



Blackwater Community School Rooted Facts Multiplication Implementation Results

The Rooted Facts (extended) technique was utilized with third graders at Blackwater Community School. The use of this technique began on 01/17/2017 and ended on 02/13/2017. The implementation consisted of 15 sessions, one session per day. Each session lasted between 20 and 30 minutes. This document details these results.

The primary goal of the Rooted Facts Multiplication technique at the third grade level is to provide an alternative method in teaching the following Arizona Mathematics Standards:

- 3.OA.A.1 (Interpret products of whole numbers.)
- 3.OA.A.2 (Interpret whole-number quotients of whole numbers.)
- 3.OA.C.7 (Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division.)

A secondary goal of this technique at the third grade level is to increase knowledge development of the following Arizona Mathematics Standards:

- 3.OA.A.3 (Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities.)
- 3.OA.A.4 (Determine the unknown whole number in a multiplication or division equation relating three whole numbers.)
- 3.OA.B.5 (Apply properties of operations as strategies to multiply and divide.)
- 3.OA.B.6 (Understand division as an unknown factor problem.)
- 3.OA.D.8 (Solve two-step word problems using the four operations.)
- 3.NBT.A.3 (Multiply one-digit whole numbers by multiples of ten in the range 10-90.)
- 3.MD.C.5 (Recognize area as an attribute of plane figures and understand concepts of area measurement.)
- 3.MD.C.6 (Measure areas by counting unit squares.)
- 3.MD.C.7 (Relate area to the operation of multiplication and division.)

The Rooted Facts Multiplication Technique has previously been used as a remedial tool for 6th, 7th and 8th grade students who have been unable to become fluent in multiplication and division. The purpose of providing the Rooted Facts Multiplication Technique in third grade classes is to provide students an improved understanding of Multiplication and Division, and thereby decrease the need for remediation in later grades.



For this report the following scores have been calculated. For detailed descriptions of these scores, please refer to the corresponding page:

- Square Fact Family Proficiency (page 3)
- Multiplication/Division Inverse Proficiency (page 4)
- Multiplication/Division Fluency (page 5)

Assessment and Implementation Information

To determine these scores each third, fourth and fifth grade student was provided *RFM Pre-assessment Version 1*. *RFM Pre-assessment Version 1* is a 5 minute assessment consisting of 50 multiplication problems and 50 division problems from the 3x3, 3x4, 3x6, 3x7, 3x8, 4x4, 4x6, 4x7, 4x8, 6x6, 6x7, 6x8, 7x7, 7x8 and 8x8 fact families. These assessments were provided in a whole class environment in month six of the 2016/2017 school year. The results received from this assessment were used to create current growth trend lines for Blackwater Community School.

Each third grade student then took part in learning both multiplication and division facts using the Rooted Facts Multiplication Technique. The implementation consisted of 15 sessions, one session per day. Each session lasted between 20 and 30 minutes.

After implementation had been completed, each third grade student was provided *RFM Post-assessment Version 1*. This second assessment also consisted of 50 multiplication problems and 50 division problems from the 3x3, 3x4, 3x6, 3x7, 3x8, 4x4, 4x6, 4x7, 4x8, 6x6, 6x7, 6x8, 7x7, 7x8 and 8x8 fact families. This assessment was five minutes in length.

The results received from the second assessment were then compared to the growth trend lines developed from the first assessment.

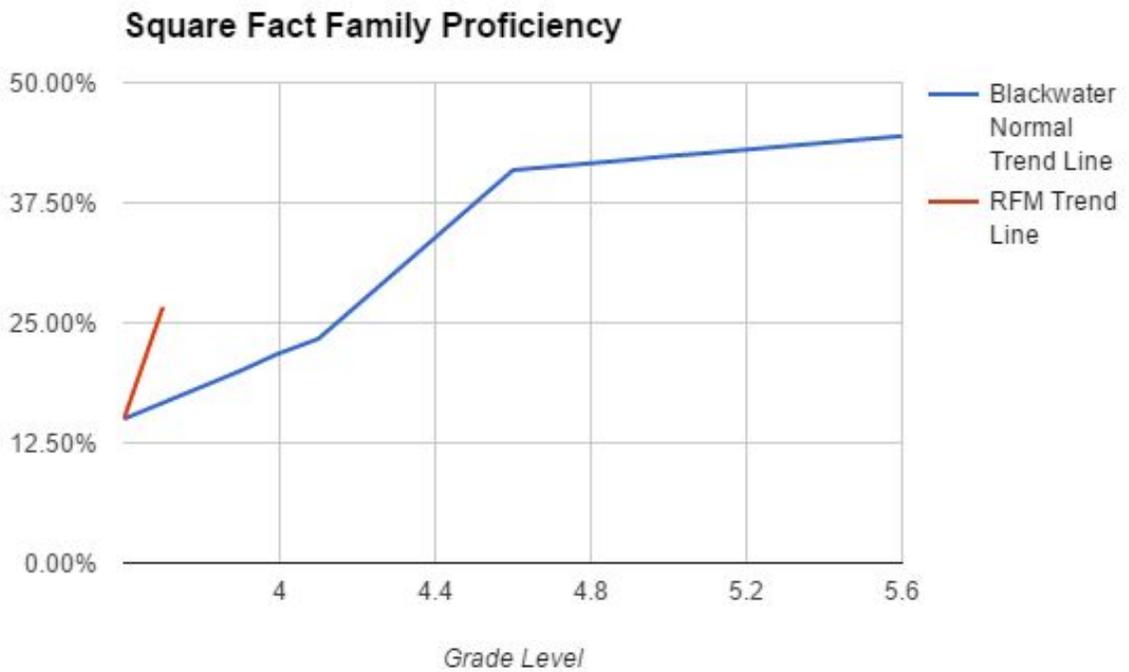
Sample Information

To determine Square Fact Family Proficiency and Multiplication/Division Inverse Proficiency a sample of each grade was analyzed. Each grade sample was developed as follows:

1. Separate data by class. This allows differences within each class to be accounted for.
2. Organize each completed assessment within each class from lowest fluency score to highest fluency score.
3. Samples were identified by taking the lowest scored class assessment, followed by the 4th lowest, 7th lowest, 10th lowest, and every third assessment thereafter within each class.
4. The highest assessment was also included. This allows for counteraction of the use of the lowest assessment.
5. Outliers were determined to be any score over 250% of the upper 25%ile average. Outliers were not included as a sample.

Square Fact Family Proficiency - Square Fact Families consist of facts used in square numbers (ex. 3×3 and $9 \div 3$, 4×4 and $16 \div 4$, 6×6 and $36 \div 6$). Square Fact Families are often the first facts to be learned. This information has been used to demonstrate development of foundational multiplication and division skills. These foundational skills can help in determining if continual, natural growth in multiplication and division fluency can take place.

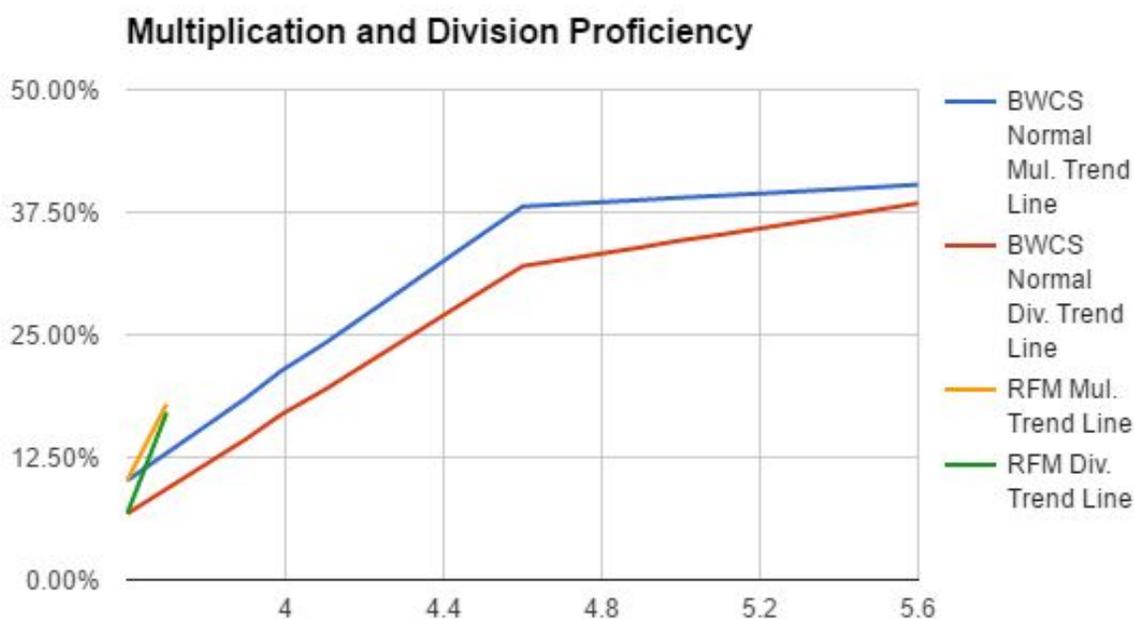
To determine Square Fact Family Proficiency a sample was used. Please refer to page 2 for information on the development of sample data.



Multiplication/Division Inverse Proficiency - The inverse to multiplication is division (ex. $3 \times 4 = 12$ and $12 \div 3 = 4$). An understanding of this relationship is a primary component of becoming proficient in multiplication and division facts. This skill can help in determining if continual, natural growth in multiplication and division fluency can take place.

Multiplication/Division Proficiency is determined by measuring the gap size between the multiplication proficiency trend line and the division proficiency trend line. Smaller gaps between these trend lines demonstrate higher proficiency development in Multiplication/Division Inverse Proficiency.

To determine Multiplication/Division Proficiency a sample was used. Please refer to page 2 for information on the development of sample data.

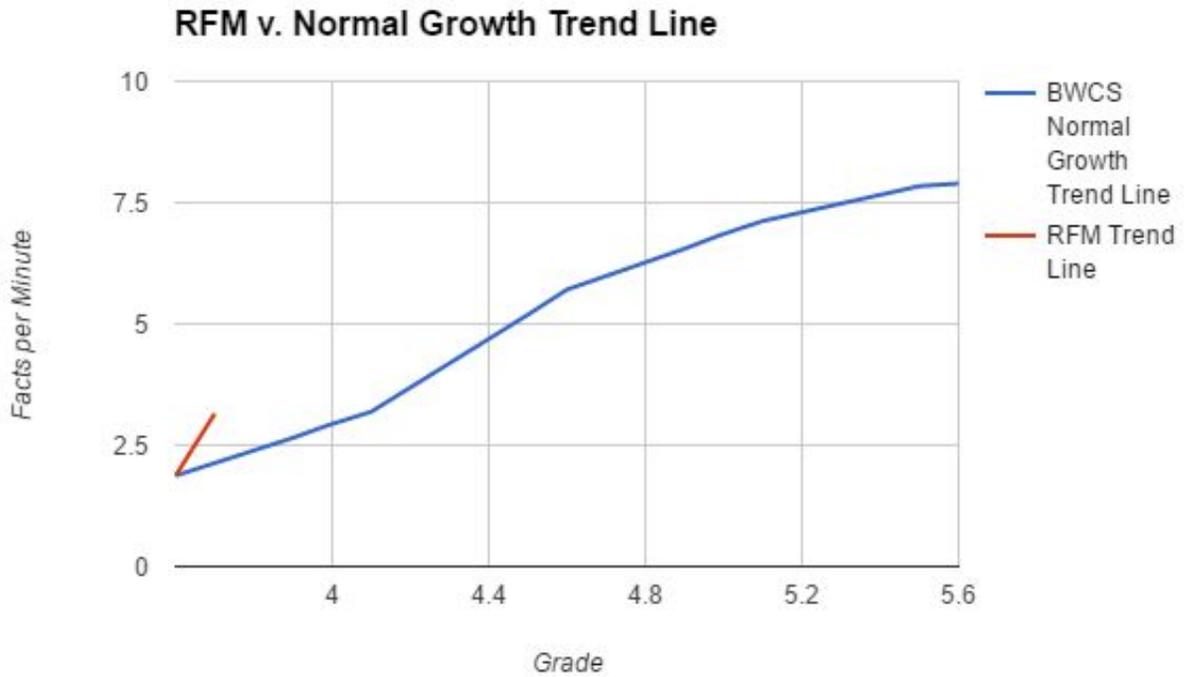


Gap Analysis:

	Multiplication	Division	Gap
3.6	10.13%	6.75%	3.38%
4.6	38.09%	32.00%	6.09%
5.6	40.32%	38.42%	1.90%
3.7	17.06%	17.95%	0.89%

Multiplication and Division Fluency - Multiplication and Division Fluency is determined by measuring how quickly multiplication and division facts can be answered. This information is able to provide an overall analysis of fluency growth rates.

To determine Multiplication and Division Fluency all scores were used. A sample was not used.



Trend Line Expectancy - The following graph has been developed to provide insight into expectant results in Multiplication and Division Fluency. The red line details higher end potential results. The orange line details lower end potential results.

