Utah Community Math Initiative:
Math Workshop and Research Proposal

Executive Summary

Mathematical proficiency is not only a school benchmark—it is a lifelong determinant of career opportunity, economic stability, and civic participation. Yet research shows that 93% of U.S. adults report some level of math anxiety (Luttenberger et al., 2018). This anxiety has measurable consequences: reduced access to post-secondary education, limited career advancement, avoidance of math-related tasks, and diminished financial well-being. Alarmingly, math anxiety begins as early as kindergarten and becomes concerning to teachers in second and third grade. Studies confirm that math anxiety and achievement have a significant negative correlation, with working memory and self-concept playing a critical role in this relationship (Wu et al., 2018; Justicia-Galliano et al., 2017). A recent survey of young people conducted by the RAND Corporation shows the flipped side of this, indicating that most people who grow to see themselves as "math people" developed that image of themselves before 6th grade (Schwartz et al., 2025)

Throughout the state, we have numerous communities who would benefit from additional support. For example, in the Ogden area the challenge is particularly urgent. Five elementary schools report math proficiency averages below 20%, with all but one of the remaining schools ranging between 20 and 37 percent. In the Granite district 15 schools are below 20% proficiency and 25 schools range between 20 and 39 percent. In areas of the state with similar demographics, elementary students are struggling in math at far higher rates than the state overall with proficiency at 20% lower than the state average. This challenge is compounded by the fact that 63% of students come from economically disadvantaged households and nearly one in five are English Language Learners (Utah State Board of Education, 2025). Families in this community face barriers that make free, accessible math support not just helpful, but essential.

To address this need, we propose a series of free after school workshops primarily focused on parents and their elementary-aged children working together to build students' math proficiency, but also open to elementary teachers who want to attend. We prioritize mathematical proficiency because it focuses on the math knowledge needed to tackle real-world mathematics throughout

life (e.g., Kilpatrick et al., 2020). Math proficiency includes not only procedural knowledge and conceptual understanding, but also the development of problem-solving skills and perseverance that allow people to feel successful at math. To support the development of math proficiency, we propose to pair instruction with manipulative modeling to build deep conceptual understanding with original strategic math games designed to strengthen procedural fluency, strategic thinking, and confidence. Early pilots have demonstrated that this approach benefits both adults (teachers and parents) and children, improving understanding while reducing anxiety.

To guide revisions to the approach as well as to ensure effectiveness, we propose conducting rigorous research to document and analyze outcomes, providing educators and policymakers with data on how modeling and strategic games impact math learning, confidence, and anxiety reduction.

Purpose and Objectives

The purpose of the proposed work is to engage parents and their children in developing mathematical proficiency together and to support teachers in being better able to promote mathematical proficiency in their classrooms. Our research perspective for this project is built on the construct of learned helplessness versus the development of a sense of control over the learning environment. We hypothesize that creating an instructional environment in which students feel they have control over their learning will lower demonstrations of learned helplessness. Decades of research on learned helplessness demonstrate that a sense of control is critical to maintaining hope and resilience. Neuroscience confirms that the perception of control governs serotonin pathways, protecting against passivity and anxiety (Maier & Seligman, 2016).

Because we are proposing an out-of-school intervention, we have freedom to explore a variety of playful approaches and to be responsive to our audience as the experience unfolds across the year.

Objective 1: Provide playful experiences to all participants that allow them to develop and support mathematical proficiency.

While we hope that this is already happening in classrooms and homes, there are many mitigating factors that prevent it. One factor, certainly, is math anxiety on the part of the parents and the teachers. Math anxiety among elementary teachers is a pervasive issue (e.g. Uğraş, 2025) and there is no reason to expect the teachers in Ogden would be immune from this problem. Similarly, many parents feel disempowered to support their child's learning of math because they either struggle with anxiety or insecurities about tackling the new approaches to math their children are learning. Research shows that parental math anxiety has a negative effect on their child's math learning in both preK and the early grades (e.g., Becker et al., 2022; Maloney et al,

2015). Thus, providing experiences in which parents and teachers learn with children provides opportunities to build parental and teacher confidence with mathematics to stop the generational cycles of anxiety.

Objective 2: Collect data to identify the presence of anxiety in participants and changes to their anxiety levels.

For many children and adults, math is not just difficult, it's intimidating. Anxiety can quietly erode confidence, limit participation, and set learners on a path of avoidance that impacts their future opportunities. Because math anxiety often takes root in the early grades, addressing it early is critical. Through this project, we will measure participants' levels of anxiety at the beginning and end of the program to see whether our workshops help shift fear into confidence. Understanding these changes will not only demonstrate the impact of our approach but will also provide insight into how schools and families can better support learners in building resilience and joy in mathematics.

Objective 3: Evaluate participant perception of the value of play through strategic games in math skill development.

Play is a powerful driver of learning because it sparks curiosity, creates a sense of safety, and sustains motivation (Parker et al., 2022; Forbes, 2021). Research with older students and adults shows that playful pedagogy can: (1) cultivate relational trust, (2) remove barriers to engagement, (3) increase positive affect and motivation, and (4) promote deeper learning. Yet in mathematics classrooms, play remains underutilized and often undervalued. Strategic games offer a unique opportunity to link the natural benefits of play with the development of procedural fluency, accuracy, and speed in math. By examining how participants perceive the role of play in building skills, we can generate evidence that not only validates its importance, but also provides teachers with practical guidance for incorporating play into daily math instruction.

Objective 4: Evaluate participant perception of the value of modeling with manipulatives in gaining conceptual math understanding.

Representing mathematical concepts in concrete ways, such as through manipulatives, is widely recognized as an essential bridge to abstract reasoning. Cognitive load theory highlights the importance of background knowledge, attention, and working memory (WM) in learning. Because WM capacity is limited, learners with stronger background knowledge are better able to "chunk" information, which allows them to manage increasingly complex concepts and procedures (Draheim et al., 2022; Endres et al., 2023). Manipulatives may play a critical role in building this background knowledge by enhancing memory recall with different colors and shapes and providing deeper sensemaking opportunities that stay in long term memory.

However, more research is needed to understand how learners themselves perceive the value of manipulatives in developing the conceptual foundations that support mastery of mathematics.

Fund Request and Use of Funds

We are requesting **$47,780** to bring math support directly to the families and teachers of Ogden and surrounding areas, where the need is urgent and the potential impact is great. This funding will allow us to run eight weeks of after-school math workshops during the second semester and 5 weeks of workshops in the summer designed for children in grades 1–5, their parents, and their teachers.

Through partnership with Weber State University, the Community Education Center has agreed to provide space for workshops twice weekly, Mondays and Wednesdays, 3:30–7:00 p.m., throughout the school year at a discounted rate. The summer session will give us the opportunity to work with teachers and help them prepare for the next school year. Each day will include two sessions:

- Grades K–2 session: 4:00–5:20 p.m.
- Grades 3–5 session: 5:30–6:50 p.m.

This schedule allows us to offer two sessions per grade band a week. We anticipate 10-15 families per session giving us the potential to serve up to 60 families each week. Our hope is that families continue participation through all 8 or 5 sessions. Parents are encouraged to attend with their children, while teachers may participate independently.

Your investment will ensure:

- Every child and parent has tools in hand: math manipulatives and original strategy games for interactive learning.
- Professional facilitation: skilled educators to lead sessions, prepare materials, and support families.
- Safe and ethical research: oversight through Institutional Review Board approval, plus recording equipment to capture data (with consent) for analysis.
- Hospitality for families: snacks and water that make workshops welcoming and sustainable for participants.

A detailed budget is shown in Figure 1 and a proposed workshop calendar is shown in figure 2. *Rethink Learning Labs* ensures fiscal responsibility, program sustainability, and maximum benefit for Utah students, parents, and teachers. With your support, Ogden families will not only gain stronger math skills but also experience learning as something joyful and empowering.

Figure 1
Math workshop budget

Operating Expenses	
Payroll & Fringe (570 hours)	$34,200
Materials/Supplies	$3,600
Snacks (13 weeks, $1.25/person)	$1,950
Room rental	$1,170
IRB Fees	$1,150
Cameras, Microphones, Accessories	$2,040
Marketing	$120
Total - nonpayroll	$10,030
Total Operating Expenses	$44,230
Indirect expenses (8%)	$3,550
Total Ask	**$47,780**

Figure 2
Proposed calendar

Workshop session number	Mondays 4 - 5:30 PM grades K-2	Mondays 5:30 - 7 PM grades 3-5	Wednesdays 4 - 5:30 PM grades K-2	Wednesdays 5:30 - 7 PM grades 3-5
	Winter Session			
1	1/26/26	1/26/26	1/28/26	1/28/26
2	2/2/26	2/2/26	2/4/26	2/4/26
3	2/9/26	2/9/26	2/11/26	2/11/26
	President's Day			
4	2/23/2026	2/23/2026	2/25/2026	2/25/2026
5	3/2/2026	3/2/2026	3/4/2026	3/4/2026
6	3/9/2026	3/9/2026	3/11/2026	3/11/2026
7	3/16/2026	3/16/2026	3/18/2026	3/18/2026
8	3/24/2026	3/24/2026	3/26/2026	3/26/2026

	Summer Session			
9	6/1/2025	6/1/2025	6/3/2025	6/3/2025
10	6/8/2025	6/8/2025	6/10/2025	6/10/2025
11	6/15/2025	6/15/2025	6/17/2025	6/17/2025
12	6/22/2025	6/22/2025	6/24/2025	6/24/2025
13	6/29/2025	6/29/2025	7/1/2025	7/1/2025

Education Research Team Expertise

Established in 2020, Rethink Learning is a 501(c)(3) nonprofit led by professional educators with over 50 years of combined experience in research, curriculum development, and classroom teaching. Rethink Learning Labs (RLL), the research arm of *Rethink Learning Inc.*, pursues the mission of transforming teaching, learning, and leadership through research. To this end, we both conduct applied research and translate existing research findings into creative, practical innovations that invite meaningful change in a variety of learning settings. We design hands-on, minds-on learning experiences, foster discussion-based instruction, and create playful approaches that help learners see themselves as capable, successful participants in STEM. For too many students, math has been a source of anxiety and failure. Our work, both in classrooms and in community settings, offers a pathway to build skills, confidence, and deeper understanding.

Our team brings depth of expertise and a proven record of success in conducting research and implementing programs that improve learning outcomes.

- **Chandra Orrill, Ph.D.**, Executive Director of Research and Development, is a nationally recognized educational researcher specializing in mathematics education and instructional technology. Formerly a Professor in STEM Education at UMass Dartmouth and Director of the Kaput Center for Research and Innovation in STEM Education, she has served as principal investigator (PI) or Co-PI on more than $13 million in funded projects. Dr. Orrill's work with teachers emphasizes inquiry-oriented, technology-rich, and discussion-driven learning environments. She has published widely in mathematics education and the learning sciences and is an active leader in professional organizations.
- **Bonni Jones**, Ph.D. Candidate in Instructional Technology and Learning Sciences at Utah State University, is a Research Scientist at Rethink Learning whose career bridges classroom teaching, instruction technology, consulting, and innovative curriculum design. With experience across K-12 district, charter, private, and university settings, she has taught subjects ranging from mathematics and computer programming to financial

literacy, innovation in education, and media production. Her research focuses on educational change readiness, math anxiety, gamification, and play-based learning. She is developing a cooperative play-based math curriculum and has published work on professional development and innovative instructional design.

- **Ezra Gouvea, Ph.D.**, a postdoctoral fellow at Rethink Learning, combines expertise in mathematics (topology and geometry) with design-based educational research. His work investigates listening and attunement as essential elements of scientific inquiry, dialogic teaching, and the repair of harm in STEM education. With a master's degree in mathematics and a Ph.D. in STEM Education, Dr. Gouvea has designed and led professional development for teachers and now studies contexts in which computational thinking can flourish in K–12 classrooms.
- **Kun Wang, Ph.D.**, also a postdoctoral fellow, holds a Ph.D. in STEM Education from UMass Dartmouth and a B.S. in Civil Engineering. She has taught SAT and AP STEM subjects in China and brings a strong commitment to supporting teachers. Her research focuses on teacher knowledge and promoting playful, interactive classroom engagement that enhances learning.

Together, the RLL team combines over five decades of expertise in mathematics education, instructional technology, and teacher professional learning. With a balance of deep research backgrounds and hands-on classroom experience, we are uniquely equipped to lead this project with both rigor and creativity—ensuring outcomes that are academically sound, practically relevant, and deeply impactful for Utah's teachers, students, and families.

Research Plan

At its core, this project asks a simple but powerful question: *How can math activities foster confidence and joy instead of anxiety and helplessness?* To answer this question, we will study how our workshops influence participants' anxiety, confidence, and mastery of math skills. We are especially interested in how hands-on modeling and strategic play work together to deepen understanding, develop procedural skill, and change attitudes toward math.

Our guiding research questions are:

1. How do children's and parents' levels of math anxiety and confidence shift across the program?
2. How important do participants find modeling with manipulatives for making sense of math concepts and solving challenges?
3. How important do participants find play for building fluency, speed, and recall of facts and relationships?

4. If the experience is successful in changing participants' level of math anxiety and confidence, are there behaviors that appear to correlate to that change?

To answer these questions, we will use a combination of validated math anxiety measures, quick ticket-out-the-door surveys, video of participants engaged in learning activities, and participant surveys. We will also invite a small number of participants who attended regularly to participate in a short interview with a member of the research team to gain some qualitative insight into the experience of participating in this innovative, family-based learning opportunity. Together, these tools will allow us to capture both the measurable outcomes and the lived experiences of participants.

All research procedures will undergo Institutional Review Board (IRB) approval to ensure participant safety and ethical standards.

At *Rethink Learning Labs*, our commitment is clear: we conduct research that is both rigorous and human centered**.** We protect confidentiality, minimize risks, and ensure families understand how their contributions shape the work. Most importantly, we collect only the data that matters—data that can be translated into real strategies for reducing math anxiety, strengthening confidence, and improving outcomes for Utah students and families.

Broad Impact

Our goal is to ensure this work benefits as many Utah families and educators as possible. To extend the reach beyond workshop participants, we will provide at least five lesson plans to the Utah Education Network, making them freely accessible for teachers statewide. We will advertise widely using social media and flyers to encourage participation from teachers and families in the Ogden area, particularly during the summer sessions when teachers are seeking support for their classrooms.

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