EdTPA Learning Progression

**High School Algebra: Simplifying Radical & Rational Exponent Expressions**

The mathematics instruction was designed for 9th grade algebra 1 students, the primary tool used, is the textbook Algebra 1 with equations, graphs, and applications. Published in 2004 by Houghton Mifflin Company. The central focus and purpose for this learning segment is to understand when and why to use the properties of exponents, fluently go from a rational expression to a radical and vice versa, can understand the difference between rational and irrational numbers. This lesson is a continuation of exponents and radical however this time there is more properties, variables, and negative powers. The lesson will provide the mathematical tools and strengthen the student’s math skills to further their success not only in the math field but also in any other field, they chose to pursue. The common core standards used to meet this central focus are CCSS.MATH.HSN-RN.A.1 Extend the properties of exponents to rational exponents. Explain how the definition of the meaning of rational exponents follow from extending the properties of integers exponents to those values, allowing for a notation for radicals in terms of rational exponents. CCSS.MATH.HSN-N.A.2- Rewrite expressions involving radicals and rational exponents using the properties of exponents. CCSS.MATH.HSN-RN.B.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. This lesson will take one day to complete, and the learning targets are; I know about the sum and product of rational and irrational numbers, I know the properties of Exponents, and I can simplify rational exponents and radical expressions.

In this lesson, conceptual understanding of simplifying expressions with rational exponents and radicals will be addressed with the homework assignment taken out from their textbook. The textbook homework is going to provide the students in the class with materials to get a more comprehensive understanding of rational and irrational numbers as well as the properties of exponents. Procedural fluency is reached also by using the textbook homework as well the practice problems from lecture and exit activity. The use of homework allows students to use the different strategies when simplifying rational exponent and radical expressions. They will also demonstrate their procedural fluency when they can rewrite an integer such as 8 in the form of an exponent to further simplify the expressions. Similarly, a practice approach will be used for mathematical reasoning and problem solving, the students should distinguish when they can write a number in exponent form such as 64 can be written as 2^6 therefore the properties of exponents can be applied. In addition, they need to know when they must turn radicals into rational exponents to once again further simplify the expression. The algebra students will work in groups to discuss the different properties and explain why or why not specific properties are appropriate for simplifying an expression. Students will be asked to explain why using certain methods or properties work better when simplifying radical or rational exponent expressions than others and what happens when the bases or powers change. This way, students will be able to gather insight and show me understanding of the exponent properties, their definitions and how they can be used to simplify radical and rational exponent expressions. The assignment will ask the students similar questions to keep practicing and getting more familiar with the different properties and definitions. During their exit activity, students will respond to questions such as, “What is a radicand and index?”, “Defined a rational number?” The students will be using their problem-solving skills to determine the best approach to simplifying the exponent expression at hand. This assignment aligns with the common core standards CCSS.MATH.HSN-RN.A.1 Extend the properties of exponents to rational exponents. Explain how the definition of the meaning of rational exponents follow from extending the properties of integers exponents to those values, allowing for a notation for radicals in terms of rational exponents. CCSS.MATH.HSN-N.A.2- Rewrite expressions involving radicals and rational exponents using the properties of exponents. CCSS.MATH.HSN-RN.B.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. And will provide the students the opportunity to expand their knowledge of exponent and radical expressions to take it to their future math class.

For building on prior knowledge, expanding vocabulary, and understanding of radical and rational exponential expressions, I will use the textbook assignment that will allow the students to continue building their understanding and to broaden their vocabulary. The students will use discussions among each other to gain further understanding of what by now would be more than just power of a power property learned in the previous lesson. The students will be asked to identify the different exponent properties as well as explain the sums and products between rational and irrational numbers. The assignment also provides me with a quick snapshot of the student’s approaches to answering the questions which are similar to the lecture examples, therefore they could use their notes to solve the problems. It also provides some real-world applications, which I will say, they might find them harder to do since those types of problems were not the focus of my lesson. The assignment is going to provided me with an insight if students understood the material and if they can apply it.

During lecture, students will participate by helping me solve sample problems, as well as having them come up to the board and visually show me how they solve them. Students will work in small groups to provide a chance to talk to their peers and share ideas on how they can complete the exit activity and sample problems. I will also monitor the group discussions by walking around the class to ensure students are on task and if not, steer them back in the correct direction. During the discussion time, the students will work on the sum and product tables of rational and irrational numbers to get a firm understanding on these numbers, and how they can be used to better understand the exponent properties. By doing this, the students will be in a better position to complete their assignment.

 From what I have been observing, this algebra 1 class has mostly freshman who have taken some sort of pre-algebra class during their junior high school education. The class has some sophomore students who seem to be re-taking the class and might be struggling due to their social skills. The junior and senior from that class do not communicate as well with their peers but if I continue to do group work, I might be able to break that barrier. This algebra class has students that are very involved and motivated in their learning and will benefit from additional support of after school tutoring. The students come from a mixture of different pre-algebra classes, different teachers and there are several students who can communicate in both Spanish and English, however the students do not prefer to converse in Spanish during class. There are currently 23 students in the class. While conversing, and observing the students, I have noticed that Spanish speaking students can speak Spanish if they chose to do so but must do not prefer to converse in their native language during class, they do however during their social time. I have also notice that some of the students in this class are athletes, most of them soccer players and therefore understand that hard work will help them maintain a good grade point average so they can continue doing sports and hopefully give them a chance at a scholarship and going to college. I have also learned that some students struggle due to their family situations. Something I would like to work on with these students is to get them out of their comfort zones and encouraged them to work in groups, which is something I would love to make it be a part of their classroom culture so students will rely on themselves for help rather than constantly on the teacher.Students are showing improvement over the semester and are drawing connections from chapter to chapter. However, students are still struggling with in their basic math skills and don’t see this class as worthwhile because most of them do not intent to move up as far as calculus. This algebra 1 class, is meant to provide students with more opportunities to explore math concepts, how they can relate it to their lives and make it an easier transition to algebra 2 and even geometry which are required classes to graduate. One of my goals is to show students that math can be a great tool for understanding our world and how in many ways, we can use it to make it better. Students have shown improvement with their procedural ability, asking questions, reflecting on their work, and working together as a group which is one of my goals as I mentioned earlier.

 Algebra 1 does teach new algebraic material and strengthens old ones. Every chapter gives students extra support and knowledge for when these students make the move to algebra 2. Algebra 1, goes over the central focus from their pre-algebra classes and provide students with an opportunity to explore some of the same algebraic concepts in a different way and with a little more difficulty since variables are added. This provides the students the chance to grasp concepts thoroughly and then can help each other. The assignment given, will address different situations in which they can use the property of exponents, vocabulary definitions, along with other methods to simplify rational and radical exponent expressions. Students will be able to see the different methods that are acceptable in answering the different questions in the assignment. Students will be asked to explain their answer during group discussion. These discussions will push students to broaden their understanding of exponent properties. The assignment also provides students with an opportunity to understand the different questions and have a deeper understanding of the vocabulary used in the lesson. Throughout the lecture, I will provide students with an opportunity to talk to their peers and check their answers from sample problems. I will also have them work in small groups to complete an assessment activity towards the end of the class period in which I will bring them together to have a class discussion on rational exponent and radical expressions. This discussion will ensure that no one misses any key concepts of the lesson and to clarify any misconceptions students might have. Small groups give students the opportunity to be in a more comfortable setting where they don’t have to be afraid to be wrong or be judged, the small group work also allows the students to share ideas back and forth to ensure a full understanding of the lesson. During the group activity, students will be allowed to converse in their native language if needed and are encouraged to discuss all the material learned to answer the questions on the textbook assignment. I will be monitoring the group activity and listening for the usage of these key words: rational number, radical, exponent, and simplify. The textbook homework allows students to work through different examples and start familiarizing with the different expressions, it also encourages students to understand the vocabulary and how that would help them solve problems without needing assistance from me. After the group activity, I will be giving positive feedback and solutions, orally. The students will use the textbook assignment, myself, and their peers as resources and will encourage using their peers, before coming to me for help. This way, they can hear different ideas from each other while the textbook homework will provide extra practice for students who may need to explore the central focus a little more.

Students will have different vocabulary due to coming from multiple pre-algebra classes taught by different teachers. This is a challenge but it provides an opportunity for the students to gain a full understanding of the central focus. Vocabulary differences as well as knowledge differences will be addressed using the textbook assignment, group activity, small group and class discussion. Another issue that might come up when addressing rational exponent and radical expressions is that not everyone might be familiar with mathematical definitions or exponent properties. These differences will continue to be worked on as I teach from the textbook. Furthermore, the assignment will give me the opportunity to work with the students on their misconceptions about the lesson. The lesson on simplifying rational exponents and radical expressions, the students will identify the difference between exponent from and radical form and can explain to each other why one form is better than the other when being simplified. In addition, they would need to describe when is appropriate to use an exponent property when simplifying the expressions. Finally, students will compare and contrast rational and irrational numbers. overall lesson will be using rational exponents, radicals, and using the properties of exponents. The students will complete a homework assignment from their textbook. Small group discussions will allow students to explain to one another the definitions used in the lesson and how they can use those to understand and simplify rational exponents and radical expressions.

For this lesson, the students will need to know and use these vocabulary words during the lesson: radical, rational number, irrational number, base, and exponent. The students will also need to be able to identify these symbols on the textbook homework: parenthesis (), powers (()^2), radicals (√), and the times symbol when parenthesis are side by side. The students will demonstrate mathematical precision by stating correctly the exponent form and radical form, identifying the correct symbols used and how the expressions are written. In addition, they need to able to explain to each other the reasoning behind answering the questions. The students will also be able to show their mathematical precision when they practice from homework assignment provided after the lesson. Students will show their syntax of the mathematical vocabulary during sample problem discussions and if time allows class discussion as well. The students will be encouraged to use the correct mathematical terminology in their discussions as well as on the assignment. The assignment will ask students to simplify rational exponent expressions and radical expressions using the properties of exponents, and rewriting radical form expressions to rational exponent expressions. The students will dismiss some of the questions from the textbook assignment and focus on the assigned ones only. Students will be encouraged during their group activity discussion to explain the reasoning behind their answers. Moreover, if they have a different answer than their peers, they must explain why that is. I expect that some students might get confused on what to do when simplifying these types of expressions and how to apply each exponent property to do so but hopefully by the end of the assignment students will have a firm understanding of what to do under those situations. After the assignment, students should be able to simplify rational exponent expressions with ease and be able to explain the steps leading to their final answer. The students will use the knowledge gained from this lesson to further understand similar lessons from the next chapter. I will be looking for students to answer and correlate their work with the correct vocabulary. As I mentioned earlier, some of the students did have some confusion with the properties of exponents and how they need to use them to simplify the expressions. Hopefully the assignment gives them enough practice to get that situated. Also, since this lesson is not all new material for all the students but is more of a reinforcement which will provide them with a better understanding of the new lesson. The lesson is tied to go over problems relating to exponents. I will be monitoring students’ progress and will make note in what they struggle with so we can better assist them and as I mentioned earlier some students did struggle. The previous lesson only explained exponent expressions with integers and how to use the product of powers property to simplify them. The textbook assignment will lead the students through an understanding of the different properties they can use to simplify more complex exponent expressions and radicals. The students are required to do a group activity from sample problems as an exit slip and used the exponent properties just learned to accomplish the activity. The class will then come together to see if they understood the meanings of the different properties. This activity will allow me to make an assessment of the student’s learning progress before continuing to the next lesson.

The textbook assignment will be from 14.2 in a sequence to provide the students with the opportunity to grasp the concept. The assignment would have to be done individually but students can work together. The assignment provides a chance for myself to formally assess the students understanding of the material. The small group discussions and group activity provides a chance to informally assess the students understanding. The assignment gives students more practice, an opportunity to see different problems, deeper understanding, and the opportunity to work with peers to gain understanding from a different point of view. My assessment will be based on if the students have an understanding of what to do with certain rational exponent expressions and how to simplify them. I will use the small group talk to move forward their understanding and clarify any misconceptions. I also will be assessing formally by looking over how the students performed on the textbook homework. Small group discussions ensure participation and understanding of the terminology. In addition, small group discussions provide students with immediate feedback on their progress and allows them to converse in their native language if needed as well as using mathematical vocabulary in a comfortable environment. If needed, I can translate the homework into Spanish for those students who need it. Algebra 1 is set up to provide all students the chance to grasp new material as well as reinforced their algebra knowledge so they can further advance in math and towards their graduation. Student voice will be heard throughout the lecture, I will be making certain pauses and asking questions to give students an opportunity to see a different approach on answering the questions from the lecture problems. Students comparing their answers from the sample problems, is also considered student voice. Small group discussions will also allow them to share their ideas with each other and ultimately with me. The homework assignment will also allow each student to express his or her level of understanding. Their lecture notes, note-taking strategies, and a calculator would be the student’s tools available to monitor their learning progress. These opportunities ensure that students are aware of different approaches and that there is not only one-way of getting the answer right.