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Answering the Question Why: The Theoretical Foundations to Instructional Choices in a Middle School Mathematics Class

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Abstract

In all public middle schools in Oregon, students are required to complete a yearlong mathematics course. And while middle school marks a time of transition and development for many students, it also marks an important transition in mathematics. Every student in the district will transition from general mathematics courses into domain-specific courses, and it is critical that both teachers and students ask the question, "Why?" in order to facilitate meaningful learning. As a teacher, the answers to this question should inform every aspect of one's practice. These answers should not only be defined by a personal philosophy of teaching, but they should also be informed by and evident of theories of learning in their application. In order to defend my own teaching practices, this thesis is a presentation of my personal philosophy of teaching, as informed by learning theories, followed by a detailed analysis of how my teaching practice was evident of these theories in application. Specifically, this analysis examines a sixth grade mathematics unit that I planned and taught to 28 students within the Salem-Keizer School District.

Introduction

All learning starts with a question. Whether posed by the teacher or the student, it is the search for answers that facilitates learning within and outside of the classroom. The practice of teaching is no different. All effective teaching must start with the answer to the question, "Why?" Why must the content be taught, and why is it being taught the way in which it is? It is the answers to these questions that give teachers purpose and direction, while also providing a foundation for student learning within a teacher's classroom. The answers to these questions are essential to providing a meaningful learning experience. However, they are also the basis of learning theory. And although the goal of becoming an effective teacher remains constant, finding the answers to the question, "Why?" reveals differing opinions and beliefs concerning learning theory.

The presence of differing learning theories presents teachers with a choice. Teachers make this choice everyday within the classroom. Whether it is explicitly acknowledged, learning theory cannot be separated from application. Instructional choices, student-teacher interactions, and management strategies are all representative of theory. The connection between theory and application makes the analysis of the educational choices that teachers make critical to their effectiveness in the classroom. Knowing the theory behind the choices being made in the classroom provides teachers with a basis for making changes to one's practice when the current educational choices made are not producing meaningful learning. As a teacher, it is my goal to explicitly develop such a theoretical foundation to my practice as my personal philosophy of education.

However, such a foundation cannot be developed without first conducting theoretical research followed by the application of such research. The following overview is an exposition of theoretical research concerning education and the resulting personal philosophy of education of mine that has emerged from this research. This overview is then followed by a detailed analysis of how my personal philosophy of education was practiced within the classroom. Specifically, the analysis will provide evidence of the theoretical grounding to the educational choices I made while teaching a ten-lesson unit in a sixth grade mathematics course. Finally, conclusions concerning the effectiveness of the theoretical foundation used to inform my practice followed by considerations of change will be addressed in order to better my future practice.

Theoretical Research

At the age of five or six years old, most people begin their experience of the learning process within a formal school setting. While experiencing this process is something to which most people can relate, describing the process itself and its purpose have proven to be complex in nature. In fact, people have been trying to understand learning for over 2,000 years. The debate over how people learn and the purpose that learning plays in life can be dated back to such philosophers as Socrates (469-399 BC), Plato (427-347 BC), and Aristotle (384-322 BC). Since then the debate has continued and recent names such as B.F. Skinner (1904-1990), Lev Vygotsky (1896-1934), and John Dewey (1859-1952) have been strongly tied to differing theories of learning. As a result, three substantial viewpoints, or theories, have developed in terms of how and why a person learns: the behaviorist theory of learning, the cognitive theory of learning, and the situative theory of learning.

The Behaviorist Theory of Learning

B.F. Skinner, an American psychologist, is known for his great influence and promotion of the behaviorist theory of learning. This theory, which is focused on events and behaviors that are quantifiable and that can be objectively observed and analyzed, rejects the link between a need for introspection and the process of learning in education. Because it is not possible to objectively observe or quantify one's thoughts, the only indicators of knowledge that behaviorism considers are actions in response to a stimulus. In the case of behaviorism, the purpose of learning and education is the acquisition of behaviors, which are manifested as displays of knowledge or skill as well as the formation of associations between a response and a specific stimulus. Knowledge is a repertoire of behaviors. It is not something that is abstract. Instead, knowledge is synonymous with action.

In a classroom setting, the behaviorist purpose of education can be described as training students what to do in order to be able to provide correct answers to presented questions. Learning is the process of transferring information from the teacher to the learner, which in turn is essentially the transferring of an appropriate response to a specific stimulus (Skinner, 1976). In social settings this purpose can be described as training people or students to behave in an appropriate manor through the use of positive reinforcement. Without the use of positive reinforcements, learned responses will eventually become extinct (Skinner, 1976). With the application of the behaviorism, behavior is specifically defined and managed. In both settings, the result, rather than what leads to the result is the only indicator of learning and mastery.

Within the classroom, the results that are obtained through the application of the behaviorist theory of learning are the ability to accurately perform mechanical skills, the memorization of facts, the ability to efficiently complete tasks or follow directions, the accurate performance of sequential tasks, etc. In order to achieve this, behaviorist instructional strategies tend to rely on "skill and drill" exercises in order to provide the consistent repetition that is needed for the effective positive reinforcement of the desired responses (Skinner, 1976) A mathematics course characterized and informed by the behaviorist theory of learning would heavily incorporate the skill and drill exercises. The traditional idea of a mathematics course is often representative of this, as the stress is "fluency in computation, without acknowledging the role of conceptual understanding" (Alberti, 2012, pg. 27). The teacher teaches a skill, and then the students are given problems to practice the appropriate response to each question. A student's grade would then be solely dependent on providing the correct answer to each question. This mathematics course is results-focused.

The Cognitive Theory of Learning

The cognitive theory of learning, which is also referenced to as cognitive constructivism, has been greatly influenced and promoted by such names as Jean Piaget. This theory rejects the idea that learning is a passive acquisition of knowledge. Rather, learning is thought of as an active process that consists of successive stages of adaptions made to reality during which learners actively construct knowledge or their own meaningful representations (Widmayer, 1999). In the case of the cognitive theory of learning, knowledge is not the actions or behaviors, but the abstract thoughts and understanding that produce actions and behavior in a person. It is the intentional

representations that a person can derive from past learning experiences, which promotes intrinsic motivation and personal investment (Perry, 1999). As a result, the purpose of learning is a "growth in conceptual structures," (Wojcikiewicz, 2011, pg. 10.), which allows someone to apply conceptual structures in differing or new contexts.

In a classroom setting, the cognitive theory of education focuses on teaching students how to do something in order to understand why a process, skill, or relationship works, and then be able to apply the same concepts when presented with different situations. This deeper level of understanding aims for students to retain concepts, information, and skills in their long-term memory and solve problems by thinking strategically about what they already know in order to find an answer that is not yet known. With the application of the cognitive theory of learning, students develop and learn processes rather than behaviors. Depending on what process or skill a student deems appropriate based on prior experiences will determine the action or behavior that is employed to solve a problem or answer a question. In fact, different process may be used to arrive at the same answer.

As a result, each new experience results in the construction and deeper understanding of knowledge, and shapes how future situations, problems, and questions will be approached. This process of active discovery allows students to demonstrate knowledge of situations that may not be specifically taught within the classroom. Because of this, a student's knowledge is indicated by the extent to which they can articulate an understanding of cognitive structures, rather than the answer that these cognitive structures produce. In fact, a student may be able to demonstrate partial

understanding even when an answer the student produced is not accurate. The final result is not the sole indicator of what a student has learned.

Within a classroom, the demonstration of understanding of conceptual structures occurs through the ability to encode, store information in long-term memory, apply general concepts or structures, reflect upon one's own understanding, apply strategies, and problem solve (Wojcikiewicz, 2011, pg. 10). In order to facilitate this in a classroom, cognitive teaching methods include "accessing prior knowledge, building concepts; problem solving, and explicit teaching and deliberate use of strategies, metacognition, conceptual change; discovery learning; use of organizers, analogies, models; pattern recognition" (Wojcikiewicz, 2011, pg. 10). Through these methods, the teacher is a facilitator, rather than a drillmaster.

A mathematics classroom characterized and informed by the cognitive theory of learning would focus on processes and understanding how something works in order to obtain an accurate answer rather than solely focusing the production of an accurate answer. For example, instead of strictly teaching formulas, students may be required to come up with the formula on their own through the employment of mathematical processes and skills they have already been taught. Mathematics courses aimed at developing cognitive understanding often employ this type of discovery learning, in which students work to understand why and how formulas work and what each mathematical process represents or means. This requires students to access and use prior knowledge, while developing new prior knowledge to use in future situations. As a result, a much deeper level of understanding of a mathematical answer is developed. Accordingly, in a mathematics course characterized by developing this understanding,

students would be able to receive points for producing mathematical work that indicates understanding of the process, even if the answer a student produced is incorrect. The processes, along with the answer, are both critical to mathematical understanding.

The Situative Theory of Learning

John Dewey, an American educational reformer, helped developed and promote yet another theory of learning. The situative theory of learning, or situated learning, is founded in the idea that learning is dependent on the ability to participate in "communities, practices, disciplines; and the awareness of meanings, identity, affordances" (Wojcikiewicz, 2011, pg. 10). Whereas learning is equated with behaviors according to behaviorism and with conceptual structures according to social constructivism, learning is equated with the context in which it is learned. The learning occurs in the direct application and need in everyday life. Learning is not seen as "the acquisition of knowledge by individuals so much as a process of social participation. The nature of the situation impacts significantly on the process" (Smith, 2009, pg. 4).

Within the classroom setting, the situative purpose of education can be described as providing students with meaningful contexts and community settings through which to learn content that corresponds with the context. Learning within this context should change and develop a student's identity and how he or she participates within the community of the classroom as well as the community outside the classroom. It is not teaching the "what" or "how" behind something, but the reason "why" behind something, which provides great motivation. "Students who have found purpose in their schoolwork gain so much satisfaction from their efforts that long hours of dedication can fly by without difficulty" (Damon, 2008, p. 62). This is the direct connection between the

content and the greater "cultural, moral, aesthetic meaning" (Wojcikiewicz, 2011, pg. 10) that it is associated with. With the application of situated learning, the learned knowledge is determined by the context, rather than the context of the learning being determined by the content that needs to be taught.

To achieve this type of learning within the classroom, teachers must create an environment in which students must participate in the building and identifying of learning communities, participate in social or authentic activities, participate in "'real-word' settings, the formulation of and working toward goals" (Wojcikiewicz, 2011, pg. 10), and play activities. Critical to each of these methods is communication and collaboration with other members of the same classroom community. As a result of these teaching methods, students would then demonstrate their knowledge in this way through being able to participate in these same activities without the assistance of the teacher. Students having affordances and constraints would also indicate having gained knowledge. Essentially, students would know why they are learning and using content skills in every context.

Within a mathematics course, a classroom characterized and informed by the situative theory of learning would greatly utilize methods of collaboration and group work. Within group settings, students would work together to interact with specific mathematical skills according to a given context. Rather than spending significant time practicing skills and how the skills work, the majority of the time would be spent participating in activities that require students to demonstrate the application of mathematical skills within appropriate contexts. However, these contexts must be meaningful and authentic to the experiences of the students within the classroom. No mathematics skill or process would be isolated from its use within a context. The success

of a student within this classroom would then depend on the students' ability to apply the content within appropriate contexts. This classroom would "meaning" oriented.

Although consolidated to three main theories of learning, these Theorists targeted three main components commonly discussed and debated within education: what students are supposed to do, how students are supposed to it, and why students are supposed to do it. The theory of learning and the associated teaching methods that an individual chooses to employ is determined by what he or she believes the purpose of education and learning is, whether it includes one or more of these components. Because of this, it is important for every teacher to have a personal philosophy of teaching. Once a personal philosophy has been determined, a teacher's instructional practices can then be analyzed according to these theories of learning to ensure that the employed practices align with the teacher's beliefs about education and learning. And as a future teacher, it is these theories along with experience that have informed my personal philosophy of teaching.

Personal Philosophy of Teaching

The action of following or pursuing someone or something is commonly referred to as a pursuit. Just as a pursuit, teaching is active, goal-oriented, and requires perseverance. It is a journey towards growth. A growth in student learning and a growth in teacher effectiveness. However, implied with the action of a pursuit that is characterized by growth is change. In fact, Benjamin Franklin once said, "When you're finished changing, you're finished." So it is with the pursuit of teaching. One cannot achieve learning growth among his or her students without the ability or willingness to

change according to the end-goal of the pursuit. However, this ability and willingness to change cannot be facilitated through the application of one theory of learning. Teaching is multi-faceted, including several components and varying audiences.

Because of this, the teaching strategies used to address these components and audiences cannot be derived from a single theory of learning. I believe that the most effective teaching strategies are differentiated according to the context of the teaching as well as the specific students being taught. In order to do this, teaching must include strategies from all three main theories of learning according to the specific purpose of each instructional choice. Effectively utilizing a combination of learning theories within the classroom begins with a question. A teacher must ask what the purpose of the specific teaching is, and who is being taught. Once a teacher has asked this, then the pursuit begins. It is with this in mind that six principles of education and teaching that must be addressed according to their purpose within the classroom and the theoretical foundations that will best foster students' learning growth. These principles, as informed by the *National Council of Teachers of Mathematics* are equity, curriculum, learning, assessment, management, and technology ("Principles for School Mathematics," N.D.).

Equity

Effective and meaningful teaching requires the quality of being fair and impartial towards all students. In order to apply principles of equity within the classroom, a personal connection has to be built with each student. This type of personal connection develops through the creation of a community environment within which each member and his or her experiences and opinions are included and valued. Creating a "community

of practice" (Smith, 2009) depends upon the context in which the teaching is taking place and the goal that is being achieved through the lesson. It depends on situated learning. Developing the equity of learning through these communities is synonymous with creating meaning within the content that directly applies to the students.

Rooted in the situative theory of learning, building the meaningful and direct applications of content for students not only promotes principles of equity within the classroom, but it provides students the tools to implement principles of equity outside of the classroom. The direct connection between "community of practice" and the meaning behind the content will directly transfer to each student's life. If each student is unable to do this as a result of a teacher's practice, then the teaching provided to the students has not been equitable. Fair and impartial education ensures that each student is able to apply his or her learning outside of the classroom, no matter the situation a particular student comes from.

Curriculum

The subjects comprising the course of study, or the curriculum, are no doubt a major component of teaching in any classroom or setting. By law, teachers are required to teach specific content according to specific grade levels and classes. However, curriculum is "much more than a collection of activities" ("Principles for School Mathematics," N.D.) or the textbooks which a school has designated to be used for a course of study. And although a teacher does not always have a choice as to what defined curriculum is to be used within the classroom, a teacher's instructional choices determine how the curriculum is taught. In the case of curriculum, how it is taught is just as important as what it is.

Additionally, the curriculum and how it is taught should be coherent and purposeful, while inciting questions among the students. The curriculum should provide students the tools to not only ask probing questions but to search out the answers to their questions according to content. While curriculum can be merely a tool to teach skills and procedures, it would be a waste if that were the case. Curriculum should be used to help students not only develop skills and procedures, but how these skills and procedures work so that they can be applied in varying settings within and outside of the classroom. As a cognitive learning theorist would say, curriculum should only teach "what," but it should also teach "how." Otherwise, curriculum is restricted to the classroom and, as a result, useless in life outside of the classroom.

Learning

I believe that learning is an active process that is dependent on not only skills, but the understanding of processes, and applications as well. Because learning is active, teaching in order to foster learning must also be active and dependent on skills, the understanding of processes, and applications as well. While learning consists of this triad, the ability to perform skills and the knowledge of applications are dependent on the understanding of process. Each is an important component to learning, but actively developing a cognitive understanding greatly enhances the other two components. It provides the basis for meaningful learning, rather than circumstantial learning.

For example, while students may be able to successfully learn skills and procedures, it is the understanding of the processes behind these skills and procedures that allows them to transfer the ability to perform these skills and procedures in varying contexts. Cognitive understanding enables students to use what they have learned without

the support of a teacher or peer. Additionally, being able to identify the application of something within a certain context is critical to the learning of content, a student will not be able to actually apply content in the appropriate context if they do not understand the processes behind what they need to apply. Because of this, achieving meaningful learning is closely tied to actively developing a cognitive understanding of what is being taught. It is a process of active discovery and so should be teaching, if the goal of teaching is to promote a growth in learning in each student.

Assessment

Assessment, or the evaluation of the nature, quality, or ability of someone or something is a controversial but necessary component of education and teaching. Assessments can be done in several different formats and at any point within a lesson or unit. Whether formative or summative, assessments should be both valid and reliable and an accurate representation of a student's learning. In order to achieve this type of accurate representation of learning, an assessment should assess components and characteristics of what a teacher believes learning is as well as its purpose. As a result, assessments will support learning and "furnish useful information to both teachers and students" ("Principles for School Mathematics," N.D.). In light of these characteristics of an effective assessment, assessments should target both answers as well as the processes that students used in order to arrive at a specific answer because learning is an active process in which students construct cognitive understanding.

If learning is a process of active discovery, then assessments should be constructed in such a way that requires students to show evidence of participating in this active process. Not only should assessments be designed in this way, but they should also

be scored according to both the cognitive understanding students communicate as well as the final answer they produce. Because I believe that learning is not strictly skills, behaviors, or the answers students produce, but the cognitive understanding of the schemas or processes that enable students to apply skills, behaviors, or produce the correct answers, I also believe that the communication of this understanding should hold equal value on assessments as the correct answer. Otherwise, an assessment, whether formative or summative, does not support learning or provide an accurate representation of the learning growth a student has made.

Management

Management, which can also be described as the process of dealing with or controlling things or people, is different from the other overarching themes of education in that it is not directly impacted by the content that is being taught. Rather than focused on learning skills, process, relationships, etc., management is strictly focused on a student's behavior within the classroom. While the appropriate behavior depends on the context of the classroom or setting in which students are learning, instructional choices concerning classroom management are most successful when informed by the behaviorist theory of learning. And although it is beneficial when students understand the reasoning behind the desired behaviors within a setting, there are times when the appropriate behavior on the part of the student is more important than the reason why a particular behavior is desired. This is the case when inappropriate behavior either harms another student or inhibits another student's ability to learn.

While managing behavior within the classroom may not be directly impacted by the content, the amount of content a student is able to learn is either increased or

decreased depending on student behavior. Because of this, it is critical that behavioral expectations are explicitly taught within the classroom and that the management of these behaviors is consistent. As management is based on behaviors, the best way to achieve one's desired behaviors within the classroom is through the consistent training of these behaviors. As behaviorists suggest, the use of positive reinforcement best achieves the desired behavioral response to a stimulus. In fact, without the use of positive reinforcements, learned responses will eventually become extinct (Skinner, 1976). And while it seems superficial to focus on student responses in reference to any component of education, strategies informed by behaviorism have their place within the classroom. As long as the agenda of behaviorist actions and instructional strategies do not solely define the classroom, they can have a positive affect within the classroom when teaching appropriate behaviors and actions within the classroom.

Technology

Recently, the use and need for technology within the classroom has increased. As society within the United States becomes more dependent on technology, the classroom and lessons taught within the classroom should therefore also prepare students for the use of technology along with content. As Benjamin Franklin said, we cannot stop changing. And while the ability to teach students the desired content should not be dependent on technology itself, I believe that technology should be used to meaningfully increase the learning that takes place within the classroom. In order to provide meaningful learning, the use of technology must therefore help students develop their conceptual understanding and meaning behind the content being taught. Without this direct

connection to learning and the purpose of learning, the use of technology within the classroom is wasted.

In order to utilize technology in such a way that cognitive and situative understanding is increased, the technology being used within the classroom must first be relevant and appropriate to the context or situation. Additionally, rather than being a source of entertainment, technology should facilitate the ability of a teacher to use instructional strategies that are rooted in developing cognitive awareness. In this case, the use of technology should target various learning styles that will enable students in "accessing prior knowledge, building concepts; problem solving, and explicit teaching and deliberate use of strategies, metacognition, conceptual change; discovery learning; use of organizers, analogies, models; pattern recognition" (Wojcikiewicz, 2011, pg. 10). Used in this way, technology has the potential to be the source of great learning within the classroom. Because of this, it should not be ignored within the classroom.

Connecting Theory to Application

Although it is the foundation to effective instructional practices within a classroom, a personal philosophy of education holds no meaning unless it is applied and evident throughout a teacher's practice and instructional choices within a classroom. It is with this in mind that a detailed analysis of my own instructional choices within the classroom is necessary. Without examination, it is difficult to determine whether or not my personal philosophy of education is, in fact, informing my practice. In order to make such a determination, the following is a detailed analysis of the instructional choices I made specific to a ten-lesson mathematics unit covering expressions and equations in a sixth grade classroom at Parrish Middle School in Salem, Oregon. After considering the

content taught throughout the unit and its purpose, both the lesson plans and the corresponding reflections I documented throughout my teaching of the unit will be examined according to my personal beliefs about the six principles of education that were outlined in my personal philosophy of teaching. As a result, a clear indication of how my personal philosophy of education is connected to my practice will be evident.

Content and Purpose

The purpose of the ten-lesson unit on expressions and equations I taught at Parrish Middle School in Salem, Oregon, was to provide sixth grade students with an introduction to concepts in algebra. Specifically, this unit was designed to be a solid foundation in developing the skills of writing and solving expressions and equations with two different operations, which would enable students to be successful in higher mathematics courses. Beyond the context of mathematics courses, the importance of purposing to build this algebraic foundation was to enable students to identify situations in which manipulating expressions and equation is beneficial and then to be able to use and solve them in appropriate life situations. The concepts and use of algebra are often inexplicitly used in several life situations, and having a solid foundation and skill set in these concepts will provide students with the ability to navigate through these situations. Algebra is essentially about solving problems, and the greater purpose behind this unit was to develop skills that would help enable students to become successful problem solvers within and outside of the classroom setting.

In order to accomplish this purpose, several skills essential to writing and solving expressions and equations were taught over the course of ten lessons throughout the unit. Because this unit fell within a larger strand of introductory skills to algebra, many of the

skills taught were a new concepts and ideas for many of the sixth grade students. Specifically, these skills were divided into two sub-topics within the unit. The first sub-topic was equations and consisted of four lessons. Within these four lessons, students learned the skills of writing descriptions or "rules" of how to solve problems that included unknown values, writing equations, solving equations, and describing the patterns and relationships between the variables in an equation.

The second sub-topic within the unit was expressions and consisted of six lessons. Within these six lessons, students learned the skills of writing expressions, solving expressions, describing the patterns and relationships between the variables in an expression, as well as the properties of the distributive property. The skills taught within both sub-topics of the unit were further developed through the use of tables, graphs, and real-life contexts presented through situational word problems. Through the inclusion of these different formats in which these skills can be used, students also learned the skills of identifying how and when to use algebraic skills they were taught within several different contexts.

Because the algebraic skills that were introduced within the ten lessons of this unit are consistently used and present within both future mathematics courses as well as life situations, there are several reasons why it was important that they were taught in a meaningful way. First, students will be held accountable for these skills through standards-based state testing. Each of the skills taught were aligned with a *Common Core State Standards* ("Common Core State Standards Initiative," N.D.) for mathematics, and is essential to each student's success on state-administered tests. Not only will students be held accountable for these skills through state-administered tests, but these skills were

also needed in order to successfully pass future mathematics course that are required for graduation from high school in the state of Oregon. The development of a solid algebraic foundation by teaching the skills in this unit will help set students on the path to successfully completing high school and help provide opportunities for higher education should a student choose to attend college.

Beyond academics, these skills were important to teach because they are so frequently needed and used in life situations. Being able to evaluate problems and come up with strategies to solve problems is an essential life skill, and using algebraic skills is one of the many strategies that can be successfully used to solve life situations. For example, within the unit students were required to write and solve an equation to figure out the revenue, expenses, and profit of a bike tour that college students are planning. Figuring out monetary amounts such as expenses and profit are just one example of how these skills are needed outside the classroom, whether or not students attend college.

These foundational algebraic skills directly translate to needed life skills, and will enable students to successfully navigate life situations. From this perspective, it is critical that students were taught these skills and developed a solid foundation in algebraic problem solving. Students will encounter situations in which these skills are needed throughout their teenage and adult lives, and it is important that they have the foundation in and practice of these algebraic problem-solving skills. According to this content, purpose, and greater context concerning the unit, the following principles were specifically addressed throughout the unit.

Equity

While this unit was focused on the introduction and teaching of expressions and equations, equity within the classroom was promoted throughout the way in which the content was presented to the students as well as through the way in which students were required to participate in classroom activities. The middle school mathematics curriculum that is required by the Salem-Keizer School District is titled *Connected Mathematics Project*. This curriculum is designed to be inquiry-based, which provided a gateway for principles of equity to be used within each lesson of the unit. Specifically, this was done through the development of "communities of practice," which was facilitated through sitting the students in consistent groups of four. Within these groups, students were required to not only work together to complete each problem within the lessons, but each student within the group was given a specific "group job" (indicated by chair color) in order to ensure that each student's contribution and opinions was validated and needed within the group.

For example, in the third lesson of the unit titled "*Variables and Patterns 3.2C: Solving and Describing an Equation with Two Operations that Represents the Cost of Renting a Golf Cart,"* the students were given the task of playing a vocabulary matching game in their groups. When the answers were to be revealed to the class, the student given the "group job" of reporting was required to share with the class the answers that the group decided on. This is indicated on page three of the lesson plan, as it states that, "the student sitting in the yellow chair of each group to hold up the index card with the word they think goes with the first word." Although simplistic in nature, assigning students "group jobs" promotes principles of equity by ensuring that each student is required to participate in a meaningful way, while also ensuring that each students

contribution and opinions is recognized and used by the other members of the group. In this way, "communities of practice" were truly developed throughout the instructional choices within this unit.

Rooted in the context of the students and the classroom, the design and the use of the group work were truly indicative of the situative theory of learning. Not only was equity promoted through the inclusion and validation of all students no matter what types of experiences they come from, but it also promoted equity through giving each student an equal opportunity to learn, apply, and build real-world relationships within a group, or "community of practice." Building this type of community provided a specific real-world connection and need for the content that was being taught, as well as a group of people for students to share this connection with. Managing equity within the class in such a way is indicative of the situative theory of learning and the benefit it can provide within the classroom.

Curriculum

In order to teach this particular unit at Parrish Middle School, I was required by the Salem-Keizer School District to use *Connected Mathematics Project,* or CMP, as curriculum. As previously discussed, CMP is inquiry-based, and the intent of its design has been to incite students to ask probing questions and discover how mathematical processes, patterns, skills, etc. are used in real-life situations. While I firmly believe that the intent of teaching "how" and "why" mathematics is used that is present in this curriculum should be the focus of every mathematics class, merely completing the problems within the curriculum does not have this result for every student. The CMP curriculum itself needs to be taught using strategies grounded in the cognitive theory of

education in order to give students the tools to ask probing questions and then search out the answers to these questions. It is how this curriculum is taught that determines whether or not the full intent of its design is realized.

Because of this, the specific chapters and lessons from CMP that were used in order to teach expressions and equations were thoughtfully scaffolded and differentiated in order to meet the specific needs of the students at Parrish Middle School. This was also done to ensure that the students were learning the "how" and the "why" of expressions and equations, rather than just what variables, terms, coefficients, expressions, and equations are. With the use of CMP, the units were taught in such a way that the students learned the patterns and processes that expressions and equations represent first. Once this understanding was developed, students learned how to write expressions and equations. Finally, students were able to solve for specific values of variables.

One specific way that I chose to foster this understanding was through the use of problems within CMP that required students to read a written situation, analyze at a table, or interpret a graph and then write a "rule" that communicated the pattern represented in these different texts. However, to begin this process, I would first ask students to verbally explain the patterns or processes they might use to find an answer to an algebraic problem. For example, in the first lesson titled, *Variables and Patterns 3.2A: Finding a Group Admission Price by Writing Equations with Two Operations*, the students were specifically asked the question "Can you describe the strategy or process that you used?" in order to incite a class discussion about what the students were doing mathematically. From this verbal description of the strategies and processes being used, "rules" or descriptions were then written using mathematical language and including two

operations. These written "rules" were expressions and equations written in sentence form.

According to CMP, the next step is writing the "rules" as expressions or equations using mathematical symbols and numbers. However, in order to build the connection between the underlying patterns and processes and the expressions and equations, I taught the curriculum to include an additional step. The specific instructional strategy used in order to deepen the level of cognitive understanding developed through CMP was "marking the text." This was also evident in the first lesson, as the lesson plan states "the teacher will then introduce the strategy of crossing out any words in the rule that can be replaced by a mathematical symbol or number in order to write it as an equation. As a class, the teacher and the students will cross out words in the sentence they wrote on the SMARTboard and replace them with symbols and numbers." This process not only explicitly connects the cognitive understanding of mathematical patterns and processes to expressions and equations, but it visually shows this connection. Once marking the text was done, the students were able to easily write an expression or equation.

Through the process of writing "rules," marking the text, and then writing an expression or equation, students were able to learn what types of questions to ask or information to search for when a problem was introduced so that an accurate expression or equation could be written without having to first write a "rule." However, a student was only able to do this once a cognitive understanding of the mathematical patterns and processes represented by expressions and equations was developed. Accordingly, the instructional strategies present throughout the lesson plans for this particular unit indicate that the development of this cognitive understanding through the thoughtful use of CMP

was the goal.

Learning

Because I believe that learning is an active process that is evident in a student's ability to apply skills in different contexts or situations as a result of developing a cognitive understanding, the specific unit designed and taught at Parrish Middle School should be indicative of this process. This active process, while developed and targeted through specific instructional strategies present within each lesson, is most evident within the sequencing of the lessons and skills taught throughout the unit. The ten lessons in the unit are divided into the two sub-topics of equations and expressions. The first sub-topic is equations, and consists of four lessons. These lessons come before expressions because they are specifically focused on equations with two different operations. This skill is an extension of the concept of writing equations with one operation, which was taught in the previous unit. Because of this, the first four lessons acted not only as a review, but it also extended the understanding of these concepts before expressions were introduced.

Within the sub-topic of equations, students were first taught how to describe the process of solving problems that include unknown values, previously described as "rules." As an active and continual process, this strategy was specifically used in the first lesson, the second lesson, the third lesson, and the fourth lesson of the sub-topic. Once students were able to verbalize or provide a written description of the mathematical processes and strategies they used to solve each problem, students were taught how to write equations with two different operations based on their descriptions. By ordering the instruction in this way, students developed a conceptual understanding of the meaning of equations before working with the symbols and numbers in an equation. This was meant

to develop the understanding that equations are not just the manipulation of values and numbers; they are representations of patterns and relationships.

Finally, once this understanding was developed, the vocabulary of equations was introduced within the sub-topic along with the practice of identifying the parts of equations using mathematical terms. This was designed to follow the instruction in writing equations because the skill of being able to identify the parts of an equation is meaningless outside of the classroom if students do not first know how to write equations as well as what they represent. With this consideration, the sequence of the content taught within this unit is evident that the learning targeted throughout the unit is the ability for students to develop cognitive understanding of mathematical concepts and then apply them in differing contexts and situations.

With the completion of the first four lessons in addition to a previous unit introducing equations, the students received instruction in all the basic skills of writing and solving equations as required by the *Common Core State Standards* for mathematics. Following the sub-topic on equations, the final six lessons in this unit covered basic skills in writing and solving expressions. This sub-topic follows the lessons on equations because the skills needed to write and solve and the conceptual understanding of these skills directly transfers to the concept of expressions. In fact, expressions, specifically their parts as well as the patterns and relationships they represent are identical to equations except for a single component. Expressions do not have an equal sign. Although the understanding of equations and expressions directly translate, there is a specific reason as to why this unit was designed to teach equations before expressions.

Often times, the idea of any type of mathematics problem not having an equal sign or a single answer is difficult for students to understand. Expressions do not have equal signs because the value represented by the expression can change as the value of the variable within an expression can also change. The answer depends on the variable, rather than the value of the variable depending on the answer. This change and variation requires a greater amount of abstraction in thinking, and the development of the cognitive understanding of the parts of equations was intended to provide a concrete foundation from which students could develop this abstraction. Students will transfer the concrete concepts from equations to the concept of expressions, which allowed them to meaningfully participate in the learning of the abstract concepts of expressions.

Similarly to the first sub-topic, each of the six lessons within the second sub-topic continued the active process of learning equations and expressions by first requiring students to write "rules" according to problems that required the use of an expression. Writing expressions using mathematical symbols and numbers followed the development of this skill. Once these similar concrete concepts to equations were learned and understood, students participated in the abstraction of thinking through the solving for specific values according to differing values of a variable.

The progression of understanding, skills, content, and abstraction in thinking that is evident throughout the sequencing of lessons within this unit is indicative of the belief that learning is an active, interconnected, and continual process. Not only this, but this process also specifically targets the development of the cognitive understanding of the patterns and processes that are represented by mathematical formulas, skills, expressions and equations. Learning is not the mere production of such things; it is the understanding

of the underlying patterns and processes, which is evident throughout each lesson as well as the specific order of each lesson within the unit.

Assessment

Similar to the process of learning present throughout the unit, the process of assessment that was present throughout the unit was active, interconnected, and continual. Without the examination of how and what the students had learned as the result of each lesson, effective teaching and meaningful learning could not have been achieved. The sequence and teaching strategies used throughout the unit indicate that learning can be equated with the cognitive understanding of the patterns and processes that are represented by expressions and equations. As a result, the assessments conducted throughout the unit should measure this type of cognitive understanding. The analysis of each of the ten lesson plans within this unit indicated that not only was there a formal, summative assessment distributed at the conclusion of the unit, but formative assessments were also taken formally and informally throughout each lesson within the unit.

And while the continued presence of assessments are evident of the belief that assessments should coincide with an active and continual process of learning, the types of and the information targeted by each assessment were useful to this goal and indicative of the development of cognitive understanding. For example, most often assessed throughout the unit was the students' understanding of the presented information and the strategies they were employing in order to solve each problem. This was assessed informally by the teacher on the daily basis through individual conversations as well as through class discussions. In both of these contexts, the processes and strategies students were using, rather than the answers that students were producing were the focus.

For example, in the eighth lesson titled, *Common Core Investigations*: Problem 2.2 Pg. 18, contained both of these specific types of assessment. In the teaching portion of the lesson, an informal assessment of the students thinking and cognitive understanding was taken during a class discussion. The lesson plan states that I planned to ask "students to explain each part of the expression and why they wrote the expression the way in which they did." Through this discussion, I was able to gain insight into a student's and his or her group members' understanding of the specific problem being addressed. Additionally, the informal assessment of students' understanding through individual conversations was also represented within this lesson plan. Specifically, it states that during the group application and work time I planned to "wander around the classroom to observe how groups are working together and the work they are producing." Through these observations and conversations, valuable assessment of what the students have learned can be done. With the information gained from conducting these types of informal assessments throughout each lesson with the unit, specific misconceptions in cognitive understanding of the mathematics being taught could be immediately addressed.

Along with this ability to continually adapt the content to the students' needs, the formal, summative assessment was indicative of the students' process of learning and ability to apply that learning in differing situations and contexts. And while the ability to produce accurate answers to each of the questions on the summative assessment was targeted, the processes that students employed to achieve these answers were also targeted. Students were able to receive points for both the answers and the work that was shown according to each answer, which both provided useful information that was

representative of each students' learning gains. Because of this, the assessments conducted throughout the unit truly indicate that the learning targeted within the unit was grounded in developing cognitive understanding.

Management

Although separate from the content taught within the unit, the teaching of the ten lessons within the unit could not have been done without the implementation of classroom management strategies. And while I believe the instructional choices implemented within the classroom specific to the majority of the six principles of education discussed should be grounded in the cognitive and situative theories of education, my personal philosophy of teaching indicates that management should both be purposeful and grounded in the behaviorist theory of education. Specifically, management should be rooted in the use of positive reinforcements and focus on appropriate behaviors and actions within the classroom. Because student behavior can have a great affect on the amount of learning that can be accomplished during the allotted class time, strategies of management should be explicitly planned and anticipated within a unit.

Throughout the ten lesson plans written for the unit, several elements of management were explicitly stated and evident. These elements were indicative of both the planning of time and behavior management. In terms of time management, each of the ten lesson plans were broken into sections of "Motivation/Hook," "Teaching," "Group Application," "Independent Application," and "Closure." Each section included within specific lessons was allotted a specific amount of time. While these amounts of time were explicitly planned for, there were lessons in which the amount of time spent on

each component was adapted according to student learning, need, and behavior as the teaching was taken place.

However, the inclusion of these time frames indicated that the lessons and the amounts of time spent on different components of the content being taught were purposefully planned according to the anticipated student needs and difficulty of the content. Additionally, the management of time was specifically used to positively reinforce student behavior during the lesson as well. For example, in the ninth lesson, the use of a timer was planned in order to manage the length of time students would have to come up with a response to a question. Within this lesson plan, it states that I had planned to "set the timer on the SMARTboard for 5 minutes and wander around the classroom to observe how groups are working together and the work they are producing." Although not specifically stated, this time frame was used to not only monitor behavior in the group work, but to provide positive verbal reinforcements for appropriate behavior.

Not only was positive behavior managed through time and the use of timers, but it was also verbally managed during the transition times between each section of the lesson plan as well as the instructional and work times. This was done through thanking students who were on task or behaving appropriately while others were still getting ready for the next section or even while others were misbehaving. The use of these positive reminders, which was indicative of the behaviorist theory of education, was quite successful within the classroom, and encouraged other students to behave appropriately. Solely based on these successful results, these strategies of positive reinforcements were continually used throughout the unit. Because the continuation solely based on results, the use of these management strategies was indicative of the behaviorist theory of education. Although

planned for, these strategies are not specifically stated within the lesson plans for this unit because their need is dependent upon student behavior. However, planning for management choices that may need to be made is critical as it often determines the ability of a lesson plan to be successfully executed within the classroom.

Technology

While the teaching of the content within this unit was not dependent on technology, the use of technology was heavily incorporated into each of the ten lesson plans. In fact, rather than having each student read the problems from a copy of the CMP books used, I chose to have the curriculum and questions typed and displayed on the SMARTboard that was available within my classroom at Parrish Middle School. This choice was made as a means to differentiate to the various language needs within the classroom as well as promote cognitive and situative awareness between the content being taught and life applications. With this goal in mind, the use of the SMARTboard was both specific and purposeful to providing a meaningful learning experience for students.

As indicated throughout the lesson plans, there were several ways in which the SMARTboard use utilized throughout the unit. On a foundational level, the SMARTboard was used to display each of the problems targeted within the curriculum being used as well as to facilitate interaction between the curriculum and the students. Because students are able to write on a SMARTboard much like they would on a whiteboard, using the SMARTboard to display images of the textbook being used allowed students to come to the SMARTboard and physically interact directly with the curriculum by writing on the SMARTboard. Students would not have been able to

experience this without the SMARTboard, as students are not allowed to write in the textbooks provided. The second lesson within the unit, titled *Variables and Patterns 3.2B: Writing and Solving an Equation With Two Operations to Represent the Cost of Rides at an Amusement Park* provides an example that is representative of this use of the SMARTboard throughout the unit.

For example, after working in groups to fill out a table that has been displayed on the SMARTboard, I was able to facilitate a discussion of the values in the table through student interaction with the SMARTboard. The lesson plan states that after beginning a class discussion I asked "for volunteers to help fill in the table on the SMARTboard" according to the values the students found within their groups. Throughout this discussion, students volunteered to come to the SMARTboard and write the answers they found in the appropriate spot on the table. This interaction with the technology of the SMARTboard not only provided meaningful learning through the facilitation of student interaction and participation in class discussions, but it was also a means of visually scaffolding the content for the students within the classroom with language needs. With the SMARTboard, I was able to use different colors to display specific words or phrases within a problem in order to provide visual cues for students who would benefit from such scaffolding of the content.

Additionally, in many cases, several problems are on a single page in the CMP textbooks. However, there were several points within the lesson at which I preferred that the students were only able to see one problem at a time because I wanted to ensure that they developed the cognitive understanding required for one problem before reading the following problem. For example, in the tenth lesson plan, titled *Common Core*

Investigations: Problem 2.4 Pg. 19, it states that I planned to "ask for a volunteer to read the introduction paragraph that is displayed on the SMARTboard." In this discussion, I was able to encourage students to start thinking about concepts and patterns before trying to figure out the answer to a problem because only the introduction paragraph was displayed to them. Through the use of the SMARTboard, I was able to display and therefore target one problem or skill at a time before students moved ahead or were distracted by another concept within the following problems. The use of the SMARTboard allowed me to have a greater amount of control over the learning that students were experiencing, which exemplifies how its use allowed me to ensure that students were developing a cognitive or situative understanding of the content.

Conclusion

While the process of examining theoretical research, developing a personal philosophy of teaching, and then thoughtfully examining my own instructional choices and practice according to my personal philosophy of teaching is greatly beneficial, it is not the end. Self-reflection requires action, and in the context of educational theory, the analysis of whether one's craft represents one's belief is a waste if it does not incite action. Self-reflection should reveal areas of practice that should be continued as well as reveal areas in which improvement is needed. And because populations within the classroom and their needs are constantly changing, these areas are also constantly changing. As Benjamin Franklin said, "When you're finished changing, you're finished."

Without a willingness to change, a teacher's practice is finished. In light of this perspective, the process of examining how the instructional choices I made within a middle school mathematics classroom connects to my personal philosophy of teaching

has incited action. While the analysis provided evidence of consistency between my practice and my beliefs, I must consider what the next step is in terms of improving my practice according to theory. I must continue to ask the question, "Why?" and search out the answers. Specifically, what areas of my practice are currently effective, and in what areas do changes need to be made.

Considering the analysis of my practice according to educational theory, developing a cognitive understanding was quite evident in many aspects of my instructional choices. This theoretical foundation provided an element of consistency throughout the unit, as well as provided a framework for my instructional choices when I was unsure of how to format a lesson plan. As a teacher, using this foundation proved to be successful within the classroom. According to the results of the summative assessment, the instructional choices made throughout the examined unit facilitated learning gains for each of the students within the class. Because of this, I will continue to develop my own understanding of and ability to connect the cognitive theory of learning to instruction in mathematics.

However, my personal philosophy of teaching is also built upon the idea that while the cognitive theory of learning should inform the majority of the instructional choices made within the classroom, effective teaching must also include aspects of all three theories of learning at the appropriate times. The examined unit showed evidence of the strong influence that the cognitive theory of education had on the instructional choices made within the classroom. And while there was evidence of the influence that both the situative and behaviorist theories of learning had on some choices, I feel as though much more practice and experience within the classroom is needed in order to

implement these theories in a way as effective as my use of the cognitive theory of learning.

As a future educator, I have much to experience and practice. The journey is just beginning. And although many changes will be made to my practice throughout my career, my goal is to ensure that each of these changes is informed by research concerning theories of learning as well as the students' needs. If this is the case, then I will be able to find the answers to the question of "Why?" concerning the content that must be taught within the classroom as well as the way in which it is taught. Just like learning, all effective teaching begins with this question, and I intend to continue asking it throughout my entire career.

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Appendix
Lesson Plans

LESSON PLAN #1

<table>
<tr><td colspan="3">Lesson Title/Description: Variables and Patterns 3.2A: Finding a Group Admission Price by Writing Equations with Two Operations</td></tr>
<tr><td colspan="2">Lesson #1 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td colspan="2">Goals:
Goal 1 Math: CC 6.EE.7
Solve real-world and mathematical problems by writing and solving equations of the form x+p=q and px=q for cases in which p, q, and x are all nonnegative rational numbers.</td><td>Objectives:
1.1: After working in groups to find the admission price at an amusement park for different sized groups and referring to a variable table, students will be able to write at least two two-step equations from a written phrase or sentence.</td></tr>
<tr><td colspan="3">Pre-Requisite Knowledge and/or Skills: Students will need to have had practice with writing rules and equations with one operation.

How I know the students have this: I know students will have had this practice by looking over their in-class work. They learned this skill in problem 3.1 on pg. 50 of Variables and Patterns, and will have completed this lesson and practice in their in-class spiral notebooks.</td></tr>
<tr><td colspan="3">Learning Target: I can find the admission price for any group by writing and solving an equation with two operations.</td></tr>
<tr><td colspan="3">Key Vocabulary:
• Rule
• Equation
• Variable</td></tr>
<tr><td colspan="3">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson’s activities (they will pick these up from the supply baskets as they enter the classroom).
• The activity/lesson will be displayed on the SMARTboard (Problem 3.2A on pg. 52 and 53 from Variables and Patterns)
• If the SMARTboard is not working, the activity/lesson will be displayed using the document camera.</td></tr>
<tr><td colspan="2">Procedure: Teacher Does…….</td><td>Procedure: Students Do……..</td></tr>
<tr><td>4 min.</td><td>Motivation/Hook:
• After a ten-minute warm-up time, the teacher will ask students, “How many of you have ever been to an amusement park?”
• Teacher will ask for a volunteer to read the introduction paragraph to</td><td>Motivation/Hook:
• Students will respond to the teacher’s question by raising their hands.
• A student will volunteer and read the introduction paragraph to problem 3.2A on pg. 52 of Variables and Patterns.</td></tr>
</table>

	problem 3.2A on pg. 52 of *Variables and Patterns*. • Teacher will ask students, "How many of you know what a group price is?" • Teacher will explain group price and that they will be using a group price at an amusement park to find out how much it would cost for the class to go to the amusement park as a group.	Others will follow along. • Students will respond to the teacher's question by raising their hands. • Students will listen to the teacher's explanation of what a group price and can take notes in their in-class spiral notebooks if they want/need to.
3 min.	**Teaching:** • Teacher will have the students set up their Cornell Notes for problem 3.2A on pg. 52 of *Variables and Patterns*. They will fill in the "Toolbox" section with the words rule, equation, and variable. • Teacher will ask for a volunteer to read the picture of a webpage that shows the prices of admission for an amusement park in problem 3.2A on pg. 52 of *Variables and Patterns*. • Teacher will ask students what the admission price for an individual is, followed by what the admission price for a group is.	**Teaching:** • Students will set up their Cornell Notes according to the teacher's modeling. • A student will volunteer and read the picture of a webpage that shows the prices of admission for an amusement park in problem 3.2A on pg. 52 of *Variables and Patterns*. • Students will listen to the teacher's question and raise their hands if they want to volunteer an answer.
5-7 min.	**Group Application:** • Teacher will read question #1 in problem 3.2A on pg. 52 of *Variables and Patterns* and ask students to work in their groups to solve the problem. • Teacher will wander the room, checking in with each group while they work to solve question #1. • Teacher will answer any questions that the students may have.	**Group Application:** • Students will listen to the teacher's instructions, and will have the opportunity to ask any questions they may have. • Students will work in their groups to solve question #1, which asks them to find the admission price for three different sized groups. • They will ask the teacher any questions they may have.

5 min.	**Teaching:** • Teacher will bring the class back together and lead a discussion about the answers each group found to question #1. • Teacher will ask groups to volunteer the admission price they found for each of the groups in question #1. • After discussing the answers and ensuring that each student found the correct answers, the teacher will ask the students to think about, "How did your group find each of these prices? Can you describe the strategy or process that you used?" • The teacher will allow the students to discuss with their group members to come up with a verbal description of how they found the admission price for each of the three groups.	**Teaching:** • Students finish up their discussions and direct their attention to the teacher. • Students will volunteer the admission prices that their groups found for the three different groups by raising their hands. • Students will have the opportunity to compare the answers that their group found to the answers that were volunteered and then ask any questions that they may have about what the answers are and how they can be found. • Students will listen to the teacher's instructions of discussing a way to verbally describe how they found the admission prices and then discuss with their groups to come up with a verbal description of their strategy or process.
2 min.	**Group Application:** • While students are discussing their strategies in their groups, the teacher will write a sentence frame on the SMARTboard for those students who need extra support with developing the language of their verbal description. • The teacher will then wander the room and provide support to those groups who may be struggling to come up with their verbal description. • Teacher will answer any questions that the students may have.	**Group Application:** • Students will discuss with their group members how they can describe the strategy or process that they used to find the admission prices for the three groups in question #1. • Students will use the sentence frame to help them come up with their descriptions if they need the language support. • Students will ask the teacher any questions they may have.
	Teaching: • Teacher will bring the class	**Teaching:** • A student will volunteer to read

12 -15 min.	back together and will ask for a student to volunteer to read question #2 in problem 3.2A on pg. 52 of *Variables and Patterns*, which asks the students to write a rule for how to find the admission price into the amusement park for any sized group.	question #2 in problem 3.2A on pg. 52 of *Variables and Patterns*.
	• Teacher will then ask students to volunteer the description that their groups came up with.	• Students will volunteer the verbal descriptions they came up with to describe the strategies and processes they used to find the admission prices for each of the groups.
	• After hearing the student descriptions, the teacher will explain that these are "rules" and will fill in the sentence frame previously written according to student suggestions.	• Students will listen to the teacher's explanation of what "rules" are, ask any questions they may have, and then help the teacher fill in the sentence frame as a class.
	• Teacher will give the students time to write down this rule in their in-class spiral notebooks.	• Students will then make sure that they have a rule written down in their in-class spiral notebooks, whether they use their own words or the sentence that the class came up with together.
	• The teacher will then ask the class if they remember what an equation is and how they might turn the rule they wrote into an equation.	• Students will volunteer what they think an equation is by raising their hands. They may look back in the "Toolbox" section of their Cornell Notes if needed.
	• The teacher will then introduce the strategy of crossing out any words in the rule that can be replaced by a mathematical symbol or number in order to write it as an equation.	• Students will listen to the teacher's explanation of a strategy they can use to turn rules into equations and ask any questions they may have.
	• As a class, the teacher and the students will cross out words in the sentence they wrote on the SMARTboard and replace them with symbols and numbers.	• Students will help the teacher replace the words in the sentence with the corresponding symbols or numbers.
	• After replacing the words, the	• Students will work independently to

	teacher will ask each student to use the symbols and numbers to write an equation to find the admission price for any sized group on their own.	write their equations.
2 min.	**Independent Application:** • Teacher will wander the classroom to observe if the students are struggling with writing their own equations for finding the admission price for any sized group. • The teacher will answer any questions that the students may have.	**Independent Application:** • Students will work on their own to write an equation that will work to find the admission price for any sized group in their in-class spiral notebooks. • Students will ask the teacher any questions they may have about writing their equations.
3 min.	**Teaching:** • Teacher will ask for a volunteer to share the equation that they wrote. • Teacher will ensure that each student has a correct equation written in his or her in-class spiral notebooks. • Teacher will clear up any questions or sources of confusion that the students may have. • Teacher will pose the question, "Will this equation work for any sized group?"	**Teaching:** • A student will volunteer the equation that he or she wrote. • Students will compare their answers to the volunteered answer and make sure that they have a correct equation written in their in-class spiral notebooks. • Students will ask any questions they may have. • Students will answer whether or not the equation will work for any sized group.
4 min.	**Closure:** • Teacher will then ask the students, "If our class went to this amusement park, how much would it cost?" • As a class, the teacher and student will use the equation to find out how much it would cost to go to the amusement park. • The teacher will then ask the students to think back to all the admission prices shown on the	**Closure:** • The students will listen to the teacher's question and ask any questions they may have. • Students will help the teacher use the equation to find out how much it would cost for them to go to the amusement park as a class. • Students will look back to pg. 52 in *Variables and Patterns* and volunteer whether or not they think it is cheaper

	picture of the webpage in problem 3.2A on pg. 52 of *Variables and Patterns.* The teacher will then ask, is it cheaper to go in a group, or is it cheaper to pay an individual admission price?	to go to the amusement park as a group or to pay the individual price.

Meeting Varying Needs of Students:

Scaffolding for students without pre-requisite knowledge:

- To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and get the additional support they need.
- Also, during the set-up of the Cornell Notes, the teacher will discuss the meaning of each of the vocabulary words in the "Toolbox" section. Each of these words were taught in previous lessons, and this discussion is intended to be a quick review of the pre-requisite knowledge. This is especially beneficial for those students who missed the previous lesson, as they will need to know the meaning of these words to complete the lesson.

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English, the visual of the webpage in problem 3.2A on pg. 52 of *Variables and Patterns* will be displayed and referenced.
- A sentence frame will also be provided to help students write descriptions and provide additional language support.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- A strategy of marking text will be explicitly modeled to the class, which will provide English language learners with additional visual and written reference for the meaning of mathematical symbols and words they may not know.

Extension task:

- As an extension task, question #4 in problem 3.2A on pg. 53 of *Variables and Patterns* asks that the students graph and analyze the relationship between the number of people in each group and the admission price. If the class is able to complete questions 1-3 quickly, than this question will be used as an extension task for the class.
- This question will also be used for those students who already have the skills needed to complete questions #2 and #3. Students who already have this knowledge will be grouped together and given question #4 to complete instead of working through questions #2 and #3 with the class.

Assessment

1. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has written:

- A rule for finding the admission price.
- An equation for finding the admission price.

2. Summative assessment is sixteen **school days after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessments planned for this lesson and observing the student participation throughout the lesson, the majority of the students were able to meet the intended objective for this lesson. In order to meet Objective 1.1, students need to have opportunities to practice writing equations and expressions that have two operations. This lesson was designed in order to provide students with the needed practice in understanding what equations are and how to write them. The formative assessment for this required that students write an equation with two operations that represents how to find the group admission price for an amusement park in problem 3.2A on pg. 52 in *Variables and Patterns.* This equation should have been written in the "Notes" section of each student's in-class spiral notebooks. The majority of students met this objective and had the equation written in there notebooks. There were a few who had work shown in their notebooks, but no actual equation written, and one student had part of the equation written. Although there were a few students who did not have the actual equation written, from observed class discussions along with the support of the work these students showed in their notebooks, they have shown evidence of an understanding of where the equation came from. They may not have met the formative assessment requirement for this lesson, but they are on their way to developing the needed understanding in order to meet the objective by the end of the unit.

Reflection:

2. Describe any changes you made *as you were teaching* the lesson.

As I was teaching, the students were moving through the material a little bit more quickly than I had originally planned for. However, they did not move through it quickly enough to be able to complete question #4 as the extension task. As a result, I had an extra five minutes at the end of the class-time. To fill this time with a worthwhile task, not only did I have the students find out how it much it would cost the class to go to the amusement park, but I also had the students think back to what a unit price is (unit prices were taught before Winter Break). I then had the students use the group admission price for the class to find out how much it would cost each of them to go to the amusement park if they split the cost evenly. This acted as both review and as an extension because it forced students to think critically about what other mathematics skills could be applied to the situation.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, I would plan better for differentiation in the content for my students, especially for those who already knew the content. I felt as though the lesson itself was planned well and was successful for the majority of the students, especially the English language learners. For differentiation however, I had only planned to allow the class to move onto question #4 if they moved through the material quickly, and I had planned to allow a group of students to work on #4 instead of #2 and #3 with the class. However I was not able to identify those students who could

do #2 and #3 without the support of the lesson before I got started teaching.

As I began teaching, I realized there were about 2 students who should have been working on question #4 instead of #2 and #3 with the class and I did not address the problem effectively. Although I was able to group them together during one of the group application times, these students ended up working on all the questions, rather than skipping questions #2 and #3. Instead of working on something different that was challenging, they were completing more work. As a result, I would change this lesson plan so that it included a completely different activity for those students who already knew the content, rather than just the next question in the problem that I was not expecting the class to accomplish. I feel as though I did provide meaningful material that challenged these students during this lesson.

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

The greatest way in which the results of this lesson will influence the way in which I will teach in the future is greatly tied to the changes that I would make to this lesson plan. The results of how poorly my plans for differentiation met the needs of the students who already knew the content has encouraged me to think more critically about differentiation techniques that can be used in the future that are not necessarily additional questions found in the curriculum. This will influence me to explicitly plan for how I can meet the needs of the lowest students, the highest students, and all the students in between in *every* lesson.

LESSON PLAN #2

<table>
<tr><td colspan="2">Lesson Title/Description: Variables and Patterns 3.2B: Writing and Solving an Equation With Two Operations to Represent the Cost of Rides at an Amusement Park</td></tr>
<tr><td>Lesson # 2 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td>Goals:
Goal 1 Math: CC 6.EE.7
Solve real-world and mathematical problems by writing and solving equations of the form x+p=q and px=q for cases in which p, q, and x are all nonnegative rational numbers.

Goal 5 Literacy: CC 6.RIT.7
Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

Goal 6 Math: CC 6.EE.9
Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d=65t to represent the relationship between distance and time.</td><td>Objectives:
1.1: After working in groups to find the admission price at an amusement park for different sized groups and referring to a variable table, students will be able to write at least two two-step equations from a written phrase or sentence.

5.1: After completing a variable table, students will be able to describe the pattern represented in the table by writing a complete sentence including two mathematics vocabulary words.

6.1:After practicing writing equations based on a sentence, students will be able to correctly list the values of ordered pairs in a table based on an equation.</td></tr>
<tr><td colspan="2">Pre-Requisite Knowledge and/or Skills: Students will need to have had practice with writing rules and equations with one operation. Additionally, students will need to have had practice with writing and solving equations with two operations by completing problem 3.2A on pg. 52 of Variables and Patterns.

How I know the students have this: I know students will have had this practice by looking over their in-class work. They learned the skill of writing equations with one operation in problem 3.1 on pg. 50 of Variables and Patterns, and will have completed this lesson and practice in their in-class spiral notebooks. Then, they were introduced to the skill of writing equations with two operations in problem 3.2A on pg. 52 of Variables and Patterns, and will also have completed this lesson and practice in their in-class spiral notebooks.</td></tr>
<tr><td colspan="2">Learning Target: I can write and solve equations with two operations.</td></tr>
</table>

<table>
<tr><td colspan="3">Key Vocabulary:
• Rule
• Equation
• Variable</td></tr>
<tr><td colspan="3">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson's activities. Students will pick these up from the supply baskets as they enter the classroom.
• Students will need colored pencils (1 for each student), which are located in the classroom set of supply baskets for each table-group in the classroom. A note will be written on the whiteboard before class to instruct students to pick up these supply baskets as they enter the classroom.
• Students will need their own copy of a "Bonus Card," on which students will be able to keep track of how many points they are spending on rides at the amusement park during the lesson. The teacher will pass out one card to each student during the lesson.
• The activity/lesson will be displayed on the SMARTboard (Problem 3.2B on pg. 53 from Variables and Patterns)
• If the SMARTboard is not working, the activity/lesson will be displayed using the document camera.</td></tr>
<tr><td colspan="2">Procedure: Teacher Does…….</td><td>Procedure: Students Do……..</td></tr>
<tr><td>2 min.</td><td>Motivation/Hook:
• After a ten-minute warm-up time, the teacher will ask the class "Does anyone remember where we went yesterday?"
• The teacher will then inform the class that after finding how much it would cost the class to go to the amusement park using the group admission price, it was decided that the class would pay the admission to get into the amusement park. The teacher will quickly review the equation they wrote for the admission price and how much it cost the class.
• The teacher will ask the students to look back at the picture of the webpage in problem 3.2A on pg. 52 of Variables and Patterns to see if there is anything else that comes with the admission. The teacher will ask, "Do any perks come with our admission?"
• Teacher will ask the students what they think the Bonus Card is, and</td><td>Motivation/Hook:
• Students will listen to the teacher's question and verbally respond with answers such as "the amusement park!" in a casual discussion setting.
• Students will listen to the teacher's explanation that they are going to be going to the amusement park. The students will look back in their Cornell Notes to review the equation they wrote for the admission price and how much it cost the class.
• Students will open their books to problem 3.2A on pg. 52 in Variables and Patterns and look at the picture of the webpage. Students will raise their hands to volunteer what they believe they think they receive with their admission to the amusement park (a Bonus Card).
• Students will raise their hand to volunteer what they think the Bonus Card means and</td></tr>
</table>

	then explain that the points on the Bonus Card can be used like tickets if there is any confusion.	will listen to the teacher's explanation of how they can spend the points on the card similarly to tickets.
7 min.	**Teaching:** • After establishing that the students will be receiving a Bonus Card containing 100 points to spend on rides at the amusement park, the teacher will pass out a copy of a Bonus Card to each student. • Once each student has a Bonus Card, the teacher will as for a volunteer to read question #1 in problem 3.2B on pg. 53 of *Variables and Patterns*, which asks the students to copy and complete a table to show the balance of points left on a Bonus Card after each ride. • Teacher will instruct the students to make their own copy of the table in the "Notes" section of the Cornell Notes they set up during the previous lesson and will model how to do this on the whiteboard. • Teacher will then instruct each student to grab one colored pencil from the group's supply basket. • Teacher will inform students that each ride they go on will cost them six points. • To help them fill out the table, the teacher will instruct the students to work with their group to mark off six points from their Bonus Cards (in alternating colors for each ride) starting at 100 points. The remaining number of points on the card is how many points you have left to spend on rides after each ride you go on. The teacher will model this for the first blank in the table.	**Teaching:** • Students will collect a Bonus Card from the teacher. • A student will volunteer to read question #1 in problem 3.2B on pg. 53 of *Variables and Patterns* out loud. • Students will follow the model provided by the teacher and draw a table in their notes. They will ask any questions that they may have. • Each student will grab one colored pencil from the group's supply basket. • Students can ask any questions that they may have. • Students will listen to the teacher's instruction, and follow the teacher's model for how to use the Bonus Card to find the remaining balance on the Bonus Card. Students will ask any questions that they may have.

	• Teacher will instruct the students to work with their group to complete the table using this method.	• Students will begin working in their groups to cross off points on their Bonus Cards, find the remaining balance, and fill in the table.
10 min.	**Group Application:** • Teacher will wander the room to observe/assess how each group is working together to cross off points on the Bonus Card and filling in the table and helping to facilitate group conversations about the math. • Teacher is answering any questions that the students may have. • Teacher is addressing any points of confusion with the entire class that multiple groups are having trouble with.	**Group Application:** • Students are working in their groups and crossing off six points on their Bonus Cards for each ride they go on according to the table and having conversations with their group members. • Students are asking the teacher any questions they may have about how to fill out the table. • Students are listening to the teacher if any points of confusion are brought up or further explanation is given to the class as a whole group.
7 min.	**Teaching:** • Teacher will bring the class back together as a whole and ask for volunteers to help fill in the table on the SMARTboard. • Teacher will ask the students, "Do you notice any patterns appearing?" "What is happening to the number of points left on the card after you go on a ride?" What operations are being used in this pattern?" • Teacher will ask for a volunteer to read question #2 in problem 3.2B on pg. 53 of *Variables and Patterns*, and ask students to discuss with their group members how they can write a rule to describe how to find the balance of points left on the Bonus Card after going on any number of rides.	**Teaching:** • Students will volunteer the answers they found for the table based on their Bonus Cards and check their answers with the correct ones written on the SMARTboard. • Students will listen to the teacher's questions and volunteer answers to what patterns they see, what operations they were using when crossing off points on their Bonus Cards, etc. • A student will volunteer to read question #2 in problem 3.2B on pg. 53 of *Variables and Patterns*, and will then discuss with their group members about how to write a rule describing how to find the balance of points left on the Bonus Card after going on any number of rides.
2 min.	**Group Application:** • Teacher will wander the room to listen to the conversations that groups are having and the rules	**Group Application:** • Students will discuss with their group members how to write a rule and write what they come up with in the "Notes" section of

	they are coming up with. The teacher will answer any questions students may have.	their Cornell Notes (in their in-class spiral notebooks). Students will ask any questions they may have.
4 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the rule that their group came up with. • Teacher will write one of the rules that the students provided on the SMARTboard. • Teacher will ask for a volunteer to read question #3 in problem 3.2B on pg. 53 in *Variables and Patterns* and instruct the students to work with their groups to turn their rule into an equation. The teacher will remind the students to use the strategy of marking the text.	**Teaching:** • Students will volunteer by raising their hands to share the rule that their group came up with. • Students will check to make sure that the rule they have written in the "Notes" section of their spiral notebooks has the same meaning as the one written on the SMARTboard. • A student will volunteer to read question #3 in problem 3.2B on pg. 53 in *Variables and Patterns.* Students will then begin to work with their groups to write an equation. Students may also ask any questions they may have.
2 min.	**Group Application:** • Teacher will wander the room to listen to the conversations that groups are having and the equations they are coming up with. The teacher will answer any questions that students may have.	**Group Application:** • Students will discuss with their group members how to write a equation and write what they come up with in the "Notes" section of their Cornell Notes (in their in-class spiral notebooks). Students will ask any questions they may have.
. 4 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the equation that their group came up with. • Teacher will write one of the equations that the students volunteered on the SMARTboard (one that is correct). • Teacher will ask for volunteers to identify what each variable in the equation represent and will write these on the SMARTboard. • Teacher will then ask students to take some time to look at the table	**Teaching:** • Students will volunteer by raising their hands to share the equation that their group came up with. • Students will check to make sure that the equation they have written in the "Notes" section of their spiral notebooks has the same meaning as the one written on the SMARTboard. • Students will volunteer what they think each variable in the equation represents, and will ask any questions they may have. • Students will look back at the table they have written and completed in their notes

	again and write a complete sentence describing the relationship between the number of rides they can go on and the number of points left on the Bonus Card. • Teacher will provide a sentence frame on the SMARTboard for those that need language support.	and begin thinking about how they may describe the relationship between the variables. • Students look at the sentence frame the teacher has provided and plan to use it if needed.
2 min.	**Independent Application:** • Teacher will be available to help students write their sentences if needed.	**Independent Application:** • Students will work independently to write their sentences, using the sentence frame if needed. Students will ask any questions they may have.
3 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the sentences that they wrote. • Teacher will discuss the differences between the sentences and the correct relationship that should be described in the sentence.	**Teaching:** • Students will volunteer by raising their hands to share the sentences that they wrote. • Students will listen to the teacher's comments and make sure that the sentence they wrote describes the correct relationship.
3 min.	**Closure:** • Teacher will pose a challenge question to the class, "What are the coordinate pairs shown in the table?" "Do you think that the same relationship we just described in the table will be shown in the graph?"	**Closure:** • Students will listen to the challenge question that the teacher asked and write down what they think the coordinate pairs shown in the table are and then volunteer by raising their hands whether they think the same relationship they described in the table will be shown in a graph.

Meeting Varying Needs of Students:

Scaffolding for students without pre-requisite knowledge:

- To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and get the additional support they need.
- Also, for students who may have been absent for the previous day's lesson, a quick review of the equation that the class wrote for finding the group admission price at an amusement park for any group and how much the admission price would be if the entire class went as a group. Students who were absent would be able to write down this information in their notes to use for reference during the lesson as well as ask any questions they may have during this time.

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English,

the visual of the webpage in problem 3.2A on pg. 52 of *Variables and Patterns* will be displayed and referenced.
- A sentence frame will also be provided to help students write descriptions and provide additional language support.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- A physical copy of the Bonus Card will be used as a manipulative to help students visualize the process of subtracting points from the card for each ride they go on.

Extension task:
- As an extension task, question #4 and #5 in problem 3.2B on pg. 53 of *Variables and Patterns* ask that the students graph and analyze the relationship between the number of rides ridden at the amusement park and how many points are left on the card. If the class is able to complete questions 1-3 quickly, than this question will be used as an extension task for the class, rather than just touched upon in the closure to the lesson.
- For students who are able to move through the material at a quicker pace than the rest of the class, instead of having them complete questions #4 and #5 on their own, they will be given the extension task of solving the following questions: "How many rides can you ride with 100 points on the Bonus Card?" "Comparing how much you paid for admission as a part of a group and how many rides you are able to go on, how much did each ride cost?" "If you paid an individual admission price and received the same 100 point Bonus Card, how much would each ride cost then?" "How much money do you save if you go to the amusement park as a part of a group?"

Assessment

2. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has written:
- A completed table.
- An equation for finding the remaining balance of points on the Bonus Card.
- A complete sentence describing the relationship shown between the variables in the table.
- A list of coordinate pairs that students found in the table they completed.

2. Summative assessment is fifteen **school days after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessments planned for this lesson and observing the student participation throughout the lesson, it is clear that the majority of the students were able to meet the objectives targeted by this lesson in reference to the formative assessment requirement. This lesson was designed to target Objective 1.1 and Objective 5.1. The formative assessment checking students' progress towards meeting Objective 1.1 required students to have filled out a variable table in their in-class spiral notebooks as well as write an equation with two operations that represents the patterns in the table. Following, the formative assessment checking students' progress towards meeting Objective 5.1 required students to write a complete sentence describing the pattern show in the same table. According to the students' notes, the majority of students were able to meet these formative assessments. There was only one student who did not meet the requirements for either of the formative assessments, and two other students who did

not fully meet the requirements for Objective 5.1's formative assessment. Aside from these three students, there are five other students who did not turn in the notes from their in-class spiral notebooks, so their work could not be assessed in terms of the formative assessment.

However, the supplement of classroom observations made during the teaching of this lesson as well as following lessons targeting the same concepts have provided the evidence that the students who did not turn in any class notes most likely at least partially met the requirements for the formative assessments. These particular students are either at or just below grade level in mathematics, yet work quite hard during in-class activities. Because of this work ethic, they commonly are able to meet parts of formative assessment requirements, but often lack the retention of the conceptual understanding. This is consistent with classroom observations made sense then. These students have developed a beginning understanding of the skills and concepts targeted by the objectives in this lesson, but they have not fully met them.

Reflection:

2. Describe any changes you made *as you were teaching* the lesson.

As I was teaching, I made several changes to this lesson. This is because the students had a lot more difficulty with using the manipulative of the Bonus Card than I expected them to. To help them understand how to mark the points off the ride, I modeled not only how many to mark off the Bonus Card after one ride, but after 3 rides and after 5 rides. Many of the students became confused because they did not mark their cards correctly, and re-teaching this took some extra time. Because of this, instead of completing the entire table, I had the students fill out the first three or four spots in the table and we used this data to write our rule and equation.

After this confusion, I felt as though the students may not have had a solid understanding of the mathematical operations that marking off the Bonus Card represented. Instead of having them work in groups to come up with a rule, we discussed the process that we used as a class and I then provided a sentence frame on the SMARTboard for writing the rule. Students were given a couple minutes to discuss with their group how to fill in the sentence frame and then we wrote a rule together as a class. We then marked the text of this rule together as a class to replace each of the words with a mathematical symbol or number. Once we had the text marked and this support in place, I then released them to write an equation with their groups.

The final change that I made to this lesson was the closure. Because of the extra time we took with the Bonus Card, writing the rule, and then marking the text to write the equation, I knew that we would not have time to meet the final objective of the lesson. This was to identify coordinate pairs in the table and I would then make the connections between the table and graphing to close out the lesson. Instead, I focused the students on the sentences they were writing to describe the relationship represented in the table we partially filled in by using the Bonus Card. I provided a sentence frame for those students who need language support and I then asked them each to write a sentence on their own. After writing their sentences, I asked for two volunteers to read their sentences. To my surprise, more than ten of the students volunteered to read their sentence. Each one of these sentences were different, but each one accurately described a relationship that was present in the table. We then closed the lesson with a discussion about the similarities and differences between the sentences they wrote and the relationships that they found.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, there a couple changes that I would make. The first

change I would make would be how the students were to mark of the points on the Bonus Card for each ride that was ridden at the amusement park. The students did not seem to be able to visualize the process in the way I was hoping by using the Bonus Card, and many of them did not understand why they were using it. It did not provide the learning I intended it to. To utilize the Bonus Card in such a way that students could learn from it instead of becoming confused by it, I would have them circle the six points, so they could more easily see "groups of six" on the Bonus Card, instead of crossing off the points. This way they could see that they were multiplying six by however many rides they were going on. I would also assign each group of students a different number of rides to go on, and then compare what each Bonus Card looks like after they have circled each group of six, this way the students could also visually see the pattern of multiplying the number of rides by six point for different numbers of rides. They would be able to see what each Bonus Card looks like in each case and see how the pattern is consistent across any number of rides that are ridden.

Second, I would have the students write an equation representing operations they are using to find the balance on the Bonus Card before writing the rule. Many of the students in the class were able to come up with an equation from the table and Bonus Card right away, but became confused when they had to right a rule before writing the equation. If I were to teach this again, I would take advantage of the natural learning process that students were going through and allow them to write the rule from the equation instead of vice versa. This would have provided an alternative perspective than learned in the previous lesson and built additional connections between rules and equations for the students.

Finally, because of the confusion that the Bonus Card provided, there did not seem to be any students that were completing the lesson at a quicker pace than the rest of the class. In fact, the students that are usually ahead of the rest of the class had to take the extra time to stop and figure out how the Bonus Card related to the table and the equation. In this way, the confusion put all the students on a level playing field and extension tasks did not need to be provided. If I were to make the changes described, I would also need to be prepared to provide extension tasks for the students who already have the knowledge needed to complete the lesson.

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

The results of this lesson have caused me to critically think about the manipulatives and the visuals that I am providing for the students. Not all visual or physical manipulatives will help students understand the processes or the content that is being taught. In fact, they may end up causing more confusion. Because of this experience, whenever I am providing a manipulative or a visual for students to use in the future, I will also plan for the case that I will need to provide instruction without the manipulative or visual. In turn, I will also ensure that the learning and understanding that are provided through a lesson are not dependent on the manipulative or visual, because they may not always facilitate the learning and understanding that I expect or have planned for. Additionally, manipulatives and visuals always need to be critically evaluated before asking students to use and work with them. Before using them in a lesson, I will be sure to ask myself, "How does this manipulative work?" "Does this manipulative represent what I think it represents?" "Is there anything that is confusing about the way this manipulative works?"

LESSON PLAN #3

<table>
<tr><td colspan="2">Lesson Title/Description: Variables and Patterns 3.2C: Solving and Describing an Equation with Two Operations that Represents the Cost of Renting a Golf Cart</td></tr>
<tr><td>Lesson # 3 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td>Goals:
Goal 1 Math: CC 6.EE.7
Solve real-world and mathematical problems by writing and solving equations of the form x+p=q and px=q for cases in which p, q, and x are all nonnegative rational numbers.

Goal 2 Math: CC 6.EE.2
Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. For example, describe the expression 2(8+7) as a product of two factors; view (8+7) as both a single entity and a sum of two terms.

Goal 5 Literacy: CC 6.RIT.7
Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.</td><td>Objectives:
1.2: After teacher modeling and working with variable tables, students will be able to correctly solve a given equation for at least three different values by creating a table.

2.1: After discussing equations as a class, students will be able to correctly identify at least three parts of an equation using mathematical terms.

5.3: After looking at a graph representing an equation, students will be able to describe the pattern represented in the graph with at least one complete sentence.</td></tr>
<tr><td colspan="2">Pre-Requisite Knowledge and/or Skills: Students will need to have had practice with writing rules and equations with one operation. Additionally, students will need to have had practice with writing and solving equations with two operations by completing problems 3.2A and 3.2B on pgs. 52-53 of Variables and Patterns.

How I know the students have this: I know students will have had this practice by looking over their in-class work. They learned the skill of writing equations with one operation in problem 3.1 on pg. 50 of Variables and Patterns, and will have completed this lesson and practice in their in-class spiral notebooks. Then, they were introduced to the skill of writing equations with two operations in problem 3.2A on pg. 52 of Variables and Patterns, and received additional practice in this skill in problem 3.B on pg. 53 of Variables and Patterns. Both of these lessons and practices will have been completed in their in-class spiral notebooks.</td></tr>
<tr><td colspan="2">Learning Target: I can use a table and a graph to help me describe the relationship between two variables.</td></tr>
<tr><td colspan="2">Key Vocabulary:
• Rule</td></tr>
</table>

<table>
<tr><td colspan="3">• Equation
• Variable
• Term
• Coefficient
• Sum</td></tr>
<tr><td colspan="3">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson’s activities. Students will pick these up from the supply baskets as they enter the classroom.
• Students will need two sets of index game cards containing three cards each. One set of cards reads A, B, or C on each card. The other set reads Term, Coefficient, or Term on each card. The teacher will pass out one set of each to every table-group during the lesson.
• The activity/lesson will be displayed on the SMARTboard (Problem 3.2B on pg. 53 from Variables and Patterns)
• If the SMARTboard is not working, the activity/lesson will be displayed using the document camera.</td></tr>
<tr><td colspan="2">Procedure: Teacher Does…….</td><td>Procedure: Students Do……..</td></tr>
<tr><td rowspan="2">5 min.</td><td>Motivation/Hook:
• After a ten-minute warm-up time, the teacher will ask the students, “Where have we been spending our time the last couple of days?”
• Teacher will tell the students, “We are going to spend one more day at the amusement park!”
• Teacher will display the introduction paragraph to problem 3.2C on pg. 53 of Variables and Patterns on the SMARTboard and ask a student to volunteer to read it out loud.
• The teacher will tell the students that there are three steps to this problem (look at the equation, look at the table, look at the graph) and that the goal for the day is to accomplish all three goals.</td><td>Motivation/Hook:
• Students will listen to the teacher’s instruction and respond that the lessons have them working on problems as if they were at an amusement park.
• Students will listen to the teacher’s instruction.
• Students will turn to pg. 53 in Variables and Patterns if they wish to and a student will volunteer to read the introduction paragraph to problem 3.2C.
• Students will listen to the teacher’s instruction and ask any questions that they may have.</td></tr>
<tr><td>Teaching:
• Teacher will display “step 1” (look at the equation) on the</td><td>Teaching:
• Students direct their attention to “step 1” on the SMARTboard and write the</td></tr>
</table>

5-6 min.	SMARTboard and will instruct students to write the equation and each of the parts of the equation in their notes (set up in the lesson over problem 3.2A on pg. 52 of *Variables and Patterns*). • The teacher will instruct students to look at the first part of the equation listed and quickly share with their partners what they think this part is called. The teacher will ask for students to share. • The teacher will ensure that the students come up with the correct definition for the first part of the equation and model on the SMARTboard how to write this in the notes. • The teacher will then pass out a set of index cards to each group which read "term," "coefficient," and "variable."	equation and each of its parts in their notes according to the model on the SMARTboard. • Students will share with their partners what they think the first part listed is called and volunteer answers. • Students will write the definition of the first part of the equation listed according to the teacher's modeling. • Students will receive a set of index cards from the teacher.
5-6 min.	**Group Application:** • Teacher will explain to students that there are words written on each of the cards that they have not learned yet, and as a group they are to decide which word describes which of the remaining parts of the equation displayed on the SMARTboard. • Teacher will inform students that they have 3 minutes to complete this task as a group, and start the timer. • Teacher will wander the room to observe how each group is working together and answer any questions that the students may have.	**Group Application:** • Students will listen to the teachers instructions and ask any questions that they may have. • Students will work with their groups for 3 minutes to try and pick out which word goes with which part of the equation. • Students will ask they teacher any questions they may have.
	Teaching: • Teacher will bring students back together and ask the student sitting in the yellow	**Teaching:** • When the teacher calls for each part of the equation, the yellow group member will hold up the index card with the

5 min.	chair of each group to hold up the index card with the word they think goes with the first word, the same will be done for the second word, and the same thing will be done for the third word. • As each word is discussed, the teacher will model how to write the correct definition to each part on the SMARTboard and clear up any questions or confusion that the students may have. • The teacher will then pass out a second set of three index cards that read "A," "B," and "C" and display the next page of the SMARTboard presentation, which contains the equation and a multiple choice problem about the equation.	word on it that their group has decided goes with that part. • The students will write the definition to each part of the equation according to the teacher's model in their notes and ask any questions that they may have. • The students will receive another set of index cards and direct their attention to the next display on the SMARTboard.
5 min.	**Group Application:** • The teacher will instruct the students to look at the equation and the problem on the SMARTboard. The question asks the students to pick out which option (A, B, or C) that contains a written rule that correctly describes the equation. • The teacher will explain to students that they have 2 minutes to work with their group to pick out the correct answer and set the timer. • The teacher will wander the room to observe how the groups are working together and answer any questions that the students may have.	**Group Application:** • Students will begin to analyze the question on the SMARTboad and think about which option they think is correct. • Students will work with their group to come up the answer to which rule they think correctly describes the equation. • Students will ask the teacher any questions that they may have.
	Teaching: • The teacher will bring the students back together and ask for the student sitting in the	**Teaching:** • The blue student in each group will hold up the answer that their group decided upon together.

5-6 min.	blue chair of each group to hold up the index card containing the answer to which option they think correctly describes the equation. • The teacher will explain the correct answer as well as lead the students in a short discussion analyzing why the other option are incorrect. • The teacher will then display "step 2" (look at the table) on the SMARTboard and give a brief explanation in how to read the table. • The teacher will instruct the students to copy the table into their notes, which ask them to solve for different values of the variable in the equation. • The teacher will model on the SMARTboard how to solve for the first value in the table and then release the students to finish filling in the values in the table.	• The students will check and make sure that have the correct answer written in their notes and participate in a short discussion about why the other answers are incorrect. • Students will direct their attention to "step 2" on the SMARTboard. • Students will copy begin to copy the table into their notes. • Students will follow the modeling of the teacher in how to find the first value asked for in the table and ask any questions they may have.
5 min.	**Independent/Group App.:** • Teacher will instruct the students to find the remaining values in the table. They may work with their group if they need to. • The teacher will wander the room to observe how the groups are working together and to answer any questions the students may have.	**Independent/Group App.:** • Students will listen to the teacher's instruction and then begin working on their own or in their groups to find the remaining values in the table. • Students will ask the teacher any questions they may have.
	Teaching: • The teacher will bring the students back together and ask for volunteers to finish filling in the values on the table. • The teacher will lead the class in a short discussion about the relationship represented	**Teaching:** • Students will volunteer to share the values they found to fill in the rest of the table and check to see if they were able to find the correct values. • Students will participate in a discussion about the relationship between the variables in the table, share any patterns

5 min.	between the values in the table and answer any questions the students may have. • The teacher will display "step 3" (look at the graph) on the SMARTboard and give a brief explanation of how the values in the table were used to build the graph. • The teacher will ask the students to write a complete sentence in their notes that describes the relationship between the variables in the graph. The teacher will provide a sentence from for the students who need language support.	they see, and ask any questions that they may have. • Students will direct their attention to "step 3" on the SMARTboard and ask any questions they may have about the graph. • Students will begin to think about how they might describe the relationship they see in the graph between the variables.
3 min.	**Independent Application:** • Teacher will wander the room to observe the sentences that students are writing and answer any questions that the students may have.	**Independent Application:** • Students will write their sentences independently, and may use the sentence frame if needed. They will ask the teacher any questions that they may have.
3 min.	**Closure:** • The teacher will bring the students back together and ask 2 or 3 students to share the sentences that they wrote. • The teacher will close the class with a brief discussion about how the descriptions that each student wrote were different, yet still described the same relationship. The teacher will explain that this is also true of tables and graphs in math.	**Closure:** • Students will volunteer to share the sentences they wrote with the rest of the class. • Students will participate in a short discussion about how the same relationship can be described differently, and how this is a valuable characteristics of math.

Meeting Varying Needs of Students:

Scaffolding for students without pre-requisite knowledge:

- To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and get the additional support they need.
- Also, for students who may have been absent for the previous day's lesson, a quick review of the context in which the previous lessons have been set will be done as well as a quick check of the content that was learned. The actual equation used in this lesson is not dependent on one's developed in previous lessons, but the concept of

what an equation is will be needed and touched upon in the warm-up activity before the lesson begins.

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English, the visual of the tables and graphs from problem 3.2C on pg. 53 of *Variables and Patterns* will be displayed on the SMARTboard.
- A sentence frame will also be provided to help students write descriptions and provide additional language support.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- A physical copy of the index cards used to play the matching games are used to give a physical and visual context to new vocabulary and content to support those students who struggle with language.

Extension task:

- There are five students in this class that already have the knowledge taught in this lesson. Because of this, the extension task that is provided for this group of students will take place in the form of a small group that is pulled out of the regular class by the mentor teacher. An activity has been designed for them in which they will be given a set of toothpicks arranged in a consecutive row of five boxes. The students will be required to work with each other to come up with three or four different ways of writing an equation for figuring out how many toothpicks are needed to make up a row of any number of boxes. Students will first figure out how many toothpicks make up a row of five consecutive boxes, and use pictures of these rows to visually group toothpicks in order to come up with different patterns that represent the pattern of how many toothpicks make up a row of boxes. The mentor teacher will take these students to an empty room for the entire class period to complete this task.

Assessment

3. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has written:

- A completed table.
- An equation for finding the remaining balance of points on the Bonus Card.
- A complete sentence describing the relationship shown between the variables in the table.
- A list of coordinate pairs that students found in the table they completed.

2. Summative assessment is thirteen **school days after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessments planned for this lesson and observing the student participation throughout the lesson, there is varied data in whether or not the students met the intended objectives for the lesson. First, there were five students who were pulled out of the normal class as a small group by the mentor teacher. These five students above grade level and completed a separate activity that was an extension of the algebra concepts being taught in the regular classroom. All five of these students did not

accomplish the formative assessments planned for the regular lesson, but they did complete their activity and provided evidence of understanding the concepts presented throughout the activity. In addition to these five students, there were three that were absent and five other students who did not turn in evidence of participation in the lesson, whether they participated or not. Finally, the rest of the students were able to meet the first and third formative assessment requirements for the three objectives targeted in this lesson.

However, none of the students, except for the five pulled for a separate activity, were able to meet the formative assessment requirements for one of the three objectives intended for this lesson. This was because as the lesson was taught, adjustments were made according to the students' needs that eliminated the specific activity that the formative assessment was dependent on. This assessment requirement was targeting Objective 5.3, which requires that students write a sentence that describes the relationship shown in a graph. Although this was not accomplished in the lesson, this objective was targeting the literacy skill of the objective rather than the graphing skill. As I realized that the students would not be able to complete a graph in this lesson, I had them write a sentence to describe the table we made instead. This still required students to show evidence of literacy skills, although they were not related to a graph. This, along with future lessons that will also require that students describe graphs, the students showed evidence of being able to use sentences to describe algebraic relationships, whether they are shown in a table or a graph. The specific objective may not have been addressed in the lesson, but the skills were still taught and assessed. It was done in a different way that was more appropriate to the changes made to the teaching of the lesson.

With this in mind, the majority of the students were able to provide evidence of being able to write sentences about mathematical concepts in the "Notes" section of their in-class spiral notebooks. From this perspective, the students were able to meet the skills targeted in the objective through a different criterion. Additionally, because this lesson was taught within the first five lessons planned for this unit, I believe that the majority of the students were able to build a foundation in these skills and objectives (even if not completely met through the completion of this lesson) that will facilitate the ability for the students to meet the objectives targeted by this lesson by the end of the unit. This will be dependent on the success of the remaining lessons and my ability to modify the lessons to the students' specific needs throughout the rest of the unit.

Reflection:

2. Describe any changes you made *as you were teaching* the lesson.

As I was teaching this lesson, there was one fundamental change that I made. When the lesson began, I realized that it was taking students longer to grasp the definitions of the different parts of the equation than I had planned for in the lesson plan. I decided that taking the additional time to develop this vocabulary would be beneficial for the students, so as they guessed the word that identified each part of the equation, I also took the time to talk about the definition and provide additional examples for the students. Because of this, I was not able to show the students the graph of the equation. Although I was not able to show the graph and meet the objective of students writing a sentence to describe the relationship shown in a graph, I was still able to incorporate literacy and have students describe the relationship between the variables in the equation.

In order to do this, instead of having students discuss the relationship between the

variables shown in the table that we completed as a class, I had them independently write a complete sentence to described this relationship. After instructing the students to do this, I wrote a sentence frame on the SMARTboard to provide language support for the students who may have needed this. I then continued with the lesson plan as if it was the graph they had described and closed the class time with having students share the sentences that they wrote and discussing the similarities and differences between the sentences that they wrote. Several of them wrote very different sentences that all accurately described the same relationship. This facilitated a brief, yet powerful discussion about how different sentences, strategies, processes, etc. can be used to describe the same thing, solve the same problem, etc.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, I think I would have removed the review of writing a rule from an equation. Although the game that was played that required students to identify the correct rule that represented the equation was beneficial and engaged the students, in light of the extra time that was taken to develop the new vocabulary, I would have rather had time to show the students the graph of the equation and discuss the relationship between the variables that was shown in both the table and the graph. I believe that building the connection between the graph, the table, and the equation would have been more beneficial for students than the extra practice with connecting rules and equations. The students have received several practice and review in this skill, and because I had to cut the graph portion out of this lesson, it needs to be added into later lessons to ensure that students get the practice of analyzing and working with graphs in terms of algebraic relationships. If were given the opportunity to reteach this lesson, I would have cut out the review activity in order to have time to analyze the graph rather than vice versa.

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

The experience of this lesson has taught me to critically examine when and how I include the review of concepts and skills into lessons. While review and practice is critically to developing strong mathematical skills, the placement of this review should not take the time of developing the foundation and understanding of a concept that is important for students to receive. This is especially true if students have shown that they have already built a strong understanding in the concept that is being reviewed.

Along with this, as I was teaching I automatically decided to cut out the graph activity because it was planned for the end of the lesson. However, this will no longer be my instinct. If activities are taking longer than planned, instead of immediately cutting out whatever is at the end of the lesson, I will critically analyze what are the most important things to be sure to include with the remaining time. I will be willing to cut out activities that are planned in the middle of the lesson, if it is of more benefit to the students to participate in what has been planned for the end of class. I do not have to complete the lesson in the order that I have originally planned, if it benefits the students more to change the order of the lesson, I have the power to do that. And I should do that. In the future I won't be so quick to cut out whatever is at the end of the lesson.

LESSON PLAN #4

<table>
<tr><td colspan="2">Lesson Title/Description: Variables and Patterns 3.3: Paying Bills and Counting Profits</td></tr>
<tr><td>Lesson # 4 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td>Goals:
Goal 1 Math: CC 6.EE.7
Solve real-world and mathematical problems by writing and solving equations of the form x+p=q and px=q for cases in which p, q, and x are all nonnegative rational numbers.

Goal 4 Math: CC 6.EE.2c
Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas V=s^3 and A=6s^2 to find the volume and surface area of a cube with sides of length s=$\frac{1}{2}$.</td><td>Objectives:
1.1: After working in groups to find the admission price at an amusement park for different sized groups and referring to a variable table, students will be able to write at least two two-step equations from a written phrase or sentence.

4.1: After creating a table to represent an equation, students will be able to use a table to accurately evaluate at least three specific values for the represented expression or equation.</td></tr>
<tr><td colspan="2">Pre-Requisite Knowledge and/or Skills: Students will need to have had practice with writing rules and equations with one operation. Additionally, students will need to have had practice with writing and solving equations with two operations, identifying the parts of an equations, as well as filling in and analyzing variable tables by completing problems 3.2A, 3.2B, and 3.2C on pgs. 52-53 of Variables and Patterns.

How I know the students have this: I know students will have had this practice by looking over their in-class work. They learned the skill of writing equations with one operation in problem 3.1 on pg. 50 of Variables and Patterns, and will have completed this lesson and practice in their in-class spiral notebooks. Then, they were introduced to the skill of writing equations with two operations in problems 3.2A and 3.2B on pgs. 52-53 of Variables and Patterns. Finally, students received practice in identifying the parts of equations as well completing and analyzing variable tables. Students should have completed problems indicating their knowledge in each of these areas in their in-class spiral notebooks.</td></tr>
<tr><td colspan="2">Learning Target: I can write and solve equations to find the revenue, expenses, and profit.</td></tr>
<tr><td colspan="2">Key Vocabulary:
• Revenue
• Expenses
• Profit</td></tr>
</table>

<table>
<tr><td colspan="3">• Equation</td></tr>
<tr><td colspan="3">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson's activities. Students will pick these up from the supply baskets as they enter the classroom.
• The activity/lesson will be displayed on the SMARTboard (Problem 3.2B on pg. 53 from Variables and Patterns)
• If the SMARTboard is not working, the activity/lesson will be displayed using the document camera.</td></tr>
<tr><td colspan="2">Procedure: Teacher Does…….</td><td>Procedure: Students Do……..</td></tr>
<tr><td rowspan="2">3-5 min.</td><td>Motivation/Hook:
• After about a ten-minute warm-up activity, teacher will ask the students to think about the reason why the college students were planning the bike tour in Variables and Patterns.
• Teacher will ask students, "What is the goal of the bike tour?" "How do we know if we can meet our goal?" (The goal is to raise money, or make a profit)</td><td>Motivation/Hook:
• Students will think and respond to the teacher's prompt to think about the reason they have been helping the college students in Variables and Patterns plan a bike tour.
• Students will volunteer responses to the teacher's questions and speculate about how they might find out if they will meet their goal.</td></tr>
<tr><td>4-5 min.</td><td>Teaching:
• After a brief discussion about why the students might want to make a profit and how they can measure whether or not the students met their goal, the teacher will ask for a volunteer to read the day's learning target.
• The teacher will underline three key words in the learning target (revenue, expenses, and profit).
• The teacher will lead the students in setting up their Cornell Notes and will ask the students to speculate why three words were underlined in the learning target.
• Teacher will then guide the students in placing the three terms in the "Toolbox" section of their Cornell Notes, along with a definition.
• The teacher will then display a</td><td>Teaching:
• A student will volunteer to read the learning target posted for the day.
• Students will listen to the student who is reading the learning target and notice that the teacher has underlined three words in the learning target.
• Students will set up their Cornell Notes, and volunteer answers as to why they think the teacher underlined the three words.
• Students will copy the words into their toolbox, along with the definitions discussed by the teacher.
• Students will listen to the teacher's</td></tr>
</table>

	table for finding the revenue of the bike tour on the SMARTboard and will instruct students to work with their groups to copy and complete the table.	instruction, ask any questions they may have, and begin to think about how they will copy and complete the table displayed on the SMARTboard in their notes.
4 min.	**Group Application:** • Teacher will wander the classroom to observe how the students are working together in their groups and the work they are doing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Group Application:** • Students will work in their groups to copy and complete filling in the table that is displayed on the SMARTboard. • Students will ask any questions that they may have.
3 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the answers they found to complete the table. • Teacher will ask the students to share how they found their answers, if they noticed any patterns, or used any specific strategies. • The teacher will then ask students to think about the answers shared and to work with their group to write a rule and then an equation for finding the revenue.	**Teaching:** • Students will volunteer to share the answers they found to complete the table, and double check to see if the answers they found match the ones written on the SMARTboard. • Students will share the strategies they used to find the answers, any patterns they recognized, etc. • Students will then begin to think about how they can use the information discussed to write a rule and then an equation for finding the revenue for any number of people that may sign up for the bike tour.
3-4 min.	**Group Application:** • Teacher will wander the classroom to observe how the students are working together in their groups and the work they are doing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Group Application:** • Students will work with their groups to come up with a rule for finding the revenue if the college students charge each customer $350. Students will then turn their rule into an equation. • Students will ask the teacher any questions they may have.

4 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the rules that they came up with. • After briefly discussing the rules that students came up with, teacher will ask for volunteers to share the equations they came up with. • After clarifying any confusion or questions about the rule and equation found for the revenue, the teacher will then display (on the SMARTboard) a table for finding the expenses of the bike tour for any number of customers if it costs the students $155 per customer. • Teacher will instruct students to work with their groups to copy and complete the table in their notes.	**Teaching:** • Students will volunteer to share the rule they came up with and check their answers with the shared work by others. • Students will volunteer to share the equation they came up with and check their answers with the shared work by others. • Students will ask the teacher any questions they may have about the rules and equations found for the revenue of the bike tour. • Students will listen to the teacher's instruction, ask any questions they may have, and begin to think about how they will copy and complete the table displayed on the SMARTboard in their notes.
4 min.	**Group Application:** • Teacher will wander the classroom to observe how the students are working together in their groups and the work they are doing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Group Application:** • Students will work in their groups to copy and complete filling in the table that is displayed on the SMARTboard. • Students will ask any questions that they may have.
3 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the answers they found to complete the table. • Teacher will ask the students to share how they found their answers, if they noticed any patterns, or used any specific strategies.	**Teaching:** • Students will volunteer to share the answers they found to complete the table, and double check to see if the answers they found match the ones written on the SMARTboard. • Students will share the strategies they used to find the answers, any patterns they recognized, etc.

	• The teacher will then ask students to think about the answers shared and to work with their group to write a rule and then an equation for finding the expenses.	• Students will then begin to think about how they can use the information discussed to write a rule and then an equation for finding the expenses for any number of people that may sign up for the bike tour.
3-4 min.	**Group Application:** • Teacher will wander the classroom to observe how the students are working together in their groups and the work they are doing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Group Application:** • Students will work with their groups to come up with a rule for finding the revenue if the college students charge each customer $350. Students will then turn their rule into an equation. • Students will ask the teacher any questions they may have.
4 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the rules that they came up with. • After briefly discussing the rules that students came up with, teacher will ask for volunteers to share the equations they came up with. • After clarifying any confusion or questions about the rule and equation found for the expenses, the teacher will then display (on the SMARTboard) a table for finding the profit of the bike tour for any number of customers if the revenue is $350 per customer and the expenses are $155 per customer. • Teacher will instruct students to work with their groups to copy and complete the table in their notes.	**Teaching:** • Students will volunteer to share the rule they came up with and check their answers with the shared work by others. • Students will volunteer to share the equation they came up with and check their answers with the shared work by others. • Students will ask the teacher any questions they may have about the rules and equations found for the revenue of the bike tour. • Students will listen to the teacher's instruction, ask any questions they may have, and begin to think about how they will copy and complete the table displayed on the SMARTboard in their notes.
	Group Application: • Teacher will wander the classroom to observe how the	**Group Application:** • Students will work with their groups to come up with a rule for finding the

3-4 min.	students are working together in their groups and the work they are doing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	revenue if the college students charge each customer $350. Students will then turn their rule into an equation. • Students will ask the teacher any questions they may have.
. 4 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the rules that they came up with. • After briefly discussing the rules that students came up with, teacher will ask for volunteers to share the equations they came up with. • After clarifying any confusion or questions about the rule and equation found for the profit, the teacher will ask the students, "Will this equation work for any number of customers? • Teacher will then instruct the students to find the profit of the bike tour if they had 20 customers and then if they had 31 customers.	**Teaching:** • Students will volunteer to share the rule they came up with and check their answers with the shared work by others. • Students will volunteer to share the equation they came up with and check their answers with the shared work by others. • Students will ask the teacher any questions they may have about the rules and equations found for the revenue of the bike tour and respond to the teacher's question. • Students will listen to the teacher's instruction, ask any questions they may have, and begin thinking about how they might find the profit for other numbers of customers.
4 min.	**Closure:** • Teacher will give students about 3 minutes to find the profit for 20 customers and then 31 customers. • Teacher will then bring the class back together to discuss the answers and then ask the students, "Do you think the bike tour is worth the work for the amount of profit it brings in for the college students?	**Closure:** • Students will find the profit for 20 customers and then 31 customers. • Students will think and respond to the teacher's question.

Meeting Varying Needs of Students:

Scaffolding for students without pre-requisite knowledge:

- To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and get the additional support they need.
- Also, for students who may have been absent for the previous day's or week's lessons, a quick review of the context of the problem will be done at the beginning of the lesson. Students will be asked to think back to situation of students planning a bike tour and the mathematics that has been so far to help the students complete their planning. This will provide the needed contextual information for any students who have missed any of the lessons targeting the needed pre-requisite knowledge. Additionally, each equation written throughout this lesson is first written as a rule, which is a skill taught in previous lessons needed for this lesson. The inclusion of this skill will provide students without this skill the opportunity to learn and practice this skills with the collaboration of their peers during group work-time.

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English, each activity has a visual image displayed on the SMARTboard.
- When writing rules during this lesson, a sentence starter will be provided on the SMARTboard to provide language support for the English language learners.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- The teacher will model any new problem solving strategies that are introduced throughout the lesson before the students are required to practice them. This will give students a visual, oral, and physical context for their learning.

Extension task:

- As an extension task, an extra challenge was created in order to increase the rigor of the lesson if students are able to complete the lesson in less time than what was allotted. This challenge question is "In order for Sidney to make a profit, she has to charge more than _____ dollars for each lesson." This question requires that students think about the expenses and revenue from a different perspective than the lesson itself facilitates. Rather than just calculating profits, this question requires students to analyze what a profit it, and how it compares to the expenses in order to ensure that money is made.
- Because of the design of the lesson, there will be no extension task for those students who generally move through the material more quickly than the rest of the class. The lesson was intentionally designed so that students would work with their groups for a short time and then come together with the rest of the class to share answers. Because of the peer-led nature of the lessons, the students who are above grade level in mathematics will be spread among different groups in order to help facilitate the peer-led learning in groups.

Assessment

1. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has written:

- An equation for calculating the revenue and the expenses.
- A completed table for find the revenue at the specific values of 4, 5, and 6.
- A completed table for finding the expenses at the specific values of 4, 5, and 6.

2. Summative assessment is ten **school days after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessments planned for this lesson and observing the student participation throughout the lesson, the majority of the students were able to meet both of the objectives for the lesson. There was one student who did not meet either of the objectives because he/she was absent for the day. Another student did not meet either objective because of a lack of work shown in the student's spiral notebook. This student had an equation written for the revenue, but not the expenses. There was also no table made for either the revenue or the expenses. Finally, the remaining four students partially met both of the objectives. They evidenced that they had some understanding needed to meet the objectives, and although they did not meet the objectives specifically through the formative assessments through this lesson, they may be able to reach the objective by the end of the unit.

In addition to these formative lessons, classroom observations during the less have informed my knowledge of whether the students have met the objectives. This is particular to those students who only partially met the objectives. I am able to communicate that these students have developed a beginning understanding of the skills needed that will enable them to meet the objectives by the end of the unit if they continue to participate and engage in the lessons. This is because the lessons are designed to build upon and expand the concepts and skills taught in the beginning lessons of the unit.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, I would provide an explicit goal for the students as to why they were calculating the profit. Although the students were engaged in the lesson and generally tried hard to complete the work, some of the students had difficulty completing work or being motivated to complete the work correctly because they did not know why they were finding the profits for different numbers of people. In order to change this, after reintroducing the context of the problem to the students, I would pose the question to the students "How much money do we need to charge in order to make a profit?" This was planned as an extension task for the students, but after teaching this lesson, I believe that beginning the lesson with this goal in mind would give students an additional understanding of what they were doing and why they were doing it. It would give students a goal and purpose.

In addition to this question, I would also give each group the goal of picking a final price for charging customers for the bike tour. I would ask, "What is a reasonable price to charge? How do the expenses affect this number? How much do you think is too much to

charge?" I would then close the lesson by having each group share the price they chose to charge and why they chose that price. Not only would these changes give a greater purpose to the lesson, but it would also be a way to start incorporating the "Math Practices" as required by the *Common Core State Standards.* Specifically, this change would require students to demonstrate the practice of, "Construct viable arguments and critique the reasoning of others."

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

After teaching this lesson and thinking through what I would do differently, the overall results have influenced the way in which I will approach lessons in the future. In particular, I will design lesson from the perspective the product of the lesson being one of the "Math Practices" from the *Common Core State Standards.* With the change to these standards in the next couple years, it is important to start thinking about how these standards will be implemented and how they can start to be incorporated into the current curriculum in order to ease the transition into different expectations. After analyzing what I would do differently, I began to see how easily these "Math Practices" can be incorporated into the current curriculum without compromising any of the standards children are held accountable for learning. In the future, my goal will to be to include at least one "Math Practice" into each lesson that is taught, at any grade level. The math skills, concepts, or "correct answer" will not be the only goal or product of each lesson that I plan in the future. The development of these practices, which so easily transfer into everyday life will become an integral part of the goal for each lesson.

LESSON PLAN #5

<table>
<tr><td colspan="2">Lesson Title/Description: What is an Expression?</td></tr>
<tr><td>Lesson # 5 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td>Goals:
Goal 1 Math: CC 6.EE.7
Solve real-world and mathematical problems by writing and solving equations of the form x+p=q and px=q for cases in which p, q, and x are all nonnegative rational numbers.

Goal 2 Math: CC 6.EE.2
Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. For example, describe the expression 2(8+7) as a product of two factors; view (8+7) as both a single entity and a sum of two terms.</td><td>Objectives:
1.1: After working in groups to find the admission price at an amusement park for different sized groups and referring to a variable table, students will be able to write at least two two-step equations from a written phrase or sentence.

2.1: After discussing equations as a class, students will be able to correctly identify at least three parts of an equation or expression using mathematical terms.</td></tr>
<tr><td colspan="2">Pre-Requisite Knowledge and/or Skills: Students will need to have had practice with writing rules and equations with both one and two different operations. Additionally, students will need to have knowledge of what a term is, what a coefficient is, and what a variable is.

How I know the students have this: I know students will have had this practice by looking over their in-class work. They learned the skills of writing equations with one and two operations in problems 3.1, 3.2, and 3.3 in Variables and Patterns, and will have completed these lessons and practice in their in-class spiral notebooks. Also, the vocabulary words term, coefficient, and variable were introduced in problem 3.2b on pg. 53 of Variables and Patterns. Students should have written the definitions of these words in their in-class spiral notebooks.</td></tr>
<tr><td colspan="2">Learning Target: I can write and evaluate algebraic expressions using variables.</td></tr>
<tr><td colspan="2">Key Vocabulary:
• Term
• Coefficient
• Variable
• Expression
• Equation</td></tr>
<tr><td colspan="2">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson’s activities. Students will pick these up from the supply baskets as they enter the classroom.
• Each table-group of students will need a set of the “Expression” matching-game pieces</td></tr>
</table>

<table>
<tr><td colspan="3">(These will be distributed to each table-group by the teacher immediately preceding the activity).
• Each student will need a copy of the “Exit Slip” (These will be distributed to each student by the teacher about 5 min before the end of class).
• The activity/lesson will be displayed on the SMARTboard.
• If the SMARTboard is not working, parts of the lesson will be displayed using the document camera, and other notes will be modified using the whiteboard.</td></tr>
<tr><td colspan="2">Procedure: Teacher Does…….</td><td>Procedure: Students Do……..</td></tr>
<tr><td rowspan="3">5-7 min.</td><td>Motivation/Hook:
• After about a ten-minute warm-up, the teacher will write “term,” “coefficient,” and “variable” on the whiteboard and ask, “How many of you remember hearing these words?”</td><td>Motivation/Hook:
• Students will read the words on the whiteboard and verbally respond as to whether they remember learning these words.</td></tr>
<tr><td>• The teacher will then display a vocabulary matching game on the SMARTboard, which requires students to match the correct part of an expression to the correct vocabulary word.</td><td>• Students will turn their attention to the SMARTboard and the teacher’s instruction.</td></tr>
<tr><td>• The teacher will lead the students in a class activity. The teacher will ask for volunteers to come to the SMARTboard to drag the correct part of an expression to the correct vocabulary word.</td><td>• Students will volunteer to come to the SMARTboard to drag the correct part of an expression to the correct vocabulary word. Students will ask any questions that they may have.</td></tr>
<tr><td rowspan="3">5 min.</td><td>Teaching:
• After completing the vocabulary review, the teacher will have the students set up their Cornell Notes.</td><td>Teaching:
• Students will set up their Cornell Notes.</td></tr>
<tr><td>• The teacher will then display an equation on the SMARTboard and ask the class to identify the term “equation.”</td><td>• Students will examine the displayed equation and volunteer to identify the vocabulary word that correctly describes the image.</td></tr>
<tr><td>• The teacher will then display an expression using the same variables, numbers, and operations as the equations and ask students to notice if there is a difference (Think-Pair-Share).</td><td>• Students will share with their elbow partner what they think the difference between the two images (an equation and an expression) is.</td></tr>
</table>

	• The teacher will explicitly inform the students that an expression looks just like an equation, except it does not have an equal sign. The teacher will answer any questions the students may have. • The teacher will ask for student volunteers to come to the SMARTboard to reveal the definition of an expression.	• Students will listen to the teacher's instruction and write any notes in their in-class spiral notebooks. Students will ask any questions that they may have. • Students will volunteer to go to the SMARTboard to reveal the definition of an expression. Students will take notes.
10-12 min.	**Group Application:** • Teacher will ask students to remember what an equation is a simplified form of (a rule). • Teacher will explain that they are going to practice doing the same thing with expressions. • Teacher will pass out one set of "Expression" matching-game pieces to each table-group and explain that as a group they are to match each rule with the correct expression. • The teacher will wander the room to help any groups that are having difficulty and to observe and listen to the mathematical discussions that are happening. • After about 5-8 minutes, the teacher will bring the class back together, and students will volunteer from each group to come to the SMARTboard to identify one of the matches that they found. • The teacher will clarify any confusing matches or questions that the students may have.	**Group Application:** • Students will think and respond to the teacher's question. They should be able to identify that an equation is a simplified rule. • Students will listen to the teacher's instruction and ask any questions they may have. • Students will receive their game pieces and organize them while listening to the teacher's instructions. Students will then work with their group members to match each rule with the correct expression. • Students will ask the teacher any questions they may have about the rules and expressions. • After completing the matching, students from each group with volunteer to go to the SMARTboard to identify one of the matches that their group made. • Students will check their matches with the correct ones on the SMARTboard and ask any questions they may have.
	Teaching: • Teacher will display a table that organizes how to find the value of an expression for a given value of the variable on	**Teaching:** • Students will direct their attention to the table displayed on the SMARTboard.

2-3 min.	the SMARTboard. • Teacher will explain how to replace the variable with the given value and model how to do find the value of the first expression listed. • Teacher will tell students to work with their groups to find the values of the remaining expressions in the table.	• Students will listen to the teacher's instruction and ask any questions that they may have. • Students will begin to work with their groups to find the values of the remaining expressions in the table.
3-5 min.	**Group Application:** • Teacher will wander the room to observe how the groups are working and to answer any questions that the students may have. • Teacher will address the class as a whole if there are any questions that several of the students are having difficulty with.	**Group Application:** • Students will work with their groups to find the values of the remaining expressions in the table. • Students will ask the teacher any questions that they may have.
2 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the values they found for the remaining expressions in the table. • Teacher will display an image of three rules on the SMARTboard and instruct students to work with their groups to simplify them into expressions or equations.	**Teaching:** • Students will volunteer the values they found for the remaining expression in the table. • Students will listen to the teacher's instruction and ask any questions they may have before working with their groups to write expressions and equations.
3 min.	**Group Application:** • Teacher will wander the room to observe how the groups are working together and answer any questions the students may have. • Teacher will address the entire class if there is a question that several of the students have.	**Group Application:** • Students will work with their group members to write expressions or equations from the given rules. • Students will ask any questions that they may have.
	Teaching: • Teacher will bring the class back together and ask for volunteers to share the	**Teaching:** • Students will volunteer to share the expressions and equations that they wrote with their groups.

. 3 min.	expressions and equations that they wrote. • Teacher will be sure to point out the difference between the equation and the expressions. • Teacher will answer any questions that the students may have. • If time, the teacher will instruct the students to write a summary of the activities they just completed. The teacher will provide sentence frames.	• Students will check to see if they found the difference between the expressions and the equation. • Students will ask any questions that they may have. • If time, students will begin to think about how they might write a summary for the learning they participated in.
If time	**Independent Application:** • Teacher will release students to write summaries in the "Summary" section of their in-class spiral notebooks. • After a couple minutes, teacher will ask a couple students to share the summaries that they wrote.	**Independent Application:** • Students will work independently to write summaries of their learning in the "Summary" section of their in-class spiral notebooks. • Students will volunteer to share the summaries that they wrote.
Last 3-5 min.	**Closure/Independent App.:** • Teacher will display an "Exit Slip" problem on the SMARTboard and pass out "Exit Slips" to each student. • Teacher will explain that each student is to complete as many of the problems on the "Exit Slip" as they can, and must hand it in to the teacher as they exit the room at the end of class.	**Closure/Independent App.:** • Students will receive their "Exit Slip" and take notice of the problem displayed on the SMARTboard. • Students will listen to the teacher's instruction and work independently on the "Exit Slip" problems and hand them in to the teacher on their way out of the classroom.

Meeting Varying Needs of Students:

Scaffolding for students without pre-requisite knowledge:

- To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and get the additional support they need.
- Also, for students who may have been absent for the previous day's or week's lessons, a quick review of the needed vocabulary through the completion of an activity will be done. Students who were absent would be able to write down this information in their notes to use for reference during the lesson as well as ask any questions they may have during this time.

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English, each activity has a visual image displayed on the SMARTboard.
- If writing a summary during this lesson, sentence frames will be provided to help support a language barrier.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- The teacher will model any new problem solving strategies that are introduced throughout the lesson before the students are required to practice them. This will give students a visual, oral, and physical context for their learning.

Scaffolding for various learning styles:

- This lesson was designed to specifically target learning styles and intelligences that are not often targeted in a mathematics classroom. Specifically, kinesthetic and visual-spatial learning styles are incorporated into this lesson by requiring students to get up out of their seats to answer questions and use physical manipulatives to answer questions.
- Along with these learning styles, intrapersonal skills are also targeted within this lesson, as each activity will be required to be completed within a group setting. Students will be required to interact with others.

Extension task:

- Because of the nature of the activities within this lesson, no extension task will be provided for those students who are often developmentally ahead of the rest of the students in mathematics. These students are strong logical-mathematical learners, and the heavy inclusion of kinesthetic and visual-spatial learning activities will be a challenge for a few of them. As a teacher, I believe these students will gain greater value from having the experience of learning in these formats than from completing an extension task.
- For the class as a whole, the extension task planned for this lesson is the writing of a summary. Students often have difficulty communicating the learning that they have gained, and writing a summary will require them to expand upon their learning and draw connections. This activity will extend their learning in terms of their own metacognition.

Assessment

4. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the "Exit Slip" that students and complete and hand in on their way out of class will be analyzed after the lesson. Also, notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has displayed an understanding of:

- The difference between an expression and an equation.
- How to find the value of an expression with a given value for the variable.
- How to identify each part of an expression with the correct vocabulary.
- How to write an expression or equation from a given rule.

2. Summative assessment is eight **school days after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessments planned for this lesson and observing the student participation throughout the lesson, the majority of the students either met one of the objectives and were able to meet part of another objective. In order to meet Objective 1.1, students need to be able to identify the difference between an equation and an expression. The formative assessment for this required students to identify given equations and expressions as either an equation or an expression. Every student in the class except for one was able to meet this objective. Objective 2.1 requires students to be able to identify the parts of an expression or equation. The formative assessment required students to look at an equation and an expression and identify which parts were the term, variable, and the coefficient. The results of the assessment showed that all students were able to meet part of this objective. However, only two were able to meet it at 100%. The majority met it to 66%, with few below that.

Along with these formative assessments, classroom observations during the lesson have informed my knowledge of whether the students met the objectives. During the activity portions of this lesson, there was significant student engagement and involvement. This was especially true of the vocabulary activity. However, the learning did not result in as high of understanding across the entire class on the formative assessment as I was expecting. I believe this was because although the vocabulary activity targeted the vocabulary words, there was no explicit instruction as to what the words meant. The students were to guess and learn the meanings implicitly. Because of this, the meanings of these words will be continually targeted and incorporated within the remaining lessons in the unit. This is in order to ensure that more students will be able to meet all of the objectives by the end of the unit.

Reflection:

2. Describe any changes you made *as you were teaching* the lesson.

As I was teaching this lesson, there were two main changes that I made in order to meet the needs of the students. The first change that I made was to the order in which I had students complete a couple of the activities. Initially, I had planned to have students complete the vocabulary game which targeted the words "term," "coefficient," and "variable," followed by them setting up their Cornell Notes in order to complete the rest of the lesson. I planned for this because I thought it would be beneficial for students to have had the vocabulary review before writing the same vocabulary words in the "Toolbox" section of their notebook. However, after I taught this lesson to a different class, I realized that it was hard to ask students to disengage from the vocabulary activity and settle down to the task of taking notes before moving on to the next page on the SMARTboard. Because of this, after the warm-up activity, I had students set up their Cornell Notes and set those aside. Students then participated in the vocabulary game and were much more engaged in the rest of the SMARTboard display when they did not have to settle their minds down to the note-taking task.

The second change that I made to the lesson as I was teaching was the time that I spent on explaining the difference between an equation and an expression after the students participated in the vocabulary game. I had planned for the students to share with their elbow partners what they noticed the differences or similarities between the equation and the expression to be. It was intended to be a short discussion to facilitate the definition of an expression, but as I was teaching and the students began sharing what they saw the similarities and differences between the equation and the expression to be, I

decided to facilitate a longer conversation about the concept of an expression. Many of the students struggled with the idea that an expression does not have an equal sign or one single answer. It can be anything depending on what the value of the variable is. While many of the students could visually recognize that the expression did not have an equal sign, they did not have a conceptual understanding of what that means. Because of this, I spent extra time allowing students to share their thinking and offering explanations for the concepts in several different ways. I believe that that students benefited from the thinking this generated, even if they felt they did not receive a solid understanding of the expression versus an equation.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, I would change the way in which I prepared for the lesson. The actual activities that were done in the classroom were very engaging for students, and I had a wide range of students participate and volunteer during these activities. These included the students that do not normally volunteer to share out during class. While these activities were successful during the lessons, I prepared way too many activities to try and fit into one class period. I only ended up accomplishing about half of the activities that I included into my preparation. Each activity expanded upon the knowledge taught and used in the previous activity, which was intended to provide the scaffolding needed in order to provide students with a conceptual understanding of what an expression is.

However, because we were only able to accomplish about half of the planned activities, students were never challenged by the activities intended to follow the ones that were accomplished. If I could teach this lesson again, I would re-plan the lessons so that they only included the activities that we were able to accomplish. However, I would reorganize these activities so that they included aspects that would provide the students with the challenge of developing their conceptual understanding of expression. As a result, students would be able to receive the challenge if they were ready, while still completing the same activity.

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

The results of this lesson will influence the way in which I will teach in the future in two basic ways. First, the success of including the interactive activities and the range of students that were engaged and volunteered showed me the benefit of including kinesthetic activities for the students. The particular activities allowed students to participate and volunteer in front of the class without necessarily having to speak or write out mathematical work. This result has encouraged me to be continually thinking about how to engage and involve all the students in the class, even if they are not comfortable speaking out. Also, it has encouraged me to not shy away from planning activities that will engage students and provide meaningful learning. Students had fun and they wanted to participate, which are two goals that are often hard to accomplish in a mathematics class. Interactive and kinesthetic activities may take extra work to plan and provide materials for, but the learning outcome is more than worth the effort.

The second way in which this lesson will influence the way I will teach in the future is

based in the idea that less is more. I was not able to accomplish every activity that I planned for this lesson. However, I could have spent more time planning the ones I was able to accomplish in order to ensure that they provided students with even more opportunities to challenge and expand their thinking. While the activities that were completed were successful and provided learning, if I had spent more time focusing on planning fewer activities, I feel as if I could have planned these activities to be even more successful than they were. They could have facilitated a greater amount of learning on a conceptual level. In the future, I will focus on less and aim to provide a deeper level of learning across fewer activities or concepts in one day rather than providing the teaching of a greater number of topics at a surface learning level. Depth, not breadth, will be my focus.

LESSON PLAN #6

<table>
<tr><td colspan="2">Lesson Title/Description: Common Core Investigations: Problem 2.1A Pg. 17</td></tr>
<tr><td>Lesson # 6 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td>Goals:
Goal 4 Math: CC 6.EE.2c
Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas V=s^3 and A=6s^2 to find the volume and surface area of a cube with sides of length s=$\frac{1}{2}$.</td><td>Objectives:
4.1: After creating a table to represent an equation, students will be able to use a table to accurately evaluate at least three specific values for the represented expression or equation.</td></tr>
<tr><td colspan="2">Pre-Requisite Knowledge and/or Skills: Students will need to have an understanding of what an expression is and how to write expressions from written rules, as taught in the previous introductory lesson on expressions created for the SMARTboard. Students will also need to have an understanding of and practice with finding profits as well as sketching graphs. Both of these skills were taught in lessons from Variables and Patterns (Connected Mathematics Project).

How I know the students have this: I know students will have had this practice and developed these skills by looking over their in-class work. They learned what an expression is and practiced writing expressions from rules in a lesson created for the SMARTboard and recorded the work they did throughout the activity in their in-class spiral notebooks. Also, students recorded their work from lessons covering profits and graphing (from Variables and Patterns) in their in-class spiral notebooks. This is the evidence that each student has provided as to whether or not they have the needed pre-requisite knowledge.</td></tr>
<tr><td colspan="2">Learning Target: I can use a table to make and describe a graph to represent an expression.</td></tr>
<tr><td colspan="2">Key Vocabulary:
• Expression
• Profit</td></tr>
<tr><td colspan="2">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson's activities. Students will pick these up from the supply baskets as they enter the classroom.
• Students will need their own piece of graph paper in order to graph the data from the table. These will be distributed to each student during the lesson and collected at the end of class.
• The activity/lesson will be displayed on the SMARTboard (Problem 2.1B&C on pg.</td></tr>
</table>

17 in *Common Core Investigatiosn*) • If the SMARTboard is not working, the activity/lesson will be displayed using the document camera		
Procedure: Teacher Does…….		**Procedure: Students Do……..**
3 min.	**Motivation/Hook:** • After about a ten-minute warm-up activity, the teacher will display the introductory slide to the *Common Core Investigations* 2.1 SMARTboard and ask the class, "How many of you have been to a pumpkin patch or a corn maze?"	**Motivation/Hook:** • Students will turn their attention to the SMARTboard and respond to the teachers questions with either a raised hand or a verbal response.
	• After this short discussion on what a corn maze and the context of the problem, the teacher will guide the students in setting up their Cornell Notes framework in their in-class spiral notebooks.	• Students will participate in a short discussion of the context of the problem, ask any questions they may have about a corn maze or pumpkin patch, and set up their Cornell Notes according to the teacher's guidance.
3 min.	**Teaching:** • After introducing the problem, the teacher will ask for a volunteer to read the introductory paragraph to problem 2.1A on pg. 17 of *Common Core Investigations*.	**Teaching:** • A student will volunteer to read the introductory paragraph while the other students listen.
	• Following this reading, the teacher will remind the students of what an expression is and then ask the students what they think the important information in the paragraph was. The teacher will be sure to ask, "What is the expression that they used?"	• Students will listen to the teacher's instruction, listen to the questions posed to them, and respond with a raised hand to the questions.
	• Teacher will then ask the students to work with their group to complete problem 2.1A1, in which they have to copy and complete a table to find the revenue for specific values for the number of customers to the corn maze.	• Students will examine the example of the table they are asked to complete that is displayed on the SMARTboard and begin to think about how to finish copying and completing the table in the "Notes" section of their in-class spiral notebooks.
7-10 min.	**Group Application:** • Teacher will wander around the classroom to observe how the groups are working together and	**Group Application:** • Students will work with their groups to copy and complete the table in problem 2.1A1 on pg. 17 of

	the work they are producing. • Teacher will answer any questions that the students may have, and address the class as a whole to discuss any component of the problem as needed.	*Common Core Investigations.* • Students will ask the teacher any questions they may have and listen to any instruction that the teacher provides at this time.
5 min.	**Teaching:** • Teacher will bring the class back together and ask students to volunteer the values they found for the total amount of money collected if their were 0 customers, 5 customers, 10 customers, and 15 customers. • Teacher will ask students what process they used to find the amount of money for these numbers of customers. The teacher will ask, "What strategy did you use? Did you use an expression?" Teacher will ensure that each student realizes that the expression 8n is the process used to find the amount of money collected. • Teacher will pass out a piece of graph paper to each student and ask a volunteer to read problem 2.1A2 on pg. 17 of *Common Core Investigations*. • Teacher will release each student to create a graph based on the table they created. They may collaborate with their groups to do this.	**Teaching:** • Students will volunteer the answers they found for the amount of money collected for the values of 0 customers, 5 customers, 10 customers, and 15 customers. Students will also check their answers compared to the ones presented on the SMARTboard. • Students will volunteer to share how they found the amount of money collected for each number of customers and double check to make sure that they have 8n written in reference to how to find the values. • Students will receive their piece of graph paper while one student volunteers to read problem 2.1A2 on pg. 17 of *Common Core Investigations*. • Students will begin to think about how to create their graphs and ask any questions they may have.
7-10 min.	**Group Application:** • Teacher will wander around the classroom to observe how the groups are working together and the work they are producing. • Teacher will answer any questions that the students may have, and address the class as a whole to discuss any component of the problem as needed.	**Group Application:** • Students will work with their groups to create a graph based on the tables they created and completed. • Students will ask the teacher any questions they may have and listen to any instruction provided by the teacher.

4-5 min.	**Teaching:** • Teacher will bring the class back together and ask two or three students to display the graphs they made on the document camera. • Teacher will display two or three student graphs at the same time and lead the students in a brief discussion comparing the similarities and differences between the graphs and emphasizing how each of the graphs represent the same relationship. • Teacher will instruct students to individually complete problem 2.1A3, which asks students to describe the shape of their graphs.	**Teaching:** • Students will volunteer to display the graphs they made to the entire class. • Students will participate in a discussion comparing the similarities and differences in the displayed graphs and how they represent the same relationship. Students will check their personal graphs to ensure that their graph represents the same relationship as well. • Students will ask any questions that they may have and will begin to think about how they may describe the shape of their graphs.
2 min.	**Independent Application:** • Teacher will wander the classroom to observe the descriptions that students are writing. • Teacher will answer any questions that students may have and address the class as a whole to discuss any component of the problem as needed.	**Independent Application:** • Students will work independently to write a short description of the graph they made. • Students will ask any questions that they may have and listen to any instruction provided by the teacher.
. 3 min.	**Teaching:** • Teacher will bring the class back together and ask for a volunteer to share the description they wrote and discuss what the shape of the graph is. • Teacher will then ask students to begin thinking about how they might be able to find the profit for each day the corn maze is open. The teacher will ask questions such as, "What do we need to know in order to find the profit?" • Teacher will read problem 2.1B on pg. 17 of *Common Core Investigations* and release	**Teaching:** • A student will volunteer to read his or her description of the graph. The remaining students will check their description and listen to the teacher's instruction in what the shape of the graph is. • Students will listen to the teacher's instruction, will respond to the teacher's questions in a brief discussion, and ask any questions they may have. • Students will begin to think about how to write an expression to represent the profit for the corn

	students to work with their groups to write an expression to represent the profit for the corn maze if the expenses are $75 per day.	maze.
2 min.	**Group Application:** • Teacher will wander the classroom to observe how the groups are working together and the work they are producing. • Teacher will answer any questions that the students may have, and address the class as a whole to discuss any component of the problem as needed.	**Group Application:** • Students will work with their groups to write an expression representing the profit for the corn maze. • Students ask the teacher any questions they may have and listen to any instruction provided by the teacher.
2 min.	**Teaching:** • Teacher will bring the students back together and ask for volunteers to share the expressions they wrote and have a brief discussion about what each part of the expression represents. • Teacher will ensure that each student has the expression for the profit written in the "Notes" section of his or her in-class spiral notebooks.	**Teaching:** • Students will volunteer to share the expressions they found for the profit and participate in a brief discussion about what each part of the expression represents. • Students will ensure they have the correct expression written in their in-class spiral notebooks and ask any questions they may have.
1 min.	**Closure:** • After discussing the expression for profit, teacher will pose a closing question of "If we made a table to represent the profits for each of number of customers we found the revenue for, do you think the graph would look similar? Would there be any similar patterns shown?" • Teacher will inform students that they will answer these questions tomorrow in class.	**Closure:** • Students will listen to the teacher's questions and respond verbally. • Students will ask any final questions they may have.
Meeting Varying Needs of Students: **Scaffolding for students without pre-requisite knowledge:** • To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and		

get the additional support they need.

- Also, for students who may have been absent for the previous day's lesson, a quick review of what an expression is, along with the vocabulary learned (term, coefficient, and variable) will be provided during the warm-up time. Because the previous day's lesson was a SMARTboard activity, students who were absent did not miss any context needed for the completion of this problem except for the understanding of what an expression is (which will be reviewed).

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English, each activity has a visual image displayed on the SMARTboard. The students will also be provided with a physical copy of graph paper in order to facilitate ease in making a graph.
- If writing a description of graphs during this lesson, sentence frames will be provided to help support a language barrier.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- The teacher will model any new problem solving strategies that are introduced throughout the lesson before the students are required to practice them. This will give students a visual, oral, and physical context for their learning.

Extension task:

- Because Investigation 2 in *Common Core Investigations* includes several elements of making tables and graphs, the extension task planned for this lesson is designed around the analysis of these tools. Creating these tools requires time, and so often little time is spent dissecting the relationships shown in these tables and graphs and how they relate to each other. If there is extra time within this class period, or if there are students who work ahead and finish early, they will be given the task of extending the description of the graph they wrote within the lesson to at a least a paragraph comparing and contrasting the table with the graph as well as noting how the graph might be used in context of finding revenue, expenses, and profit at the corn maze in problem 2.1. This extension will require students to build greater conceptual connections between visual representations and number sentences in mathematics as well as how these concepts relate to real-world situations.

Assessment

5. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has written:

- A complete table that represents a revenue amount and find the specific values of the revenue for the amount of customers in increments of five from zero to one-hundred.

2. Summative assessment is six **school days after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessment planned for this lesson and observing the student participation throughout the lesson, all students except for those who were absent were able to meet the requirements for meeting Objective 4.1 through the

formative assessment. In order to meet these requirements, students were to create a table in their notes and find the revenue for specific values of the customers in increments of five from zero to fifty. The observation of every student's in-class spiral notebooks showed that every student was able to accomplish this task. There was one student who was absent on this day who was unable to meet this objective. However, this student has since been expelled from the school.

I believe that all the students were able to successfully meet the requirements of the formative assessment because of the scaffolding provided throughout the lesson and the opportunities they had for group collaboration to complete the table. There are several students who are English language learners who have strengths in visual representations of mathematics, and the inclusion of creating the table catered to this strength. Although students were able to work with their groups, I do not believe that any of the students relied too heavily on their peers to accomplish the tasks. The students were having mathematical conversations and discussing the points of confusion they had. The participation I observed in this lesson indicates that although some students may have struggled, they were all able to meet the formative requirements with an individual understanding.

Reflection:

2. Describe any changes you made *as you were teaching* the lesson.

As I was teaching this lesson, there were few major changes that I made to the lesson in terms of timing or the order of the lesson. There were, however, changes and clarifications made along the way to cater to the students' understanding of the problems and the questions they were asking. For example, before teaching the lesson, I had planned on not modeling the entire table they were required to make. I wanted to see them struggle through the process and work together in their groups to come to an understanding before modeling the correct table. Some minor changes I made to this process were adding reminders to the information given in the introductory paragraphs to the problem and the information given in these paragraphs. I assumed that students would remember this information and be able to use it to make their tables.

However, during their group work time, I spent additional time addressing the class about different problem solving strategies. For example, instead of telling students what the information they needed was, I would ask them, "Where can you find some information that you know that you can use to figure out what you don't know?" While I had planned and prepared myself to answer questions about common mathematical misconceptions students have when finding revenue, expenses, and profit, I ended up teaching problem solving strategies so that they could come to the answers with their groups. Once questions involving strategies came started to come up, I was able to change my idea of how to help the students create their tables and find the values. I changed the types of questions I was planning to ask and I tried to be purposeful as to when I gave them actual values, and how many answers I provided to the table in class. Looking at the formative assessment requirements, I believe this change in my questioning strategy was successful towards student learning.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, I would make one major change to the table I

asked the students to create. In the lesson, they were required to make a table representing revenue values for different numbers of customers in increments of five from zero to one hundred. I required that students do this, although I only formatively assessed that they were able to do it up through fifty customers. If I were to reteach this lesson, I would only require that students have to make this table up through fifty customers. This would require less time needed for students to make the table and also the graph. Although there would be fewer data points, there would still be a sufficient amount to show the relationship and the pattern represented by the values in the table. Students would not lose any mathematical value by working with a smaller amount of data. The time that this change would add into the lesson plan could then be used to have a longer discussion about the descriptions students wrote about the graphs they made. Rather than just having the students write about the shape of the graph, I believe it would be beneficial to have had them write what the similarities between the graph and the table and whether or not they believed the same relationship between the variables was shown in both formats.

The decrease in data required for these formats may only provide a few extra minutes, but they would add a greater depth to the students' conceptual understanding of the representations graphs and tables provide. Building this conceptual understanding was not necessarily required by the goal and objective targeted by this lesson, but my overarching goal for any lesson and unit is to strengthen students' conceptual understandings and the connections they are making between their lives and the content they are learning. At the end of this lesson, I believed students had gained an understanding of how to make a table according to specific values as well as learned a valuable problem solving strategy, but I do not think they were able to build strong connections between their tables and graphs in the time they were allowed to work with these tools. If I were to teach this lesson again, I would focus on increasing those connections.

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

As I finish reflecting on this lesson, I believe the most impactful element of the teaching of this lesson was the inclusion of the problem solving strategies. Before walking into the classroom, I had a moment of doubt of whether or not letting the students struggle through making the table without much modeling on my part would contribute to or hinder the learning. However, as I realized that I needed to address problem-solving strategies rather than just giving the answers to students, I realized that learning was happening in a powerful way. By allowing students to struggle, while providing them with tools rather than answers, they were learning how to take responsibility for their own learning.

In the future, this is something that I want to include into most, if not all of my lessons. I want to preface all of my instruction with the question, "What tools or strategies am I teaching my students through this lesson that will enable them to find information or solve problems on their own?" Along with this, I think I gained the understanding from this lesson that it is ok to let students struggle with something. As a student teacher, I have been so focused on getting successful results to take for may data that I have almost gained the mindset that if students do not understand something right

away, I am not doing a good job as a teacher. However, sometimes letting students struggle is more beneficial for students and facilitates a more impactful and lasting experience. With this in mind, it is important to also remember that allowing students to struggle has to be appropriate to the goal of the lesson. There is a fine line between allowing them to struggle through something and not providing support when it is greatly needed. This is something that I am still learning, but that I know will impact my future teaching. I want to include appropriate opportunities for students to struggle and be successful with new material, but I want to be mindful of when that may cause harm by encouraging students to give up. In other words, in my future teaching, I want to always be mindful of my students and the strategies (rather than just the content) I am teaching to them.

LESSON PLAN #7

<table>
<tr><td colspan="2">Lesson Title/Description: Common Core Investigations: Problem 2.1B&C Pg. 17</td></tr>
<tr><td>Lesson #7 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td>Goals:
Goal 4 Math: CC 6.EE.2c
Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas V=s^3 and A=6s^2 to find the volume and surface area of a cube with sides of length s=$\frac{1}{2}$.</td><td>Objectives:
4.1: After creating a table to represent an equation, students will be able to use a table to accurately evaluate at least three specific values for the represented expression or equation.</td></tr>
<tr><td colspan="2">Pre-Requisite Knowledge and/or Skills: Students will need to have an understanding of what an expression is and how to write expressions from written rules, as taught in a previous introductory lesson on expressions created for the SMARTboard. Students will also need to have an understanding of and practice with finding profits as well as sketching graphs. Both of these skills were taught in lessons from Variables and Patterns (Connected Mathematics Project). Along with these skills, students will have completed the previous lesson covering problem 2.1A on pg. 17 of Common Core Investigations. This lesson introduces revenue in terms of writing and evaluating expressions rather than equations.

How I know the students have this: I know students will have had this practice by looking over their in-class work. They learned what an expression is and practiced writing expressions from rules in a lesson created for the SMARTboard and recorded the work they did throughout the activity in their in-class spiral notebooks. Also, students recorded their work from lessons covering profits and graphing (from Variables and Patterns) as well as the lesson covering problem 2.1A on pg. 17 of Common Core Investigations in their in-class spiral notebooks. This is the evidence that each student has provided as to whether or not they have the needed pre-requisite knowledge.</td></tr>
<tr><td colspan="2">Learning Target: I can use a table to make and describe a graph to represent an expression.</td></tr>
<tr><td colspan="2">Key Vocabulary:
• Expression
• Profit</td></tr>
<tr><td colspan="2">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson’s activities. Students will pick these up from the supply baskets as they enter the classroom.
• Students will need a copy of a table showing the number of customers, the amount of</td></tr>
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<table>
<tr><td colspan="3">money collected, and the profit made by Ben's family. These will be passed out to each student during the lesson.
• Students will need their own piece of graph paper in order to graph the data from the table. These were distributed to each student during the previous lesson and collected at the end of class. They will be redistributed by the teacher at the beginning of class.
• The activity/lesson will be displayed on the SMARTboard (Problem 2.1B&C on pg. 17 in Common Core Investigatiosn)
• If the SMARTboard is not working, the activity/lesson will be displayed using the document camera.</td></tr>
<tr><td colspan="2">Procedure: Teacher Does…….</td><td>Procedure: Students Do……..</td></tr>
<tr><td rowspan="2">3-4 min.</td><td>Motivation/Hook:
• After about a ten-minute warm-up time, teacher will ask students to think back to the previous day's lesson and ask "What were we helping Ben's family find?"
• Teacher will lead class in a short review of the table they made in class and the patterns they see in the table. Teacher will ask students to share with their elbow partners.
• Teacher will ask students, "What strategies did you use to find the needed information?</td><td>Motivation/Hook:
• Students will think back to the previous day's lesson and respond to the teacher's question.
• Students will look over the table they made and share with their partners any patterns they saw in the table.
• Students will think about the teacher's question and volunteer answer to how they found the information they needed in order to fill out the rest of the table.</td></tr>
<tr><td>3 min.</td><td>Teaching:
• After discussing the table and the patterns found in the table, the teacher will pass out each student's graph paper and instruct the students to finish sketching their graphs and completing problem A3 (which asks them to describe the shape of the graph).
• Teacher will explain to the students that they will be given about 7 min to finish sketching their graphs before having a discussion as a class about the graphs. Teacher will set the timer.
• Because some students are very close to finishing their graphs, an extension problem will be displayed on the SMARTboard</td><td>Teaching:
• Students will receive their pieces of graph paper and listen to the instructions that the teacher gives.
• Students will begin to think about how they will complete their graphs. Students will ask the teacher any questions they may have at this time.
• If already completed with the graph, students will direct their attention to the SMARTboard for additional problems to be working on.</td></tr>
</table>

	for those students to be working on.	
7-8 min.	**Independent/Group App.:** • Teacher will wander the room as students are working on their graphs to observe how groups are working together and student work. • Teacher will address any questions that the students may have and provide additional support for students who are struggling.	**Independent/Group App.:** • Students will work independently or with their groups to finish their graphs and describe them or complete the additional problems on the SMARTboard. • Students will ask the teacher any questions they may have.
4-5 min.	**Teaching:** • At the end of 7 minutes on the timer, the teacher will bring the students back together, even if they haven't completely finished describing their graphs. • Teacher will lead the students in a short discussion about the characteristics of the graphs they drew and ask one or two students to share their descriptions. • Teacher will then introduce Problem 2.1B on pg. 17 of *Common Core Investigations* and ask the students to share with their elbow partners what they think "expenses" means. • Teacher will then instruct students to complete Problems 2.1 B1 &2 on pg. 17 of *Common Core Investigations*.	**Teaching:** • Students will direct their attention back to the teacher. • Students will discuss the graphs that they drew and volunteer to share the descriptions that they wrote. • Students will share with their elbow partners what they think the word "expense" means and volunteer to share with the rest of the class. • Students will begin to look at Problems 2.1 B1&2 on pg. 17 of *Common Core Investigations* and ask any questions that they may have.
8 min.	**Group Application:** • Teacher will wander the room as students are working in their groups to write an equation and find profits. Teacher will observe how students are working together and checking to see if the work is being done correctly. • Teacher will address any questions that the students may have and provide additional support for students who are	**Group Application:** • Students will work with their groups to write an equation and find profits. • Students will ask the teacher any questions they may have.

	struggling.	
3 min.	**Teaching:** • Teacher will bring the students back together and conduct a brief group check of the equation that was written and the profits found. • Teacher will then pass out a pre-made table to each student and instruct them to fill out the missing values in order to find the profit of any number of visitors up to 100 (in increments of 5). They are to finish Problem 2.1C1, 2, &3 on pg. 17 in *Common Core Investigations.*	**Teaching:** • Students will volunteer answers to the equation that they wrote and the profits they found. They will also check to make sure they have the correct answers in their notes. • Students will receive a table and begin thinking about how to find the missing values. Students will ask any questions that they may have.
8 min.	**Group Application:** • Teacher will wander the room to observe how students are working together and the work that is being done. • Teacher will address any questions that the students may have.	**Group Application:** • Students will work in their groups to finish filling out the table and completing Problems 2.1 C1, 2, &3 on pg. 17 in *Common Core Investigations.* • Students will ask the teacher any questions they may have.
. 3 min.	**Teaching:** • Teacher will bring the students back together to discuss the table, the graphs, and the comparisons of the graphs that the students came up with. • Teacher will ask for two or three volunteers to share the descriptions they wrote of the graphs they drew. • Teacher will answer any questions that the students may have.	**Teaching:** • Students will volunteer to share the answers they came up with for their tables, their graphs, and their comparisons of the graphs. • Students will volunteer to share their descriptions and why they chose to describe the graphs in that way. • Students will ask any questions that they may have.
	Closure: • Teacher will ask students to think about the descriptions they wrote about the graphs as well as the problem solving strategies they used to solve the problems in this lesson. Teacher will ask "Did we all write the same description or	**Closure:** • Students will think about the descriptions they wrote and the strategies they used during the lesson. They will respond to the teacher's questions and volunteer their answers.

Last 5 min.	use the same process?" • Teacher will have students write a brief summary of the lesson, focusing on a problem solving strategy they used during the lesson. • Teacher will ask two or three students to share their summaries.	• Students will individually write a brief summary describing one problem solving strategy they used during the lesson. • Two or three students will volunteer to share their summaries with the rest of the class.

Meeting Varying Needs of Students:

Scaffolding for students without pre-requisite knowledge:

- To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and get the additional support they need.
- Also, for students who may have been absent for the previous day's lesson, a quick review of the expression that the students used to find the amount of money collected by the owner of the corn maze if they charged eight dollars for each customer will be done. The students used this expression to fill in missing values of a variable table in the previous day's lesson. Knowing this expression will allow students who missed the previous day complete this day's lesson, as the lesson requires them to use the same expression to then find the profit of the corn maze.

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English, each activity has a visual image displayed on the SMARTboard. The students will also be provided with a physical copy of the table they are required to make and fill-in.
- If writing a description of graphs during this lesson, sentence frames will be provided to help support a language barrier.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- The teacher will model any new problem solving strategies that are introduced throughout the lesson before the students are required to practice them. This will give students a visual, oral, and physical context for their learning.

Extension task:

- Because of the wide range of ability levels within the class and the nature of the activities required by this lesson, some of the students will be able to work at the pace of the planned lesson, while other groups will be able to move much more quickly through the lesson than the planned application/teaching times. Because of this, there is additional practice in algebraic concepts and skills planned for students to work on during the planned application times if they are finished with the problems the rest of the class is working on. These are questions 1-4 on pg. 22 and questions 14-21 on pg. 23 of *Common Core Investigations*. Questions 1-4 review concepts previously learned, while questions 14-21 require students to apply the concepts they are learning to new situations involving specific values for variables as well as using numbers in fraction

and decimal form. As students move through these questions, which they are able to do at their own pace throughout the traditional lesson time, the rigor of the skills they are required to use will also increase.

Assessment

6. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has written:

- A complete table and an expression for revenue to help find the profit.
- The profit for specific values given for the number of customers a business receives.

2. Summative assessment is five **school days after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessments planned for this lesson and observing the student participation throughout the lesson, the majority of the students were able to meet the formative assessment requirements for meeting Objective 4.1, which was targeted by this lesson. In fact, of the students who were not absent or unable to leave their in-class work for observation, only one student was unable to meet the formative assessment requirements. For those students who were not able to leave their in-class notes (four students who keep their notes along with notes needed for other classes), classroom observations provided the evidence that these students were able to meet the objective for the lesson.

I believe that so many of the students were able to be successful at meeting the objective and formative assessment requirements for this lesson because this specific objective was also targeted by the previous day's lesson. This was the second day in which students were developing and practicing the skills required by the objective. Hopefully, with additional practice throughout the rest of the unit, students will be able to retain knowledge of these concepts and skills. It will be interesting to see how they perform in finding profits when the scaffolding of creating and filling in a variable table is not provided.

Reflection:

2. Describe any changes you made <u>*as you were teaching*</u> the lesson.

As I was teaching this lesson, there were two major changes that I made to the lesson. First, the table required for students to complete is designed so that they find the expenses and profit for different numbers of customers in increments of five from 0 to 100 customers. However, because students made a similar table in the previous lesson and analyzed the pattern they saw in the graph based on the patter, I felt as though it was unneeded practice for the students to complete this second table all the way to 100 customers. Instead, I only had the students find the expenses and the profit for different numbers of customers in increments of five from 0 to 50 customers. This reduction allowed more time for discussion of the values found in the table. This was particularly beneficial because the business in the problem would not a make a profit for 0 or 5 customers. In fact, they lost money if that few customers came. This became a critical learning point for students as many of them had the misconception that a profit could not be a negative number and put 0 for each of those values, even though the expression they used to find the profit produced a negative number for them. This was a valuable teaching

moment that I am thankful was not overlooked because of a lack of time.

The second change that I made to this lesson was the graphing component to the lesson plan. From the previous days lesson, I was able to see that the majority of the students have the needed graphing skills appropriate to the sixth grade level. However, it takes the students so long to draw their own graphs that I wanted to spend more time discussing the pattern developing in this lesson's variable table versus the pattern that developed in the previous day's table. While this pattern can be seen in a graph, it can also be seen in the tables, and being able to compare these patterns was more critical for the students understanding of the concepts than seeing them through the format of a graph. I would have had the students complete a graphical representation of the values in the table they made from this lesson if there had been the planned time in class to do so. However, the students moved through the lesson at a different rate than I thought they would. This resulted in the need to remove something from the lesson, and removing the graphing component, but not the analysis of the pattern allowed the students to still learn and practice the needed concepts.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, I would make the changes that I made to the lesson as I was teaching in the initial planning of the lesson. In other words, I would not have planned to have the students create table showing the profit for customers in increments of five from 0 to 100. I would have planned to have them do this from 0 to 50 customers. In the lesson previous to this lesson, students created a table for finding the revenue for any number of customers in increments of five from 0 to 100. I would have changed this table to customers in increments of five from 0 to 50 as well, meaning that there would have been less data to graph in the previous lesson. With these changes, there would not only have been more time within the lesson to discuss the negative profits shown in the table, but there would have been less data for the students to have to compare when analyzing the patterns shown in two tables they created over the course of this lesson and the previous day's lesson. The pattern would have still been present, but students would not have spent as much time being lost in so much data.

With the goal of having less time wasted in the lesson, I would have also planned to give the students shorter application times (work time) on each of the problems. Most of the students were able to move on to the extension tasks, which was beneficial to their learning. However, with planned application times that were shorter along with less data to work with, I believe I would have been able to have the students complete the graph the was originally planned for the lesson. While students were still able to practice the needed skills without the actual graphing, I do think that having them be able to complete the graph and then compare this lessons graph to the previous lesson's graph would have provided a beneficial extension to the students' conceptual understanding of revenue, expenses, and profits. I believe an extension that targets a student's conceptual understanding would have benefited students more in the long-term than the planned extension task they were completing during the application times. These changes in terms of time management to the lesson plan could have a great impact in the students' learning. While students were able to meet objectives and great conceptual discussions took place during this lesson, I believe that this learning could have been even greater

with a few small changes in planning.

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

After reflecting on the changes I made during the lesson, what I would change if I were to teach the lesson again, and how closely related these two things were for this specific lesson, I have determined the importance of time management within a classroom and how greatly the time that is allotted to each component of a lesson can impact how much learning takes place within one class period. This will have a huge impact as I plan lessons in the future. If my goal is to create the greatest opportunities for students to learn during the lessons I teach, then I will have to pay careful attention to how much time I am spending on activities or specific concepts and skills. Although it may be the difference of a minute or two here and there, these minutes add up. In the future, I want to spend more time analyzing the importance of each component in the lesson and then plan to spend the most time in the class period devoted to the most important components. Students do not naturally spend the most time on the components of the lesson that generate the greatest learning. Often times they have to be guided in recognizing what is most important within a lesson, and it is just as important that time within a lesson is planned accordingly to this as well.

LESSON PLAN #8

<table>
<tr><td colspan="3">Lesson Title/Description: Common Core Investigations: Problem 2.2 Pg. 18</td></tr>
<tr><td colspan="2">Lesson #8 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td colspan="2">Goals:
Goal 7 Math: CC 6.EE.3
Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3(2+x) to produce the equivalent expression 6+3x; apply the distributive property to the expression 24x+18y to produce the equivalent expression 6(4x+3y); apply properties of operations to y+y+y to produce the equivalent expression 3y.</td><td>Objectives:
7.1: Working in groups to write an expression according to a word problem, students will be able to apply the distributive property to accurately rewrite the expression into another equivalent expression.</td></tr>
<tr><td colspan="3">Pre-Requisite Knowledge and/or Skills: Students will need to have an understanding of what an expression is and how to write expressions from written rules, as taught in a previous introductory lesson on expressions created for the SMARTboard. Students will also need to have an understanding of and practice with finding profits from problem 2.1 on pg. 17 of Common Core Investigations. This problem introduces the context needed in order to complete this lesson and provides the students with expressions that they will use to solve the problems presented in problem 2.2 on pg. 18 of Common Core Investigations.

How I know the students have this: I know students will have had this practice by looking over their in-class work. They learned what an expression is and practiced writing expressions from rules in a lesson created for the SMARTboard and recorded the work they did throughout the activity in their in-class spiral notebooks. Also, students recorded their work from lessons covering problem 2.1 on pg. 17 of Common Core Investigations in their in-class spiral notebooks. This is the evidence that each student has provided as to whether or not they have the needed pre-requisite knowledge.</td></tr>
<tr><td colspan="3">Learning Target: I can write and solve equivalent expressions.</td></tr>
<tr><td colspan="3">Key Vocabulary:
• Equivalent
• Expression</td></tr>
<tr><td colspan="3">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson’s activities. Students will pick these up from the supply baskets as they enter the classroom.
• The activity/lesson will be displayed on the SMARTboard (Problem 2.2 on pg. 18 in Common Core Investigatiosn)
• If the SMARTboard is not working, the activity/lesson will be displayed using the document camera.</td></tr>
<tr><td colspan="2">Procedure: Teacher Does…….</td><td>Procedure: Students Do……..</td></tr>
<tr><td></td><td>Motivation/Hook:</td><td>Motivation/Hook:</td></tr>
</table>

1-2 min.	• After about a ten-minute warm-up time, teacher will display the introductory slide to problem 2.2 on pg. 18 of *Common Core Investigations* and ask students, "Let's think about the Corn Maze again. Do you think that Ben's family might want to know how much money they might make over more than just one day?" • Teacher will ask for a volunteer to read the introductory paragraph to problem 2.2 on pg. 18 of *Common Core Investigation*.	• Students will listen to the teacher's instruction and verbally respond to the teacher's question. • A student will volunteer to read the introductory paragraph to problem 2.2 on pg. 18 of *Common Core Investigations* while the other students listen and/or follow along in the book..
3 min.	**Teaching:** • Teacher will ask the students comprehension questions about the paragraph just read such as, "How many days is the maze open? What does n represent? What does m represent?" • Teacher will guide students in setting up Cornell Notes in their in-class spiral notebooks. • Teacher will then ask for a volunteer to read problem 2.2A1 on pg. 18 of *Common Core Investigations*, which asks students to write an expression. • Teacher will inform students that they will have 4 minutes to work with their groups to write an expression.	**Teaching:** • Students will respond verbally or with raised hands to the teacher's questions to check their comprehension of the problem. • Students will set up their Cornell Notes in their in-class spiral notebooks. • A volunteer will read problem 2.2A1 on pg. 18 of *Common Core Investigations* while other students listen and/or follow along. • Students will ask any questions they may have and will begin to think about how they might write their expression.
4 min.	**Group Application:** • Teacher will set the timer on the SMARTboard for 4 minutes and wander around the classroom to observe how groups are working together and the work they are producing. • Teacher will answer any questions they may have and address the class as a whole if needed.	**Group Application:** • Students will work with their groups to come up with an expression according to problem 2.2A1 on pg. 18 of *Common Core Investigations*. • Students will ask the teacher any questions they may have and listen to any instruction provided.

4 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the expression that they wrote. • Teacher will discuss the expression briefly, asking students to explain each part of the expression and why they wrote the expression the way in which they did. • Teacher will read problem 2.2A2 on pg. 18 of *Common Core Investigations* and instruct students to work for the next 4 minutes to come up with as many ways to write the expression they just wrote without changing the meaning.	**Teaching:** • Students will share the expressions that they wrote with the rest of the class and check their expressions with the ones presented in class. • Students will offer explanations for each part of the expressions they wrote and why they wrote the expression in that way. • Students will listen to the teacher's instruction, ask any questions they may have, and begin to think about how they may write equivalent expressions to the one they just wrote.
4 min.	**Group Application:** • Teacher will set the timer on the SMARTboard for 4 minutes and wander around the classroom to observe how groups are working together and the work they are producing. • Teacher will answer any questions they may have and address the class as a whole if needed.	**Group Application:** • Students will work with their groups to come up with as many equivalent expressions to the one they just wrote. • Students will ask the teacher any questions they may have and listen to any instruction provided.
5 min.	**Teaching:** • Teacher will bring the students back together and ask for volunteers to share the equivalent expressions they found. The teacher will write these on the SMARTboard. • Teacher will lead the students in a discussion about whether these are equivalent and will have the students replace variables with numbers to check to see if they are equivalent. • If the students did not bring up the equivalent expression	**Teaching:** • Students will volunteer the equivalent expressions they came up with and check their answers with those volunteered by their peers. • Students will participate in the class discussion and check the equivalent expressions by replacing the variables with actual values. • Students will note the distributive property.

	representative of the distributive property, then the teacher will bring it up. • Teacher will read problem 2.2A3 on pg. 18 of *Common Core Investigations* and inform students that they will have 4 minutes with their groups to evaluate the expression according to the values given.	• Students will listen to the teacher's instruction, ask any questions they may have, and begin to think about how they will solve problem 2.2A3 on pg. 18 of *Common Core Investigations.*
4 min.	**Group Application:** • Teacher will set the timer on the SMARTboard for 4 minutes and wander around the classroom to observe how groups are working together and the work they are producing. • Teacher will answer any questions they may have and address the class as a whole if needed.	**Group Application:** • Students will work with their groups to evaluate their expression according to the given values. • Students will ask the teacher any questions they may have and listen to any instruction provided.
5 min.	**Teaching:** • Teacher will bring the students back together and ask for volunteer to share the answer they found. • Teacher will ask the students which form of the expression they used. • Teacher will read problem 2.2B1 on pg. 18 of *Common Core Investigations* and ask students, "What do expenses mean?" • Teacher will inform the students that they will have 4 minutes to work with their groups to write an expression to find the profit according the expenses given.	**Teaching:** • Students will volunteer the answer they found and check their answer according to those shared in class. • Students will share which expression they used to evaluate the expression. • Students will listen to the teacher's instruction and respond verbally or with a raised hand to the questions asked. • Students will listen to the teacher's instruction, ask any questions they may have, and begin to think about how they might write an expression for the profit.
4 min.	**Group Application:** • Teacher will set the timer on the SMARTboard for 4 minutes and wander around the classroom to observe how groups are working together and the work they are producing. • Teacher will answer any	**Group Application:** • Students will work with their groups to come up with an expression for the profit. • Students will ask the teacher any

	questions they may have and address the class as a whole if needed.	questions they may have and listen to any instruction provided.
. 4 min.	**Teaching:** • Teacher will bring the students back together and ask volunteers to share the expressions that they wrote. • Teacher will take special note as to whether there were any expressions written that were different, yet equivalent. • Teacher will ensure that the students found the correct answer. • Teacher will read problem 2.2B2 on pg. 18 of *Common Core Investigations* and inform students that they will have 4 minutes to work with their groups to solve the problem.	**Teaching:** • Students will volunteer the expressions they wrote and check to see if the one they wrote is equivalent to the ones other students wrote. • Students will take special note to which expressions volunteered are equivalent to each other, and which ones are not. • Student will make sure that they came to the correct answer by evaluating their expression. • Students will listen to the teacher's instructions, ask any questions they may have, and begin to think about how they might begin to solve problem 2.2B2 on pg. 18 of *Common Core Investigations.*
4 min.	**Group Application:** • Teacher will set the timer on the SMARTboard for 4 minutes and wander around the classroom to observe how groups are working together and the work they are producing. • Teacher will answer any questions they may have and address the class as a whole if needed.	**Group Application:** • Students will work with their groups to evaluate their expression according to the given values. • Students will ask the teacher any questions they may have and listen to any instruction provided.
2-3 min.	**Closure:** • Teacher will bring the students back together and ask for volunteers to share the answer they came up with. • In light of the students finding whether or not they made a profit, the teacher will ask the students the closing question of "Why is it important that Ben and his family calculate if they	**Closure:** • Students will volunteer to share the answers they found and check their answers according to those that were shared. • Students will listen to the teacher's instruction and respond verbally in a brief discussion.

	make a profit for certain amounts of visitors?" • Teacher will have students write a sentence in their in-class spiral notebooks communicating why it is important to find the profit.	• Students will end the lesson with writing a sentence communicating why they think finding the profit is important.

Meeting Varying Needs of Students:

Scaffolding for students without pre-requisite knowledge:

- To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and get the additional support they need.
- Also, for students who may have been absent for the previous day's lesson, a quick review of the expression that the students used to find the amount of money collected by the owner of the corn maze if they charged eight dollars for each customer as well as the expression they found for the profit will be done. Knowing these expressions and this context will allow students to extend this knowledge to multiple days the farm is open, as required by this lesson.

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English, each activity has a visual image displayed on the SMARTboard.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- The teacher will model any new problem solving strategies that are introduced throughout the lesson before the students are required to practice them. This will give students a visual, oral, and physical context for their learning.

Extension task:

- The extension task planned for this lesson is problem 2.2B3 on pg. 18 of *Common Core Investigations*. This question asks students to figure out the least number of visitors the farm needs in order to make a profit. This is a great extension task to complete after students write why they think finding the profit is an important thing for businesses to do. It takes this thinking a step further and requires students to apply their thinking to real life. This task will be done if the class is able to complete the lesson much more quickly than planned or if a student/small group of students demonstrates the ability to move through the material quickly.
- If an extension task is used during this lesson, it will be done after the concept of the distributive property is introduced to students. Most of the students have not been introduced to the distributive property, and it would be beneficial for even the students above grade level to receive this introduction.

Assessment

7. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has written:

- Each expression they found in problem 2.2A and B in two equivalent forms.

2. Summative assessment is four **school days after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessments planned for this lesson and observing the student participation, the majority of the students except for those who were absent were able to meet the requirements of the formative assessments. This formative assessment targeted Objective 7.1, which is the only objective targeted by this lesson. Except for two students who were absent, there were seven students who did not turn in their in-class spiral notebooks to be examined according to the formative assessment requirement. However, from classroom observations done in order to compensate for this situation and to supplement my own understanding of what the students understood, I believe that there were only three students who did not meet the objective for this lesson.

Classroom observations also indicated that the students who did meet this objective for this lesson met it at a much higher level than expected. Because this was an introductory lesson into the idea of the distributive property (the language distributive property was not even introduced at this time), I was expecting to have to present an equivalent expression to the students that had been obtained through the distributive property. I did not expect any students to be able to come up with it. However, there were students who were able to apply the distributive property to find an equivalent expression, even though they did not know what the property was. Because of this, and the fact that they share in groups, there were a greater number of students who were able to meet this objective through their own inquiry rather than through my direct instruction. Learning has a greater impact when done through this type of inquiry, which is why I believe that some students were able to obtain a greater understanding of the targeted objective than what was aimed for.

Reflection:

2. Describe any changes you made *as you were teaching* the lesson.

As I was teaching this lesson, I decided to increase the amount of time that was spent on discussing and pointing out examples of the distributive property. However, I did not change the fact that I never made mention to the name of the property itself. Because I had not expected students to share expressions that were representative of the distributive that they had come up with on their own, I had not planned to create as much emphasis on this property throughout the rest of the lesson. The remainder of the lesson touches on the concept of finding the profit again, and I had planned on focusing on this as a review concept for the students. Instead, I took this opportunity to continue to explicitly mention the characteristics of the distributive property. In order to do this, whenever students were required to write an expression or solve an expression, I asked the students to share any form of the expression that they used. Once every form was shared, we would evaluate the expressions in each written form to show that these were equivalent. Then, I would ask the students why wrote the expression in the particular form they did or why they chose the particular form to solve the expression for specific values.

Not only did this give students additional practice with the distributive property that was implicit, but it also gave me and the other students insight into the thinking of students and how they solve and view problems. Because of this, I believe this change in the lesson plan better facilitated students being able to meet the intended objective. More time was spent completing activities and having discussions that directly related to the

objective rather than explicitly reviewing the concepts of profit, revenue, and expenses through the completion of these same problems. It may have been a small change in the focus of the discussions in which I lead students, but it provided a completely different learning opportunity for them.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, I would change the way in which that the students are grouped and how I used the groups within this lesson. The students sit in the same groups of four for six weeks at a time. I think this lesson plan would have been stronger if I had changed the way the groups were made in order to ensure that each group had at least one student who is at above grade level. These are the students that were able to come up with equivalent expressions through unknowingly using the distributive property. If I had intentionally spread these students across the groups, I believe their presence in the groups would have made the process of inquiry greater for the other students in the class, as they could have discussions using sixth grade language about these equivalent expressions.

Along with this, in order to prove the equivalence of expressions developed through the use of the distributive property, whenever the curriculum asked students to evaluate expressions according to specific values, I would have intentionally had half of the groups use one form of the expression and the other half use another. I would have then had volunteers come to the SMARTboard to model their work. This could have been the foundation for the discussions in which I lead, rather than the comparisons being made from my modeling of the work students were doing. This would have enabled students to take the lead in the classroom discussions.

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

One successful element of this lesson that I have not mentioned in the reflections so far was the use of the timer. Using this timer not only kept me on track with the amount of time I spent on each component of the lesson, but it created motivation for the students to stay on task as well. Explicitly knowing that they only had a certain amount of time, and then being able to visually see how much time they had left, helped motivate students to try and complete the tasks being asked of them right away. This eliminated a lot of wasted time that students often create by doing other things before participating in a group discussion or trying to solve a problem. In one sense, it added accountability to both the students and myself to stay on task so that all the goals could be accomplished during the class period.

This strategy of time management was so successful in this lesson, that I am planning on using this strategy whenever appropriate to a lesson. Currently, I have this capability through the SMARTboard, but other timers can be used in the future if I do not have access to a SMARTboard. Even if the use of a timer is not appropriate to the activity or lesson, the concept behind the use of a timer will influence each lesson that I plan. I will always be thinking, how can I motivate students to stay on-task and try to complete tasks within a timely manner. The buzz of the timer may not be the incentive used, but other things may work as well. For example, a reward activity at the end of class or an extra

credit point for being on task, etc. The point is, adding an element of accountability was beneficial to both the students and myself. As I continue my teaching career, I am hoping that I do not forget or eliminate an element of accountability from any lesson that I plan. It will not only impact the day's lesson, but learning how to be accountable to someone or something other than oneself is a critical life skill that will have far-reaching impacts into the students' future lives. Although realized through the simple use of a timer, "accountability" has become one of the themes that I want to characterize the way I teach in the future.

LESSON PLAN #9

<table>
<tr><td colspan="2">Lesson Title/Description: Common Core Investigations: Problem 2.3 Pg. 18</td></tr>
<tr><td>Lesson # 9 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td>Goals:
Goal 1 Math: CC 6.EE.7
Solve real-world and mathematical problems by writing and solving equations of the form x+p=q and px=q for cases in which p, q, and x are all nonnegative rational numbers.

Goal 5 Literacy: CC 6.RIT.7
Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.</td><td>Objectives:
1.1: After working in groups to find the admission price at an amusement park for different sized groups and referring to a variable table, students will be able to write at least two two-step equations from a written phrase or sentence.

5.2: After working in a group to write an expression according to a word-problem, students will be able to explain what each of the variables in the expression represent with a complete sentence.</td></tr>
<tr><td colspan="2">Pre-Requisite Knowledge and/or Skills: Students will need to have an understanding of what an expression is and how to write expressions from written rules, as taught in a previous introductory lesson on expressions created for the SMARTboard. Students will also need to have an understanding of and practice with finding profits from problem 2.1 on pg. 17 of Common Core Investigations. This problem introduces the context needed in order to complete this lesson and provides the students with expressions that they will use to solve the problems presented in problem 2.2 and then problem 2.3 on pg. 18 in Common Core Investigations. Additionally, students will need to have gained an understanding that there is more than one way to write an expression without changing the value represented by the expression, which is introduced in problem 2.2 on pg. 18 in Common Core Investigations.

How I know the students have this: I know students will have had this practice by looking over their in-class work. They learned what an expression is and practiced writing expressions from rules in a lesson created for the SMARTboard and recorded the work they did throughout the activity in their in-class spiral notebooks. Also, students recorded their work from lessons covering problem 2.1 on pg. 17, as well as problem 2.2 on pg. 18 of Common Core Investigations in their in-class spiral notebooks. This is the evidence that each student has provided as to whether or not they have the needed pre-requisite knowledge.</td></tr>
<tr><td colspan="2">Learning Target: I can write and solve equivalent expressions.</td></tr>
<tr><td colspan="2">Key Vocabulary:
• Equivalent
• Expression</td></tr>
<tr><td colspan="2">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson’s activities. Students will pick these up from the supply baskets as they enter the classroom.
• The activity/lesson will be displayed on the SMARTboard (Problem 2.2 on pg. 18 in</td></tr>
</table>

Common Core Investigatiosn) • If the SMARTboard is not working, the activity/lesson will be displayed using the document camera.		
Procedure: Teacher Does…….		**Procedure: Students Do……..**
3 min.	**Motivation/Hook:** • After about a ten-minute warm-up time, teacher will display the introductory slide to problem 2.3 on pg. 18 of *Common Core Investigations* and ask students, "What other attractions might Ben's family have on the farm? What do you think about tractor rides? Have any of you ever ridden on a tractor?" • Teacher will ask for a volunteer to read the introductory paragraph to problem 2.3 on pg. 18 of *Common Core Investigations*.	**Motivation/Hook:** • Students will listen to the teacher's instruction and verbally respond to the teacher's questions. • A student will volunteer to read the introductory paragraph to problem 2.3 on pg. 18 of *Common Core Investigations* while the other students listen and/or follow along in the book.
5 min.	**Teaching:** • After the introduction is read, the teacher will ask the students comprehension questions about what was read such as, "How much does Ben charge for a tractor ride?" • Teacher will guide students in setting up their Cornell Notes in their in-class spiral notebooks. • Teacher will then ask for a volunteer to read problem 2.3A on pg. 18 of *Common Core Investigations*, which asks students to write an expression representing the revenue collected from the tractor rides. • Teacher will inform students that they will have 5 minutes to work with their groups to write the expression.	**Teaching:** • Students will respond verbally or with raised hands to the teacher's questions to check their comprehension of the problem. • Students will set up their Cornell Notes in their in-class spiral notebooks. • A volunteer will read problem 2.2A1 on pg. 18 of *Common Core Investigations* while other students listen and/or follow along. • Students will ask any questions they may have and will begin to think about how they might write their expression.
5 min.	**Group Application:** • Teacher will set the timer on the SMARTboard for 5 minutes and wander around the classroom to	**Group Application:** • Students will work with their groups to come up with an expression according to problem 2.3A on pg. 18 of *Common*

	observe how groups are working together and the work they are producing. • Teacher will answer any questions they may have and address the class as a whole if needed.	*Core Investigations*. • Students will ask the teacher any questions they may have and listen to any instruction provided.
5 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the expression that they wrote. • Teacher will discuss the expression briefly, asking students to explain each part of the expression and why they wrote the expression the way in which they did. • Teacher will read problem 2.3B on pg. 18 of *Common Core Investigations* and ask comprehension questions such as, "What do we need to know to find the profit? What was the revenue from the corn maze?" • Teacher will instruct students to work for the next 5 minutes to come up with an expression to find the profit on the farm including both the corn maze and the tractor rides.	**Teaching:** • Students will share the expressions that they wrote with the rest of the class and check their expressions with the ones presented in class. • Students will offer explanations for each part of the expressions they wrote and why they wrote the expression in that way. • Students will listen to the teacher's instruction, verbally respond to the teacher's questions, and ask any questions they may have. • Students will begin thinking about how they can write an expression to find the profit on the farm including both the corn maze and the tractor rides.
5 min.	**Group Application:** • Teacher will set the timer on the SMARTboard for 5 minutes and wander around the classroom to observe how groups are working together and the work they are producing. • Teacher will answer any questions they may have and address the class as a whole if needed.	**Group Application:** • Students will work with their groups to come up with an expression according to problem 2.3B on pg. 18 of *Common Core Investigations*. • Students will ask the teacher any questions they may have and listen to any instruction provided.
	Teaching: • Teacher will bring the class	**Teaching:** • Students will share the expressions that

5 min.	back together and ask for volunteers to share the expression that they wrote. • Teacher will discuss the expression briefly, asking students to explain each part of the expression and why they wrote the expression the way in which they did. Teacher will also provide any clarifications needed. • Teacher will read problem 2.3C on pg. 18 of *Common Core Investigations.* • Teacher will instruct students to work for the next 4 minutes to complete problems 2.3C1&2 on pg. 18 of *Common Core Investigations*, which asks them to evaluate the expression for profit at specific values of the corn maze and tractor rides.	they wrote with the rest of the class and check their expressions with the ones presented in class. • Students will offer explanations for each part of the expressions they wrote and why they wrote the expression in that way. Students will ask any questions they may have. • Students will direct their attention to problem 2.3C on pg. 18 of *Common Core Investigations* and follow along with the teacher. • Students will listen to the teacher's instruction, begin thinking about how they can evaluate the expression they wrote for profit, and ask any questions they may have.
4 min.	**Group Application:** • Teacher will set the timer on the SMARTboard for 3 minutes and wander around the classroom to observe how groups are working together and the work they are producing. • Teacher will answer any questions they may have and address the class as a whole if needed.	**Group Application:** • Students will work with their groups to evaluate their expression for profit in problem 2.3C1&2 on pg. 18 of *Common Core Investigations*. • Students will ask the teacher any questions they may have and listen to any instruction provided.
.	**Teaching:** • Teacher will bring the class back together and ask for a volunteer to come to the SMARTboard to show the work he or she did to evaluate their expression for problem 2.3C1 on pg. 18 of *Common Core Investigations*. • Teacher will discuss the work shown with the class.	**Teaching:** • A student will volunteer to show the work he or she did for problem 2.3C1 on pg. 18 of *Common Core Investigations* on the SMARTboard while other students check • Students will participate in a discussion about the value found.

5-6 min.	• Teacher will ask for a volunteer to come to the SMARTboard to show the work he or she did to evaluate their expression for problem 2.3C2 on pg. 18 of *Common Core Investigations*. • Teacher will discuss the work shown with the class and provide any clarifications needed for the students. • Teacher will instruct students to find their summary rubrics, and spend the next 5 minutes to write a summary of the lesson. Specifically, the teacher will ask the students to pay attention to their topic sentences and the conventions they are using.	• A student will volunteer to show the work he or she did for problem 2.3C1 on pg. 18 of *Common Core Investigations* on the SMARTboard while other students check their work. • Students will participate in a discussion about the value found, and ask any questions they may have. • Students will find their summary rubrics and begin thinking about how they will write their summaries.
5 min.	**Independent Application:** • Teacher will set the timer on the SMARTboard for 5 minutes and wander around the classroom to observe the summaries that the students are writing. • Teacher will answer any questions they may have and address the class as a whole if needed.	**Independent Application:** • Students will work independently to write a summary of the lesson. They will use their summary rubrics and specifically work on their topic sentences and their conventions. • Students will ask any questions they may have and listen to any instruction provided.
Final 3-5 min.	**Closure:** • Teacher will bring the class back together and ask for two or three volunteers to read the summaries that they wrote. • Teacher will thank the students for sharing, making a few closing comments about the similarities and differences in the summaries.	**Closure:** • Two or three students will volunteer to share the summaries they wrote, while the other students listen and compare. • Students will listen to the teacher's closing comments and verbally respond to the similarities and differences noted.
Meeting Varying Needs of Students: **Scaffolding for students without pre-requisite knowledge:** • To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and get the additional support they need. • Also, for students who may have been absent for the previous day's lesson, a quick review of the expression that the students used to find the amount of money collected		

by the owner of the corn maze if they charged eight dollars for each customer as well as the expression they found for the profit will be done. Additionally, a revue of the expressions found for the revenue over the course of two days will be done. Knowing these expressions and this context will allow students to extend this knowledge to finding the profit on for times when the farm is open for multiple days, as required by this lesson.

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English, each activity has a visual image displayed on the SMARTboard.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- The teacher will model any new problem solving strategies that are introduced throughout the lesson before the students are required to practice them. This will give students a visual, oral, and physical context for their learning.

Extension task:

- If the class is able to complete problem 2.3 on pg. 18 of *Common Core Investigations*, then they will complete problems 35-38 on pg. 23 of *Common Core Investigations* as an extension task. These are all word problems that require students to apply their knowledge of expressions to contexts other than profit, revenue, and expense. Using expressions and even equations in this setting has been focused on in this unit, and these tasks would require students to approach and use the same skills from a different perspective. Because of this, these tasks would provide evidence as to whether students have a conceptual understanding of expressions to the extent that they can transfer their use across contexts.

Assessment

8. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has written:

- An expression representing the revenue Ben's family makes by running their corn maze.
- A complete sentence explaining what each variable in one of the expressions they wrote in their in-class spiral notebooks represents.

2. Summative assessment is three **school days after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessments planned for this lesson and observing the student participation, the majority of the students were able to meet the requirements of the formative assessments. Based on turned in evidence, there were five students who did not meet. Three of these students were absent and two of these students did not turn in their in-class spiral notebooks, in which they were to complete the work required by the formative assessments. This lesson targeted Objective 1.1 and Objective 5.2. For the first objective, the formative assessment required students to write an expression that represents a profit in their in-class spiral notebooks, and the requirements for the second objective required students to make a list of the variables that they used to write an

expression using complete sentence. Of the students that provided the evidence of work shown in their in-class spiral notebooks, they were able to meet the requirements of the formative assessments.

However, based on classroom observation, the two students who were in class but did not provide evidence of their work were able to meet these requirements. And while the students were able to meet the requirements of the formative assessments for this lesson, I am not quite sure that they were able to meet both objectives to the criteria required of the post-assessment. From previous formative assessments and classroom observations, I am confident that the majority of the students have gained a solid understanding of Objective 1.1 because there have been several lessons targeting this objective over the course of the unit. However, this is the only lesson targeting Objective 5.2, and from observing the students participation in the lesson, I am not confident that they have met the objective at a deep level that will result in the long-term retention of the information. This will be something to look for on the results of the post-assessment.

Reflection:

2. Describe any changes you made *as you were teaching* the lesson.

As I was teaching this lesson, there was one change that I made in order to ensure that students were able to understand the correct context and background information needed to complete problem 2.3B on pg. 18 of *Common Core Investigations.* In the previous lesson, students were working no finding the revenue and profit for the farm if it were open two days in a row. In this lesson, students are required to find the revenue the farm receives just for tractor rides, followed by finding the profit for both the corn maze and the tractor rides. The sequence of these lessons meant that there were a couple days between when students were working with the revenue and profit of the corn maze for one day and the revenue for the tractor rides.

When I presented problem 2.3Bon pg. 18 of *Common Core Investigations* to the class, I was given several blank and confused looks. While I had planned on asking some review questions about what needs to be known in order to find the profit, I knew that this would not be enough build up of the context and background information needed in order to answer the problem. Because of this, instead of asking the students leading questions and expecting answers right away, I asked leading questions about the corn maze and then required each student to look back in their in-class spiral notebooks in order to find the answer to lease questions. In this way, I had students review the context and needed background information on their own by having them investigate their own notes.

Also, during this time, I spent a few minutes discussing problem-solving strategies. Specifically, I taught the students how to use what is known in order to find out what is not known. This is one reason why students keep their class notes in an in-class spiral notebook. After they completed their investigation, I asked students to share why I had them look back in their notes, and how they could use this strategy to solve problems in other contexts. Through this process, I was able to build background knowledge without having to explicitly give the students the needed information. They were able to find it on their own.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, I think I would have designed an activity to correspond to problem 2.3C1&2 on pg. 18 of *Common Core Investigations.* These problems required students to evaluate their expression for the profit earned from the corn maze and tractor rides for different numbers of visitors. While the students were capable of doing this, I think that I would have been able to provide a more meaningful form of practice for evaluating expressions at specific values that would also provide a greater amount of practice.

In order to do this, I would have picked different values and put them in a bucket. Then, I would have each group pick different values for the numbers of visitors to the corn maze and the tractor rides. Each group would then evaluate the expression according to the values they picked out of the bucket. After each group evaluated their expression, one student from each group would present their work to the rest of the class on the SMARTboard. Finally, I would use the profits found for different numbers of visitors to hold a brief discussion comparing the difference between the amounts of visitors to the corn maze and the tractor rides. This discussion would be designed around the question of "Does Ben make more money if he has more visitors to the corn maze or more visitors to the tractor rides?"

By having each group evaluate the expression for different values (rather than all the same values as required by the written problem) and then present their answers on the SMARTboard exposes all the students to a greater amount of practice at different values. They may only be completing one problem on their own, but they get to observe other students showing the work to evaluate at least 6 other values. Through this, they will be exposed to a greater amount of instruction in the process of evaluating expressions, which is meaningful for students. Specific expressions will change, but the process used to evaluate these expressions will remain the same. Because of this, I think it would have been more beneficial to students to teach problems 2.3C1&2 on pg. 18 of *Common Core Investigations* in this way.

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

Overall, this lesson went smoothly in terms of order, time management, and the ability of students to progress through the problems. While I wish I had included a brief activity in order to increase learning further, the lesson went well and the students gained in terms of learning. This success, followed by the reflection of what I would change if I were to teach this lesson again caused me to learn a valuable lesson as well. Although the lesson was successful, it is always beneficial to reflect on what could be done in order to provide a greater learning opportunity for students. Lessons can always be improved, but these improvements must cater to the strengths of the lesson. For example, I realized that the sequence of the lesson and the time management went well, so I analyzed an improvement in terms of an activity that fit into this sequence and time management.

However, without the requirement of reflecting on my lesson in this way, I do not know that I would have thought of this lesson in terms of what I could change. On the surface it went well and I imagine it would be successful if taught again in the same way. But my reflection caused me to realize that I do not want to be the kind of teacher that accepts what seems like a successful teacher and does not reflect on what could be changed to be even better next time. I always want to strive for improvement in my future

teaching, even if when lessons go better. I do not want to settle with one success. I want to continually be changing, reflecting, and improving in order to bring about greater learning opportunities. Remaining stagnant only brings about harm for students. As a result, I want my teaching to be characterized by proactive and continual improvement. Improvement is never unneeded nor is it ever harmful.

LESSON PLAN #10

<table>
<tr><td colspan="3">Lesson Title/Description: Common Core Investigations: Problem 2.4 Pg. 19</td></tr>
<tr><td colspan="2">Lesson # 10 of 10</td><td>Time Allotted for this Lesson: One 56 min. class period</td></tr>
<tr><td colspan="2">Goals:
Goal 3 Math: CC 6.EE.6
Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.</td><td>Objectives:
3.1: After practice with writing expressions and equations, students will be able to conclude at least two values in real-world problems that can be represented by a variable.</td></tr>
<tr><td colspan="3">Pre-Requisite Knowledge and/or Skills: Students will need to have an understanding of what an expression is and how to write expressions from written rules, as taught in a previous introductory lesson on expressions created for the SMARTboard. Students will also need to have an understanding of and practice with writing and solving expressions from problem 2.1 on pg. 17 and problems 2.2 and 2.3 on pg. 18 of Common Core Investigations. These problems introduce the context needed in order to complete this lesson and provide the students with the practice they need in order to be able to complete problem 2.4 on pg. 19 of Common Core Investigations.

How I know the students have this: I know students will have had this practice by looking over their in-class work. They learned what an expression is and practiced writing expressions from rules in a lesson created for the SMARTboard and recorded the work they did throughout the activity in their in-class spiral notebooks. Also, students recorded their work from lessons covering problem 2.1 on pg. 17, as well as problems 2.2 and 2.3 on pg. 18 of Common Core Investigations in their in-class spiral notebooks. This is the evidence that each student has provided as to whether or not they have the needed pre-requisite knowledge.</td></tr>
<tr><td colspan="3">Learning Target: I can collaborate with my group to write and evaluate expressions involving speed and time.</td></tr>
<tr><td colspan="3">Key Vocabulary:
• Evaluate
• Expression</td></tr>
<tr><td colspan="3">Materials/Equipment/Supplies/Technology/Preparation:
• Students will need their in-class spiral notebooks in which they will complete the lesson’s activities. Students will pick these up from the supply baskets as they enter the classroom.
• The activity/lesson will be displayed on the SMARTboard (Problem 2.2 on pg. 18 in Common Core Investigatiosn)
• If the SMARTboard is not working, the activity/lesson will be displayed using the document camera.</td></tr>
<tr><td colspan="2">Procedure: Teacher Does…….</td><td>Procedure: Students Do……..</td></tr>
<tr><td></td><td>Motivation/Hook:
• After about a ten-minute warm-</td><td>Motivation/Hook:
• Students will respond verbally or with</td></tr>
</table>

3 min.	up time, teacher will display the introductory paragraph to problem 2.4 on pg. 19 of *Common Core Investigations* and ask students to help remind everyone of the context of the problem. • The teacher will ask the students, "What were we finding last week?" and will inform students that they will be using expressions to help find out other useful information that Ben can use on his family's farm.	a raised hand to remind the teacher and other students of the context in which they have been solving problems in Investigation 2 of *Common Core Investigations*. • Students will listen to the teacher's questions and respond verbally or with a raised hand. Students may even try to predict what they may be using expressions to find out according to the context of Ben's family farm.
5 min.	**Teaching:** • After activating students' prior knowledge, teacher will guide the students in setting up their Cornell Notes. Teacher will be sure that the words "evaluate" and "expression" in the "Toolbox" section of the notes. • Teacher will ask for a volunteer to read the introduction paragraph that is displayed on the SMARTboard. The teacher will then inform the students that they will be using expressions involving speed, rather than money. • Teacher will ask for a volunteer to read problem 2.4A on pg. 19 of *Common Core Investigations*. Teacher will then ask students to think-pair-share with their elbow partners and write down what they think can be represented by a variable in problem 2.4A on pg. 19 of *Common Core Investigations.* • Teacher will ask for volunteers to share what they think can be replaced by a variable.	**Teaching:** • Students will follow the teacher's modeling to set up their Cornell Notes. They will make sure that the words "evaluate" and "expression" are written in the "Toolbox" section of the notes. • A volunteer will read the paragraph displayed on the SMARTboard while other students follow along. • A volunteer will read problem 2.4A on pg. 19 of *Common Core Investigations.* Following, students will discuss with their elbow partners what can be represented by a variable and write down their decision. • Volunteers will share what they think can be represented by a variable and check their answer with those shared by their peers.

	• Teacher will then introduce problem 2.4A1 and inform students that they will have 3 minutes with their groups to write an expression, and then set the timer.	• Students will listen to the teacher's instruction of problem 2.4A1, ask any questions they may have, and begin to think about how they might write the expression required of the problem.
3 min.	**Group Application:** • Teacher will wander the room to observe how the groups are working together and the work they are producing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Group Application:** • Students will work in their groups to write an expression as required by problem 2.4A1 on pg. 19 on *Common Core Investigations*. • Students will ask the teacher any questions they may have and listen to any instruction provided.
4 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the expressions that they wrote. • Teacher will hold a brief discussion about the expression and make sure that the students have the correct expression written in their in-class spiral notebooks. • Teacher will introduce problem 2.4A2 and inform students that they will have 2 minutes to evaluate the expression and check their answer with their group members. Teacher will then set the timer.	**Teaching:** • Volunteers will share the expressions they wrote and check their answers with those provided by their peers. • Students will participate in a brief discussion about the expression, make sure they have an accurate expression written in their in-class spiral notebooks, and ask any questions they may have. • Students will listen to the teacher's instruction and begin to think about how they will solve problem 2.4A2 on pg. 19 of *Common Core Investigations*.
2 min.	**Independent Application:** • Teacher will wander the room to observe how the groups are working together and the work they are producing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Independent Application:** • Students will work to solve problem 2.4A2 on pg. 19 on *Common Core Investigations* and check their answers with their group members. • Students will ask the teacher any questions they may have and listen to any instruction provided.
	Teaching: • Teacher will bring the class back together and ask for volunteers to share the answer	**Teaching:** • Students will volunteer to share the answers they found and check their answers with those shared by their

5 min.	they found. • Teacher will hold a brief discussion about the answer, particularly the units. Teacher will ask, "Would we normally express this in minutes?" • Teacher will have students work with their elbow partners to convert the units into hours and minutes, and then share out their answers. • Teacher will introduce problem 2.4A3 on pg. 19 of *Common Core Investigations* and inform students that they will have 3 minutes to work with their groups to answer the problem, and will then set the timer.	peers. • Students will participate and verbally respond to the discussion the teacher initiates about the units used in this problem. • Students will work with their elbow partner to convert the units used in the problem to hours and minutes and then share their answers. • Students will listen to the teacher's instruction, ask any questions they may have, and begin to think about how they might answer problem 2.4A3 on pg. 19 of *Common Core Investigations.*
3 min.	**Group Application:** • Teacher will wander the room to observe how the groups are working together and the work they are producing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Group Application:** • Students will work in their groups to write an expression as required by problem 2.4A3 on pg. 19 on *Common Core Investigations*. • Students will ask the teacher any questions they may have and listen to any instruction provided.
. 5 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the answers they found. • Teacher will hold a brief discussion about the expressions they wrote and what each component represents. • Teacher will then introduce problem 2.4A4 on pg. 19 of *Common Core Investigations* and ask students share with their elbow partners what they think the answer is, and then to raise their hands to share their answers. • Teacher will then introduce problem 2.4B1 on pg. 19 of	**Teaching:** • Students will volunteer to share the answers they found and check their answers with those shared. • Students will participate in the discussion held by the teacher and ask any questions they may have. • Students will listen to the teacher's instruction, share with their elbow partners, and then volunteer to share their answers with the rest of the class. • Students will listen to the teacher's instruction, ask any questions they may

	Common Core Investigations and inform students that they will have 3 minutes to work with their groups to answer the problem. Teacher will then set the timer.	have, and begin to think about how they might answer problem 2.4B1 on pg. 19 of *Common Core Investigations.*
3 min.	**Group Application:** • Teacher will wander the room to observe how the groups are working together and the work they are producing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Group Application:** • Students will work in their groups to write an expression as required by problem 2.4B1 on pg. 19 on *Common Core Investigations*. • Students will ask the teacher any questions they may have and listen to any instruction provided.
3 min.	**Teaching:** • Teacher will bring the class back together and ask for volunteers to share the answers they found. • Teacher will hold a brief discussion about the expressions they wrote and what each component represents. • Teacher will then introduce problem 2.4B2 on pg. 19 of *Common Core Investigations* and inform students that they will have 3 minutes to work with their groups to answer the problem, and will then set the timer.	**Teaching:** • Students will volunteer to share the answers they found and check their answers with those shared by their peers. • Students will participate in the discussion held by the teacher, ask any questions they may have and respond to the teacher's prompts. • Students will listen to the teacher's instruction and begin to think about how they might answer problem 2.4B2 on pg. 19 of *Common Core Investigations.*
3 min.	**Group Application:** • Teacher will wander the room to observe how the groups are working together and the work they are producing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Group Application:** • Students will work in their groups to write an expression as required by problem 2.4B2 on pg. 19 on *Common Core Investigations*. • Students will ask the teacher any questions they may have and listen to any instruction provided.
	Teaching: • Teacher will bring the class back together and ask for volunteers to share the answers	**Teaching:** • Students will volunteer to share the answers they found and check their answers with those shared by their

	they found. • Teacher will hold a brief discussion about the expressions they wrote and what each component represents.	peers. • Students will participate in the discussion held by the teacher, ask any questions they may have and respond to the teacher's prompts.
4 min.	• Teacher will then introduce problem 2.4B3 on pg. 19 of *Common Core Investigations* and instruct students to work with their elbow partners to find the answer and then share out with the rest of the class. • Teacher will then instruct students to think about what they learned in this lesson and then write a summary of their learning in the "Summary" section of their Cornell Notes. The teacher will provide a guiding question for the students to follow and instruct students to use the rubric in their agendas as a guide.	• Students will listen to the teacher's instruction and work with their elbow partners to answer problem 2.4B2 on pg. 19 of *Common Core Investigations* and then share out with the class. • Students will listen to the teacher's instruction, ask any questions they may have, and think about how they might write their summaries.
4 min.	**Independent Application:** • Teacher will wander the room to observe the work that each student is producing. • Teacher will answer any questions the students may have and address the class as a whole if needed.	**Independent Application:** • Students will work individually to write a summary according to the provided rubric. • Students will ask the teacher any questions they may have and listen to any instruction provided.
3-4 min.	**Closure:** • Teacher bring the students back together and ask the students to give themselves a grade for their topic sentences and conventions according to the rubric. • Teacher will ask for two or three students to share the summaries that they wrote.	**Closure:** • Students will listen to the teacher's instruction, and give themselves a grade for their topic sentences and conventions according to the rubric. • Two or three students will volunteer to share the summaries that they wrote.
Meeting Varying Needs of Students: **Scaffolding for students without pre-requisite knowledge:** • To address students who may not have the needed pre-requisite knowledge, the students are seated in groups of four and given several opportunities to work and discuss the math with their peers. This allows them to ask their peers questions and		

get the additional support they need.

- Also, for students who may have been absent for the previous day's or week's lessons, a quick review of the context of the problems that Investigation 2 in *Common Core Investigations* is designed around will be done. This context provides the setting for problem 2.4 on pg. 19 and will give students insight into how the content is being applied to situational contexts. Also, within this review, it will be mentioned that expressions were used to find revenue, expenses, and profit. Because problem 2.4 on pg. 19 does not involve these concepts, students who have missed any of the previous lessons in Investigation 2 will be able to complete problem 2.4 on pg. 19. None of the expressions used rely on these previous lessons.

Scaffolding for English language learners:

- To provide additional support for those students in the class who are not proficient in English, each activity has a visual image displayed on the SMARTboard.
- Students are seated in groups of four in order to gain additional help and support from their peers. This is beneficial for English language learners because it allows them to ask questions in a low-anxiety setting.
- The teacher will model any new problem solving strategies that are introduced throughout the lesson before the students are required to practice them. This will give students a visual, oral, and physical context for their learning.

Extension task:

- The goal of this lesson is for students to be able to complete problem 2.4A&B on pg. 19 of *Common Core Investigations* and then complete a summary on the concepts they learned throughout the lesson. If these are all able to be completed, then problem 2.4C on pg. 19 of *Common Core Investigations* will be presented to students as an extension task. This problem increases the rigor of writing and solving expressions because it presents the concept within the situation of finding the area. Although students have found area before, they have not used a specific formula for finding the area and this problem would require them to derive a formula (write an expression). Also, the rigor is advanced in this problem because it involves exponents. The students have not written any expressions or equations that involve exponents, and this would require students to transfer their knowledge of exponents to what they have learned about writing expressions. Not only does this problem involve finding the area and using exponents, but it also utilizes fractions. This would require students to apply what they have learned earlier in the year about multiplying fractions to their knowledge of writing and evaluating expressions. As an extension task, it includes review while pushing students to extend their thinking.
- For those students who are above grade level in mathematics and who may work through problem 2.4A&B on pg. 19 of *Common Core Investigations* more quickly than the rest of the class, problem 2.4C on pg. 19 will be presented to them before the rest of the class. If the lesson goes according to plans, the rest of the class will not have time to start this problem after completing a summary of the lesson.

Assessment

9. <u>Evidence</u> collected during/as a result of this lesson:

As a formative assessment, the notes taken and work done in the set-up Cornell Notes in each student's in-class spiral notebooks will be analyzed after the lesson. The teacher will look at whether each student has written:

- What values can be represented by a variable in a word problem.
- What information needs to be given in order to evaluate given expressions.

10. Summative assessment is one **school day after this lesson.**

Reflection:

1. Did all the students meet the objectives? How do you know?

After analyzing the formative assessments planned for this lesson and observing the student participation, the majority of the students were able to meet the formative assessment requirements for the targeted objective in this lesson. This lesson targeted Objective 3.1, and the formative assessment required students to have written what values in a problem can be represented by a variable in their in-class spiral notebooks as well as write what information needs to be given in order to evaluate a given expression. While I expected several students to struggle with making these identifications because they require the students to analyze word problems from a perspective other than finding what the final answer may be, all the students except for those who were absent were able to meet these formative assessment requirements. The students struggled at first, but they were able to come to a solid understanding through group discussions by the end of the class.

According to classroom observations, the biggest struggle that students had with this objective was that they were trying to give an answer to the problem other than what the question was asking for. This was consistent with the students' performance on the pre-assessment. Based on their ability to meet the formative assessment requirements of this lesson, I look forward to seeing what growth they will be able to show on the post-assessment. I am hoping that students will be able to retain the progress they made towards meeting the objective for this lesson, particularly because this objective is only targeted by one lesson at the end of the unit. However, from classroom observations, it appeared as though the students were able to discuss the thought processes they went through to obtain their answers rather than just writing down the answer after it was discussed with the entire class. This is an indicator that some students should be able to also meet this objective on the post-assessment.

Reflection:

2. Describe any changes you made *as you were teaching* the lesson.

As I was teaching this lesson, there were few changes that I made to the lesson plan itself. The order in which I ended up teaching the content was consistent with the way in which I initially planned to teach it, and the students seemed to be able to progress through the lesson with the planned scaffolding. There was one change that I was forced to make to the way in which I planned to manage the time and behavior in the classroom. In a previous lesson, I had experienced great success with using a timer to keep track of how long students have group-discussion time and to audibly signal to the class that it is time to turn their attention back to the teacher. Not only did this keep students on task by providing them a form of external motivation to complete problems within a designated amount of time, but it decreased off-task behavior because students were focused on solving problems before the buzzer went off. Because of this success, I had planned to use the timer built into the SMARTboard software during this lesson as well. However, when the lesson was downloaded onto the computer, the timer did not work. I realized that the time did not work the first time I went to use it during my lesson, and I had to come up with a new plan. I ended up keeping track of the time on

my own.

While this did not provide the systematic structure I was aiming for in this lesson, this change did have some benefits. The way in which I kept track of time allowed me to give students more time to work on or discuss a problem that was facilitating deep conversation or causing confusion. In order to keep an element of motivation similar to a timer, I would tell students the amount of time I was giving them and given them time reminders as well to increase on task behavior. However, I would also give students extra time if needed without explicitly telling them I increased the time given. This was to keep students motivated to meet the time requirements without cutting off valuable teaching or learning moments. The structure of the class may not have been as orderly or organized as I would have liked it to be, but I believe this change I made in how I managed time in the lesson was overall successful.

Reflection:

3. What would you change about this lesson plan before you teach it again? Pay attention to situations where students either did not learn or already knew.

If I were to teach this lesson again, I think I would not have scaffolded the lesson as much as I did. While this scaffolding was successful with the majority of the students, I wonder what the students would have been able to produce in terms of writing and evaluating expressions without so much scaffolding of the information on my part. I wonder this because this was the final lesson taught in the unit and the students had several opportunities for practice in writing expressions. Although this lesson provided a different context for which students were required to write expressions, the students were able to transfer their knowledge of expressions from previous lessons to this one. Because of this, I think I would teach this lesson differently by presenting the context and the problem to the students and then giving them a larger amount of time allotted to complete the entire problem without the constant "whole-class" check-ins. I would manage and scaffold this work time with brief time checks according to what problems the students should be working on and providing two "whole-class" check-in times. I think this would force the students to struggle through reading and deciphering the text with their groups to answer the problems. As a result, students would be able to share thinking processes, strategies, etc at a deeper level in the class discussions. Not only this, but I think this would have been a good test of what the students have learned about what and how they can use expressions.

While I chose to scaffold this lesson the way in which I did because of the varying ability levels in the group, the high level of English language learners, and the different perspective from which the lesson required students to analyze the problems, I am curious as to how the students would have performed if the lesson were designed in the way described above. If I had the opportunity to reteach this lesson, I might take the risk to try something that is somewhat out of the norm for the students. This is especially because I know they have received training in the foundational skills needed from previous lessons I taught. I would want to stretch the students a little further than they are used to in order to see how they respond, and I believe this could have been a lesson that would have successfully facilitated that goal.

Reflection:

4. How did the results of this lesson influence the way that you will teach in the future?

I think that the greatest way that the results of this lesson will influence the way in which I will teach in the future is greatly tied to how I can be mindful of when it is appropriate to take instructional risks. While I scaffolded this lesson because I wanted to give my students the greatest opportunity for success, I have been having great discussions with my mentor teacher about when it is appropriate to let students experience struggle or failure. Accordingly, this will push them out of their comfort zones and require them to extend their thinking. However, this is not always appropriate, which is why it is important to be mindful of when this is appropriate. This appropriateness is affected by several classroom characteristics. The place at which a lesson or activity occurs in a unit, the classroom environment, the ability levels of the students, and students' attitudes and motivation in class all need to be considered. In the future, I want to teach in a way that is not only mindful to all these components of the classroom, but to take action when this mindfulness indicates it is appropriate to push the students a little bit out of their comfort zones than they are used to be being pushed. With mindfulness comes action, and in the future, I want to teach in such a way that risks are taken at the appropriate times. I want continue to reflect upon my lessons, and I always want to ask myself if there is a way in which better results could be obtained through the design and teaching of a lesson. In the future, I want the word "mindful" to be used to describe the way in which I teach each of my lessons, especially if I am asking students to take risks and step outside of their comfort zones.