2026

Minutes to Mastery with Red Hot Math: Evaluating a Tier 1 Fact Fluency Program

Grande Prairie Public School Division

Grande Prairie Public School Division

AIM COLLECTIVE

Executive Summary

The Project

In Fall 2024, four school divisions in Northern Alberta (i.e., Zone 1) and researchers from Carleton University collaborated to evaluate the effectiveness of a Tier 1 classroom math intervention. The purpose of the intervention was to improve the fact fluency skills of students in Grade 2 through 6. In this report, we examined the growth in fluency of 255 Grande Prairie students (Grades 4 and 5) in one intervention cycle across two time points. We examined the change in fluency scores using pre- and post-intervention assessments from the Provincial Numeracy Screening Assessment (PNSA; Douglas & LeFevre, 2023).

Results

1. Students who received the intervention showed significantly greater growth in their multiplication and division fluency scores than students who did not receive the intervention.

Conclusions

1. The intervention was effective. Students' fluency skills improved in response to the full-class instruction.
2. The PNSA is an effective tool for tracking student progress and response to intervention.

Acknowledgements

This report describes the results of a collaborative project between four Northern Alberta public school divisions which included the Grande Prairie Public School Division (GPPSD) and researchers from the Math Lab at Carleton University. Fort Vermilion (FVSD), Peace River (PRSD) and Peace Wapiti (PWSDB) school divisions also participated in the research but because GPPSD used a modified protocol, the other Zone 1 results are described in a separate report. Tracie Anthony, the Curriculum Lead for the GPPSD led the intervention program. The project was supported by Corrine Kruse, the Director of Teaching and Learning in GPPSD. This report is based on de-identified data provided to the Carleton team. The report was written by Heather Douglas, Jo-Anne LeFevre, Shuyuan Yu, and Ayushi Chitranshi.

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Background

Arithmetic fluency is the ability to quickly and efficiently retrieve number facts or apply efficient strategies to solve arithmetic problems (Codding et al., 2023; McNeil et al., 2025). Arithmetic fluency is a foundational mathematical skill that supports the acquisition of other mathematical skills (Price et al., 2013), including word-problem solving (Lin, 2020), fractions (Namkung & Fuchs, 2016) and algebra (Siegler et al., 2012). In essence, fluent access to basic arithmetic facts makes higher level math easier (Price et al., 2013), reduces demands on working memory during word problem solving (Frigitta et al., 2023), and increases students' math confidence (Maki et al., 2024). In short, fact fluency is a foundational skill that students need to succeed in mathematics.

In the 2024-25 school year, four school divisions in Northern Alberta came together to share best practices to improve students' fact fluency skills. The group implemented a full class (Tier 1) intervention across their divisions. In this report, we discuss the findings from the Grande Prairie Public School Division (GPPSD) where the intervention was adapted and implemented by Math Lead, Tracie Anthony and supported by Corinne J. Kruse, the Director of Teaching and Learning in the GPPSD.

The Intervention

Overview

Minutes to Mastery with Red Hot Math follows a protocol initially developed by Peace Wapiti math leads Rhonda Giesbrecht and Nicki Nightingale (Zone 1 report) then adapted by Anthony for Grand Prairie. The purpose of the intervention is to build students' arithmetic fact fluency skills. In Grande Prairie, students in grades 4 and 5 worked on building their multiplication and division fact fluency.

The intervention protocol is grounded in the research on building fact fluency (Codding et al., 2011; VanDerHeyden & Peltier, 2023). Specifically, the intervention builds skill acquisition through strategy instruction and builds mastery through fluency practice. The strategy instruction in the intervention followed the sequence and lessons recommended by the National Centre for Excellence in the Teaching of Mathematics (2018, 2019). The recommended sequence of strategies and links to lessons are included in Appendix A.

Delivery

The delivery of the intervention was based on the pedagogy of effective instruction (Fuchs et al., 2021; Powell et al., 2023). Specifically, the intervention involves:

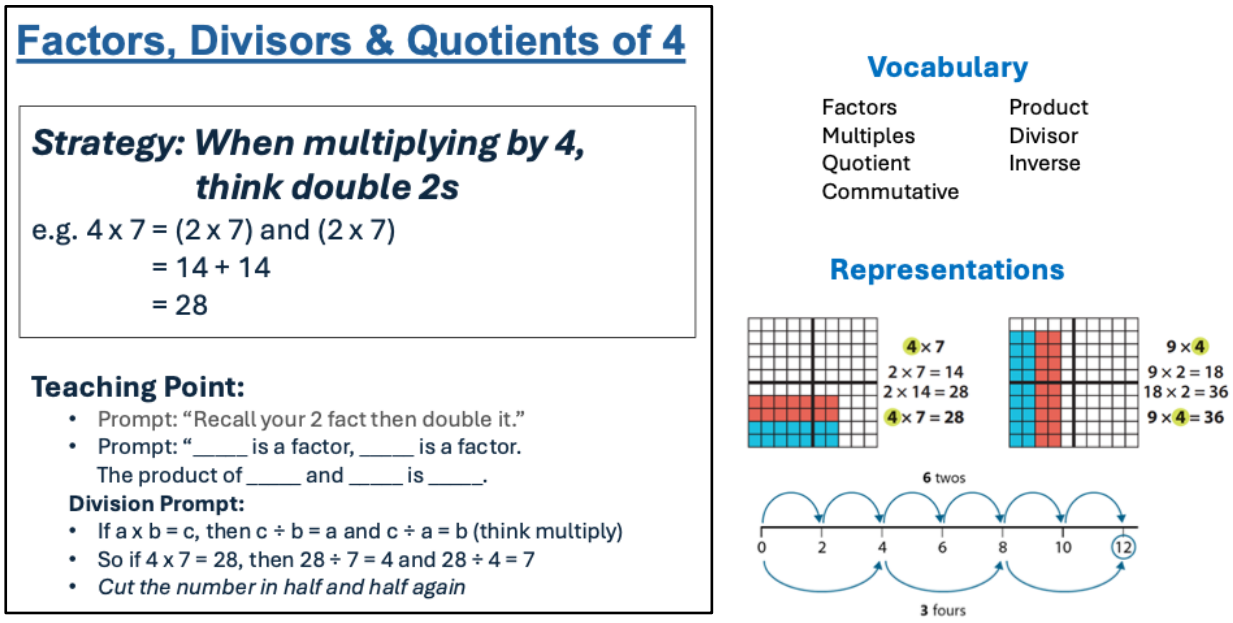
a) Systematic and explicit instruction to develop students' understanding of math ideas (Doabler et al., 2015; Doabler & Fien, 2013; Stockard et al., 2018).

b) The use of multiple representations (e.g., rekenreks, number lines, and ten frames) to build students' conceptual knowledge (Heinze et al., 2009).
c) Multiple opportunities for students to learn and use clear and concise math terms (Hughes et al., 2016).
d) Fact retrieval practice to help support students' fluency (Codding et al., 2011; Nelson et al., 2013; Stocker & Kubina, 2017).

Implementation of the Intervention

Before starting the intervention, teachers attended a half-day in-person professional development session. This session included theory on the why and how of building arithmetic fluency and training on implementing the intervention. A slide deck was made available that described each strategy and included multiple representations that illustrate the strategy to support students' practice. Figure 1 shows the description of a strategy for "Factors, Divisors & Quotients of 4". Clear and concise math vocabulary is emphasized and multiple representations such as number lines and 100s grids are used to build understanding.

Figure 1. *Factors of 4: Strategy, Vocabulary and Supporting Representations*



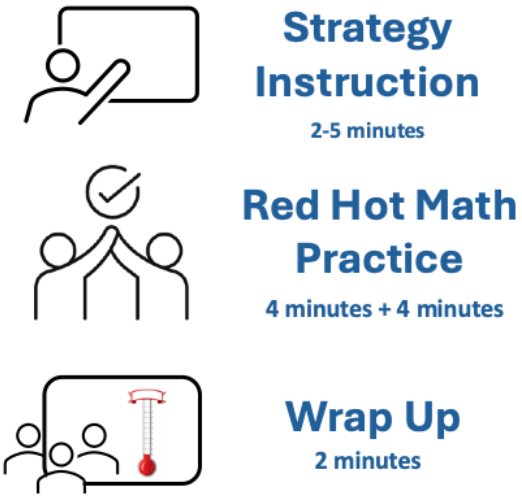
Note: the teaching points have been edited to highlight math vocabulary and inverse operations

Daily Lessons

The breakdown of the 15-minute daily lessons is shown in Figure 2. The lesson begins with *strategy instruction*. During this time, the teacher gives clear, direct explanations of an "efficient method for deriving facts and highlight patterns to help students generalize their fact knowledge" (Morano et al., 2020, p. 61). Instruction may focus on arithmetic concepts such as the *commutative property* for addition and multiplication (e.g., 3 + 4 = 4 + 3; 3 x 4 = 4 x 3) which minimizes the

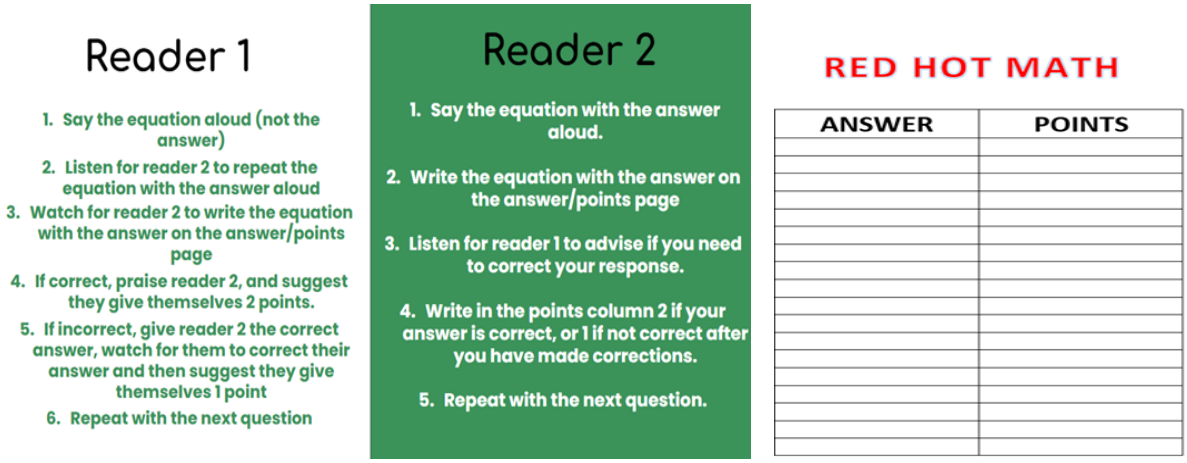
number of facts student need to remember, or *inverse operations* (e.g., 3 x 4 = 12; 12 ÷ 4 = 3) or *adding or subtracting one* (e.g., 6 + 1 = 7; 6 – 1 = 5) which builds on students' knowledge of the count sequence (Purpura et al., 2016). Other strategies focus on known patterns such as *making 10* (e.g., 8 + 6 = 8 + 2 + 4) and recognizing *doubles*, the latter because they are inherently easier to memorize (Bagnoud et al., 2025). Importantly, training students on the use of efficient strategies can help them build their fact fluency (Powell et al., 2023). Once students develop mastery for addition and subtraction facts, they advance to multiplication and division facts. Multiplication builds on students' knowledge directly through use of *repeated addit*ion (e.g., 3 x 5 = 5 + 5 + 5), and *structured counting* (e.g., 3 x 5 = 5, 10, 15). Conceptual knowledge remains key to developing persistent, long-term fluency (Robinson, 2017; Robinson & LeFevre, 2011; Robinson & Sander, 2024). *Mastery* "is characterized by fluent, facile, adaptable, and flexible skill" (Codding et al., 2023, p. 2). Once students respond consistently and accurately to specific items, they build mastery through retrieval practice and repetition.

Figure 2. *Intervention Lesson Sequence*



In the second phase of the 15-min lesson, students used *Red Hot Math* to practice their math facts. This is a gamified approach where students work together to build skills and increase achievement of the whole class. In Red Hot Math, practice follows a protocol in which students have a list of equations that focus on the strategy being taught. Students work in pairs taking turns being Reader 1 and Reader 2 (see Figure 3). At the end of each week students do a fluency test and track their weekly results on a graph so they can see their progress.

Figure 3. *Red Hot Math Student Protocol*



At the send of each session, there is a brief wrap up. Student pairs tally their points, and these are added to the class total on the "red hot" thermometer that is posted in the class (See Figure 2). The teacher consolidates the learning by reviewing errors and reinforcing strategies. When the class total reaches a "red hot" target level, students celebrate with freezies to "cool things down".

The Assessment Tool

The Alberta Provincial Numeracy Screening Assessment (PNSA) is a universal numeracy screener for students in kindergarten to Grade 4 developed by math cognition researchers at Carleton University (Douglas & LeFevre, 2023). The screener is administered in the classroom and includes a battery of subtests that measure students' foundational numeracy skills. In grade 4, these skills include students' understanding of the symbolic number system (e.g., number writing, place value), number relations e.g., number line estimation) and operations (e.g., multiplication and division fluency for simple facts [3 x 4; 45÷5], calculation fluency for multi-digit addition and subtraction). For this study, Grade 4 and Grade 5 students did the Grade 4 version of the assessment. In this report we focus on students' combined multiplication/division fluency and their multi-digit calculation skills.

Study Design

Students (intervention and control) were tested with the PNSA in January of 2025. Following the base-line testing, teachers ($N = 6$) delivered the first round of intervention approximately three times per week. All students were re-tested with the PNSA in May of 2025, after 12 weeks of intervention.

Progress Reports

Intervention teachers completed a weekly survey where they reported the strategies they practiced, how many lessons they did that week and how engaged (1=not at all engaged, 5=very engaged) they felt the students were during the intervention. All teachers in the intervention condition focused on building students' multiplication and division fluency versus addition and subtraction fluency.

Research Questions

Research Question 1: Did the intervention affect the growth of students' fluency in multiplication and division?

Research Question 2: Did teachers implement the intervention as was suggested?

Method

Participants

Fourteen teachers volunteered to participate in the study. Six teachers implemented the intervention and eight did not (i.e., were in the control condition). Together, these teachers taught 255 students in grades 4 and 5, with 114 in the intervention condition and 109 in the control condition.

Analyses

To test the effectiveness of the intervention, we compared pre- and post-test fluency scores for students in the intervention and control groups using a series of 2(test time: Winter, Spring) x 2(group: intervention, non-intervention) x 2 (grade: 4, 5) mixed ANOVAs. We expected to see an effect of time by group indicating that the change in skills for students in the intervention were greater than those in the control condition.

Results

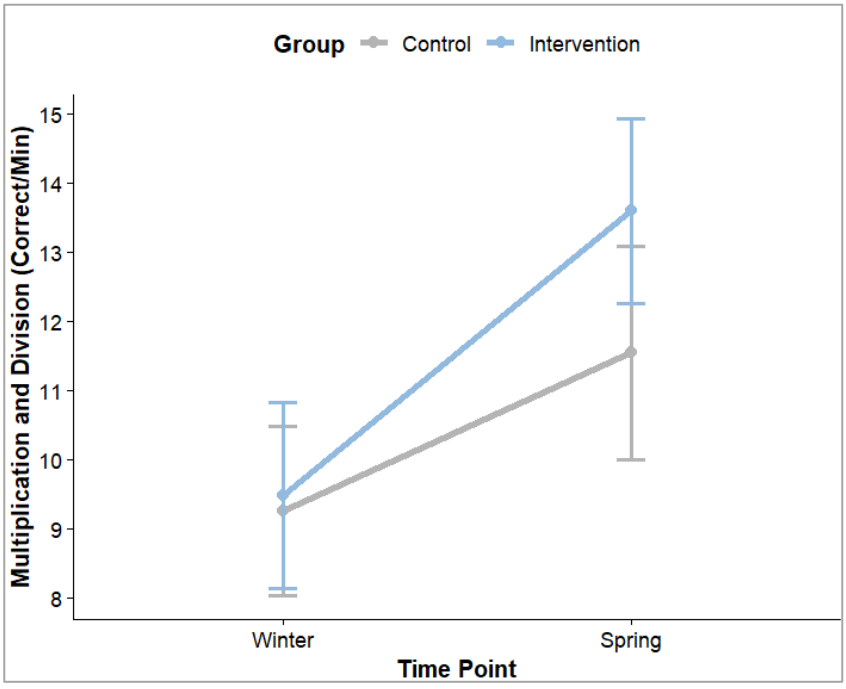
Research Question 1: Did the intervention affect the students' growth in multiplication and division fluency?

As expected, in response to classroom instruction the fluency skills of both groups of students (intervention and control) improved from Winter to Spring, as shown in Figure 2. Did the scores of the students who received intervention improve more? Yes, there was a significant interaction between group and time, $F(1, 219) = 6.59$, $p = .011$, indicating that the change in fluency scores were different for students in the intervention group compared to students in the control group. Although starting scores for both groups of students were not significantly different ($p = .65$), by Spring the students in the intervention group scored significantly higher than the students in the control group ($p = .04$). Yes, fluency skills improved more for students who received the intervention.

Was this pattern of change different for grade 4 students compared to grade 5 students? No. the pattern was not significantly different by grade and group, $F(1, 219) = 0.58$, $p = .45$ (complete statistical analysis is shown in Appendix B, Table B1). By the end of the year, students in grades 4 and 5 who participated in the intervention had increased their scores twice as much (4 items versus 2) as their peers who did not participate in the intervention.

Figure 1

Multiplication and Division Fluency (number correct/minute) from Winter to Spring by Group



Note. The error bars represent 95% confidence intervals.

Research Question 2: Did teachers implement the intervention as suggested?

Yes! As shown in Table 1, most teachers implemented the intervention in each of the twelve weeks. Teachers taught the multiplication and division strategies and students practiced their fluency an average of 2.4 times per week, close to the recommended three times per week. Notably, the teachers felt their students were engaged during the lessons. One teacher captured it best, *"It is going awesome! The kids are very excited about it and ask me every day if we 'get' to do red hot math."* Another said *"… my students are loving the Red Hot Math game! They already reached their goal and we had a freezie reward yesterday."*

Table 1

Descriptives for the Progress Reports

	N	*M*	*SD*	*Min*	*Max*
Weeks Reported	6	10.3	2.2	6.0	12.0
Student Engagement	6	4.6	0.5	3.6	5.0
Total Frequency	6	29.0	7.0	19.0	37.0
Weekly Frequency	6	2.4	0.6	1.6	3.1

Note. *SD* = standard deviation, Min. = minimum score, Max. = maximum score. Student engagement was rated on a 5-point scale from 1 = not at all engaged to 5 = very engaged.

Discussion

The purpose of this study was to determine if the fact fluency intervention implemented in the Grande Prairie Public School Division was effective at improving students' multiplication and division fact fluency. The results of the study indicate that the intervention was effective. Intervention students' fact retrieval improved more from Winter to Spring than control students' fact retrieval. In fact, in the one-minute post-intervention fluency test, they could successfully answer about 2 more questions than their peers who did not receive the intervention. Importantly, the teachers who administered the intervention felt their students were engaged and excited by the practice. Red Hot Math was a red-hot success.

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Appendix A

Details of the Fact Retrieval Game, Red Hot Math

Red Hot Math – How to Play

Goal: Practice math fact fluency through strategy, teamwork, and points—working together to heat up the class thermometer!

Setup

1. **Pairing Students:** Teacher assigns partners of similar ability. These partners stay together until the target is reached (2 days–2 weeks).
2. **Assigning Roles:** In each pair, the student who struggles most becomes **Reader 1**, the other becomes **Reader 2**.
3. **Strategy Warm-Up (2–3 minutes):** Teacher leads a quick discussion on math strategies, using the Zone 1 PowerPoint and following the fact progression. (*Pre-assess on all facts to know where to start. Each practice sheet includes mixed-in earlier facts and answers.*)

Playing the Game

4. **Roles:**
   - **Reader 1**: Reads questions out loud.
   - **Reader 2**: Answers and records responses on the Answer/Point page.
   - Switch roles after 1–2 minutes per student (longer when new facts are introduced).
5. **Scoring:**
   - Correct answer = **2 points**
   - Incorrect answer (corrected after feedback) = **1 point**
   - Bonus points are awarded by the teacher for teamwork and good citizenship.
6. **Teacher Role:**
   - Walks around awarding bonus points.
   - Watches for facts students consistently miss (to use in mini lessons).
   - If a partner is absent, assign the student as the “ticky person” to help track points.

Wrapping Up

7. **Pair Scoring:** Students total their points. Scores are added to the **whole class total** on the board.
8. **Thermometer Tracking:** Points are recorded on the class thermometer chart.
9. **Quick Strategy Talk:** Teacher highlights a commonly missed fact (e.g., "How could we solve 8 × 4 more efficiently?").
10. **Reaching the Target:**

- First target should be reachable in 2–3 days.
- When reached, the class earns ice cream to "cool down" because they are **Red Hot!**
- Thermometer is reset, partners are reassigned, and the next target is set higher.

Ongoing Progress

11. **Weekly Check-In:** Students complete a fact page to measure readiness for the next set of facts.
12. **Data Tracking:** Students graph their progress over time.

Differentiation

- Pairs can work on different fact families (addition/subtraction or multiplication/division), depending on their needs.

Appendix B

Table B1

Summary of Main and Interaction Effects for Multiplication and Division Fluency

Effect	*df*	*F*	*p*	η_p^2
Time	1, 219	74.81***	< .001	.255
Group	1, 219	1.88	.172	.008
Grade	1, 219	0.39	.531	.002
Time x Group	1, 219	6.59**	.001	.029
Time x Group x Grade	1, 219	0.58	.449	.003

Note. *df* = degrees of freedom, *F* = F ratio, *p* = level of significance, η_p^2 = partial eta squared effect size. *** $p < .001$; ** $p < .01$.

Table B2

Descriptive Statistics Multiplication and Division Fluency

Grade	Test Time	Intervention Group			Control Group		
		N	*M*	*SD*	*N*	*M*	*SD*
4	Winter	35	9.80	7.74	76	9.50	6.58
	Spring	35	13.54	7.24	76	11.95	8.30
5	Winter	79	9.33	7.18	33	8.70	6.42
	Spring	79	13.63	7.33	33	10.61	8.04
All	Winter	114	9.47	7.33	114	9.26	6.51
	Spring	109	13.60	7.27	109	11.54	8.21