student provides further insight by making connections with other components of the real world, other units, or themselves with PARTIAL success.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>In addition to Level 2.0 performance, the student exhibits NO major errors or omissions of more complex information such as:</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>The student demonstrates PARTIAL knowledge of the more complex ideas and processes stated in level 3.0 and there are NO major errors or omissions regarding the simpler details and processes stated in level 2.0.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>There are NO MAJOR ERRORS or OMISSIONS regarding the simpler details and processes such as:</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>The student demonstrates partial knowledge of the simpler details and processes stated in level 2.0, but there are major errors or omissions regarding the more complex ideas and processes stated in level 3.0.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>With help, the student shows partial understanding of some of the simpler details and processes stated in level 2.0, and some of the more complex ideas and processes stated in level 3.0.</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>With help, the student shows partial understanding of some of the simpler details and processes stated in level 2.0, and some of the more complex ideas and processes stated in level 3.0.</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>With help, the student shows NO understanding of some of the simpler details and processes stated in level 2.0, and some of the more complex ideas and processes stated in level 3.0.</td>
</tr>
</tbody>
</table>

**a. I can use “level 2 knowledge” to analyze unknown examples of volcanoes for the purpose of determining the sequence and different phases of Volcanic activity.**

1. Sequencing the process or stages of a volcanoes activity. (1a)

**b. I can use “level 2 knowledge” to analyze the different locations of volcanoes.**

1. Explain why volcanoes develop at certain locations on the Earth. (1e&f)
2. Analyzing maps and diagrams to predict the movement of plates and island volcanoes. (1f&f)

**a. I can name and describe the structure of a volcano.**

1. Identifying, describing and labeling the basic structures of a volcano. (1a)

**b. I can identify and describe the location of volcanoes.**

1. Identifying the plate boundaries where volcanoes appear. (1e&f)
2. Identifying and describing the Ring of Fire. (1e&f)
Appendix D

Quiz #: ______
February 8th, 2011

Earthquake Quiz

DO NOT WRITE ON ME PLEASE!

Level 2 Questions (12 Questions)

1) The energy of an earthquake is spread through Earth’s crust by:
   a. sound waves
   b. tsunamis
   c. seismic waves
   d. radiation waves
   e. convection currents

2) An earthquake is a form of _______ motion.
   a. convergent
   b. divergent
   c. transform
   d. subduction
   e. stick-slip

Use the diagram below to answer questions 3 - 5.

3) Identify the FOCUS in the diagram above? (Choose only ONE LETTER)
   Write your response on the ANSWER SHEET

4) Identify the FAULT in the diagram above? (Choose only ONE LETTER)
   Write your response on the ANSWER SHEET

5) Identify the EPICENTER in the diagram above? (Choose only ONE LETTER)
Write your response on the ANSWER SHEET

6) The release of built-up stored _______ causes earthquakes.
   a. aftershocks  
   b. stick-slip motion  
   c. S waves  
   d. P waves  
   e. potential energy

7) The location on the surface of the Earth where plates slide past one another and cause rocks to break is called a(n):
   a. focus  
   b. fault  
   c. stick-slip motion  
   d. epicenter  
   e. potential energy

8) The fastest type of seismic wave that arrives to an earthquake first is called a(n):
   a. tsunami wave  
   b. P-wave  
   c. S-wave  
   d. surface wave  
   e. body wave

9) _______ cause the rocks in the crust to move in a side-to-side direction.
   a. Tsunami waves  
   b. P-waves  
   c. S-waves  
   d. Surface waves  
   e. Epicenter waves

10) When a seismic wave researches Earth's surface it is known as a(n):
    a. tsunami wave  
    b. P-wave  
    c. S-wave  
    d. surface wave  
    e. body wave

11) Waves that travels inside the Earth are known as:
    a. convection currents  
    b. P-waves  
    c. S-waves  
    d. surface waves  
    e. body waves

12) _______ push and pull the rock in the crust.
    a. Tsunami waves  
    b. P-waves  
    c. S-waves  
    d. Surface waves  
    e. Body waves

Level 3 Questions (6 Questions)

13) Which of the following is NOT needed for stick-slip motion to occur?
I. Two pieces that are touching and can move past one another.
II. A magnetic charge between the two pieces.
III. Friction between the pieces strong enough to stop them from moving.

a. I only  
 b. II only  
 c. III only

d. II and III  
e. I, II and III

14) Identify which statement is **FALSE** about Earthquakes.

a. A fault is needed in order for an Earthquake to occur.
b. A fault is required in order to create a focus and epicenter.
c. A focus is required in order to have an epicenter.
d. A focus point on the surface of the Earth creates Earthquakes.
e. Seismic waves spread from the focus point.

15) Identify the relationship between Potential Energy and Focus.

I. Potential energy is stored at the focus.
II. Potential energy is released at the focus.
III. Potential energy is needed in order for the focus of an earthquake to be created.

a. I only  
 b. II only  
 c. III only

d. I and II  
e. I, II and III

16) Identify what makes P waves and S waves similar?

I. Both are Body waves.
II. Both start at the epicenter
III. Both start at the focus.

a. I only  
 b. II only  
 c. III only

d. I and II  
e. I and III

17) Identify what makes Body waves and Surface waves similar?

I. Both are equally damaging.
II. Both waves are how earthquakes travel through earth.
III. Both travel at the same speed.

a. I only  
 b. II only  
 c. III only

d. I and II  
e. II and III
18) Identify the location of when S waves first appear on the seismograph below:

![Seismograph recorded in the UK from a distant earthquake](image)

**Level 4 Question**

<table>
<thead>
<tr>
<th></th>
<th>Complete (C)</th>
<th>Partial (P)</th>
<th>Not there (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A and B have a few minor errors.</td>
<td>Part A and B have some minor errors and a few major errors.</td>
<td>Part A and B have many errors.</td>
<td></td>
</tr>
</tbody>
</table>

To earn a ....

Below is a map of the different plate boundaries.

**Part A**: Place "X"s on 2 locations on the map where you predict there will be a lot of earthquakes. Place "O"s on 3 locations on the map where you predict there will be a lot of Tsunamis originate (begin).

**Part B**: Based on Part A, what can you conclude about the relationship between Tsunamis and Earthquakes?

**Appendix E**

<table>
<thead>
<tr>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 16 = Complete</td>
<td>8 - 10 = Complete</td>
</tr>
<tr>
<td>8 - 11 = Partial</td>
<td>5 - 7 = Partial</td>
</tr>
<tr>
<td>0 - 7 = Not Yet</td>
<td>0 - 4 = Not Yet</td>
</tr>
</tbody>
</table>

TEST #: __________
February 16th, 2011
Earthquake TEST

DO NOT WRITE ON ME PLEASE!

Level 2 Questions (16 Questions)

19) Earthquakes are best described as a __________.
   a. convergent motion   d. subduction motion
   b. divergent motion   e. stick-slip motion
   c. transform motion

20) __________ are spread through Earth’s crust from the location of an Earthquake.
   a. sound waves
   b. seismic waves
   c. tsunamis
   d. radiation waves
   e. convection currents

Use the diagram below to answer questions 3 - 5.

21) Identify the FOCUS in the diagram above? (Choose only ONE LETTER)
   Write your answer on the ANSWER SHEET

22) Identify the FAULT in the diagram above? (Choose only ONE LETTER)
   Write your answer on the ANSWER SHEET

23) Identify the EPICENTER in the diagram above? (Choose only ONE LETTER)
   Write your answer on the ANSWER SHEET

24) Earthquakes are caused by the build up and release of ____________.
   a. aftershocks   b. stick-slip motion
c. S waves
d. P waves
e. potential energy

25) The location under the surface of the Earth where rocks to break and causes an Earthquake is called a(n):
a. focus
d. epicenter
b. fault
e. potential energy
c. stick-slip motion

26) The most damaging type of seismic wave that arrives to an earthquake last is called a(n):
a. tsunami wave
d. surface wave
b. P-wave
e. body wave
c. S-wave

27) ______ cause the rocks in the crust to move in a push and pull motion.
a. Tsunami waves
d. Surface waves
b. P-waves
e. Epicenter waves
c. S-waves

28) P waves and S waves are examples of _______ waves.
a. tsunami
d. surface
b. Convection
e. body
c. Epicenter

29) During our Epicenter lab last Friday, what was the measurement we had to take in order to locate the epicenter of an Earthquake?
a. The distance/time between the S and Surface Waves.
b. The distance/time between the P and S Waves.
c. The distance/time between the P and Surface Waves.
d. The location of the seismic stations on the map.
e. Change the measurement from km to cm to allow us to use the compass.

30) Waves that travels inside the Earth are known as:
a. convection currents
d. surface waves
b. P-waves
e. body waves
c. S-waves

31) How many seismic stations are needed in order to determine the epicenter of an earthquake.
a. 1
b. 2
32) Seismic waves are recorded and measured by an instrument called a

a. Seismograph
d. Seismic Waves
b. Seismologist
e. Body Waves
c. Epicenter

d. 4

e. 5

33) Identify the location of surface waves from the image below: Choose only 1 letter

16) Identify the location where all three circles intersect in the image below:

a. Focus
d. Seismic Waves
b. Epicenter
e. Earthquake
c. Fault

Level 3 Questions (10 Questions)

17) Identify which statement is TRUE about Earthquakes.
a. Stick slip motion causes potential energy to be stored.
b. A fault is required in order to create a focus and epicenter of an Earthquake.
c. Stick slip motion occurs at the epicenter.
d. A focus point on the surface of the Earth creates Earthquakes.
e. Seismic waves spread from the epicenter.

18) Which of the following IS NEEDED for stick-slip motion to occur?

I. Two pieces that touch and move past one another.
II. Potential energy is stored and released at the epicenter.
III. Potential energy is stored and released at the focus.

a. I only  
b. II only  
c. III only  
d. I and II  
e. I and III

19) What is the relationship between the Focus and Potential Energy?

a. The focus of an earthquake causes potential energy to be stored.
b. The focus releases potential energy straight to the epicenter.
c. Potential energy is stored and released at the focus.
d. Potential energy and the focus occur at the same time.
e. Potential energy is continuously released at the focus non-stop.

20) Identify what makes Seismic Waves and Surface Waves similar?

I. Can cause equal amounts of damage.
II. Both travel at the same speed through the Earth.
III. Both start at the focus.

a. I only  
b. I only  
c. III only  
d. I and III  
e. I, II, and III

21) Identify what makes Body waves and Surface waves different?

I. Surface waves can cause more damage.
II. Body waves arrive before Surface waves to an Earthquake.
III. Body waves travel faster than Surface Waves.

a. I only  
b. II only  
c. III only  
d. I and II  
e. I, II and III

22) Which of the following could you determine if you knew only the arrival times of the P-waves and S-waves?

a. The direction to the earthquake.
b. The distance to the epicenter.
c. How far underground the earthquake focus is.
d. The exact location of the epicenter
e. What time an Earthquake will occur.

Use the table below to answer question 23 - 26

<table>
<thead>
<tr>
<th>A. Station Name</th>
<th>B. Arrival time difference between P- and S- wave (seconds)</th>
<th>C. Distance to epicenter (km)</th>
<th>D. Calculated distance to epicenter in (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vista</td>
<td>60</td>
<td>2500</td>
<td>5</td>
</tr>
<tr>
<td>2. Bakersfield</td>
<td>10</td>
<td>500</td>
<td>1</td>
</tr>
<tr>
<td>3. San Francisco</td>
<td>20</td>
<td>1500</td>
<td>3</td>
</tr>
<tr>
<td>4. Chico</td>
<td>15</td>
<td>1000</td>
<td>2</td>
</tr>
<tr>
<td>5. Napa Valley</td>
<td>30</td>
<td>2000</td>
<td>4</td>
</tr>
</tbody>
</table>

23) From the table, determine the scale ( ? km = 1cm) needed in order to complete Column D.
   a. 500              d. 30
   b. 50               e. need more information
   c. 300

24) Which city would have felt the Earthquake the strongest?
   a. Vista           d. Chico
   b. Bakersfield     e. Napa Valley
   c. San Francisco

25) Which city would have had the weakest Surface Waves?
   a. Vista           d. Chico
   b. Bakersfield     e. Napa Valley
   c. San Francisco

26) What could you infer (predict) from the table above?
   a. Vista and Napa Valley would the least damage from the Earthquake.
   b. Vista would have had the most damage from the Earthquake.
   c. All five cities would have felt the earthquake at the exact same time.
   d. The earthquake focus was right below Bakersfield.
   e. The earthquake was large enough to cause damage to buildings.

**Level 4 Question**
The diagram below shows two different sections of a fault. Section A has an average of 4 earthquakes per year. Section B has an average of 1 earthquake every 12 years. Which section would have the stronger earthquakes? Explain your reasoning.
Volcano Quiz

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Level 2 Questions (12 Questions) - All Level 2 questions cover 2a on the unit rubric.

1) Melted rock located inside a Volcano is known as:
   a. ava.
   b. magma.
   c. magma chamber.
   d. conduit.
   e. vent.

2) A volcano can be defined as:
   a. a mountain.
   b. a pile of dirt and rocks.
   c. an explosive mountain.
   d. an increase in pressure that finally slips and causes an eruption.
   e. an opening in the Earth’s crust that allows melted rock to escape.

Use the diagram below to answer questions 3 – 5.

3) Identify the LAVA in the diagram above? (Choose only ONE LETTER)
   Write your response on the ANSWER SHEET

4) Identify the MAGMA CHAMBER in the diagram above? (Choose only ONE LETTER)
   Write your response on the ANSWER SHEET

5) Identify the type of volcano above.
   a. Composite
   b. Shield
   c. Cinder Cone
   d. Krakatoa
e. Fire Fountain

6) __________ volcanoes are at the end of their life and are no longer able to erupt.
   a. Active
   b. Dormant
   c. Extinct
   d. Shield
   e. Cinder Cone

7) __________ volcanoes are not active now, but may become active again in the future.
   a. Active
   b. Dormant
   c. Extinct
   d. Composite
   e. Cinder Cone

8) __________ are erupting or have erupted recently, and are expected to erupt again in the near future.
   a. Active
   b. Dormant
   c. Extinct
   d. Composite
   e. Fire fountain

9) Identify the type of volcano that has the type of eruption displayed below:

   ![Image of a volcano erupting]

   a. Composite
   b. Shield
   c. Cinder Cone
   d. Krakatoa
   e. Stratovolcano

10) Low amounts of silica make magma that is:
    a. thick.
    b. sticky.
    c. dense.
    d. cooler in temperature.
11) __________ volcanoes have flat tops and have low eruption activity.

a. Composite  
b. Shield  
c. Cinder Cone  
d. Krakatoa  
e. Stratovolcano

<table>
<thead>
<tr>
<th>Low silica content</th>
<th>High gas content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiet eruption, lava flows easily</td>
<td>Fire fountain, lava flows easily</td>
</tr>
<tr>
<td>Thick, sticky magma</td>
<td>Thick, sticky magma</td>
</tr>
<tr>
<td>Runny magma, like syrup</td>
<td>Runny magma, bubbly</td>
</tr>
</tbody>
</table>

12) Using the chart above, identify the best description about a volcano that has low silica content and high gas content.

a. The volcano will have thick and sticky magma that erupts explosively.  
b. The volcano will have thick and sticky magma and will have an easy flow of lava.  
c. The volcano will have runny bubbly magma and will have lava flow easily.  
d. The volcano will have runny magma like syrup and will have lava flow easily.  
e. The volcano will have thick and sticky magma and will erupt quietly.

Level 3 Questions (6 Questions) - All Level 3 questions cover 3a on the unit rubric.

13) Using the chart above for assistance, identify the type of volcano that has low silica content and high gas content.

a. Composite  
b. Shield  
c. Cinder Cone  
d. Stratovolcano  
e. b and d

14) Using the chart above for assistance, identify the type of volcano that has low silica content and low gas content.

a. Composite  
b. Shield  
c. Cinder Cone  
d. Stratovolcano  
e. c and d

15) Using the chart above for assistance, identify the type of volcano that has high silica content and high gas content.
a. Composite  
  b. Shield  
  c. Cinder Cone  
  d. Stratovolcano  
  d. a and d

16) Identify what makes **Shield** Volcanoes and **Cinder Cone** Volcanoes similar?

I. Both contain a magma chamber.
II. Both contain low levels of silica content.
III. Both erupt quietly and lava flows easily.

a. I only  
  b. II only  
  c. III only  
  d. I and II  
  e. I and III

17) Identify what makes **Cinder Cone** Volcanoes and **Stratovolcanoes** similar?

I. Both have explosive eruptions.
II. Both contain high levels of silica content.
III. Both contain high levels of gas content.

a. I only  
  b. II only  
  c. III only  
  d. I and II  
  e. II and III

18) Place the following volcanoes in the order of the volcanic “life” stages from beginning to end.

A  
B  
C

Beginning of volcanic “life” stage → Ending of Volcanic “life” stage

a. A → B → C  
  b. A → C → B  
  c. B → C → A  
  d. C → B → A  
  e. C → A → B

4 Question
To earn a ....

<table>
<thead>
<tr>
<th>Complete (C)</th>
<th>Partial (P)</th>
<th>Not there (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A and B have a few minor errors.</td>
<td>Part A and B have some minor errors and a few major errors.</td>
<td>Part A and B have many errors.</td>
</tr>
</tbody>
</table>

Below is a map of the different plate boundaries.

**Part A:** Using your knowledge of plate boundaries and Earthquakes, PREDICT where you would expect to see Volcanoes appear by placing 5 “X”s on where you predict volcanoes exist.

**Part B:** Explain why you placed the “X”s in those specific areas. Remember to use academic language like the different types of plate movements that cause volcanoes to become formed. Also, use complete sentences. (Don’t forget the capital letter at the start of the sentence and a punctuation mark to end your sentence.

**Appendix F**

<table>
<thead>
<tr>
<th>Scores:</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 – 16</td>
<td>Complete</td>
<td>8 – 10</td>
</tr>
<tr>
<td>8 – 11</td>
<td>Partial</td>
<td>5 – 7</td>
</tr>
<tr>
<td>0 – 7</td>
<td>Not Yet</td>
<td>0 – 4</td>
</tr>
</tbody>
</table>

**TEST #:** ______

March 17th, 2011
Volcano TEST

DO NOT WRITE ON ME PLEASE!

Level 2 Questions (16 Questions)

1) What does the VEI number tell you about a volcano?
   a. How much lava is made.
   b. How explosive the eruption was.
   c. How much silica is in the magma.
   d. How tall the volcano is.
   e. How long the eruption lasted.

2) __________ volcanoes are not erupting now, but may erupt in the future.
   a. Active
   b. Dormant
   c. Extinct
   d. Hot Spot
   e. Composite

3) A volcano can be defined as:
   a. a mountain.
   b. a pile of dirt and rocks.
   c. an explosive mountain.
   d. an opening in the Earth’s crust that allows melted rock to escape.
   e. an increase in pressure that finally slips and causes an eruption.

4) High amounts of silica make magma that is:
   a. sticky.
   b. thick.
   c. dense.
   d. cooler in temperature.
   e. runny.

5) The ___________ is a region where MOST of the active volcanoes on
   Earth occur.
   a. Pacific Plate
   b. Ring of Fire
   c. Fire Fountain
   d. Active Volcano
   e. Plume
6) __________ volcanoes are tall, explosive, and cone-shaped.
   a. Dormant
   b. Hot Spot
   c. Composite
   d. Cinder Cone
   e. Shield

Use the diagram below to answer questions 7 - 9.

7) Identify the **Vent** in the diagram above? (*Choose only ONE LETTER*)
   
   *Write your answer on the ANSWER SHEET*

8) Identify the **Plume** in the diagram above? (*Choose only ONE LETTER*)
   
   *Write your answer on the ANSWER SHEET*

9) Identify the **Magma Chamber** in the diagram above? (*Choose only ONE LETTER*)
   
   *Write your answer on the ANSWER SHEET*
10) Most Volcanic Islands are formed away from the edge of plates due to ________ in the Earth.
   a. subduction  
   b. fire fountains  
   c. converging plates  
   d. diverging plates  
   e. hot spots

Level 2b2

11) During the volcano location lab we did in class, what did you notice about the location of most of the volcanoes on the Earth?
   a. Volcanoes usually form away from plate boundaries.
   b. Volcanoes usually form on land.
   c. Volcanoes usually form in bodies of water.
   d. Volcanoes usually form near the edge of plate boundaries.
   e. Volcanoes usually form where there is a build up of potential energy.

Level 2b2

12) When two plates ________________ the plates crash into one another and can cause one plate to go under the other.
   a. subduct  
   b. converge  
   c. diverge  
   d. transform  
   e. plume

Level 2b3

13) Identify the region on the map below where all the arrows are pointing towards.

   a. Pacific Plate  
   b. Active Volcanoes  
   c. Ring of Plume  
   d. Silica  
   e. Ring of Fire

Use the diagram below to answer questions 14 -
14) Identify the area of **subduction** in the diagram above? *(Choose only ONE LETTER)*

_Write your answer on the ANSWER SHEET_

15) Identify the area of **diverging** plates in the diagram above? *(Choose only ONE LETTER)*

_Write your answer on the ANSWER SHEET_

16) Identify the **hot spot** in the diagram above? *(Choose only ONE LETTER)*

_Write your answer on the ANSWER SHEET_

**Level 3 Questions (10 Questions)**

17) A volcano directly over a hot spot would be considered...?

   a. A dormant volcano  
   b. An active  
   c. An extinct  
   d. A cinder cone volcano  
   e. A shield volcano

18) Which of the following usually occur at the edge of plates?

   I. Subduction  
   II. Divergent  
   III. Hot Spots

   a. I and II  
   b. I and III  
   c. III only  
   d. I, II, and III

19) Identify what makes Divergent Plate Movement and Hot Spots different when it comes to forming volcanoes?

   I. Divergent plate movement contains volcanoes with low VEI numbers.  
   II. Divergent plate movement occurs at plate boundaries.  
   III. Divergent plate movement obtains magma from the aesthenosphere.

   a. I only
b. II only
c. III only
d. I and II
e. I, II and III

Level 3b2

20) The dots represent volcanoes on the map below. What caused most of these volcanoes to form?

![Map of volcanoes]

a. Divergent plates
b. Convergent plates
c. Hot Spots in the Earth
d. Subduction
e. Increase in plume height

Use the table below to answer questions 21 - 24.

<table>
<thead>
<tr>
<th>VEI/Description</th>
<th>Plume Size</th>
<th>Volume Height</th>
<th>Classification</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Nonexplosive</td>
<td>&lt;100 m</td>
<td>1,000 m³</td>
<td>Hawaiian</td>
<td>Daily</td>
</tr>
<tr>
<td>1 Gentle</td>
<td>100-1,000 m</td>
<td>10,000 m³</td>
<td>Hawaiian/Strombolian</td>
<td>Daily</td>
</tr>
<tr>
<td>2 Explosive</td>
<td>1-5 km</td>
<td>1,000,000 m³</td>
<td>Strombolian/Vulcanian</td>
<td>Weekly</td>
</tr>
<tr>
<td>3 Severe</td>
<td>3-15 km</td>
<td>10,000,000 m³</td>
<td>Vulcanian</td>
<td>Yearly</td>
</tr>
<tr>
<td>4 Cataclysmic</td>
<td>10-25 km</td>
<td>100,000,000 m³</td>
<td>Vulcanian/Plinian</td>
<td>10 years</td>
</tr>
<tr>
<td>5 Paroxysmal</td>
<td>&gt;25 km</td>
<td>1 km³</td>
<td>Plinian</td>
<td>100 years</td>
</tr>
<tr>
<td>6 Colossal</td>
<td>&gt;25 km</td>
<td>10 km³</td>
<td>Plinian/Ultra-Plinian</td>
<td>100 years</td>
</tr>
<tr>
<td>7 Supercolossal</td>
<td>&gt;25 km</td>
<td>100 km³</td>
<td>Ultra-Plinian</td>
<td>1,000 years</td>
</tr>
<tr>
<td>8 Megacolossal</td>
<td>&gt;25 km</td>
<td>1,000 km³</td>
<td>Ultra-Plinian</td>
<td>10,000 years</td>
</tr>
</tbody>
</table>

NOTES:
- Frequency = time between eruptions
- "m" are smaller than "km"

Level 3a1

21) Identify which statement is TRUE about the table above.
   i. The eruptions become more explosive as the volcano increases in the amount of time it takes between eruptions.
   ii. The eruptions become more explosive as the volcano gets older.
   iii. More active volcanoes have less violent eruptions.
22) Identify which statement is FALSE about the table above.
   a. The larger the volcano is the smaller the volcanic eruption will be.
   b. The larger the volcano is the larger the volcanic eruption will be.
   c. The longer the time between eruptions will result in a larger VEI number.
   d. As the VEI number increases the Plume increases as well.
   e. Hawaiian volcanoes usually have gentle or non explosive eruptions.

23) What can we infer(conclude) about volcanoes with a VEI number between 0-3.
   i. The volcanoes are dormant.
   ii. The volcanoes are active.
   iii. They can be shield volcanoes.
   a. I only                  d. I and III
   b. II only                 e. II and III
   c. III only

24) Volcanoes with a VEI number between 4 – 8 can be considered as ___________ volcanoes.
   a. extinct
   b. active
   c. dormant
   d. low silica
   e. high silica

The diagram below displays the Samoan Islands. Use the diagram below to answer questions 25 - 26.
25) Predict which statement is TRUE about the volcanic islands labeled “A”.

a. The volcanoes will become active because it will move to the hot spot.
b. The volcanoes will become dormant because it will move to the subducting zone.
c. The volcanoes will sink because the amount of silica will weigh it down.
d. The volcanoes will remain extinct because no magma will be produced under the island.
e. The volcanoes will separate because it is located on diverging plate boundaries.

26) Infer the movement of the lithosphere. Use the compass on the right to help describe movement.

a. The lithosphere is moving towards the North West (NW) direction.
b. The lithosphere is moving towards the South East (SE) direction.
c. The lithosphere is moving towards the Northern (N) direction.
d. The lithosphere is moving towards the Western (W) direction.
e. The lithosphere is moving towards the Southern (S) direction.
To earn a ....

<table>
<thead>
<tr>
<th>Complete (C)</th>
<th>Partial (P)</th>
<th>Not there (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response and reasoning has little to no errors.</td>
<td>Response and reasoning has some minor errors and a few major errors.</td>
<td>Response and reasoning has major errors.</td>
</tr>
</tbody>
</table>

Tables 1 and 3 below display example information collected about different volcanoes. Scientist had to collect this information to determine the explosivity of each volcano.

### Table 1: Examples of volcanoes and VEI ratings

<table>
<thead>
<tr>
<th>VEI</th>
<th>Plume height</th>
<th>Volume (m³)</th>
<th>Average time interval between eruptions</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>&lt;100 m</td>
<td>≥10,000</td>
<td>one day</td>
<td>Kilauea</td>
</tr>
<tr>
<td>1</td>
<td>100–1000 m</td>
<td>&lt;1,000,000</td>
<td>one day</td>
<td>Stromboli</td>
</tr>
<tr>
<td>2</td>
<td>1–3 km</td>
<td>≥1,000,000</td>
<td>one week</td>
<td>Colima 1992</td>
</tr>
<tr>
<td>3</td>
<td>3–15 km</td>
<td>≥10,000,000</td>
<td>one year</td>
<td>Ruiz 1985</td>
</tr>
<tr>
<td>4</td>
<td>15–25 km</td>
<td>≥100,000,000</td>
<td>≥50 years</td>
<td>Galunggung 1982</td>
</tr>
<tr>
<td>5</td>
<td>&gt;25 km</td>
<td>≥1,000,000,000</td>
<td>≥100 years</td>
<td>Mount St Helens 1980</td>
</tr>
<tr>
<td>6</td>
<td>&gt;25 km</td>
<td>≥10,000,000,000</td>
<td>≥100 years</td>
<td>Krakatoa 1883</td>
</tr>
<tr>
<td>7</td>
<td>&gt;25 km</td>
<td>≥100,000,000,000</td>
<td>≥100 years</td>
<td>Tambora 1815</td>
</tr>
<tr>
<td>8</td>
<td>&gt;25 km</td>
<td>≥1,000,000,000,000</td>
<td>≥100 years</td>
<td>Toba, 74,000 years ago</td>
</tr>
</tbody>
</table>

### Table 3: Type of volcano and magma composition

<table>
<thead>
<tr>
<th>Volcano</th>
<th>Type</th>
<th>VEI</th>
<th>Volcanic Rock (Magma composition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinatubo (PN)</td>
<td>composite</td>
<td>6</td>
<td>andesite</td>
</tr>
<tr>
<td>Krakatoa (KR)</td>
<td>composite</td>
<td>2</td>
<td>dacite/lavastite</td>
</tr>
<tr>
<td>Kilauea (KA)</td>
<td>complex</td>
<td>3</td>
<td>andesite</td>
</tr>
<tr>
<td>New Britain (NR)</td>
<td>complex</td>
<td>2</td>
<td>basalt</td>
</tr>
<tr>
<td>Mount Etna (ME)</td>
<td>shield</td>
<td>8</td>
<td>basalt</td>
</tr>
<tr>
<td>Etna Als (EL)</td>
<td>shield</td>
<td>8</td>
<td>basalt</td>
</tr>
<tr>
<td>Piton de la Fournaise (PF)</td>
<td>shield</td>
<td>8</td>
<td>basalt</td>
</tr>
</tbody>
</table>

Imagine you are asked to investigate a newly discovered volcano to find out whether it will produce a gentle or violent eruption. Develop a plan for studying the new volcano.

*You must list and describe the evidence (proof) you need in order to identify the explosivity of the volcanic eruption.*