DEVELOPMENT AND IMPACT OF SIM-MOD (STRATEGIC INTERVENTION MATERIAL AND MODULE COMBINED) ON STUDENTS’ ACADEMIC ACHIEVEMENT IN MATHEMATICS AT THE 8TH GRADE LEVEL

by

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ABSTRACT

This study aimed to develop learning materials known as SIM-MOD (Strategic Intervention Material and Module Combined) and to investigate its impact on the student’s achievement in Mathematics. It is used as a treatment of the study covered one of the difficult topics in Grade 8 Mathematics which is “Rational Algebraic Expressions”.

Descriptive method of research was employed for the development and evaluation of the SIM-MOD. To investigate the impact of these learning materials, a mixed method was used to provide more depth in the study by implementing more than one research methods such as quasi-experimental design (quantitative) along with interview with open ended questions (qualitative).

There are two groups, the control and the experimental, each with 45 students, for a total of 90 students from Pulong Buhangin National High School. One group was taught using the SIM-MOD while the other was not. Both the groups were pre and post tested. Further, detailed statistical analysis was conducted for data analysis.

There has been a pattern on the preferences of the participants with regards to the design of the SIM-MOD. Most of them have been attracted to the distinct design of the learning materials and they found the tasks contained in the SIM-MOD not that easy to accomplish. There has also been a pattern on the preferences of the participants with regards to the delivery of the intervention program on “Rational Expressions”. Majority of them have appreciated the support provided for them before, during and after the intervention program. Most of them have found the allotted time per session, per week, not enough for them to accomplish the tasks contained in the SIM-MODs.

The independent sample t-test shows the scores of the control and experimental groups on the pretest do not have significant differences before the SIM-MOD was used by the experimental group (p-value is 0.855). Upon using the SIM-MOD, a posttest was given to the participants. The p-value of 0.000 with a t-value of -11.019 is an indication of the significant differences between the scores of the participants from the control and experimental groups. This implies that the participants who used the SIM-MOD have significant higher scores than those who did not use the learning materials. Also, there is a significant difference (p-value of 0.000 and t-value of 7.727) present in the mean gain scores of the participants with regards to their pretest and posttest scores. This is an indication that the use of SIM-MOD is an effective way of improving the achievement of the students in their Mathematics subject.
The study recommends teachers to develop and use SIM-MOD in other topics in Grade 8 Math. Conduct similar studies on the use of SIM-MOD in other discipline. Use SIM-MOD as a remediation material to enhance the academic achievements of low performing students in Math and as enhancement material to furtherly improve the cognitive skills of above average and average type of students in Math and in other discipline. Encourage administrators, mathematics supervisors, and teachers to make SIM-MOD in all topics not only the least mastered skills in a given subject area. Teachers shall be provided with more seminars and workshops on the principles of SIM-MOD construction.

Rationale

Today, mathematical methods pervade literally every field of human endeavor and play a fundamental role in economic development of a country. In our journey towards scientific and technological advancement, we need nothing short of good performance in Mathematics at all levels of schooling. Unfortunately, performance of students in Mathematics at the end of secondary education has not improved in the past decade (NAT 2005-2015).

Among all approaches aimed at reducing poor Mathematics achievement, adaption of appropriate methods of teaching appears to be more rewarding. In this study, learning materials are developed to ascertain students’ achievement in Mathematics at the Grade 8 level, most particularly on Rational Algebraic Expressions which has been the main topic in Intermediate Algebra (now Grade 8 Mathematics) that is posing the greatest challenge among students. A greater majority of them believed that Rational Algebraic Expressions was difficult. This belief was confirmed by the posttest administered to more than 800 Grade 8 students of Pulong Buhangin National High School, in Pulong Buhangin, Santa Maria, Bulacan last AY 2013-2014 where the researcher had observed that out of the ten least learned skills of the students, six of them fell under the main topic Rational Algebraic Expressions. Moreover, the result was congruent to the observation of the researcher that the sophomores (now Grade 8 students), found Rational Algebraic Expressions one of the toughest topics to deal with in Grade 8 Mathematics. Furthermore, in a pretest administered to about 230 students, AY 2014-2015, of sections Sampaguita, Daisy, Gumamela, Santan and Dahlia, only 3 out of 230 students or 1.31% obtained “Moving Toward Mastery Level,” 93 out of 230 students or 40.43% fell under “Average Mastery Level,” and 134 out of 230 students or 58.26% belong to “Low Mastery Level.”

There are many possible reasons for this. One is that many students have a weak foundation with rational numbers and so are unable to handle something that looks like a “fraction with x’s on it.” Another reason is the students’ inadequate skills on factoring, most particularly Factoring Trinomials of the form \(x^2 + bx + c\) where the numerical coefficient of \(x^2\) is one (1) and the other type of Factoring Trinomials of the form \(ax^2 + bx + c\), where the numerical coefficient of \(x^2\) is greater than one (1). One last reason is the scarcity of effective learning materials. It is along this light that the researcher was motivated to develop learning materials to be able to address these problems encountered by some Grade 8 students of PBNHS.

Intervention for students with learning difficulties in Mathematics is commonly based on a behaviorist framework of learning. As a result, these students might acquire procedural knowledge but are weak in process skills and without sufficient conceptual understanding. To help them (most particularly some Grade 8 PBNHS students) gain mathematical knowledge and process skills on Rational Algebraic Expressions, the researcher had used these developed learning materials as part of the intervention program for students with learning difficulties on Rational Algebraic Expressions.
These learning materials are called SIM-MODs. SIM-MOD is a combination of strategic intervention materials and modular instructions. These SIM-MODs were evaluated by the experts and the respondents themselves and the impact of these SIM-MODs to some Grade 8 students were likewise investigated.

Bunagan (2012) defined Strategic Intervention Material (SIM) as meant to reteach the concepts and skills (least mastered). It is a material given to students to help them master competency-based skills which they were not able to develop during a regular classroom teaching. It consists of both learning strategies (for students) and content enhancement (for teachers). It is multifaceted approach to help students to become independent and successful learners. He further differentiated SIM and modules. This intervention material (SIM) focuses on the skill not mastered by students during regular class. It does not involve pretest and posttest and includes fun activities. Module, on the other hand, contained different topics included in a given chapter and intended for regular classroom teaching and distance learning. Module requires pretest and posttest and also includes fun activities. A SIM may have six parts and these are: title card, guide card, activity card, assessment card, enrichment card and reference card. On the other hand, a module may contain the following parts: statement of purpose, desirable skills, instructional objectives, pretest, learning activities, posttest, and answer key.

The combination of Strategic Intervention Material (SIM) and Module otherwise known as SIM-MOD is a two-in-one packet of learning materials used for remediation and enhancement purposes, consisting of cognitive objectives, a sequence of activities, and provisions for evaluation.

These packets of materials aimed at enhancing poor achievements of the learners, are learning materials developed by the researcher. This contribution of his which he considered to be one of the latest innovations in the field of Mathematics education has combined features that of a SIM and a module. The objectives are written in cognitive terms and are specific. The sequence of learning activities is designed to:

a. Provide instant feedback to the learner on his achievement;
b. Proceed from lower to higher cognitive levels;
c. Contain relevant materials with intrinsic interest for the learner;
d. Provide optional and recycling paths to achieve the objectives;
e. Be self-continuative to the conclusion of the learning materials; and
f. Equip the learner to achieve the stated cognitive objectives.

SIM-MOD has many purposes. Some of them are:

1. To individualize (or to permit use of teams of learners in) instruction;
2. To provide a conceptual model for learning that minimizes the need for conventional, verbalized, instructional techniques;
3. To enable (or require) teachers to analyze the learning process;
4. To improve instruction through improved evaluation, resulting from the formulation and measurement of learning outcomes expressed in measurable terms; and
5. To permit learning to occur outside the presence of the teacher.

There had been a number of conducted researches that proved the effectiveness of intervention materials and other related strategic and modular approach. Some of them are as follows:

Dutt (1998) conducted a research on Effect of Self-Learning Modules on Achievement of Senior Secondary Students in Relation to their Sex and Place of Residence. It was found that sex
accounted for differential achievement in Economics. Male students got significantly higher mean post achievement test scores than female students. Students belonging to both rural and urban places of residence achieved almost identical mean post achievement scores.

Kohal (1999) conducted a research on the Effectiveness of Self-Learning Modules on Achievement in Geography in relation to Mastery and Non Mastery Teaching Strategies, Intelligence and Study Habits. The objectives of the study were to develop self-learning modules in Geography as a subject at 10+1 level in arts stream and to study the effectiveness of self-learning modules in Geography in terms of achievement. It was found that the students taught through Mastery Teaching Strategies attained more Geographic concepts than the students taught through Non-mastery Teaching Strategy. So Mastery Strategy proved more superior to Non-mastery strategy in teaching Geographic concept.

Aggabao (2002) conducted a study aimed at developing Individualized Self Instructional Modules on Selected Topics in Basic Mathematics for instructional use at the Teachers College in Isabela State University. After making use of the experimental method, it was concluded that the students as well as teachers have a positive attitude towards the use of self-instructional materials as a mode of instructions in Basic Mathematics.

Rastogi (2003) developed Self-Instructional Material on Educational Statistics for B. Ed. Students. In this experimental research, a comparison was seen between two strategies as Traditional Classroom Teaching and Self-Instructional Material. The statistical analysis revealed that a significant change in level of knowledge regarding Educational Statistics was obtained in both the groups. Also, learning in both the groups was enhanced to a significant level and there was more retention through Self-Instructional Material Strategy. This indicated that Self-Instructional Material Strategy was more effective than Traditional Classroom Teaching Strategy.

Arora and Singh (2005) conducted research on Development and Evaluation of Self-Learning Modules to Enhance the Traditional Physiology Class at CMC Ludhiana. The results (posttest average of 84%) indicated that Self-Learning Modules to enhance were an effective method of studying and reinforcing learning. Comparison with other teaching methods indicated that the students would prefer Self Learning Modules as an additional method of learning but not a replacement for lectures and textbooks. Students recommended that SLM experiment should continue and suggested an SLM library for self-study.

Soberano (2010) mentioned that Strategic Intervention Materials were effective in mastering the competency based skills in chemistry based on the mean gain scores in the posttests of the experimental and control groups. He found out that there was a positive transfer of learning in both the groups. However, the higher mean was observed from the experimental group after the presentation of the intervention materials.

The study conducted by Togonon (2011) on the development and evaluation of Project-Based Strategic Intervention Materials (PB-SIMs), PB-SIM is a valid instructional material in teaching high school chemistry. Results showed a significant difference between the achievement of the students before and after being exposed to PB-SIMs.

The study of Escoreal (2012) on Strategic Intervention Material as a tool to reduce least mastered skills in Grade 4 Science, concluded that SIM provides baseline information and should be implemented to avoid marginalization of pupils. Her study also indicated that there is a significant reduction in the pupils’ mean number of least mastered skills after SIM implementation.
Salviejo, Edwin I., Arcanes, F., and Espinosa, A. (2014) on their study on Strategic Intervention Material – Based Instruction, Learning Approach and Students’ Performance in Chemistry revealed that the use of SIM-BI is effective in terms of improving students’ performance and learning approach. The surface learners performed equally well as the deep learners when SIM-BI was used. The positive result of the survey suggested that the SIM was appreciated and appealed to both types of learners.

The traditional curriculum focused on the teacher rather than the learner. However, in recent years, there has been a paradigm shift taking place, moving the emphasis from teaching to learning a more student-centered curriculum. This change has impacted on the curriculum design process with a greater emphasis on the learning in terms of knowledge, skills and competencies within intervention/learning materials. The focus is on how learners learn and the design of effective learning environment.

Even the best designed intervention/learning materials, with very worthwhile defined learning outcomes, can fail if the teaching strategies employed are inappropriate to encourage and support the learners towards meeting the desired learning outcomes (Ramsden, 1992).

Toohey (1999) defined a teaching strategy as “a plan for someone else’s learning, and it encompasses the presentations which the teacher might make, the exercises and activities designed for students, materials which will be supplied or suggested for students to work with, and ways in which evidence of their growing understanding and capability will be collected.”

This definition is very helpful as it emphasizes that a teaching strategy is fundamentally about supporting student’s learning. In giving consideration to how, as academics, one can teach in order to ensure that students are engaging with the learning process, it is necessary to focus on the type of teaching strategies one can employ to achieve this end.

The question remains when designing modules for learning, why is it important to be aware of the theories the underpin learning? A theory should make explicit the underlying psychological dynamics of events related to learning. Each theory is based on different assumptions about the nature of learning and it is suggested that one should identify his own theory of learning because the strategies one might use to enhance learning will directly follow from one’s orientation.

In addition to taking cognizance of different learning theories, it is also important to take into account that there is no universal way of learning. Brown and Atkins (1991) state that differing students will use different strategies on different tasks. They stress the importance of ‘learning-for-understanding’ and ‘learning-for-knowledge’ orientations, with learning being a continuous process of development back and forth between the two.

When designing intervention/learning materials, it is important for teachers to be aware of concepts of deep and surface approaches to learning. Much research has previously been conducted on the relationship between courses and the approach students take to learning (Marton and Saljo 1976; Entwistle 1981; Gibbs 1992; Ramsden 1992; Biggs 1999). Arising from these studies, there are implications in terms of intervention/learning materials design. Seeking to incorporate the following one’s intervention/learning material design can offer a greater likelihood of fostering a deep approach to learning:

- sustained interaction with content and others;
- relating new ideas to previous knowledge;
- providing explicit explanations and a clear knowledge base to students;
- structuring in a reasonable student workload;
• providing opportunities for students to pursue topics in depth so that they can understand the material for themselves;
• ensuring an appropriate formative and summative assessment strategy.

These ideas resonate with teachers in today's secondary education environment and have implications both for choice of learning and teaching strategies and how one assess learning. An awareness of these approaches to learning is fundamental to the entire intervention/learning material design process.

Constructive alignment is an approach to curriculum design that maximizes the condition for quality learning by ensuring alignment through the process, from the forming of learning outcomes, to the choice of teaching methods to assessment.

The fundamental principle of constructive alignment is that a good teaching system aligns teaching method and assessment to the learning activities started in the objectives so that all aspects of this system are in accord in supporting appropriate student (Biggs 1999:25).

There are three elements involved in the process of constructively aligning a module:
1. Defining the learning outcomes;
2. Choosing the learning and teaching methods that can lead to attainment of outcomes;
3. Assessing student learning outcomes.

The following approach will help one to think through and decide on appropriate teaching strategies for developing learning materials. First, take time to read over the materials aims, learning outcomes and content material. Then, focus on how best one can involve students in making sense of the material through active engagement and application.

According to Blair (1998), students achieve at a higher level in their work if they are directly taught by their teachers. In the Direct Instruction (DI) model, the teacher assumes the major responsibility for the lesson's progress and practice flexibility by adapting the class activities and lessons to their students' age and abilities. The teacher explains, demonstrates and monitors progress of the students.

A. Characteristics of the Direct Instruction Model
A. It is a teacher-centered model. Main characteristics are:
1. The teacher is the authority figure in the classroom;
2. Emphasis is on using the lecture technique-questioning;
3. There is a strong emphasis on “drill-and-practice”;  
4. Students essentially told what they need to learn and how they should learn it; and
5. It emphasizes both guided and independent practice.

B. The emphasis is on mastery of subject matter.
1. Questioning emphasizes many low level (cognitive) questions – with the emphasis on students providing primarily correct answers;
2. Rapid pace is emphasized; and
3. Teacher checks for understanding frequently. If students do not give correct answers, the teacher re-teaches the material.

B. Aspects of Planning and Organization of Direct Instruction
1. Brief placement tests are given for each curriculum to ensure that each child begins with lessons for which he/she is prepared.
2. Instruction is organized in a logical and developmental sequence.
3. Each lesson consists of short exercises from direct strands.
4. Gradually, instruction moves in a way from a more teacher-guided to a more students-guided format.
5. Short proficiency tests are used about every ten (10) lessons to ensure that all students have mastered the material and to determine which skills need enhancement.

C. Steps in the Direct Instruction Model
1. Review Previously Learned Materials
   The teacher does the following:
   • Reviews the prerequisite information needed by students prior to the beginning of the instruction on the topic for the day
   • Provides a basis for the lesson for the day and focuses the attention of the students on the task at hand

   Research shows that effective teachers spent an average of 5 minutes reviewing information prior to starting a new lesson.

   **Basic Skills, Facts and Knowledge that a teacher must possess:**
   • Checking of homework (routines for students to check each other’s papers)
   • Reteaching when necessary
   • Reviewing relevant past learning (may include questioning)
   • Review prerequisite skills (if applicable)

2. State Objectives for the Lesson
   The teacher does the following:
   • States clearly what will be learned from the lesson
   • Enumerates what the teacher expects the students to accomplish or be able to do

   Research has shown that effective teachers clearly explain to students what is expected to them prior to beginning of instruction.

   **Basic Skills, Facts and Knowledge that a teacher must provide:**
   • Provide short statement of objectives
   • Provide overview and structuring
   • Proceed in small steps but at a rapid pace
   • Intersperse questioning within the demonstration to check for understanding
   • Highlight main points
   • Provide sufficient illustrations and concrete examples
   • Provide demonstrations and models
   • When necessary, give detailed and redundant instructions and examples

3. Present New Materials
   The teacher does the following:
   • Presents information to be learned
   • Continues in small steps, stopping at the end of each step to ask low level cognitive questions (checking for understanding)
   • Proceeds at a rapid pace such that emphasis is on covering a lot of materials in the time allocated
Research has shown that low level questions are most effective with at risk students.

Basic Skills, Facts and Knowledge that a teacher must do:

- Organizing content – the content to be learned must be selected and then analyzed according to the learners’ needs
- Lectures – often an essential part of the classroom instruction and one way in which new material is delivered to students
- Demonstrations – visual examples work particularly well in the presentation stage of this model
- Student practice takes place with teacher guidance
- High frequency of questions and overt student practice (from teacher and/or materials)
- Questions are directly relevant to the new content or skill
- Teacher checks for understanding by evaluating student responses, then teacher gives additional explanation, process feedback or repeats explanation – where necessary
- All students have a chance to respond and receive feedback; teacher ensures that all students participate
- Prompts are provided during guided practice (where appropriate)
- Initial student practice is sufficient so that students can work independently
- Guided practice continues until students are firm
- Guided practice is continued until a success rate of 80% is achieved

4. Guided Practice with Corrective Feedback
The teacher does the following:

- Leads students through an activity with students paying close attention to every step
- Emphasizes each step
- Makes sure the students understand each step involved before proceeding

Basic Skills, Facts and Knowledge that a teacher must practice:

- Questioning – the most common form of guided practice by the teacher to check for understanding
- Correcting error
- Quick, firm and correct responses can be followed by a question or a short acknowledgement of correctness (“that's right”)  
- Student errors indicate a need for more practice
- Monitor students for systematic errors
- Try to obtain a substantive response to each question
- Corrections can include sustaining feedback (i.e. simplifying the questions, giving clues, explaining or reviewing steps, giving process feedback or reteaching the last step)
- Try to elicit an improved response when the first one is incorrect
- Guided practice and corrections continue until the teacher feels that the group can meet the objective of the lesson
- Individual praise is more effective that general praise

5. Assign Independent Practice with Corrective Feedback
The teacher does the following:

- Teacher assigns activity that allows students to practice the new materials learned
- Teacher moves throughout the room, monitoring student progress and providing feedback
  
  This occurs after students have mastered the guided practice step.

Basic Skills, Facts and Knowledge that a teacher must exercise

- Sufficient practice
• Practice is directly relevant to skills/content taught
• Practice until responses are firm, quick and automatic
• Ninety-five percent correct rate during independent practice
• Students alerted that seatwork will be checked
• Students held accountable for seatwork
• Teachers actively supervise students, when possible

6. Review Periodically with Corrective Feedback if Necessary
   The teacher does the following:
   • Reviews the lesson taught for the day, emphasizing major points learned
   • Asks a series of questions about the lesson to check for understanding

   Research has shown that the effective teacher spends an average of 5-10 minutes
   at the end of the lesson in closure activity.

   Basic Skills, Facts and Knowledge that a teacher must apply
   • Systematic review of previously learned materials
   • Include review in homework
   • Frequent tests
   • Reteaching of material missed in tests

The major concerns of the study were to develop and use intervention materials / SIM-MODs and to investigate their impact in enhancing Grade 8 students’ skills in performing operations on Rational Algebraic Expressions. The conceptual framework of the study is shown on Figure 1.

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**Figure 1. Research Paradigm of the Study**

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<thead>
<tr>
<th>INPUT</th>
<th>PROCESS</th>
<th>OUTPUT</th>
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<tbody>
<tr>
<td>1. Unmastered Skills in 8th Grade Mathematics: Performing Operations on Rational Expressions</td>
<td>1. Planning and Conceptualization</td>
<td>Developed Learning Materials (SIM-MODs) with their Impact on the Students’ Achievement in Mathematics at the Grade 8 Level Investigated</td>
</tr>
<tr>
<td>2. Use of SIM-MOD -intervention strategy for the experimental group</td>
<td>2. SIM-MOD Development</td>
<td>Target Competencies:</td>
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<tr>
<td>3. Direct Instruction - intervention strategy for the control group</td>
<td>• Thinking through a rationale</td>
<td>Improved skills in Performing Operations on Rational Algebraic Expressions</td>
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<td></td>
<td>• Deciding on aims and learning outcomes</td>
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<td>• Thinking about the context</td>
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<td>• Exploring learning and teaching strategies and the appropriate learner support</td>
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<td>• Focusing on assessment</td>
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<td>• Considering learner support</td>
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<td>• Planning evaluation strategy</td>
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<td>3. SIM-MOD Evaluation</td>
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<td>• Design</td>
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<td>• Readability</td>
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<td>• Importance of the content</td>
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<td>• Appropriateness of activities</td>
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<td></td>
<td>• Ease of Task Completion</td>
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<td>• Opportunities for active learning</td>
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<td></td>
<td>• Usefulness in meeting learners needs</td>
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<td></td>
<td>• Others</td>
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<td>4. Investigating Impact of SIM-MOD</td>
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<td></td>
<td>• Gain score from pretest/posttest of the respondents under the experimental group</td>
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</tbody>
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The research paradigm illustrates an Input-Process-Output (IPO) model. Frame one presents the input which is made up of the unmastered skills in Grade 8 Mathematics that is Performing Operations on Rational Algebraic Expressions. To address this problem, learning materials called SIM-MODs were developed and were used by the researcher for the respondents under the experimental group. On the other hand, Direct Instruction (conventional method) was used for the respondents under the control group.

The second frame enumerates the process or set of procedures that were to be undertaken in the course of the study. The process involved: (1) Planning and Conceptualization of the study; (2) SIM-MOD Development; (3) Evaluation of the SIM-MOD by subject matter experts and students; and (4) Investigating Impact of SIM-MOD on students’ achievement in Mathematics at the Grade 8 level was the second phase of the study and the last step of the process. The products or outputs of the study were the developed learning materials (SIM-MODs) and the target competencies: Improved Skills in Performing Operations on Rational Algebraic Expressions are shown in the last frame.

Statement of the Problem

The aims of the study were to develop and use learning materials otherwise known as SIM-MOD, and to investigate the impact of these learning materials on the students’ achievements in Mathematics at the Grade 8 level. Specifically, this study sought to answer the following questions:

1. What are the procedures in the development of the SIM-MOD?
2. How do the students and the experts evaluate these SIM-MODs based on:
   2.1. Design
   2.2. Clarity of directions used
   2.3. Readability
   2.4. Importance of the content
   2.5. Appropriateness of activities
   2.6. Ease of task completion
   2.7. Opportunities for active learning
   2.8. Usefulness in meeting their needs (for students only)?
3. How do the students evaluate the delivery of the program (Intervention Program with SIM-MOD employed) based on:
   3.1. Orientation to the program
   3.2. Time allotted for the program
   3.3. Support provided for the learners?
4. Do the students of the 8th Grade class under the experimental group get significantly higher Mathematics achievement after having been exposed to learning materials otherwise known as SIM-MOD?

Hypothesis

In this study, one null hypothesis was tested for significance level at 0.05 margin of error. This is:
HO1: There is no significant difference in the impact of SIM-MOD on Students’ Academic Achievements in Mathematics at the 8th Grade Level.

Significance of the Study

The findings of the study are deemed particularly useful to the following users:

Mathematics Teachers. This study can make Mathematics teachers more aware of the nature and extent of the prevailing problems in teaching Grade 8 Mathematics most particularly “Performing Operations on Rational Algebraic Expressions”) and the possible remedial measures to address these concerns.

Students. The students serve as the ultimate beneficiaries of the findings of the study through the identification of teaching strategies that are appropriate to their characteristics as learners and enhance their level of achievement in Mathematics.

Parents. The involvement of parents in the study habits of their children can be addressed by the SIM-MOD. This will help the family bonding and boost morale of the students.

School Administrators. This research can guide the principal, curriculum planners and other school decision makers through feedbacks on which learning approach should be adopted by the students in learning a particular task. This also would enable them to make adjustments in the Mathematics program/curriculum so that it will become more effective and responsive to the needs of the teachers and make them more effective in teaching Mathematics.

Other Researchers. The study is also expected to serve as a source of useful information in the conduct of related studies in the field of Mathematics instruction and in other areas of educational management.

Definition of Terms

To make the readers understand more this research, the following terms are hereby operationally defined:

Achievement. According to Oxford Advanced Learner’s Dictionary of Current English, achievement means a thing that somebody has done successfully, especially using his own effort and skill. In this study, achievement refers to the scores obtained by the students on the criterion-referenced test after learning through SIM-MODs and conventional teaching (Direct Instruction).

Activity Card. This defines the task/s that the learner should undertake in order to develop the skill. It provides enough example and work-out solutions. If the learner will have difficulty in answering the exercises, he can always refer to an example for help.

Answer Key. The answers in the pretest and posttest are listed down in this section and are found at the last page of learning materials/SIM-MOD.

Assessment Card. This helps the learner measure his mastery of the skill upon completion of the task/s. The result of the assessment also gives the teacher information on the knowledge/skills the learner failed to understand so that the teacher could revise or improve the materials to further develop/enhance the identified skills.

Components and Organization. It is one of the criteria in the evaluation of the SIM-MOD. This had included the composition of the SIM-MODs, the terms used, the available number of the learning materials, and the time required to use the SIM-MODs.

Control Group. As used in the study, the students in this group underwent intervention activities through conventional strategies (direct instructions). They were the students from the Grade 8 level of Sections Daisy, Santan, Gumamela and Dahlia, AY 2014-2015.
Data Analysis Techniques or Statistical Tests. In order to analyze data and calculate different statistics the most widely, commonly and comprehensive computer software in social sciences, SPSS has been used. In this study the researcher has specifically used mean, standard deviation, independent sample t-test for testing the difference between two groups.

Design. It is one of the criteria in the evaluation of the SIM-MOD. This had included the SIM-MOD size, lay-outing, packaging, etc.

Development (SIM-MOD Development). It refers to the set of procedures done in the design and construction of a learning material.

Direct Instruction. According to Blair (1998), Direct Instruction is a teaching strategy where the teacher assumes the major responsibility for the lesson’s progress and practice flexibility by adapting the class activities and lessons to their students’ age and abilities. The teacher explains, demonstrates and monitors progress of students.

Effectiveness/Impact. This refers to the instructional and learning advantage of using an instructional method in teaching/learning selected topics. In this study the selected topic is in Grade 8 Mathematics which is “Performing Operations on Rational Algebraic Expressions.” This was determined through a quasi-experimental design in the second phase of the study.

Enrichment Card. This extends learning providing additional concepts and exercises for further application of knowledge/skills. This will challenge the learner to think creatively and develop higher order thinking skills.

Experimental Group. The students in this group were the ones who were exposed to using learning materials called SIM-MODs, AY 2014-2015.

Gain Score. This refers to the accomplishment of ability required as a result of teaching shown in the difference of posttest score and pretest score.

Grade Level Handled. Pertains to the level of the students being taught by the Mathematics teacher, which, as used in this study was the Grade 8 level.

Guide Card. This provides the topic under focus and the skills the learner should master. It introduces the activities the students have to perform. It also gives a review of the previous lessons learned.

Mathematics. Refers to the science that deals with the relationship and symbolism of numbers and magnitude which includes quantitative problems. For the purpose of this study, the term referred to mean Mathematics subject taught in the Grade 8 level.

Mathematics Teaching. Pertains to the different activities employed by the teacher in imparting lessons in Mathematics to Grade 8 students.

Methods of Teaching. Generally refers to all the activities performed by the teacher inside the classroom during the teaching learning process.

Module. According to Oxford Advanced Learner’s Dictionary, module is a unit that can form part of a course of a study. It provides thorough understanding of the content matter in a more effective manner. In this study, modules refer to self-instructional, self-explanatory, self-contained, self-directed, self-motivating, and self-evaluating material to assess the achievement of the students.

Participants. Grade 8 students of Pulong Buhangin National High School selected. The permission to conduct the action research was acquired from the approval of the principal. A total of 90 students participated in the study.

Posttest. It is a measurement of what has been learned by the student.

Pretest. A measure which identifies the weakness of a student’s achievement.

Problems in Teaching Mathematics. Refer to the difficulties encountered by the teachers in teaching Mathematics. For the purpose of the study, this had included problems in teaching “Performing Operations on Rational Algebraic Expressions.”

Rational Algebraic Expressions. It is the quotient of two polynomials and can be represented as $\frac{P}{Q}$, where P and Q are polynomials and Q ≠ 0. 
Reference Card. This provides additional content and emphasizes important facts or details relevant to the concept in focus. It also provides a list of resources or books the learner may refer to for further reading.

Research Design. A descriptive method approach was used in this study for the development and evaluation of the learning materials and for investigating the impact of these learning materials, a mixed method was used to provide more depth in the research by implementing more than one research methods such as quasi-experimental design (quantitative) along with interviews with open-ended questions (qualitative).

SIM-MOD or Strategic Intervention Materials and Module Combined. It is a two-in-one packet of learning materials consisting of cognitive objectives, a sequence of activities and provisions for evaluation aimed at enhancing skills of the students in Mathematics.

Strategic Intervention Materials (SIM). According to Togonon (2011), strategic intervention material is an instructional material prescribed by the Department of Education to improve students’ performance in Mathematics and in other learning areas. Bunagan (2012) defined SIM as meant to reteach the concepts and skills (least mastered). It is a material given to students to help them master competency based skills which they were not able to develop during a regular teaching.

Students’ Level of Achievement in Mathematics. Refers to the performance level in Mathematics of Grade 8 students, most particularly in Performing Operations on Rational Algebraic Expressions.

Subject-Matter Experts. A subject matter expert is a person who is an expert in a particular area or topic. In this study, they are the Math teachers, English teachers and experts in SIM-MOD writing.

Traditional/Conventional Approach. In this study, it means delivering lesson using the lecture-discussion method and traditional work exercises.

Usefulness. This refers to the effectiveness of the SIM-MOD in enhancing the skills in “Performing Operations on Rational Algebraic Expressions.”

Research Design

For the development and evaluation of the learning materials/SIM-MODs, a descriptive method was used. In investigating the impact of these learning materials, a mixed method was used to provide more depth in the study by implementing more than one research methods such as quasi-experimental design (quantitative) along with, interviews with open-ended questions (qualitative).

The quasi – experimental design was utilized by the researcher to investigate the impact of these learning materials. The experimental and control group each comprised of 45 students, making a total sample size of 90 students. Teaching methodology using the SIM-MOD is the (independent variable) X, while the students’ learning is (dependent variable) Y. Students’ demographics were same. Each group had equal number of boys and girls. Sampling was matching technique in accordance to the grade average of all the students handled by the researcher. After such, the students were distributed to two groups, the experimental and the control group. It was made sure that the average of the two groups are almost equivalent. Those with the highest and lowest scores were distributed to the groups. A pretest was conducted to both the groups. After such, teaching of the topic was conducted to the groups. One group was taught using the SIM-MOD while the other was not. Then a posttest was conducted to both the groups. Further, detailed statistical analysis was conducted for data analysis.

This quasi - experimental design is illustrated on Figure 2 below.

<table>
<thead>
<tr>
<th>Subject Group</th>
<th>Pretest</th>
<th>Measure</th>
<th>Treatment</th>
<th>SIM-MOD</th>
<th>Measure</th>
</tr>
</thead>
</table>
The study was composed of two phases. Phase 1 was the development of the intervention materials/SIM-MOD. Phase 2 was the evaluation and investigation of the impact of SIM-MOD on the students’ achievement in Mathematics at the Grade 8 level.

The study was guided by the steps of instructional design method, specifically by the ADDIE model. The model has been modified for the study, and hereby composed of the following stages:

**Original ADDIE Model**

<table>
<thead>
<tr>
<th>Preparatory Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIM-MOD Development</td>
</tr>
<tr>
<td>Experts’ Review &amp; Validation</td>
</tr>
<tr>
<td>Investigation of SIM-MOD’s Impact</td>
</tr>
<tr>
<td>Evaluation of SIM-MOD</td>
</tr>
</tbody>
</table>

**SIM-MOD Development Procedures**

**Preparatory Stage**

This includes conceptualization and planning of the learning materials developed. Grade 8 students were assessed. Based on the pretest given to them AY 2014-2015, the results revealed that most of these Grade 8 students or about 58.26% (134 out of 230) of the students belonged to “Low Mastery Level. Hence, the researcher came up with an idea of developing learning materials to address this problem. The preparation of materials and other pertinent aspects in the development of the SIM-MOD were established in this stage.

**SIM-MOD Development**

This includes the design and development of the learning materials. The following steps were undertaken in the development of the SIM-MOD: (1) Thinking through a rationale; (2) Deciding on aims and learning outcomes; (3) Thinking about the content; (4) Exploring learning and teaching
strategies and the appropriate learner support; (5) Focusing on assessment; (6) Considering learner support; (7) Planning evaluation strategy.

(1) **Developing SIM-MOD Rationale.** A need to enhance the skills of 217 Grade 8 students in “Performing Operations on Rational Expressions” is the primary reason why these packets of learning materials were developed. The baseline data the researcher obtained every start of every academic year revealed that indeed the sophomores, now Grade 8 students, find Rational Expressions as the most difficult topic to deal with in 8th Grade Mathematics under the K to 12 curriculum. Providing interventions for the students was not a first to the researcher. Interventions were done yearly. The difference is, before, the learning tools provided only for the students were some exercises taken from the reference book. Now, the learning materials which were being offered to the students were learning materials developed by the researcher. Plus the assessment done before was not as comprehensive and scientific as it is today. Findings before were not put into writing as compared to the present study where every single detail and every action taken by the researcher were properly documented. The subject matter is very important because for a Grade 8 student to proceed to the next higher level of Math learning there is need for him to master first these skills in “Performing Operations on Rational Expressions.” The researcher believes that it is only through constant practice one can succeed in learning Mathematics. Hence, numerous hands-on activities provided in these SIM-MODs are highly recommended to every Grade 8 Student.

(2) **Deciding on Aims and Learning Outcomes of the SIM-MOD.** The aim of the learning materials indicates the general direction or orientation of the SIM-MOD in terms of its content and its context within the programme. Aims were formulated based on the need to enhance the skills of the students in “Performing Operations on Rational Expressions.”

Learning outcomes focus on learning rather than teaching and are not about what the teacher can provide but what the lesson can demonstrate at the end of the course or intervention program (with SIM-MOD employed).

(3) **Thinking about the SIM-MOD content.** The topics tackled in this SIM-MODs were as follows:

**SIM-MOD 1. What Are Rational Expressions?**
1. Distinguishing between rational numbers and rational expressions
2. Finding all the meaningful replacements of the variable of the denominator of a rational expression
3. Simplifying rational expressions

**SIM-MOD 2. Products and Quotients of Rational Expressions**
1. Recalling multiplication and division of rational numbers
2. Recalling factoring polynomials
3. Multiplying rational expressions
4. Dividing rational expressions

**SIM-MOD 3. Sums and Differences of Rational Expressions**
1. Recalling LCM, addition and subtraction of fractions
2. Recalling how to simplify rational expressions
3. Finding LCD of rational expressions
4. Adding rational expressions having the same denominator
5. Adding rational expressions having the different denominators
6. Subtracting rational expressions having the same denominator
7. Subtracting rational expressions having the different denominators

(4) **Exploring learning teaching strategies and the appropriate learner support.** According to Ramsden (1992), even the best designed modules, with very worthwhile defined learning
outcomes, can fail if the teaching strategies employed are inappropriate to encourage and support the learners towards meeting the desired learning outcomes. With these SIM-MODs, the researcher has maintained printing of colorful pictures, icons, cover page, etc. to catch students' interest. It was a common observation, that when a learning material to be used by a student is thick or voluminous, he/she loses interests in reading it, so, to avoid such a situation, the learning materials were subdivided into three packets entitled “What Are Rational Expressions? (SIM-MOD 1); Quotients and Products of Rational Expressions (SIM-MOD 2); and Sums and Differences of Rational Expressions (SIM-MOD 3).”

This innovation by the researcher entitled “SIM-MOD (Strategic Intervention Materials and Module Combined: A Two-in-One Packet of Learning Materials for Enhancing Grade 8 Math Students' Skills in Performing Operations on Rational Expressions”, has the following features:

a. **What this SIM-MOD is all about.** It gives a preview of what students will learn.
b. **What you are expected to learn.** It presents the focus skills.
c. **How to learn from this SIM-MOD.** This contains some tips on how to use these learning materials and mentions the virtues one learner has to possess while answering these packet of intervention materials.
d. **Flow chart in using this SIM-MOD.** It includes the step by step procedure in using these materials. Questions on when to start and when to stop are answered in this section.
e. **Pretest.** A measure which identifies the weaknesses of a student’s achievements. In this study, students' weakness in “Performing Operations on Rational Algebraic Expressions” were identified and served as basis of remediation type of intervention program.
f. **Guide Card.** This provides the topic under focus and the skills the learner should master. It introduces the activities the students have to perform. It also gives a review of the previous lessons learned.
g. **Activity Card.** This defines the task/s that the learner should undertake in order to develop the skill. It provides enough example and work-out solutions. If the learner will have difficulty in answering the exercises, he can always refer to an example for help.
h. **Assessment Card.** This helps the learner measure his mastery of the skill upon completion of the task/s. The result of the assessment also gives the teacher information on the knowledge/skills the learner failed to understand so that the teacher could revise or improve the materials to further develop/enhance the identified skills.
i. **Enrichment Card.** This extends learning providing additional concepts and exercises for further application of knowledge/skills. This will challenge the learner to think creatively and develop higher order thinking skills.
j. **Reference Card.** This provides additional content and emphasizes important facts or details relevant to the concept in focus. It also provides a list of resources or books the learner may refer to for further reading.
k. **Posttest.** It is a measurement of what has been learned by the student in performing operations on Rational Expressions after undergoing series of intervention program.
l. **Answer Key.** The answers in the pretest and posttest are listed down in this section and are found at the last page of these learning materials.

(5) **Focusing on assessment.** Assessment methods should be in accord with the learning outcomes of the learning materials and should foster a deep approach to learning. The formative assessment employed in this SIM-MOD by the researcher was used to inform the respondents as to how they were progressing. Integral to this process was the feedback that the respondents received from the researcher to improve their learning. Summative assessment was also used to Grade 8 students at the end of a SIM-MOD to accredit them at the end of the programme. With these SIM-MODs, assessment was given serious consideration and reflection and the choice of assessment methods were all related to the learning outcomes. There was rarely one method of assessment which satisfied all learning outcomes for a SIM-MOD. It is recommended that in
devising an assessment strategy, a variety of methods should be included. It is also important to guard against over-assessing students based on the unit of study. This is an unacceptable burden for students and it is therefore vitally important that within a programme of study, the time table of assessment is planned thoroughly in advance so the students do not face this problem.

(6) **Considering learner support.** From day 1 of the intervention program up to the time it was ended, the researcher never left his target respondents answering alone these packets of learning materials. The proponent had provided moral support, motivated the learners, and guided them in performing tasks provided in the SIM-MOD. Answer sheets were also given for free by the researcher.

(7) **Planning evaluation strategy.** Module design and development is an ongoing process. The kind of evaluation mechanisms employed in this SIM-MOD by the researcher was used to elicit meaningful information to assist him in reviewing and improving his module. It was based upon criteria that were cooperatively developed and concerned with gathering information about the quality and effectiveness of the learning materials. Evaluation is not just a retrospective process, but can be an integral part of SIM-MOD development, informing one before, during and after the process. The questionnaire used here by the researcher was the same questionnaire used by an educationist in the field of mathematics education. The evaluation was based on the following:

a. Design  
b. Clarity of directions used;  
c. Readability  
d. Importance of the content;  
e. Appropriateness of activities;  
f. Ease of task completion;  
g. Opportunities for active learning; and  
h. Usefulness in meeting learner’s needs

**Experts’ Review and Validation**

The developed learning materials have been checked and evaluated by experts before subjecting it to final testing with the respondents.

The learning materials (SIM-MODs 1-3) have received the following mean ratings from the experts. Each rating has its corresponding verbal interpretation. (1) Design of the SIM-MOD, 4.67 (Excellent); (2) Clarity of Directions used, 4.00 (Above Average); Readability, 4.67 (Excellent); Importance of the Content, 4.44 (Above Average); Appropriateness of activities, 4.22 (Above Average); Ease of task completion, 4.11 (Above Average); Opportunities for active learning, 4.11 (Above Average); and Usefulness of the SIM-MOD in meeting learner’s needs, 4.11 (Above Average). 4.29 is the overall mean of these intervention materials with an “Above Average” rating from the experts.

**Investigating SIM-MOD’s Impact**

This is actually the second phase of the study, where the developed and evaluated learning materials were investigated to determine their impact on students’ achievement in Mathematics at the Grade 8 level. In investigating the SIM-MOD’s impact, the researcher utilized the quasi-experimental design.

The design involved two groups of students, the control group and the experimental group. Each group took the pretest before the conduct of the intervention program. After the experimental phase (intervention) of the study, each group took the posttest. The gain score were compared for
significant difference using the t-test for independent means. This was done to determine whether the use of SIM-MOD had positive impact on the students’ achievement in Mathematics at 8th Grade level.

Evaluation of SIM-MOD

After the testing stage, the experimental group, the one that used SIM-MOD, served as the evaluators of the learning materials. Evaluation of SIM-MOD was based on: (1) design; (2) clarity of directions used; (3) readability; (4) importance of the content; (5) appropriateness of activities; (6) ease of the task completion; (7) opportunities for active learning; and (8) usefulness in meeting the students’ needs.

Participants

The students considered for this study were Grade 8 students of Pulong Buhangin National High School, in Pulong Buhangin, Santa Maria, Bulacan of Section Daisy with 45 students; Section Gumamela, 43 students; Section Santan, 42 students; and Section Dahlia, 41 students.

The participants mostly from Grade 8 level were grouped into two. One group was assigned as the experimental group that had used the SIM-MOD while the other group was the control group that was given traditional work exercises/assignment.

The participants of the study were chosen using the matching technique. The students’ average grade in the first and second grading in Mathematics during the AY 2014-2015 were calculated and collected. The two groups were divided according to the following means. The top students were distributed to both the groups. This was also done to the students who have low averages. This means that both the groups will have almost the same participants. The average of the grades was calculated using the excel. The results were the basis of distribution. The control group has 45 students as well as the experimental group.

Instruments

The instruments used in the study were the evaluation instrument for the assessment of the SIM-MODs, and the achievement test used as pretest/posttest in the study. The SIM-MODs, after the development stage served as an instrument for the second phase of the study, which was the investigation of the impact of the developed learning materials/SIM-MODs.

Pretest/Posttest

A 40-item multiple-choice type of test was prepared by the researcher as pretest and posttest for investigating the impact of SIM-MOD on students’ achievement in Mathematics at the Grade 8 level. The parallel tests were made after making a table of specification. The constructed test items were validated by the subject matter experts and were tested to 9-A students of PBNHS during AY 2014-2015. Minor changes have been made basing on the comments and suggestions of the subject matter experts. This test was also again given to 9-B students to determine the reliability of the test.

SIM-MOD

The three sets of learning materials (SIM-MOD numbers 1-3) developed in the first phase of the study were used as research instrument in investigating the impact of SIM-MOD on students’ achievement in Math at the Grade 8th level. This instrument has undergone a meticulous process of development and evaluation during the first phase of the study.
Evaluation of the Instrument

The instrument used to evaluate the developed learning materials was a five-point rating scale adopted from a study by Nivera (2006). The adopted instrument was then revised, mainly through the researcher’s preferences to suit the needs of the study. The revised questionnaire has been validated by two faculty members of Pulong Buhangin National High School, one is the Head Teacher of the Mathematics Department and the other one is the Master Teacher of the same department who is currently teaching Grade 10 Mathematics.

The evaluation sheet was made up of the following: (1) directions on how the learning materials will be evaluated; (2) the series of statements as the basis for the evaluation of the SIM-MOD; (3) section for general comments and suggestions for the improvement of the SIM-MOD; and (4) the respondent’s name, grade level and section.

For the students/respondents, the five-point Likert Scale was used in the evaluation of SIM-MOD #’s 1-3. The degree values were determined by the ratings of the respondents and were interpreted as follows: More Than Adequate (4.51 - 5.00); Adequate (3.51 - 4.50); Partially Adequate (2.51 - 3.50); Inadequate (1.51 - 2.50); and Somewhat Inadequate (1.00 - 1.50).

For the experts’ evaluation of SIM-MOD #’s 1-3, the five-point Likert Scale was also used. The degree values were determined by the ratings of the respondents and were interpreted as follows: Excellent (4.51 - 5.00); Above Average (3.51 - 4.50); Average (2.51 - 3.50); Below Average (1.51 - 2.50); and Needs Improvement (1.00 - 2.50).

Only the students/respondents have evaluated the Delivery of the Program since they were the only ones who underwent the intervention program on “Rational Algebraic Expressions.”

Data Collection Procedure

To identify the participants’ mastery level in Performing Operations on Rational Algebraic Expressions, a pretest was given among them. These Grade 8 students were PBNHS students of Sections Sampaguita, Daisy, Gumamela, Santan and Dahlia. Out of these respondents, two groups were formed. The first group was known as the experimental group and the other was known as the control group.

After determining the participants’ weaknesses on the said competencies, an intervention program was offered to them by the researcher.

Before the intervention program was held, the recommending approval of the EPS I Secondary and Elementary Mathematics, EPS I Research and Evaluation, and the approval of the Schools Division Superintendent of the Division of Bulacan and of the parents were sought through communication letters. Scores on the activities in the SIM-MOD of each student in each group (comprised of 2 classes in all) were compiled and attendance was monitored as well. The sessions lasted for about two rating periods. Included in the program were the follow-up activities in the forms of enhancement tests, worksheets and collaborative learning facilitated by the researcher with the help of his student teacher from PUP Santa Maria and high performing students of Grade 8-Sampaguita. The entire intervention program was monitored by Mrs. Evelyn R. Sicat and Mrs. Ederlinda P. dela Cruz, Head Teacher of the Mathematics department and School Head of PBNHS, respectively.
After the intervention period, the participants have evaluated these packets of learning materials otherwise known as SIM-MOD. And finally, the obtained data from the results of the intervention program were processed, treated statistically, and interpreted.

Data Analysis

In investigating the impact of SIM-MOD on the students’ achievement in Mathematics at the Grade 8 level, the t-test for independent means was used to determine if there was a significant difference in the gain score from pretest to posttest in each group of the two Mathematics classes. For each class, learning will be considered to have taken place if the achievement of the students in the posttest was greater than that of the pretest. That is, if the difference between the pretest scores and posttest scores was found significant.

Data collected from the evaluation process were collated, processed, and analyzed statistically using frequency distribution, mean and standard deviation. These were calculated using the SPSS. Frequency distribution was used to show the participants’ evaluation of the SIM-MOD in each of specific indicators in the questionnaire.

On the other hand, the mean was used to analyze the measure of the participants’ assessments developed materials. The presented in which served for presenting and Mastery Equivalence

<table>
<thead>
<tr>
<th>Percentage Score</th>
<th>Descriptive Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>96-100</td>
<td>Mastered</td>
</tr>
<tr>
<td>86-95</td>
<td>Closely Approaching Mastery</td>
</tr>
<tr>
<td>66-85</td>
<td>Moving Toward Mastery</td>
</tr>
<tr>
<td>35-65</td>
<td>Average Mastery</td>
</tr>
<tr>
<td>15-34</td>
<td>Low Mastery</td>
</tr>
<tr>
<td>5-14</td>
<td>Very Low Mastery</td>
</tr>
<tr>
<td>0-4</td>
<td>Absolutely No Mastery</td>
</tr>
</tbody>
</table>

To determine the mastery level of the participants, the following Mastery Descriptive Equivalence was used before and after the remediation program.

Table 1. Mastery Descriptive Equivalence

The Percentage Score will be computed based on the following formula:

$$PS = \frac{\text{Score Obtained}}{\text{Total Number of Items}} \times 100\%$$

This formula was also used to determine whether the respondents have successfully passed or failed the intervention program employed to them by the researcher.
RESULTS AND DISCUSSIONS

Effectiveness of the SIM-MOD

To investigate the impact of the learning materials used for the intervention program on Rational Algebraic Expressions, a quasi-experimental design was utilized. The mean grade scores for the 1st and 2nd rating periods were used as baseline data for the comparability of the two groups (control and experimental). t –test for the independent and dependent means were the statistical tool used in this phase of the study.

<table>
<thead>
<tr>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal Variances assumed</td>
<td>F</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>.265</td>
</tr>
<tr>
<td>Posttest</td>
<td>Equal Variances assumed</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-11.109</td>
</tr>
<tr>
<td>Deviation</td>
<td>Equal Variances assumed</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-7.727</td>
</tr>
</tbody>
</table>

An independent sample t-test was conducted to compare the student scores and mean gain scores who used the SIM-MOD and those who did not while under the intervention of “Performing Operations on Rational Algebraic Expressions” for about two rating periods, 3rd and 4th quarters of AY 2014-2015. The table shows that scores of the control and experimental group on the pretest do not have significant differences before the SIM-MOD was used by the experimental group (p-
value is 0.855). Upon using the SIM-MOD, a posttest was given to the participants. As seen on the table, the p-value of 0.000 with a t-value of -11.019 is an indication of the significant difference between the scores of the students from the control and experimental group. This implies that the participants who used the SIM-MOD have significant higher scores than those who did not use the intervention materials. Also, there is significant difference (p-value of 0.000 and t-value of -7.727) present in the mean gain scores of the participants with regards to their pretest and posttest scores. This is an indication that the use of SIM-MOD is an effective way of improving the achievement of the students in their Mathematics subject. The results confirmed findings of Salviejo, Aranes and Espinosa (2014) that Strategic Intervention Material-Based Instruction has motivating capabilities that demands attention and creates strong impact to the learners. It also mentioned in their earlier study that SIM-BI could provide effective communication and proper instruction matched with the learning needs of the students.

Evaluation of the SIM-MOD as an intervention/learning material

The researcher interpreted students’ responses based on frequency distribution, weighted mean, and a brief verbal interpretation in each of given item and criterion in the evaluation instrument. Individual table per criterion were used in the presentation of the results.

Table 3 presents the participants’ evaluation based on the design, presentation, usefulness, etc. of the developed learning material. It can be viewed from the table that students find the design, presentation, usefulness, etc. of SIM-MOD #1 to be “Adequate” (average mean of 4.33).

Table 3
Descriptive Measures of Students’ Evaluation on the Design, Presentation, and Usefulness, etc. of SIM-MOD #1 (n=45)

<table>
<thead>
<tr>
<th>Items</th>
<th>Frequency</th>
<th>Mean</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Design of the SIM-MOD</td>
<td>29 12 4</td>
<td>4.56</td>
<td>More Than Adequate</td>
</tr>
<tr>
<td>2. Clarity of the directions used.</td>
<td>21 23 1</td>
<td>4.44</td>
<td>Adequate</td>
</tr>
<tr>
<td>3. Readability</td>
<td>22 22 1</td>
<td>4.47</td>
<td>Adequate</td>
</tr>
<tr>
<td>4. Importance of the content</td>
<td>20 23 2</td>
<td>4.40</td>
<td>Adequate</td>
</tr>
<tr>
<td>5. Appropriateness of activities</td>
<td>21 22 2</td>
<td>4.42</td>
<td>Adequate</td>
</tr>
<tr>
<td>6. Ease of task completion</td>
<td>2 13 30</td>
<td>3.38</td>
<td>Partially Adequate</td>
</tr>
<tr>
<td>7. Opportunities for active learning</td>
<td>22 22 1</td>
<td>4.47</td>
<td>Adequate</td>
</tr>
<tr>
<td>8. Usefulness of the SIM-MOD in meeting learner’s needs</td>
<td>23 21 1</td>
<td>4.49</td>
<td>Adequate</td>
</tr>
<tr>
<td>Average Mean</td>
<td></td>
<td>4.33</td>
<td>Adequate</td>
</tr>
</tbody>
</table>
Most items in the evaluation of SIM-MOD #1 have received an “Adequate” rating from the participants. Only item 6 (Ease of task Completion) got the lowest mean rating of 3.38. Item 1 (Design of SIM-MOD) has received the highest mean rating of 4.56. The results indicate that majority of the participants has appreciated the design of SIM-MOD #1 but the completion of the task contained in it was not that easy for them.

Table 4 presents the participants’ evaluation based on the Delivery of the Program or the Way the Intervention Program with SIM-MOD #1 employed was delivered to the students. It can be viewed from the table that the students find the Delivery of the Program with SIM-MOD #1 to be “Adequate” (average mean of 4.18).

<table>
<thead>
<tr>
<th>Table 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive Measures of Students’ Evaluation on the Delivery of the Program with SIM-MOD #1 (n=45)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Items</th>
<th>Frequency</th>
<th>Mean</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Orientation to the Program</td>
<td>22 21 2</td>
<td>4.44</td>
<td>Adequate</td>
</tr>
<tr>
<td>2. Time allotted for the Program</td>
<td>4 12 29</td>
<td>3.44</td>
<td>Partially Adequate</td>
</tr>
<tr>
<td>3. Support Provided for the learners</td>
<td>35 5 5</td>
<td>4.67</td>
<td>More Than Adequate</td>
</tr>
<tr>
<td>Average Mean</td>
<td></td>
<td>4.18</td>
<td>Adequate</td>
</tr>
</tbody>
</table>

It can be gleaned from the Table 4 that only Item 2 (Time allotted for the program) has received the lowest mean rating of 3.44 and Item 3 (Support provided for the learners) has received the highest mean rating of 4.67. The results indicate that majority of the students who underwent intervention program on “Rational Algebraic Expressions” with the use of SIM-MOD #1 has appreciated the support provided for them. But what they considered as a problem was the time allotted for the program. For them, they had a hard time accomplishing tasks in the SIM-MOD due to the limited time that was given to them in every session per week.

Table 5 presents the participants’ evaluation based on the design, presentation, usefulness, etc. of the developed learning materials. It can be viewed from the table that students find the design, presentation, usefulness, etc. of the SIM-MOD #2 to be “Adequate” (average mean of 4.28).

<table>
<thead>
<tr>
<th>Table 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive Measures of Students’ Evaluation on the Design, Presentation, and Usefulness, etc. of SIM-MOD #2 (n=45)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Items</th>
<th>Frequency</th>
<th>Mean</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Design of the</td>
<td>22 22 1</td>
<td>4.47</td>
<td>Adequate</td>
</tr>
</tbody>
</table>
Most items in the evaluation of SIM-MOD #2 have received an “Adequate” rating from the participants except for Item 6 (Ease of tasks completion) with a mean rating of 3.49 (Partially Adequate). On the other hand, Item 1 (Design of the SIM-MOD) has received the highest mean rating of 4.47. The results indicate that majority of the participants have found the design of SIM-MOD #2 very appealing. But they have perceived that tasks contained in it as something not easy to accomplish.

Table 6 presents the participants’ evaluation based on the Delivery of the Program or the Way the intervention Program with SIM-MOD #2 employed was delivered to the students. It can be viewed from the table that the students find the Delivery of the Program with SIM-MOD #2 to be “Adequate” (average mean of 4.11).

Table 6
Descriptive Measures of Students’ Evaluation on the Delivery of the Program with SIM-MOD #2 (n=45)

<table>
<thead>
<tr>
<th>Items</th>
<th>Frequency</th>
<th>Mean</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery of the Program with SIM-MOD #1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Orientation to the Program</td>
<td>20</td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td>2. Time allotted for the Program</td>
<td>6</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Average Mean</td>
<td></td>
<td></td>
<td>4.11</td>
</tr>
</tbody>
</table>

The Delivery of the Program with the use of SIM-MOD #2 has received an average mean of 4.11 with “Adequate” rating except for Item 2 (Time allotted for the Program) with the lowest mean rating of 3.49. Support provided for the learners (Item 3) has obtained the highest mean rating of 4.47. The time allotted for the program was a problem to majority of the participants and this was based on the results of the survey. They believed that given only with enough time they could have
well accomplished the tasks contained in SIM-MOD #2. However, the results also indicate that the support provided for them was very much appreciated by them.

Table 7 presents the participants’ evaluation based on the design, presentation, usefulness, etc. of the developed learning material. It can be viewed from the table that students find the design, presentation, usefulness, etc. of the SIM-MOD #3 to be “Adequate” (average mean of 4.31).

Table 7
Descriptive Measures of Students’ Evaluation on the Design, Presentation, and Usefulness, etc. of SIM-MOD #3 (n=45)

<table>
<thead>
<tr>
<th>Items</th>
<th>Frequency</th>
<th>Mean</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The SIM-MOD’s Design, Presentation, Usefulness, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. 1. Design of the SIM-MOD</td>
<td>32</td>
<td>4.64</td>
<td>More Than Adequate</td>
</tr>
<tr>
<td>2. Clarity of the directions used.</td>
<td>21</td>
<td>4.42</td>
<td>Adequate</td>
</tr>
<tr>
<td>3. Readability</td>
<td>20</td>
<td>4.40</td>
<td>Adequate</td>
</tr>
<tr>
<td>4. Importance of the content</td>
<td>21</td>
<td>4.44</td>
<td>Adequate</td>
</tr>
<tr>
<td>5. Appropriateness of activities</td>
<td>21</td>
<td>4.42</td>
<td>Adequate</td>
</tr>
<tr>
<td>6. Ease of task completion</td>
<td>5</td>
<td>3.44</td>
<td>Partially Adequate</td>
</tr>
<tr>
<td>7. Opportunities for active learning</td>
<td>20</td>
<td>4.36</td>
<td>Adequate</td>
</tr>
<tr>
<td>8. Usefulness of the SIM-MOD in meeting learner’s needs</td>
<td>19</td>
<td>4.36</td>
<td>Adequate</td>
</tr>
<tr>
<td>Average Mean</td>
<td></td>
<td>4.31</td>
<td>Adequate</td>
</tr>
</tbody>
</table>

In the evaluation of SIM-MOD #3, most items have received an “Adequate” rating except for Item 6 (Ease of task completion) with the lowest mean rating of 3.44. Design of the SIM-MOD (Item 1) has obtained the highest mean rating of 4.64. The results of the survey indicate that majority of the students who underwent intervention program on “Rational Expressions” have been attracted to the distinct design of SIM-MOD #3. However, accomplishing the task contained in it was not that easy for them.

Table 8 presents the participants’ evaluation based on the Delivery of the Program or the Way the Intervention Program with SIM-MOD #3 employed was delivered to the students. It can be viewed from the table that the students find the Delivery of the Program with SIM-MOD #3 to be “Adequate” (average mean of 4.05).
Table 8
Descriptive Measures of Students' Evaluation on the Delivery of the Program with SIM-MOD #3
(n=45)

<table>
<thead>
<tr>
<th>Items</th>
<th>Frequency</th>
<th>Mean</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Delivery of the Program with SIM-MOD #1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Orientation to the Program</td>
<td>19</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>2. Time allotted for the Program</td>
<td>4</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>3. Support Provided for the learners</td>
<td>20</td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td>Average Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Delivery of the Program with SIM-MOD #3 has received an “Adequate” rating except for Item #2, Time allotted for the Program, with the lowest mean rating of 3.40. The support provided for the learners (Item 3) has received the highest mean rating of 4.38 from the participants. The perception of the students on the Delivery of the Program with SIM-MOD #3 was just the same as the Delivery of the Program with the other two SIM-MODs. The support provided by the researcher was very much appreciated by the participants. But what bothered them in accomplishing the tasks contained in the intervention material was the time allotted to them in every session per week.

Table 9 presents the summary of the students’ evaluation of the developed SIM-MODs/learning materials. It can be gleaned from the table that all criteria of the developed learning materials have received an “Adequate” rating from the participants with an overall mean of 4.31. In general, the overall mean for the Delivery of the Program was 4.11 with an “Adequate” rating from the Grade 8 participants.

Table 9
Summary of Students’ Evaluation of SIM-MODs (1-3)

<table>
<thead>
<tr>
<th>Items</th>
<th>Weighted Mean</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. The SIM-MOD’s Design, Presentation, Usefulness, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Design of the SIM-MODs</td>
<td>4.56</td>
<td>More Than Adequate</td>
</tr>
<tr>
<td>2. Clarity of the directions used</td>
<td>4.41</td>
<td>Adequate</td>
</tr>
<tr>
<td>3. Readability</td>
<td>4.42</td>
<td>Adequate</td>
</tr>
<tr>
<td>4. Importance of the content</td>
<td>4.42</td>
<td>Adequate</td>
</tr>
<tr>
<td>5. Appropriateness of activities</td>
<td>4.39</td>
<td>Adequate</td>
</tr>
<tr>
<td>6. Ease of task completion</td>
<td>3.44</td>
<td>Partially Adequate</td>
</tr>
<tr>
<td>7. Opportunities for active learning</td>
<td>4.40</td>
<td>Adequate</td>
</tr>
</tbody>
</table>
8. Usefulness of the SIM-MOD in meeting learner’s needs  

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OVERALL MEAN</strong></td>
<td><strong>4.31</strong></td>
<td><strong>Adequate</strong></td>
</tr>
</tbody>
</table>

II. Delivery of the Program

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Orientation to the program</td>
<td><strong>4.39</strong></td>
<td><strong>Adequate</strong></td>
</tr>
<tr>
<td>2. Time allotted for the program</td>
<td><strong>3.44</strong></td>
<td><strong>Partially Adequate</strong></td>
</tr>
<tr>
<td>3. Support provided for the learners</td>
<td><strong>4.51</strong></td>
<td><strong>More Than Adequate</strong></td>
</tr>
<tr>
<td><strong>OVERALL MEAN</strong></td>
<td><strong>4.11</strong></td>
<td><strong>Adequate</strong></td>
</tr>
</tbody>
</table>

In general, the Design of the SIM-MODs (Item 1) has received the highest mean rating of 4.56. On the other hand, Ease of Task Completion has obtained the lowest mean rating of 3.44. The Delivery of the Program with SIM-MODs 1-3 has obtained an overall mean of 4.11.

The time allotted for the program got the lowest mean rating of 3.44 and 4.51 was the highest mean rating received and that was for the support provided for the learners.

The data indicate that the design of SIM-MOD Numbers 1-3 together with the support provided by the researcher were highly appreciated by majority of the participants. Ease of Task Completion was a problem to them due to the time allotted to them in every session per week. These results conformed with the views of Guerra (1996) on the importance of designing our own classroom materials. That by creating and designing our own materials, we are making a systematic reflection; we are enriching our own process. The same results also conformed with the statement made by Salviejo (2014) that a learning material if well design, can also help motivated students to learn by attracting/marinating their attention. Likewise, materials should be examined for the level of difficulty. They must be readable and accomplishable if they are to be truly accessible to the students. Words to be used in the learning material should be suited to the reading comprehension level of the students that need remediation for a particular topic.

**Evaluation of SIM-MOD by the Experts and their Suggestions**

Before the final implementation of the intervention program, the developed learning materials were validated by the subject matter experts.

The following are the suggestions made by the subject matter experts for the improvement of the developed learning materials aimed at enhancing Grade 8 students’ skills in “Performing Operations on Rational Algebraic Expressions”:

<table>
<thead>
<tr>
<th></th>
<th>Experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layout/Presentation</td>
<td>“The color printing must be maintained all throughout the production as well as the paper quality. Having it produced otherwise will lose its appeals to the students.”</td>
</tr>
<tr>
<td>Instructions used</td>
<td>“Revise some of the instruction used in the activity cards (SIM-MOD #2) because it might confuse the learners.” “Choose the letter of the correct answer (How?).”</td>
</tr>
<tr>
<td>Content</td>
<td>“Compared to the first SIM-MOD, some of the discussions (SIM-MOD #2) do not have guide card.” “Content wise. Very good!”</td>
</tr>
</tbody>
</table>
### Summary

SIM-MOD, a learning material can be developed guided by an instructional design model such as ADDIE (Analysis-Design-Development-Implementation-Evaluation) model. Steps and processes should be customized to the nature of the learning material. There has been a pattern on the preferences of the participants with regards to the design of the SIM-MOD. Most of the participants have been attracted to the distinct design of the learning materials and most of them found the tasks contained in the SIM-MOD not that easy to accomplish.

There has also been a pattern on the preferences of the participants with regards to the delivery of the Intervention Program on “Rational Algebraic Expressions.” Majority of the participants have appreciated the support provided for them before, during and after the intervention program in one of the least mastered skills in Grade 8 Mathematics. Most of them have found the allotted time per session per week not enough for them to accomplish the tasks contained in the SIM-MODs.

SIM-MOD is a valid learning material in teaching Grade 8 Mathematics most specifically “Performing Operations on Rational Algebraic Expressions.” An independent sample t-test was conducted to compare the student scores and mean gain scores who used the SIM-MOD and those who did not while under the intervention of “Performing Operations on Rational Algebraic Expressions” for about two rating periods, 3rd and 4th quarters of AY 2014-2015. The independent sample t-test shows the scores of the control and experimental groups on the pretest do not have significant differences before the SIM-MOD was used by the experimental group (p-value is 0.855). Upon using the SIM-MOD, a posttest was given to the participants. The p-value of 0.000 with a t-value of -11.019 is an indication of the significant differences between the scores of the participants from the control and experimental groups. This implies that the participants who used the SIM-MOD have significant higher scores than those who did not use the learning materials. Also, there is a significant difference (p-value of 0.000 and t-value of 7.727) present in the mean gain scores of the participants with regards to their pretest and posttest scores. This is an indication that the use of SIM-MOD is an effective way of improving the achievement of the students in their Mathematics subject.

### Conclusions

The following conclusions were drawn based on the findings of the study.

1. What are the procedures in the development of the SIM-MOD?
SIM-MOD can be developed guided by an instructional design model such as the ADDIE (Analysis-Design-Development-Implementation-Evaluation) model. Steps and processes should be customized to the nature of the learning material to be developed. Specifically, for this study the intervention material/SIM-MOD was developed through these stages: (1) Preparation; (2) SIM-MOD Development; and (3) Evaluation.

2. How do the students/experts evaluate SIM-MOD 1-3?
2.1 There has been a pattern on the preferences of the participants with regards to the design of the developed learning materials otherwise known as SIM-MODs 1-3.
2.2 Most of the students who underwent intervention program on “Rational Expressions” have been attracted to the distinct design of the learning materials. Included in the design are layout and presentation of the printed materials.
2.3 Most of the participants have found the tasks contained in the SIM-MOD not that easy to accomplish.

3. How do the students evaluate the Delivery of the Program (Intervention Program with SIM-MODs employed)
3.1 These have been a pattern on the preferences of the participants with regards to the Delivery of the Remediation Program on “Rational Algebraic Expressions.”
3.2 Majority of the participants have appreciated the support provided for them (free bond papers, proper motivation, moral support, etc.) before, during and after the intervention program in one of the least mastered skills in 8th Grade Mathematics.
3.3 Most of the participants have found the time allotted per session per week not enough for them to accomplish the tasks contained in these SIM-MODs.

4. What changes do the experts and students suggest to improve the layout/presentation, instruction used, content and activities of the SIM-MOD including the delivery of the intervention program?

SIM-MOD is a valid learning material in teaching Grade 8 Mathematics most specifically “Performing Operations on Rational Algebraic Expressions.” Results showed that the scores of the control and experimental groups on the pretest do not have significant differences before the SIM-MOD was used by the experimental group (p-value is 0.855). Upon using the SIM-MOD, a posttest was given to the participants. The p-value of 0.000 with a t-value of -11.019 is an indication of the significant difference between the scores of the participants from the control and experimental groups. Which led to the conclusions that SIM-MOD has significantly improved the achievements of the Grade 8 students most particularly in “Performing Operations on Rational Algebraic Expressions.” This furtherly led to the implications that there was a positive impact of using these intervention materials in developing cognitive skills in the students of Mathematics at the Grade 8 level.

In order to extract information from the students beyond the remediation program, an interview was conducted. This was done to ensure that some may be captured in order to shed more light into the results of the research.

Qualitative Findings

When asked about the SIM-MOD experience through interview using open-ended questions, the students had a lot to say. Even a simple answer and question session would turn into a discussion as everyone had something to say. They were very excited because of the exposure to the SIM-MOD.

Ease of Learning

Students gave their feedback. Most of them said that their learning of the rational expressions made them understand the lessons better. They said the materials helped them in the learning process. One student said, the SIM-MOD’s presentation made her learning of Mathematics more
interesting. “I learned a lot,” one said comparing her dismal of Math for many years in the elementary grades.

Attitude towards using SIM-MOD

When students were asked whether they would want other teachers to also use SIM-MOD and continue using it as a teaching mode, there were mixed responses. Most students were very confident and said yes, out of dramatic change in their learning of rational expressions. Others also showed support to its usage but with a little constraint. For instance, some of the students said that teachers do have liberty to teach their students. Moreover, some said that the teacher’s knowledge of the students’ readiness and learning style will be a way to determine its usage or not or even adopt a different way to teach students.

Perceived Usefulness

When students were asked about how they perceive to be the benefits of using the SIM-MOD in their learning the rational expressions, they responded that it was a way that helped them to apply the same techniques in studying other lessons. Some students also indicated that its usefulness can be used as well even when they go to higher education – when they reach the college level. The exposure to using the SIM-MOD according to some have given them the needed self-reliance on doing mathematical activities by themselves. Their self-esteem was boosted as the SIM-MOD promoted independence in solving mathematical problems as well as establishing opportunities to mingle with their classmates.

Recommendations

The following recommendations were made on the basis of the results obtained from the analysis of data:
1. Develop and use SIM-MODs in other topics in Grade 8 Mathematics to further validate the results of the study.
2. Conduct similar studies on the use of SIM-MOD in other discipline to confirm the results of the study.
3. Use SIM-MOD as a remediation material to enhance the academic achievements of low performing students in Math and as an enhancement material to furtherly improve the cognitive skills of average and above average type of students in Math and in other discipline.
4. Encourage administrators, Mathematics supervisors and teachers to make SIM-MOD in all topics not only the least mastered skills in a given subject area.
5. Teachers shall be provided with more seminars, workshops on the principles of SIM-MOD construction.
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APPENDICES

“B” PRETEST

Pretest (Performing Operations on Rational Expressions)

Directions: This is a test of your ability to perform operations on Rational Expressions. Analyze and solve each item carefully. Determine the correct answer from the four choices a, b, c, d. After you have decided on the best answer, write the letter that corresponds to your answer in your answer sheet.

1. Which of the following is not a rational number?
   a. \(\frac{3x}{4}\)  
   b. \(\frac{3}{2}\)  
   c. 40%  
   d. 0.5

2. What is the equivalent fraction of \(\frac{24}{36}\)?
   a. \(\frac{2}{3}\)  
   b. \(\frac{3}{4}\)  
   c. \(\frac{8}{10}\)  
   d. \(\frac{18}{20}\)

3. The common monomial factor of \(x^2\) and 3x?
   a. 3x  
   b. \(x^2\)  
   c. x  
   d. -3x

4. The product when y is multiplied by three less than y can be represented by
   a. 3y - y  
   b. y(y - 3)  
   c. y(3 - y)  
   d. \(y^2 - 3\)

5. In \(\frac{x + 3}{y^2 + 4x + 4}\), all expressions are factorable except for
   a. \(x + 3\)  
   b. \(x^2 - 4\)  
   c. \(x^2 + 4x + 4\)  
   d. \(2x^2 + x - 15\)

6. Simplify \(\frac{8y^3}{20x^2y^2}\).
   a. \(\frac{2}{5}xy\)  
   b. \(\frac{2x}{5y}\)  
   c. \(\frac{2y}{5x}\)  
   d. \(\frac{5y}{2x}\)

7. The quotient when x is divided by 5 more than x can be represented by
   a. \(\frac{x + 5}{5}\)  
   b. \(\frac{x}{x + 5}\)  
   c. \(\frac{x}{5x}\)  
   d. \(\frac{5x}{x}\)

8. Write \(\frac{x^2 - 4}{2x^2 + x - 10}\) as a quotient in lowest term.
   a. \(\frac{x - 2}{2x + 5}\)  
   b. \(\frac{x - 4}{2x - 10}\)  
   c. \(\frac{-2}{2x - 5}\)  
   d. \(\frac{x + 2}{2x + 5}\)

9. What is the GCF in \(\frac{7}{8},\frac{9}{12}\)?
   a. 2  
   b. 3  
   c. 4  
   d. 6

10. Which expression in \(\frac{a^2 - 16}{2a - 8},\frac{a^2 - 1}{a^2 + 5a + 4}\) has \((a + 4)(a + 1)\) as its factors?
    a. \(a^2 - 16\)  
    b. \(2a - 8\)  
    c. \(a^2 - 1\)  
    d. \(a^2 + 5a + 4\)

11. Which of the following is the simplest form of \(\frac{3x - 5}{2y + 1},\frac{6y - 3}{6x - 10}\)?
    a. \(\frac{1}{2}\)  
    b. \(\frac{3}{2}\)  
    c. \(\frac{1}{2}\)  
    d. \(\frac{3}{2}\)

12. What is the LCM of 18 and 24?
    a. 18  
    b. 24  
    c. 36  
    d. 72

13. The difference in \(\frac{4a - 3b}{a + b},\frac{2a + 8b}{a + b}\)
    a. \(\frac{2a - 11b}{a + b}\)  
    b. \(\frac{2a + 11b}{a + b}\)  
    c. \(\frac{-2a - 11b}{a + b}\)  
    d. \(\frac{-2a + 11b}{a + b}\)
14. Find the sum in lowest terms: \( \frac{2x}{x-3} + \frac{7}{x+3} \)?
   a. \( \frac{2x^2 + 13x - 21}{(x-3)(x+3)} \)
   b. \( \frac{2x^2 - 13x - 21}{(x-3)(x+3)} \)
   c. \( \frac{2x^2 - 13x + 21}{(x-3)(x+3)} \)
   d. \( \frac{-2x^2 - 13x - 21}{(x-3)(x+3)} \)

15. To get the sum of \( \frac{5}{x^2 + x - 6} \) and \( \frac{2x + 2}{x^2 + 2x - 3} \), both denominators must be factored first.
   What are the factors of \( x^2 + x - 6 \)?
   a. (x + 3)(x - 2)
   b. (x + 3)(x - 1)
   c. (x - 3)(x + 2)
   d. (x - 3)(x + 1)

16. What is the LCD in \( \frac{x}{3x - 1} + \frac{1}{3x + 1} - \frac{2x}{9x^2 - 1} \)?
   a. 3x - 1
   b. 3x + 1
   c. (3x - 1)(3x + 1)
   d. (3x - 1)(3x + 1)(9x^2 - 1)

17. What is the missing numerator in \( \frac{4}{x - 4} = \frac{?}{(x - 4)} \)?
   a. 4x - 4
   b. 4x + 16
   c. x - 4
   d. 4x - 16

18. What is the difference in lowest term of \( \frac{d^2}{d - 4} - \frac{16}{d - 4} \)?
   a. d - 4
   b. d + 4
   c. (d - 4)(d + 4)
   d. (d - 4)^2

19. What sum is obtained when you added \( \frac{2}{x + 2} \) to \( \frac{1}{x - 1} \)?
   a. \( \frac{3x}{(x-1)(x+2)} \)
   b. \( \frac{3x^2 + 4}{(x-1)(x+2)} \)
   c. \( \frac{3x - 4}{(x-1)(x+2)} \)
   d. \( \frac{3x - 4}{(x-1)(x+2)} \)

20. Which of the following expressions has \( x \) as its simplest form?
   a. \( \frac{x^2 - 9x}{x - 9} \)
   b. \( \frac{x^2 + 5x + 6}{2x + 4} \)
   c. \( \frac{x^2 + x}{2x + x^2} \)
   d. \( \frac{x - y}{x^2 - 2xy + y^2} \)

21. \( \frac{5y^2 - 5b}{a^2 - b} \) when expressed in lowest term is equal to
   a. \( a^2 - b \)
   b. \( a^2 + b \)
   c. \( a + b \)
   d. 5

22. Which of the following expressions has \( (x + 4)(x - 3) \) as its factors?
   a. \( x^2 - 2x - 15 \)
   b. \( 4x^2 - 25 \)
   c. \( x^2 - 4x + 4 \)
   d. \( x^2 + x - 12 \)

23. What is the common monomial factor in the numerator of the expression \( \frac{8x^2 - 16x}{x^2 - 4x + 4} \)?
   a. 8
   b. -8
   c. 8x
   d. -8x

24. What is the value of \( x \) in \( ax + bx = a^2 - b^2 \)?
   a. \( a + b \)
   b. \( a - b \)
   c. \( -a + b \)
   d. \( (a + b)(a - b) \)

25. \( \frac{9}{12} \) and \( \frac{36}{48} \) are equivalent fractions which when reduced to lowest term is equal to?
   a. \( \frac{1}{4} \)
   b. \( \frac{1}{2} \)
   c. \( \frac{3}{4} \)
   d. \( \frac{4}{5} \)

26. What factor is common to the numerator and denominator of the expression \( \frac{4x^2 - 12x + 9}{4x^2 - 9} \)?
   a. \( 2x + 3 \)
   b. \( 2x - 3 \)
   c. \( -2x + 3 \)
   d. \( -2x - 3 \)

27. What is the simplest form of \( \frac{x^2 - 1}{x^2 + 2x + 1} \)?
   a. \( \frac{x - 1}{x + 1} \)
   b. \( \frac{x + 1}{x - 1} \)
   c. \( x + 1 \)
   d. \( x - 1 \)
28. What are the factors of the numerator in the expression \( \frac{1 - 2x + x^2}{1 - x^2} \)?
   a. \((1 + x)(1 - x)\)  
b. \((1 - x)(1 - x)\)  
c. \(1 + x\)  
d. \(1 - x\)

29. Simplify: \(\frac{8a^2b}{5}\)
   a. \(\frac{9}{10a}\)  
b. \(\frac{9b}{10a}\)  
c. \(\frac{9ab}{10}\)  
d. \(\frac{9a}{10}\)

30. The product of \(7ab^3\) and \(6a^3b^2\) can be written as
   a. \(13a^4b^5\)  
b. \(42a^3b^6\)  
c. \(42a^4b^5\)  
d. \(42a^3b^5\)

31. Divide and simplify: \(\frac{4x + 8}{5} \div \frac{x^2 - 4}{15}\)
   a. \(\frac{12x}{x + 2}\)  
b. \(\frac{12}{x - 2}\)  
c. \(\frac{x - 2}{12}\)  
d. \(\frac{x + 2}{3}\)

32. What is the quotient of \(\frac{6x^2}{9} + \frac{2}{3}\) in lowest term?
   a. \(x\)  
b. \(2x\)  
c. \(3x\)  
d. \(4x\)

33. Find the sum in lowest terms: \(\frac{x}{x + y} + \frac{y}{x + y}\)
   a. \(\frac{xy}{x + y}\)  
b. \(\frac{x + y}{x + y}\)  
c. \(\frac{x + y}{xy}\)  
d. \(1\)

34. Which expression is in simplest form?
   a. \(\frac{2x + 1}{2x - 1}\)  
b. \(\frac{3x + 6}{3}\)  
c. \(\frac{x - 1}{1 - x}\)  
d. \(\frac{x^2 + x}{2x}\)

35. \(\frac{x - y}{y - x}\) when simplified becomes what?
   a. -1  
b. 1  
c. x  
d. y

36. In \(\frac{x^2 - 4x}{16 - x^2}\), what are the factors of its denominator?
   a. \((4 + x)(4 - x)\)  
b. \((4 + x)(4 + x)\)  
c. \((4 - x)(4 - x)\)  
d. \((x + 4)(x - 4)\)

37. \(\frac{ab}{3bx}\) is the common factor of the numerator and the denominator of which rational expression?
   a. \(\frac{3ax}{3bx}\)  
b. \(\frac{5a^2 - 5b}{a^2 - b}\)  
c. \(\frac{a^3}{ab}\)  
d. \(\frac{25a^3 - b^3}{5a^3b^3}\)

38. What would the result be when \(\frac{3x^2 - 5}{4x^2 + 4x}\) is expressed in lowest term?
   a. \(\frac{3}{4}\)  
b. \(\frac{3}{4x}\)  
c. \(\frac{3(x - 1)}{4}\)  
d. \(\frac{3(x - 1)}{4x}\)

39. Which values of \(x\) will give the expression a zero denominator?
   a. \(\frac{2a + 3}{x}\)  
b. \(\frac{4}{x + 1}\)  
c. \(\frac{3x + 5}{2x - 2}\)  
d. \(\frac{x + 3}{x^2 - 4}\)

40. Which fraction is in lowest term?
   a. \(\frac{18}{27}\)  
b. \(\frac{56}{49}\)  
c. \(\frac{13}{52}\)  
d. \(\frac{25}{39}\)
"C" POSTTEST

**Posttest (Performing Operations on Rational Expressions)**

**Directions:** This is a test of your ability to perform operations on Rational Expressions. Analyze and solve each item carefully. Determine the correct answer from the four choices a, b, c, d. After you have decided on the best answer, write the letter that corresponds to your answer in your answer sheet.

1. Which of the following is not a rational expression?
   a. \( \frac{x-2}{3x+5} \)  
   b. \( 3x + 2 \)  
   c. \( \frac{5+x}{x} \)  
   d. \( \frac{a-2}{a^2} \)

2. What is the factor common to the numerator and the denominator of \( \frac{x-2}{2x-4} \)?
   a. \( x - 2 \)  
   b. \( x + 2 \)  
   c. \( 2 \)  
   d. \( -2 \)

3. What value(s) of \( x \) will make the expression \( \frac{4x}{x^2-4} \) undefined?
   a. none  
   b. \( -2 \)  
   c. 0  
   d. 2

4. Which fraction is in lowest term?
   a. \( \frac{18}{27} \)  
   b. \( \frac{56}{49} \)  
   c. \( \frac{13}{52} \)  
   d. \( \frac{25}{39} \)

5. Which of the following expressions is equal to -1?
   a. \( \frac{3m-1}{1-3m} \)  
   b. \( \frac{5-3x}{-3x+5} \)  
   c. \( \frac{x+y}{y-x} \)  
   d. \( \frac{x-1}{x} \)

6. Which of the following is the simplest form for \( \frac{x^2 + 2}{x^2 + 2x} \)?
   a. \( \frac{2}{3x} \)  
   b. \( \frac{x+1}{x^2+x} \)  
   c. \( \frac{x}{x^2+x} \)  
   d. \( \frac{1}{x} \)

7. Simplify: \( \frac{48}{10} \cdot \frac{4c^2}{c^5} \)
   a. \( \frac{c^3}{4c^4} \)  
   b. \( 24c^8 \)  
   c. \( 12c^5 \)  
   d. \( 12c^8 \)

8. Which expression is in simplest form?
   a. \( \frac{2x+1}{2x-1} \)  
   b. \( \frac{3x+6}{3} \)  
   c. \( \frac{x-1}{1-x} \)  
   d. \( \frac{x^2 + x}{2x} \)

9. Find the quotient in simplest form:
   \( \frac{x^2 + 6x - 16}{x^2 - 64} \div x - 2 \)
   a. \( \frac{1}{x - 2} \)  
   b. \( \frac{1}{x - 8} \)  
   c. \( x - 2 \)  
   d. \( x - 8 \)

10. What would the quotient be when you divide \( \frac{2}{a} \) by \( \frac{5}{a} \)?
    a. \( \frac{10}{a} \)  
    b. \( \frac{10}{a^2} \)  
    c. \( \frac{2}{5} \)  
    d. \( \frac{5}{2} \)

11. Simplify \( \frac{x^2 - y^2}{x^2 + xy} \).
    a. \( \frac{x+y}{x} \)  
    b. \( \frac{x-y}{x} \)  
    c. \( \frac{x+y}{x+y} \)  
    d. \( \frac{x-y}{x(x+y)} \)

12. Divide and simplify: \( \frac{4x + 8}{5} \div \frac{x^2 - 4}{15} \)
    a. \( \frac{12x}{x + 2} \)  
    b. \( \frac{12}{x - 2} \)  
    c. \( \frac{x - 2}{12} \)  
    d. \( \frac{x + 2}{3} \)

13. In \( \frac{4x^2 + 11x + 6}{9x^2 - 4} + \frac{8x^2 - 6x - 9}{6x^2 - 5x - 6} \), which expression has the factors \((2x - 3)\) and \((4x + 3)\)?
    a. \( 4x^2 + 11x + 6 \)  
    b. \( 9x^2 - 4 \)  
    c. \( 8x^2 - 6x - 9 \)  
    d. \( 6x^2 - 5x - 6 \)
14. What is the sum of $\frac{3}{5}$ and $\frac{4}{5}$?
   a. $\frac{7}{10}$  
   b. $\frac{7}{5}$  
   c. $\frac{12}{25}$  
   d. $\frac{15}{20}$

15. Add: $\frac{3x}{4} + \frac{2x - 2}{6}$
   a. $\frac{13x + 4}{12}$  
   b. $-\frac{13x + 4}{12}$  
   c. $-\frac{13x - 4}{12}$  
   d. $\frac{13x - 4}{12}$

16. What is the missing numerator in $\frac{-11}{k} = \frac{8k}{?}$
   a. -88  
   b. 88  
   c. -88k  
   d. 88k

17. Find the sum of $\frac{1}{x}$ and $\frac{2}{3x}$ in simplest form.
   a. $\frac{5}{3x}$  
   b. $\frac{5}{3x}$  
   c. $\frac{3}{4x}$  
   d. $\frac{3}{3x^2}$

18. Write $\frac{x^2 - 4}{2x^2 + x - 10}$ as a quotient in lowest term.
   a. $\frac{x - 2}{2x + 5}$  
   b. $\frac{x - 4}{2x - 5}$  
   c. $\frac{-2}{2x - 5}$  
   d. $\frac{x + 2}{2x + 5}$

19. The quotient in simplest form of $\frac{x^2 + 2x - 35}{x + 2} + \frac{x^2 + 5x - 14}{x^2 + x - 2}$
   a. $\frac{(x - 5)(x + 1)}{x - 2}$  
   b. $\frac{(x - 5)(x + 1)}{x - 7}$  
   c. $\frac{x - 5}{(x - 2)(x - 3)}$  
   d. $\frac{x - 5}{x - 2}$

20. In $\frac{15}{x^3 - 49} + \frac{20}{x + 7}$, all expressions are non-factorable except for
   a. 15  
   b. 20  
   c. $x + 7$  
   d. $x^2 - 49$

21. What is the quotient of $\frac{6x^2}{9} - \frac{x}{3}$ in lowest term?
   a. $x$  
   b. $2x$  
   c. $3x$  
   d. 4$x$

22. What is the sum of $\frac{2a}{b^2}$ and $\frac{3a}{b^2}$ in simplest form?
   a. $\frac{5a}{b^4}$  
   b. $\frac{5a}{b^3}$  
   c. $\frac{5a^2}{b^3}$  
   d. $\frac{6a}{b^3}$

23. Find the LCD: $\frac{x^2 - 4}{(x + 2)^2} + \frac{x - 2}{x + 2}$
   a. $x + 2$  
   b. $(x + 2)^2$  
   c. $(x - 2)^2$  
   d. $(x + 2)(x - 2)$

24. The LCM of $x^2 - 2x - 35$ and $x^2 - 25$ is
   a. $(x + 5)(x - 7)$  
   b. $(x + 5)(x - 5)$  
   c. $(x - 7)(x - 5)$  
   d. $(x + 5)(x - 7)(x - 5)$

25. Compute as indicated and express the result in simplest form: $1 + \frac{3}{x} - \frac{4}{x^2 - x}$
   a. $\frac{x^2 + 2x - 7}{x(x - 1)}$  
   b. $\frac{x^2 - 2x - 7}{x(x - 1)}$  
   c. $\frac{x^2 + 2x + 7}{x(x + 1)}$  
   d. $\frac{x^2 - 2x + 7}{x(x - 1)}$

26. What is the difference in lowest term of $\frac{d^2}{d - 4} - \frac{16}{d - 4}$?
   a. $d - 4$  
   b. $d + 4$  
   c. $(d - 4)(d + 4)$  
   d. $(d - 4)^2$
27. What factors is common to the factors of both denominators of \( \frac{5}{x^2 + x - 6} + \frac{2x + 2}{x^2 + 2x - 3} \)?
   a. \(x + 3\)  
   b. \(x - 2\)  
   c. \(x - 1\)  
   d. \(x - 3\)

28. What sum is obtained when you added \(\frac{2}{x + 2}\) to \(\frac{1}{x - 1}\)?
   a. \(\frac{3x}{(x - 1)(x + 2)}\)  
   b. \(\frac{3x + 4}{(x - 1)(x + 2)}\)  
   c. \(\frac{-3x}{(x - 1)(x + 2)}\)  
   d. \(\frac{3x}{(x - 1)(x + 2)}\)

29. Which of the following expressions has \(x + 5\) as its greatest common factor?
   a. \(\frac{14x^2y}{7x}\)  
   b. \(\frac{4 + x}{x^2 + 16}\)  
   c. \(\frac{13x^2y}{17y^2x}\)  
   d. \(\frac{5 + x}{x^2 - 25}\)

30. What value of \(x\) cannot be used as a replacement for the variable form \(\frac{x + 2}{x^2 + 5x + 6}\)?
   a. \(x \neq -2\)  
   b. \(x \neq -3\)  
   c. \(x \neq 2, 3\)  
   d. \(x \neq -2, -3\)

31. What is the simplest form \(\frac{-5a - 5b}{a^2 - b^2}\)?
   a. \(\frac{5}{a + b}\)  
   b. \(\frac{5}{a - b}\)  
   c. \(-\frac{5}{a + b}\)  
   d. \(-\frac{5}{a - b}\)

32. What is the factor common to the numerator and the denominator of \(\frac{x - 2}{2x - 4}\)?
   a. \(x - 2\)  
   b. \(x + 2\)  
   c. \(2\)  
   d. \(-2\)

33. \(\frac{x + y}{y - x}\) when simplified becomes what?
   a. \(-1\)  
   b. \(1\)  
   c. \(x\)  
   d. \(y\)

34. What is the value of \(x\) in \(ax + bx = a^2 - b^2\)?
   a. \(a + b\)  
   b. \(a - b\)  
   c. \(-a + b\)  
   d. \((a + b)(a - b)\)

35. What is the domain of \(\frac{3x + 1}{x^2 - 1}\)?
   a. \(x \neq 1\)  
   b. \(x \neq -1\)  
   c. \(x \neq \pm 1\)  
   d. none

36. The product of \(7ab^3\) and \(6a^3b^2\) can be written as
   a. \(13a^4b^5\)  
   b. \(42a^6b^9\)  
   c. \(42a^4b^5\)  
   d. \(42a^3b^5\)

37. In \(x^2 - 4 = \frac{x - 2}{x + 2}\), what must be done with \(x^2 - 4\)?
   a. Rewrite it.  
   b. Get it's reciprocal.  
   c. Find its factors.  
   d. All of these

38. Multiply and simplify: \(\frac{x^2 - 25}{x^2} \cdot \frac{3x^2 + x}{3x + 5}\)
   a. \(\frac{(x - 5)(x + 4)}{x(x + 5)}\)  
   b. \(\frac{x - 5}{x}\)  
   c. \(\frac{x(x + 5)}{3x + 1}\)  
   d. \(\frac{x + 5}{x(3x + 1)}\)

39. Divide and simplify:
   \(\frac{4x^2 + 11x + 6}{9x^2 - 4} \div \frac{8x^2 - 6x - 9}{6x^2 - 5x - 6}\)
   a. \(\frac{4x + 3}{3x - 2}\)  
   b. \(\frac{3x + 2}{2x - 3}\)  
   c. \(\frac{x + 2}{3x - 2}\)  
   d. \(\frac{x + 2}{2x - 3}\)

40. What is the area of a square if each side has a length \(\frac{4x}{7}\) cm?
   a. \(\frac{16x}{7}\) cm\(^2\)  
   b. \(\frac{16x}{49}\) cm\(^2\)  
   c. \(\frac{16x^2}{7}\) cm\(^2\)  
   d. \(\frac{16x}{49}\) cm\(^2\)
“D” INTERVIEW: OPEN-ENDED QUESTIONS ON THE TOPIC, ”PERFORMING OPERATIONS
ON RATIONAL ALGEBRAIC EXPRESSIONS.”

1. How well did you learn, “Performing Operations on Rational Algebraic Expressions”?

2. Do you suggest that teaching by all your teachers done the same way? Why?

3. Do you think that your learning of Mathematics will be different if you were taught the
same way when you were in the elementary grade?

4. What is your overall assessment of the way you were taught “Performing Operations on
Rational Algebraic Expressions”?

5. What is your overall assessment of the way you have learned “Performing Operations on
Rational Algebraic Expressions”?

“E” PRETEST, POSTTEST AND GAIN SCORES OF THE EXPERIMENTAL AND
CONTROL GROUPS

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"F" DESCRIPTIVE EQUIVALENT OF THE AVERAGE SCORES (1ST AND 2ND RATING PERIODS, AY 2014-2015) OF THE STUDENTS IN THE EXPERIMENTAL AND CONTROL GROUPS

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## Evaluation Sheet

**Remediation/Enhancement Program**

**Performing Operations on Rational Expressions**

**SY 2014–2015**

**Evaluations of SIM-MOD 1**

<table>
<thead>
<tr>
<th>No.</th>
<th>What are Rational Expressions?</th>
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<tbody>
<tr>
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</table>

Please complete this evaluation sheet to help the researcher assess how useful this SIM-MOD has been in meeting your needs as a learner.

For numbers 1 and 2 only: Rate the following by ticking the box that best describes your response. **1, Needs Improvement, 2, Below Average, 3, Average, 4, Above Average** and **5, Excellent**

### 1. The SIM-MOD

- Design of the SIM-MOD
- Clarity of directions used
- Readability
- Importance of the content
- Appropriateness of activities
- Ease of task completion
- Opportunities for active learning
- Usefulness of the SIM-MOD in meeting your needs

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### 2. Delivery of the Program

- Orientation of the program
- Time allotted for the program
- Support provided for the learners

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</table>
3. What changes (if any) would you suggest to improve the following aspect of the SIM-MOD?

3.1. Layout/Presentation

3.2. Instruction used

3.3. Content

3.4. Activities

3.5. Others

4. What would you suggest to improve the way the program was conducted in your classroom?

5. What specific comments would you like to make about any other aspects of the SIM-MOD?

STUDENT/ RATER            SECTION

Thank you for your evaluation. Please return this form to the researcher.
**REMEDICATION/ ENHANCEMENT PROGRAM**
**PERFORMING OPERATIONS ON RATIONAL EXPRESSIONS**
**SY 2014−2015**

Evaluations of SIM-MOD 2

<table>
<thead>
<tr>
<th>Product and Quotients of Rational Expressions</th>
<th>Title</th>
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Please complete this evaluation sheet to help the researcher assess how useful this SIM-MOD has been in meeting your needs as a learner.

For numbers 1 and 2 only: Rate the following by ticking the box that best describes your response. 1, means SOMEWHAT INADEQUATE, 2, INADEQUATE, 3, PARTIALLY ADEQUATE, 4, ADEQUATE and 5, MORE THAN ADEQUATE.

1. **The Module**
   - Design of the SIM-MOD
   - Clarity of directions used
   - Readability
   - Importance of the content
   - Appropriateness of activities
   - Ease of task completion
   - Opportunities for active learning
   - Usefulness of the module in meeting your needs

2. **Delivery of the Program**
   - Orientation of the program
   - Time allotted for the program
   - Support provided for the learners
3. What changes (if any) would you suggest to improve the following aspect of the SIM-MOD?

3.1. Layout/Presentation

__________________________________________________________________________

__________________________________________________________________________

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3.2. Instruction used

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__________________________________________________________________________

3.3. Content

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3.4. Activities

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3.5. Others

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4. What would you suggest to improve the way the program was conducted in your classroom?

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5. What specific comments would you like to make about any other aspects of the SIM-MOD?

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STUDENT/RATER: ___________________________  SECTION: ___________

Thank you for your evaluation. Please return this form to the researcher.
REMEDICATION/ENHANCEMENT PROGRAM
PERFORMING OPERATIONS ON RATIONAL EXPRESSIONS
SY 2014–2015

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<tr>
<td>No.</td>
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Please complete this evaluation sheet to help the researcher assess how useful this SIM-MOD has been in meeting your needs as a learner.

For numbers 1 and 2 only: Rate the following by ticking the box that best describes your response. 1, means SOMETHING INADEQUATE, 2, INADEQUATE, 3, PARTIALLY ADEQUATE, 4, ADEQUATE and 5, MORE THAN ADEQUATE.

1. The Module
   - Design of the SIM-MOD
   - Clarity of directions used
   - Readability
   - Importance of the content
   - Appropriateness of activities
   - Ease of task completion
   - Opportunities for active learning
   - Usefulness of the module in meeting your needs

2. Delivery of the Program
   - Orientation of the program
   - Time allotted for the program
   - Support provided for the learners
3. What changes (if any) would you suggest to improve the following aspect of the SIM-MOD?

3.1. Layout/Presentation

3.2. Instruction used

3.3. Content

3.4. Activities

3.5. Others

4. What would you suggest to improve the way the program was conducted in your classroom?

5. What specific comments would you like to make about any other aspects of the SIM-MOD?

STUDENT/ RATER

SECTION

Thank you for your evaluation. Please return this form to the researcher.
"H"
Enhancement Tests
(Factoring and Performing Operations on Rational Expressions)

Enhancement Tests #1
Factoring Trinomials of the form $x^2 + bx + c$

Factor completely, if possible:

1. $x^2 - 17x + 30$
   A. $(x+15)(x+2)$  B. $(x-15)(x+2)$  C. $(x-15)(x-2)$  D. $(x+15)(x-2)$

2. $x^2 - 4x - 5$
   A. $(x-5)(x+1)$  B. $(x-5)(x-1)$  C. $(x+4)(x+1)$  D. $(x+5)(x+1)$

3. $x^2 + 4x + 3$
   A. $(x-3)(x+1)$  B. $(x+3)(x+1)$  C. $(x+3)(x-1)$  D. $(x-3)(x+1)$

4. $x^2 - 3x + 2$
   A. $(x+2)(x-1)$  B. $(x+2)(x+1)$  C. $(x-2)(x+1)$  D. $(x-2)(x-1)$

5. $x^2 + 7x + 10$
   A. $(x-5)(x+2)$  B. $(x+5)(x+2)$  C. $(x-5)(x+2)$  D. $(x+5)(x-2)$

6. $x^2 - 6x + 5$
   A. $(x-5)(x+1)$  B. $(x+5)(x+1)$  C. $(x-5)(x-1)$  D. $(x+5)(x-1)$

7. $x^2 + 5x + 4$
   A. $(x+4)(x+1)$  B. $(x+2)(x+2)$  C. $(x+4)(x-1)$  D. $(x-1)(x+4)$

8. $x^2 + 8x + 12$
   A. $(x+4)(x+3)$  B. $(x+12)(x+1)$  C. $(x-4)(x-3)$  D. $(x+6)(x+2)$

9. $x^2 + 12x + 20$
   A. $(x+4)(x+5)$  B. $(x+20)(x+1)$  C. $(x+10)(x+2)$  D. $(x-10)(x-2)$

10. $x^2 + 9x + 18$
    A. $(x+6)(x+3)$  B. $(x+18)(x+1)$  C. $(x+9)(x+2)$  D. $(x-6)(x-3)$
Enhancement Tests #2
Factoring Trinomials of the form \(x^2+bx+c\)

Factor completely, if possible:

1. \(x^2+36x+35\)
   A. \((x+7)(x+5)\)
   B. \((x+35)(x-1)\)
   C. \((x-7)(x-5)\)
   D. \((x+1)(x+35)\)

2. \(x^2-7x+10\)
   A. \((x+5)(x-2)\)
   B. \((x-2)(x-5)\)
   C. \((x+10)(x+1)\)
   D. \((x-10)(x+1)\)

3. \(x^2-11x+18\)
   A. \((x-6)(x+3)\)
   B. \((x+9)(x-2)\)
   C. \((x-9)(x-2)\)
   D. \((x-3)(x+6)\)

4. \(x^2-16x+15\)
   A. \((x-15)(x-1)\)
   B. \((x-3)(x-5)\)
   C. \((x+15)(x-1)\)
   D. \((x-15)(x+1)\)

5. \(x^2-16x+28\)
   A. \((x-14)(x-2)\)
   B. \((x-4)(x-7)\)
   C. \((x+14)(x+2)\)
   D. \((x-14)(x+2)\)

6. \(x^2-14x+24\)
   A. \((x+6)(x+4)\)
   B. \((x-12)(x-2)\)
   C. \((x+24)(x-1)\)
   D. \((x-8)(x-3)\)

7. \(x^2+11x-12\)
   A. \((x+6)(x-2)\)
   B. \((x+4)(x-3)\)
   C. \((x+12)(x-1)\)
   D. \((x-4)(x-3)\)

8. \(x^2-7x-18\)
   A. \((x+3)(x-6)\)
   B. \((x+9)(x-2)\)
   C. \((x-9)(x+2)\)
   D. \((x-9)(x-2)\)

9. \(x^2-2x-24\)
   A. \((x-12)(x+2)\)
   B. \((x-8)(x+3)\)
   C. \((x-24)(x+1)\)
   D. \((x-6)(x+4)\)

10. \(x^2+29x-30\)
    A. \((x+5)(x-6)\)
    B. \((x+15)(x-2)\)
    C. \((x+10)(x-3)\)
    D. \((x+30)(x-1)\)
Enhancement Tests #3
Factoring Trinomials of the form $x^2+bx+c$

Factor completely, if possible:

1. $x^2+6x-16$
   A. $(x+16)(x-1)$  B. $(x+8)(x-2)$  C. $(x-8)(x-2)$  D. $(x-16)(x+1)$

2. $x^2+4x+3$
   A. $(x+3)(x+1)$  B. $(x+3)(x-1)$  C. $(x+3)(x-1)$  D. $(x-1)(x+3)$

3. $x^2+8x+7$
   A. $(x-7)(x+1)$  B. $(x-1)(x+7)$  C. $(x-1)(x-7)$  D. $(x+7)(x+1)$

4. $y^2-4y+3$
   A. $(y-3)(y+1)$  B. $(y-1)(y-3)$  C. $(y+1)(y+3)$  D. $(y-1)(x+3)$

5. $y^2-6y+5$
   A. $(y-5)(y+1)$  B. $(y+5)(y-1)$  C. $(y-5)(y-1)$  D. $(y+5)(y+1)$

6. $m^2-14m+13$
   A. $(m-13)(m+1)$  B. $(m-13)(m-1)$  C. $(m+13)(m+1)$  D. $(m+13)(m-1)$

7. $m^2+12m+11$
   A. $(m+11)(m-1)$  B. $(m-11)(m-1)$  C. $(m+11)(m+1)$  D. $(m-11)(m+1)$

8. $x^2-3x-10$
   A. $(x+5)(x-2)$  B. $(x-5)(x-2)$  C. $(x+5)(x+2)$  D. $(x-5)(x+2)$

9. $y^2-2y-3$
   A. $(y-3)(y+1)$  B. $(y+3)(y+1)$  C. $(y+3)(y-1)$  D. $(y-3)(y-1)$

10. $x^2-16x-17$
    A. $(x-17)(x+1)$  B. $(x-17)(x-1)$  C. $(x+17)(x-1)$  D. $(x+17)(x+1)$
## Enhancement Tests #4

**Factoring Trinomials of the form \( x^2 + bx + c \)**

Factor completely, if possible:

1. \( m^2 + 6m + 8 \)
   - A. \((m+8)(m+1)\)
   - B. \((m+2)(m+4)\)
   - C. \((m-2)(m-4)\)
   - D. \((m-8)(m-1)\)

2. \( x^2 - 7x + 12 \)
   - A. \((x+4)(x+3)\)
   - B. \((x-4)(x-3)\)
   - C. \((x+6)(x-2)\)
   - D. \((x+12)(x-1)\)

3. \( x^2 - 7x - 18 \)
   - A. \((x-6)(x+3)\)
   - B. \((x-9)(x+2)\)
   - C. \((x-18)(x+1)\)
   - D. \((x+9)(x-2)\)

4. \( m^2 + 12m + 36 \)
   - A. \((m+6)(m+6)\)
   - B. \((xm+4)(m+9)\)
   - C. \((m+12)(m+3)\)
   - D. \((m+18)(m+2)\)

5. \( y^2 + 10y + 24 \)
   - A. \((y+6)(y+4)\)
   - B. \((y+3)(y+8)\)
   - C. \((y+12)(y+2)\)
   - D. \((y+24)(y+1)\)

6. \( x^2 - 9x - 10 \)
   - A. \((x-10)(x-1)\)
   - B. \((x+10)(x-1)\)
   - C. \((x-10)(x+1)\)
   - D. \((x+10)(x+1)\)

7. \( x^6 + 2x^3 - 63 \)
   - A. \((x^3-9)(x^3+7)\)
   - B. \((x^3+9)(x^3-7)\)
   - C. \((x^3+21)(x^3-3)\)
   - D. \((x^3-9)(x^3-7)\)

8. \( x^2 + x - 30 \)
   - A. \((x+15)(x-2)\)
   - B. \((x+10)(x-3)\)
   - C. \((x+30)(x-1)\)
   - D. \((x+6)(x-5)\)

9. \( a^2 + 6ab - 7b^2 \)
   - A. \((a-7b)(a+b)\)
   - B. \((a+7b)(a-b)\)
   - C. \((a-7b)(a-b)\)
   - D. \((a+7b)(a+b)\)

10. \( x^2 + 7x - 30 \)
    - A. \((x+15)(x-2)\)
    - B. \((x+6)(x-5)\)
    - C. \((x+10)(x-3)\)
    - D. \((x+30)(x-1)\)
Enhancement Tests #5
Factoring Trinomials of the form $ax^2+bx+c$

Factor completely, if possible:

1. $b^2+14b+13$
   A. $(b+13)(b+1)$
   B. $(b-13)(x-1)$
   C. $(b-13)(b+1)$
   D. $(b+13)(b-1)$

2. $x^2-8x+15$
   A. $(x+3)(x-5)$
   B. $(x-3)(x-5)$
   C. $(x-3)(x+5)$
   D. $(x+15)(x-1)$

3. $x^2+12x+35$
   A. $(x+7)(x-5)$
   B. $(x+5)(x+7)$
   C. $(x+35)(x+1)$
   D. $(x-7)(x+5)$

4. $x^2+4x-12$
   A. $(x+6)(x-2)$
   B. $(x-6)(x+2)$
   C. $(x-6)(x-2)$
   D. $(x+4)(x-3)$

5. $x^2-5x-50$
   A. $(x+10)(x-5)$
   B. $(x-5)(x-10)$
   C. $(x+10)(x-5)$
   D. $(x-10)(x+5)$

6. $x^2+13x-30$
   A. $(x+6)(x-5)$
   B. $(x+10)(x-3)$
   C. $(x+15)(x-2)$
   D. $(x-15)(x+2)$

7. $m^2+8m-33$
   A. $(m+33)(m-1)$
   B. $(m-33)(m-1)$
   C. $(x+11)(m-3)$
   D. $(m-11)(m+3)$

8. $d^2+14d-32$
   A. $(d+4)(d+8)$
   B. $(d+16)(d-2)$
   C. $(xd+32)(d-1)$
   D. $(d-16)(d+2)$

9. $b^2+11b+28$
   A. $(b+14)(b+12)$
   B. $(b+28)(b+1)$
   C. $(b-4)(b-7)$
   D. $(b+4)(b+7)$

10. $n^2+12n+35$
    A. $(n-7)(n-5)$
    B. $(n+7)(n+5)$
    C. $(n+35)(n+1)$
    D. $(n+7)(n-5)$
Enhancement Tests #6
Factoring Trinomials of the form ax^2+bx+c

Factor completely, if possible:

1. 3x^2+8x+5
   A. (x+1)(3x+5)       B. (3x+1)(x+5)       C. (x-1)(3x-5)       D. (3x+5)(x-1)

2. 2x^2-7x+6
   A. (2x-3)(x-2)       B. (2x-3)(x-2)       C. (2x-1)(x+6)       D. (2x-6)(x-1)

3. 2x^2+9x+4
   A. (2x-1)(x-4)       B. (2x+4)(x+1)       C. (2x+2)(x+2)       D. (2x+1)(x+4)

4. 2x^2-15x+7
   A. (2x-7)(x-1)       B. (2x+1)(x+7)       C. (x-7)(2x-1)       D. (x+7)(2x-1)

5. 5x^2+21x+4
   A. (5x+2)(x+2)       B. (5x+1)(x+4)       C. (5x-2)(x-2)       D. (5x-5)(x-4)

6. 3x^2+17x+10
   A. (x+5)(3x+2)       B. (3x+1)(x+2)       C. (3x+10)(x+1)      D. (3x+1)(x+10)

7. 2x^2+21x+40
   A. (2x+10)(x+4)      B. (2x+20)(x+2)      C. (2x+1)(x+40)      D. (2x+5)(x+8)

8. 12x^2-20x+3
   A. (4x-3)(3x-1)      B. (6x-1)(2x-3)      C. (4x-1)(3x-3)      D. (12x-1)(x-3)

9. 8x^2-24x+16
   A. 8(x+1)(x-2)       B. 8(x-1)(x+2)       C. 8(x-1)(x-2)       D. 8(x+1)(x+2)

10. 6x^2-23x+7
   A. (6x-1)(x-7)       B. (3x-1)(2x-7)      C. (6x-7)(x-1)       D. (3x-7)(2x-1)
Enhancement Tests #7
Factoring Trinomials of the form $ax^2+bx+c$

Factor completely, if possible:

1. $9x^2-5x-4$
   A. $(9x+4)(x-1)$  B. $(9x-4)(x+1)$  C. $(9x-1)(x+4)$  D. $(3x+4)(3x-1)$

2. $8x^2-11x-10$
   A. $(8x-5)(x+2)$  B. $(8x+5)(x-2)$  C. $(4x+5)(2x-2)$  D. $(8x+1)(x-10)$

3. $5x^2+7x-6$
   A. $(x+2)(5x-3)$  B. $(x-2)(5x+3)$  C. $(5x+6)(x-1)$  D. $(x-2)(5x-3)$

4. $9x^2+23x+10$
   A. $(3x+5)(3x+2)$  B. $(9x+2)(x+5)$  C. $(9x+5)(x+2)$  D. $(9x+10)(x+1)$

5. $6x^2+x-12$
   A. $(6x+4)(x-3)$  B. $(x+12)(3x-1)$  C. $(3x+4)(2x-3)$  D. $(2x+3)(3x-4)$

6. $10x^2-43x-9$
   A. $(2x+9)(5x-1)$  B. $(2x-9)(5x+1)$  C. $(10x+1)(x-9)$  D. $(10x+9)(x-1)$

7. $6x^2-29x+35$
   A. $(6x-1)(x-35)$  B. $(3x+7)(2x+5)$  C. $(3x-7)(2x-5)$  D. $(6x+1)(x-35)$

8. $4x^2-xy-5y^2$
   A. $(2x+5y)(2x-y)$  B. $(4x+5y)(x-y)$  C. $(2x-5y)(2x+y)$  D. $(4x-5y)(x+y)$

9. $2x^2+x-1$
   A. $(2x-1)(x-1)$  B. $(2x-1)(x+1)$  C. $(2x+1)(x-1)$  D. $(2x+1)(x+1)$

10. $3x^2-4x-7$
    A. $(3x+7)(x-1)$  B. $(3x-7)(x+1)$  C. $(3x+7)(x+1)$  D. $(3x-1)(x+7)$
Enhancement Tests #8
Factoring Trinomials of the form \( ax^2 + bx + c \)

Factor completely, if possible:

1. \( y^4 + 11y - 80 \)
   A. \((y^2+16)(y^2-5)\)  
   B. \((y^2+10)(y^2-8)\)  
   C. \((y^2+20)(y^2-4)\)  
   D. \((y^2+40)(y^2-2)\)

2. \( 3m^2 + m - 2 \)
   A. \((3m+2)(m-1)\)  
   B. \((3m-2)(m+1)\)  
   C. \((43m-2)(m-1)\)  
   D. \((m+2)(3m-1)\)

3. \( 3x^2 - 7x + 2 \)
   A. \((3x+1)(x+2)\)  
   B. \((3x+2)(x-1)\)  
   C. \((3x-1)(x-2)\)  
   D. \((3x-2)(x-1)\)

4. \( 2x^2 - 7x + 3 \)
   A. \((2x+1)(x-3)\)  
   B. \((2x-1)(x+3)\)  
   C. \((2x-3)(x-1)\)  
   D. \((2x-1)(x-3)\)

5. \( 3x^2 - x - 4 \)
   A. \((3x+4)(x-1)\)  
   B. \((3x-4)(x+1)\)  
   C. \((3x-1)(x+4)\)  
   D. \((3x+1)(x-4)\)

6. \( 2d^2 - 26d + 24 \)
   A. \((2d-2)(d-12)\)  
   B. \((2d+12)(d-2)\)  
   C. \(2(d-1)(d-12)\)  
   D. \(2(d+1)(d-12)\)

7. \( 3p^2 - 6p - 72 \)
   A. \((3p+9)(p-8)\)  
   B. \((3p+6)(p-4)\)  
   C. \((3p+6)(p-4)\)  
   D. \((3p-6)(p-4)\)

8. \( 6e^2 + 5e - 1 \)
   A. \((2e+1)(3e+1)\)  
   B. \((2e-1)(3e-1)\)  
   C. \((6e+1)(e+1)\)  
   D. \((6e-1)(e-1)\)

9. \( 3m^2 - 10m + 8 \)
   A. \((3m+4)(m-2)\)  
   B. \((3m-4)(m-2)\)  
   C. \((3m-4)(m+2)\)  
   D. \((3m-1)(m-8)\)

10. \( 2a^2 + 2ab - 84b^2 \)
    A. \((a+7b)(a-6b)\)  
    B. \((2a-7b)(a+6b)\)  
    C. \((2a+21b)(a-4b)\)  
    D. \((2a-21b)(a+4b)\)
Factors completely, if possible:

1. $2x^2 + 6x + 4$
   A. $(2x+1)(x+4)$  B. $2(x+2)(x+1)$  C. $2(x-2)(x-1)$  D. $(2x-1)(x-4)$

2. $3y^2 - 13y + 10$
   A. $(8y-1)(y-10)$  B. $(3y+10)(y-1)$  C. $(3y-10)(y+1)$  D. $(3y-10)(y+1)$

3. $9x^2 - 5x - 4$
   A. $(9x-4)(x+1)$  B. $(9x+4)(x-1)$  C. $(3x+6)(3x-1)$  D. $(3x-4)(3x+1)$

4. $4t^2 + 8t + 4$
   A. $4(t+1)(t+1)$  B. $(4t+1)(t+4)$  C. $(2t+1)(2t+1)$  D. $(4t-1)(t-4)$

5. $8x^2 - 24x - 80$
   A. $8(x+5)(x-2)$  B. $(8x-5)(x+16)$  C. $(8x+5)(x-16)$  D. $8(x-5)(x+2)$

6. $6x^2 - 6x - 72$
   A. $(6x+8)(x-9)$  B. $(2x-18)(3x+4)$  C. $6(x-4)(x+3)$  D. $6(x+4)(x-3)$

7. $10y^2 + 10y - 20$
   A. $(5y+4)(2y-5)$  B. $10(y+2)(y-1)$  C. $(5y-4)(2y+5)$  D. $10(y-2)(y+1)$

8. $6t^2 - 30t + 36$
   A. $(2t-9)(3t-4)$  B. $(6t-4)(t-9)$  C. $6(t+2)(t-3)$  D. $6(t-2)(t-3)$

9. $10a^2 - 40ab - 120b^2$
   A. $10(a+6b)(a-2b)$  B. $10(a-6b)(a+2b)$  C. $10(a-6b)(a-2b)$  D. $(5a-40b)(2a+3b)$

10. $4m^2 + 40mn + 100n^2$
    A. $4(m+5n)(m-5n)$  B. $4(m-5n)^2$  C. $4(m+5n)^2$  D. $4(m+5n)(x+5n)$
Enhancement Tests #10
Factoring Trinomials of the form $ax^2+bx+c$

Factors completely, if possible:

1. $4x^2-7x+3$
   A. $(4x-3)(x-1)$  B. $(2x-3)(2x-1)$  C. $(4x+3)(x+1)$  D. $(4x-1)(x-3)$

2. $3x^2+11x+10$
   A. $(3x+5)(x+2)$  B. $(3x+10)(x+1)$  C. $(3x+2)(x+5)$  D. $(3x+1)(x+10)$

3. $6x^2-7x-20$
   A. $(2x+5)(3x-4)$  B. $(2x-5)(3x+4)$  C. $(2x-5)(3x-4)$  D. $(6x-1)(x+20)$

4. $3x^2-14x-24$
   A. $(3x+8)(x-3)$  B. $(3x+4)(x-6)$  C. $(3x-4)(x+6)$  D. $(3x-8)(x+3)$

5. $2x^2-17x+30$
   A. $(2x-15)(x-2)$  B. $(2x-10)(x-3)$  C. $(2x-6)(x-5)$  D. $(2x-5)(x-6)$

6. $3x^2-22x+24$
   A. $(3x-8)(x-3)$  B. $(3x-2)(x-12)$  C. $(3x-1)(x-24)$  D. $(3x-4)(x-6)$

7. $10x^2-31x+15$
   A. $(10x-1)(x-15)$  B. $(5x+3)(2x+5)$  C. $(10x+1)(x+15)$  D. $(5x-3)(2x-5)$

8. $5x^2-33x-18$
   A. $(5x-6)(x-3)$  B. $(5x-2)(x-9)$  C. $(x-6)(5x-3)$  D. $(5x-18)(x-1)$

9. $3x^2-17x-6$
   A. $(3x+2)(x-3)$  B. $(3x+1)(x-6)$  C. $(3x-1)(x+6)$  D. $(3x-6)(x+1)$

10. $15x^2-4x-3$
    A. $(15x+1)(x-3)$  B. $(5x+3)(3x-1)$  C. $(5x-3)(3x+1)$  D. $(15x-1)(x+3)$
### Enhancement Tests #1
Performing Operations on Rational Expressions

1. Simplify \( \frac{z^2w - z^2}{z^3 - z^3w} \)

   A. \( -\frac{1}{z} \)  
   B. \( \frac{1}{z} \)  
   C. \( \frac{2}{z} \)  
   D. \( \frac{3}{z} \)

2. Find \( \frac{4a}{5b} \cdot \frac{15b}{16a} \). Write the answer in simplest form.

   A. \( \frac{1}{4} \)  
   B. \( \frac{1}{2} \)  
   C. \( \frac{3}{4} \)  
   D. \( \frac{5}{4} \)

3. Find \( \frac{4x^2y^2}{15a^3b^3} + \frac{2xy^2}{5ab^3} \). Write the answer in simplest form.

   A. \( \frac{2x}{3ay} \)  
   B. \( \frac{2x^2}{3a^2y} \)  
   C. \( \frac{2x}{3ay^2} \)  
   D. \( \frac{2x}{3a^2y} \)

4. Find the GCF of the numerator and denominator of \( \frac{42y}{18xy} \).

   A. 6  
   B. 6x  
   C. 6y  
   D. 6xy

5. Simplify \( \frac{w+12}{4w-16} - \frac{w+4}{2w-8} \).

   A. \( \frac{1}{4} \)  
   B. \( \frac{3}{4} \)  
   C. \( \frac{5}{4} \)  
   D. \( \frac{7}{4} \)

6. Find the LCM of 12 and 27.

   A. 12  
   B. 27  
   C. 54  
   D. 108

7. Find the product in simplest form: \( \frac{3ab}{4a} \cdot \frac{6a^2}{3b^2} \).

   A. \( \frac{3a}{2b} \)  
   B. \( \frac{3a^2}{2b^2} \)  
   C. \( \frac{3a^2}{2b} \)  
   D. \( \frac{3a}{2b^2} \)

8. Find the LCD of the following rational expressions: \( \frac{11}{10} - \frac{7}{2a} - \frac{6}{5a} \).

   A. 10  
   B. 2a  
   C. 5a  
   D. 10a

9. Find the sum in simplest form: \( \frac{7}{ab} + \frac{9}{b} \).

   A. \( \frac{7+9a}{ab} \)  
   B. \( \frac{7a+9}{ab} \)  
   C. \( \frac{7a+9b}{ab} \)  
   D. \( \frac{7+9a}{b} \)

10. Find the difference in lowest term: \( \frac{x}{x+3} - \frac{6x}{x^2-9} \).

    A. \( \frac{x^2-9x}{(x+3)(x-3)} \)  
    B. \( \frac{x-9}{(x+3)(x-3)} \)  
    C. \( \frac{x-9}{(x+3)} \)  
    D. \( \frac{x-9}{(x-3)} \)
Enhancement Tests #2
Performing Operations on Rational Expressions

1. \( \frac{14x+21y+7}{7} \) is equal to
   A. 14x+3y+1       B. 14x+3y+7       C. 2x+3y+1       D. 21+21y+7

2. \( m - \frac{m^2-n^2}{m} \) is equal to
   A. \( n^2 \)       B. \( -n^2 \)       C. \( \frac{n^2}{m} \)       D. \( -\frac{n^2}{m} \)

3. The sum of \( \frac{1}{x-1} + \frac{1x}{1-x} \) is equal to
   A. 1       B. -1       C. \( \frac{x+1}{x-1} \)       D. \( \frac{-x-1}{x-1} \)

4. Express \( \frac{-10x^2-10}{1-x^2} \) in simplest form.
   A. 10       B. -10       C. \( \frac{10(x+1)}{x-1} \)       D. \( \frac{10(x-1)}{x+1} \)

5. Express \( \frac{3xy}{14} \cdot \frac{28}{5xy^2} \) in lowest term.
   A. 6y       B. \( \frac{6y}{10y} \)       C. \( \frac{6}{5y} \)       D. \( \frac{6}{10y^2} \)

6. The LCD of \( \frac{3x}{4x+6} \) and \( \frac{5x}{6(2x+3)^2} \) is
   A. 6(2x+3)       B. 12(2x+3)^2       C. 6(2x+3)^2       D. 3(2x+3)^2

7. Simplify \( \frac{n-5}{35} - \frac{n-10}{105} \).
   A. \( \frac{2n-25}{105} \)       B. \( \frac{4n-25}{105} \)       C. \( \frac{n-15}{105} \)       D. \( \frac{2n-5}{105} \)

8. Express \( 5 + \frac{a+4}{a-4} \) in simplest form.
   A. \( \frac{9+a}{a-4} \)       B. \( \frac{9-a}{4-a} \)       C. \( \frac{6a-16}{a-4} \)       D. \( \frac{2n-5}{105} \)

9. Multiply: \( \frac{3x}{y} \cdot \frac{y^2}{6x^2} \).
   A. \( \frac{y}{2} \)       B. \( \frac{y}{x} \)       C. \( \frac{y}{2x} \)       D. \( \frac{y}{3x} \)

10. Simplify \( \frac{2}{m-n} \).
    A. 2(m+n)       B. -2(m+n)       C. 2(m-n)       D. \(-2(m-n)\)
1. Reduce \( \frac{6a+6}{a^2+2a+1} \) to lowest term.
   
   A. 6  
   B. \( \frac{6}{a+1} \)  
   C. a+1  
   D. \( \frac{3}{a+1} \)

2. Simplify \( \frac{12}{24} \)
   
   A. \( \frac{1}{4} \)  
   B. \( \frac{1}{2} \)  
   C. 2  
   D. 4

3. Multiply \( \frac{x^2+4x+3}{x+3} \cdot \frac{x+2}{x^2+3x+2} \)
   
   A. \(-1\)  
   B. 0  
   C. 1  
   D. Undefined

4. The LCM of 4, a, 3 and \( a^2 \) is
   
   A. 12a^2  
   B. 8a  
   C. 12a  
   D. 8a^2

5. Write \( \frac{20}{45} + \frac{16}{45} \) as a single fraction.
   
   A. \( \frac{5}{3} \)  
   B. \( \frac{4}{5} \)  
   C. \( \frac{3}{5} \)  
   D. \( \frac{5}{3} \)

6. Simplify \( \frac{6x^2}{9} \div \frac{x}{3} \)
   
   A. -2x  
   B. x  
   C. 2x  
   D. -x

7. In the fractions \( \frac{3}{8} \) and \( \frac{5}{12} \), the LCD is
   
   A. 16  
   B. 20  
   C. 18  
   D. 24

8. Write \( \frac{3}{7} \) as a single fraction in reduced form.
   
   A. \( \frac{3}{4} \)  
   B. \( \frac{1}{4} \)  
   C. \( \frac{5}{4} \)  
   D. \( \frac{7}{4} \)

9. Find the difference of \( \frac{6}{x} \) and \( \frac{2}{x} \)
   
   A. \( \frac{4}{x} \)  
   B. \( \frac{4}{x^2} \)  
   C. \( \frac{2}{x} \)  
   D. \( \frac{2}{x^2} \)

10. Find the quotient of \( \frac{3a}{4b^2} \div \frac{5}{12ab} \).
    
    A. \( \frac{9a}{b} \)  
    B. \( \frac{9a^2}{5} \)  
    C. \( \frac{9a^2}{b} \)  
    D. \( \frac{9a^2}{5b} \)
Enhancement Tests #4
Performing Operations on Rational Expressions

1. Write \( \frac{3a-6b}{9a-18b} \) in simplest form.
   A. 1          B. \( \frac{3}{4} \)          C. \( \frac{1}{3} \)          D. \( \frac{1}{8} \)

2. Find the product of \( \frac{4x^3}{3x} \cdot \frac{12}{x} \)
   A. 20x          B. 3x          C. 16x          D. 5x

3. For what value of x is \( \frac{x-2}{x^2-9} \) undefined?
   A. \( x \neq \pm 3 \)          B. \( x \neq \pm 1 \)          C. \( x \neq \pm 2 \)          D. \( x \neq \pm 4 \)

4. The GCF of 36 and 45 is
   A. 9          B. 10          C. 4          D. 6

5. Which of the following statements is true?
   A. \( \frac{x+4}{x} = 4 \)          B. \( \frac{x^2+7}{7} = x^2 + 1 \)          C. \( \frac{2x+5}{2x+9} = \frac{5}{9} \)
   D. \( \frac{-5x-10}{x+2} = -5 \)

6. Multiply \( \frac{x^4}{5} \cdot \frac{4}{x^2} \).
   A. \( \frac{x^2}{2} \)          B. \( \frac{2}{x^2} \)          C. \( \frac{x^2}{4} \)          D. \( \frac{4}{x^2} \)

7. Find the quotient of \( \frac{5a+5b}{a^2} \div \frac{a^2-b^2}{5a} \)
   A. \( \frac{5a}{a-b} \)          B. \( \frac{25}{a(a-b)} \)          C. \( \frac{25}{a-b} \)          D. \( \frac{5}{a(a-b)} \)

8. What number must be added to \( \frac{4}{11} \) to get \( \frac{1}{2} \)?
   A. \( \frac{3}{22} \)          B. \( \frac{3}{11} \)          C. \( -\frac{3}{22} \)          D. \( -\frac{3}{11} \)

9. Add \( \frac{4}{3x} + \frac{5}{3x} \) and simplify.
   A. \( \frac{9}{3x} \)          B. \( \frac{3}{x} \)          C. \( \frac{9}{6x^2} \)          D. \( \frac{9}{6x} \)

10. Find the LCM of 12x and 15y.
    A. 6xy          B. 600xy          C. 60xy          D. 6000xy
Enhancement Tests #5
Performing Operations on Rational Expressions

1. What rational expression is the same as \( \frac{x^2-1}{x-1} \)?
   A. \( x + 1 \)  B. \( x - 1 \)  C. 1  D. -1

2. Perform the indicated operation: \( \frac{2}{5} + \frac{3}{10} \)
   A. \( \frac{1}{10} \)  B. \( \frac{3}{10} \)  C. \( \frac{7}{10} \)  D. \( \frac{9}{10} \)

3. What is the LCD of \( \frac{1}{2x^3}, \frac{-3}{6x^2}, \text{ and } \frac{x+1}{9x} \)?
   A. \( 9x^3 \)  B. \( 18x^3 \)  C. \( 54x^2 \)  D. \( 54x^3 \)

4. Write the quotient in simplest form: \( 2j - 3k + \frac{10j - 15k}{-2} \)
   A. \( \frac{2}{5} \)  B. \( \frac{1}{5} \)  C. \( -\frac{2}{5} \)  D. \( \frac{1}{5} \)

5. What is the difference between \( \frac{m}{2} \) and \( \frac{m}{3} \)?
   A. \( \frac{m}{6} \)  B. \( -\frac{m}{2} \)  C. \( \frac{m}{2} \)  D. \( -\frac{m}{6} \)

6. Simplify \( \frac{x^2-3x-10}{x+2} \)
   A. \( (x + 5)(x + 2) \)  B. \( \frac{(x+5)(x-2)}{x+2} \)  C. \( \frac{(x+5)}{x-2} \)  D. \( x - 5 \)

7. To say that \( \frac{4}{m-4} \) is equal to \( \frac{8}{m-4} \), the value of \( m \) must be
   A. 4  B. 8  C. 16  D. 32

8. What is the sum in simplest form? \( \frac{2x}{x+2} + \frac{4}{x+2} \)
   A. -2  B. 1  C. 2  D. 4

9. Express \( \frac{x}{y^2} \cdot \frac{y^2}{z} \cdot \frac{z}{x^3} \) in simplest form.
   A. \( \frac{x}{x^3y} \)  B. \( \frac{1}{x^2} \)  C. \( \frac{x^2}{y} \)  D. \( \frac{xy^2}{z^2} \)

10. What value of \( x \) will make \( \frac{5y}{x+5} \) undefined?
    A. 5  B. 1  C. 0  D. -5
Enhancement Tests #6
Performing Operations on Rational Expressions

1. Write \( \frac{3x}{3x-2} \) and \( \frac{2}{3x-2} \) into a single fraction.
   A. \(-1\)  B. 1  C. \(\frac{3x+2}{3x-2}\)  D. \(\frac{3x-2}{3x+2}\)

2. Express the quotient in simplest form: \(\frac{\frac{3x}{2}}{\frac{4x}{3y}}\)
   A. \(\frac{9y}{8x}\)  B. \(\frac{9x}{8y}\)  C. \(\frac{x}{y}\)  D. \(\frac{9}{8}\)

3. Which of the following rational expressions is equivalent to \(\frac{x}{3(y+5)} - \frac{4}{y+5}\)?
   A. \(\frac{x-12}{3(y+5)}\)  B. \(\frac{x-7}{3(y+5)}\)  C. \(\frac{x-4}{3(y+5)}\)  D. \(\frac{x-1}{12}\)

4. Find the LCD of the given rational numbers: \(\frac{2}{3}, \frac{3}{4}, \frac{1}{5}\)
   A. 15  B. 25  C. 35  D. 70

5. Reduce to lowest term: \(\frac{6x+18}{4x+12}\)
   A. \(\frac{1}{2}\)  B. \(\frac{3}{2}\)  C. \(\frac{5}{2}\)  D. \(\frac{7}{2}\)

6. Simplify \(\frac{\frac{1+3}{2}}{1-\frac{3}{2}}\)
   A. \(\frac{1}{4}\)  B. 4  C. \(5\frac{1}{4}\)  D. 6

7. Find the difference: \(\frac{5}{10} - \frac{3}{10}\)
   A. \(\frac{1}{5}\)  B. \(\frac{1}{2}\)  C. 1  D. \(-\frac{1}{5}\)

8. Which of the following rational expressions is equal to \(\frac{x+y}{x-y}\)
   A. \(\frac{x+y}{x-y}\)  B. \(\frac{x-y}{x+y}\)  C. 1  D. \(-1\)

9. Find the product of \(\frac{a^2-9}{a^2+a-20}\) and \(\frac{a^2-8a+16}{3a-9}\).
   A. \(\frac{a}{a-1}\)  B. \(\frac{a-1}{1-a}\)  C. \(\frac{(a-3)(a-4)}{3(a+5)}\)  D. \(\frac{(a-4)(a+3)}{3(a+5)}\)

10. Do the indicated operation: \(\frac{a^5}{4} + 4a^2\)
    A. \(a^7\)  B. 4a  C. \(\frac{a^3}{16}\)  D. \(\frac{16}{a^3}\)
Enhancement Tests #7
Performing Operations on Rational Expressions

1. In \( \frac{3x}{2x-1} \), the value of the variable that must be excluded is
   A. 2  B. -2  C. \( \frac{1}{2} \)  D. \( -\frac{1}{2} \)

2. Rename \( \frac{3x-21}{x^2-49} \) in lowest term.
   A. \( \frac{3}{x-7} \)  B. \( \frac{3}{x+7} \)  C. \( \frac{3(x-7)}{x+7} \)  D. \( \frac{3(x+7)}{x-7} \)

3. Simplify: \( \frac{r^2-r-20}{r^2+9r+20} \)
   A. \( \frac{r-4}{r+5} \)  B. \( \frac{r+4}{r-5} \)  C. \( \frac{r+5}{r-5} \)  D. \( \frac{r-5}{r+5} \)

4. Find the LCM of \((x+2),(x+1)\) and \(x^2-1\).
   A. \((x+2)(x-1)\)  B. \((x+2)(x+1)\)  C. \((x-2)(x+1)\)  D. \((x+2)(x-1)(x+1)\)

5. The factor common to both numerator and denominator of \( \frac{x^2+3x-10}{x^2+8x+15} \) is
   A. \( x-2 \)  B. \( x+3 \)  C. \( x+5 \)  D. \((x+3)(x-2)\)

6. Find the product in simplest form: \( \frac{(y-2)^2}{(x-4)^2} \cdot \frac{x-4}{y-2} \)
   A. \( x-4 \)  B. \( y-2 \)  C. \( \frac{y-2}{x-4} \)  D. \( \frac{x-4}{y-2} \)

7. Give the LCD of \( \frac{3}{15y^2} \) and \( \frac{5}{36y^4} \)
   A. \( 36y^2 \)  B. \( 36y^4 \)  C. \( 90y^2 \)  D. \( 180y^4 \)

8. Rewrite \( \frac{17}{9r} = \frac{7}{36r^2} \) with indicated denominator
   A. \( 4 \)  B. \( 4r \)  C. 68  D. 68r

9. Add: \( \frac{4}{b^2+2b-8} + \frac{b}{b^2+2b-8} \)
   A. \( \frac{1}{b-2} \)  B. \( \frac{1}{b+2} \)  C. \( \frac{1}{b} \)  D. \( \frac{1}{2} \)

10. Find \( \frac{1}{m-1} - \frac{1}{m+1} \)
    A. \( \frac{2}{m-1} \)  B. \( \frac{2}{m+1} \)  C. \( \frac{2}{(m+1)(m-1)} \)  D. \( \frac{2}{(m-1)^2} \)
Enhancement Tests #8
Performing Operations on Rational Expressions

1. Find any value for variable x which \(\frac{2x^2 - 4}{x^2 - 2x - 24}\) is meaningless.
   A. \(x \neq 6, -4\)  
   B. \(x \neq 6, 4\)  
   C. \(x \neq -6, 4\)  
   D. \(x \neq -6, -4\)

2. Simplify: \(\frac{y^4 - 13y^2 + 36}{y^2 + 5y + 6}\).
   A. \((y - 2)(y + 3)\)  
   B. \((y - 2)(y - 3)\)  
   C. \((y + 2)(y - 3)\)  
   D. \((y + 2)(y + 3)\)

3. Subtract and express the difference in lowest term: \(\frac{1}{b^2 - 1} - \frac{1}{b^2 + 3b + 2}\).
   A. \(\frac{3}{(b+2)(b+1)}\)  
   B. \(\frac{3}{(b+2)(b-1)}\)  
   C. \(\frac{3}{(b-1)(b+1)}\)  
   D. \(\frac{3}{(b+2)(b+1)(b-1)}\)

4. Give the LCD of \(\frac{4}{b^2 - 16}\) and \(\frac{10b}{b - 2}\).
   A. \((b^2 + 4)(b + 2)\)  
   B. \((b^2 + 4)(b + 2)(b - 2)\)  
   C. \((b + 2)(b - 2)\)  
   D. \((b^2 + 4)(b - 2)\)

5. Add \(\frac{x}{x(x^2 - y^2)}\) and \(\frac{y}{x(x^2 - y^2)}\).
   A. \(\frac{1}{x}\)  
   B. \(\frac{1}{x(x-y)}\)  
   C. \(\frac{1}{x(x+y)}\)  
   D. \(\frac{1}{x(x-y)(x+y)}\)

6. Subtract \(\frac{a-b}{7}\) from \(\frac{a+b}{7}\).
   A. \(\frac{2b}{7}\)  
   B. \(\frac{b}{7}\)  
   C. \(\frac{-b}{7}\)  
   D. \(\frac{a}{7}\)

7. Give the GCF of \(\frac{2x - 4y}{x - 2y}\).
   A. 2  
   B. \(x - 2y\)  
   C. \(2(x - 2y)\)  
   D. \(2(x + 2y)\)

8. Multiply \(\frac{4a+8}{a^2 - 25}\) and \(\frac{a-5}{5a+10}\).
   A. \(\frac{4}{5(a+5)}\)  
   B. \(\frac{4}{5(a-5)}\)  
   C. \(\frac{4}{a+5}\)  
   D. \(\frac{4}{a-5}\)

9. Divide: \(\frac{y}{y+3} + \frac{y}{y+5}\).
   A. \(\frac{y+5}{y+3}\)  
   B. \(\frac{y-5}{y+5}\)  
   C. \(\frac{y+3}{y-3}\)  
   D. \(\frac{y-3}{y+5}\)

10. What must be multiplied to \(\frac{m^2 - n^2}{m-n}\) to get \(7mn\)?
    A. \(\frac{7mn}{m-n}\)  
    B. \(\frac{7m}{m+n}\)  
    C. \(\frac{7n}{m+n}\)  
    D. \(\frac{7mn}{m+n}\)
Enhancement Tests #9
Performing Operations on Rational Expressions

1. Give the lowest term of \( \frac{x^2+5x+6}{x^2+x+4} \).
   A. \( x+3 \)  
   B. \( \frac{x+2}{x+3} \)  
   C. \( (x+2)(x+3) \)  
   D. \( \frac{x+3}{x+2} \)

2. Find the difference between \( \frac{2}{(m+3)(2-m)} \) and \( \frac{m}{(m+3)(2-m)} \).
   A. \( \frac{1}{m-3} \)  
   B. \( \frac{1}{m+3} \)  
   C. \( \frac{2-m}{m+3} \)  
   D. \( \frac{2+m}{2-m} \)

3. Add \( \frac{a}{a-b} \) and \( \frac{b}{b-a} \).
   A. -1  
   B. 1  
   C. \( \frac{a+b}{a-b} \)  
   D. \( \frac{a-b}{a+b} \)

4. Give the LCD of \( \frac{3}{x^2-9x} \) and \( \frac{2}{x(x-9)(x-5)} \).
   A. \( x^2 - 9x \)  
   B. \( x(x-9)(x-5) \)  
   C. \( (x-9)(x-5) \)  
   D. \( x(x+9)(x+5) \)

5. Give the factor common to the numerator and denominator of \( \frac{w^2-15w+50}{w^2-9w+20} \).
   A. \( w-5 \)  
   B. \( w-10 \)  
   C. \( w-4 \)  
   D. \( w-5 \)

6. Find the value of the variable that must be excluded in \( \frac{(3-m)(4-m)}{m^2-m-12} \).
   A. -4, -3  
   B. -4, 3  
   C. 4, -3  
   D. 4, 3

7. Find the product of \( \frac{x+5}{3x} \) and \( \frac{12x^2}{x^2+7x+10} \).
   A. \( \frac{4x}{x+2} \)  
   B. \( \frac{4x}{x-2} \)  
   C. \( \frac{4}{x+2} \)  
   D. \( \frac{x}{x+2} \)

8. Simplify: \( \frac{5n-5}{3} \cdot \frac{9}{n-1} \).
   A. 3  
   B. 5  
   C. 15  
   D. 5(n-1)

9. What must be divided to \( \frac{a^2-b^2}{4} \) to get \( 4(a+b) \)?
   A. \( \frac{a+b}{16} \)  
   B. \( \frac{a}{16} \)  
   C. \( \frac{b}{16} \)  
   D. \( \frac{a-b}{16} \)

10. What is the GCF in the expressions \( \frac{b^2+20b+99}{b+9} \) and \( \frac{b^2+12b+11}{b+9} \)?
    A. \( b+11 \)  
    B. \( b+9 \)  
    C. \( b+7 \)  
    D. \( (b+11)(b+9) \)
**Enhancement Tests #10**

**Performing Operations on Rational Expressions**

1. In the rational expressions \( \frac{x+y}{x^2+3xy+2y^2} \), give the factors of the denominator.

A. \((x-y)(x+2y)\)  
B. \((x+y)(x-2y)\)  
C. \((x+y)(x+2y)\)  
D. \((x-y)(x-2y)\)

2. Simplify \( \frac{z^2-3z}{z-3} \).

A. \(z\)  
B. \(z-3\)  
C. \(z(z-3)\)  
D. \(z(z+3)\)

3. Find the product of \( \frac{7b}{7a} \) and \( \frac{18a^2}{b} \).

A. \(2a\)  
B. \(7a\)  
C. \(14a\)  
D. \(14ab\)

4. Factor \( \frac{a^2+ac-ab-bc}{a^2-b^2} \) by grouping and then rename into lowest term.

A. \(\frac{a+c}{a-b}\)  
B. \(\frac{a-c}{a-b}\)  
C. \(\frac{a+c}{a+b}\)  
D. \(\frac{a-c}{a+b}\)

5. What value of \(x\) that must be excluded in \( \frac{x(x-5)}{x(x+1)} \)

A. \(x\neq 1\)  
B. \(x\neq -1\)  
C. \(x\neq 5\)  
D. \(x\neq -5\)

6. Find the GCF in the expressions \( \frac{x^2-y^2}{x-y} \).

A. \(2(x+y)(x-y)\)  
B. \(2(x+y)\)  
C. \(2(x-y)\)  
D. \((x+y)(x-y)\)

7. Find the quotient in simplest form: \( \frac{w^2+2w+1}{w+1} \).

A. \(3\)  
B. \(w+1\)  
C. \(3(w+1)\)  
D. \(-3(w+1)\)

8. Simplify: \( \frac{(x^2)^2}{y^2} \cdot \frac{5}{3x} \).

A. \(\frac{5x^4}{y^2}\)  
B. \(\frac{5x}{y^2}\)  
C. \(\frac{5x^3}{y}\)  
D. \(\frac{5x^3}{y^2}\)

9. Find the sum of \( \frac{3}{a-2} \) and \( \frac{2}{a-3} \) in lowest term.

A. \(\frac{5a-13}{(a-2)(a-3)}\)  
B. \(\frac{-5a+13}{(a-2)(a-3)}\)  
C. \(\frac{5a+13}{(a-2)(a-3)}\)  
D. \(\frac{-5a-13}{(a-2)(a-3)}\)

10. Give the LCM of \(3x+15\) and \(x^2+2x-15\)

A. \(3(x+5)\)  
B. \(3(x-3)\)  
C. \(3(x-5)\)  
D. \(3(x+5)(x-3)\)