

1. CONTEXT

Traditional secondary math classrooms are teacher-centered and students are passive learners at best.

Students in today’s math classrooms report lack of interest and boredom, preferring to engage in real-world scenarios and activities¹.

Most classrooms use district-mandated curriculum and pacing guides which can thwart teacher autonomy and innovative approaches to teaching².

Students psychological needs of autonomy, competence, and relatedness are not being met in today’s secondary math classrooms³.

2. CONCEPTUAL FRAMEWORK

- **Challenges in Secondary Math Classrooms**
 - Decline in motivation
 - Math Avoidance Behavior (MAB)
 - Lost interest in math
 - Attendance
- **Traditional Instruction vs Active Engagement**
 - Traditional Instruction
 - Teacher-centered instruction
 - Passive learning experiences
 - Active Engagement
 - Multiple teaching strategies
 - Active learning experiences
 - Students constructing knowledge
- **Cognitive Development and Representation**
 - Stages of development (Jean Piaget)
 - Modes of representation (Jerome Bruner)
- **Active Learning as a Theoretical Approach to Instruction**
 - Active participants, constructing their own knowledge
 - Improvement in performance, attitude, and motivation
- **Engagement and Inquiry in Secondary Mathematics**
 - CRA, IBL, PBL instructional strategies

PURPOSE

To encourage an active learning environment in a secondary mathematics classroom by including opportunities for inquiry and exploration.

FOCUS STATEMENT

The focus of this project is to present a revised classroom structure with inquiry-based learning opportunities and materials aligned with existing curriculum to promote active learning in a secondary mathematics classroom.

INSTRUCTIONAL RESOURCES

for Algebra 1 Linear Functions Unit

Concrete, Representational, and Abstract (CRA) Scaffolds: Active Learning

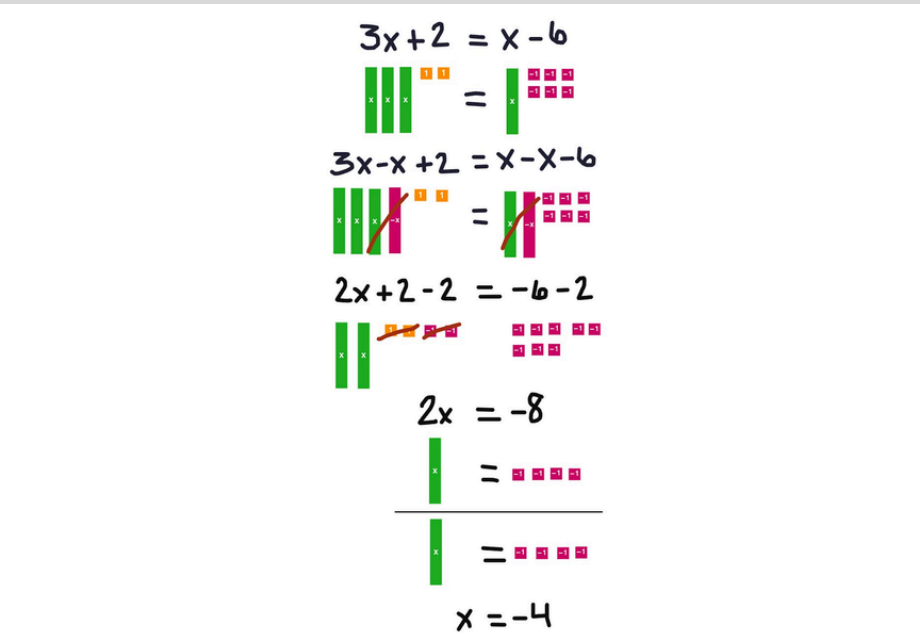


Figure 1: Algebra tiles used to build equations (Explore Phase)

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The algebra tiles are used in conjunction with the CRA Mat, an instructional design product for scaffolding

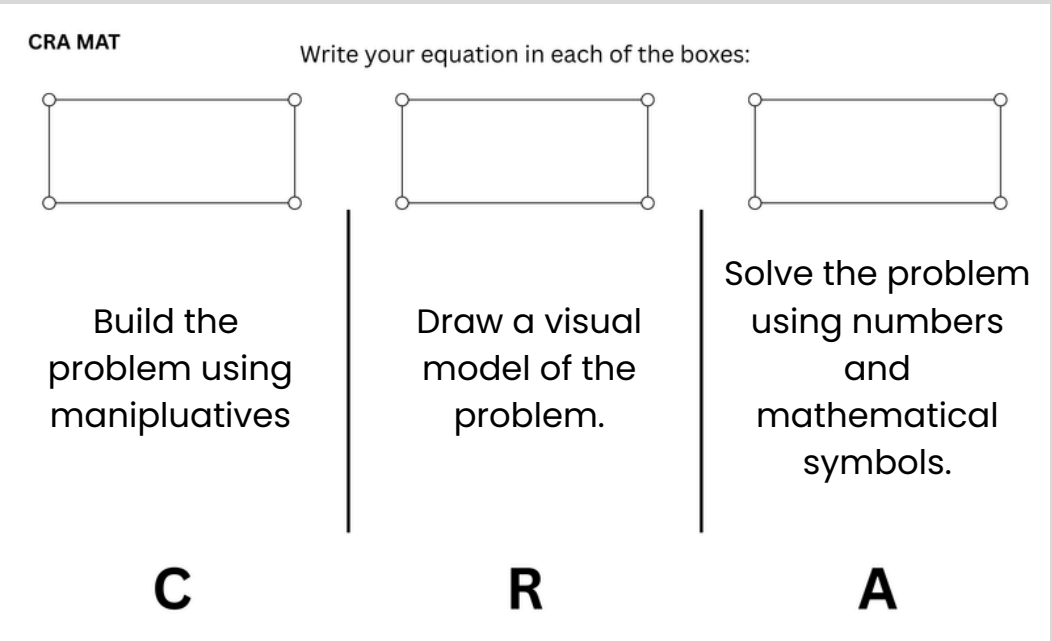


Figure 4: A teacher-created CRA mat to scaffold students through CRA stages (Explore Phase)

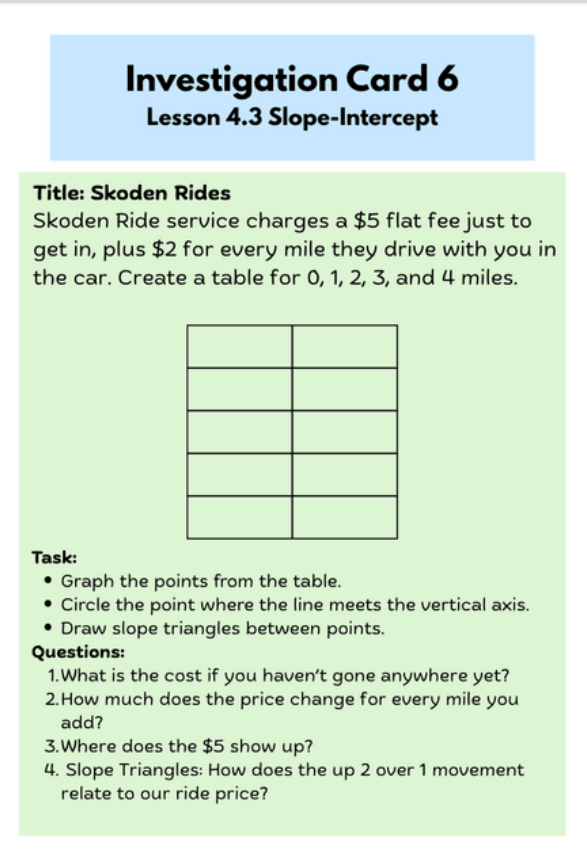
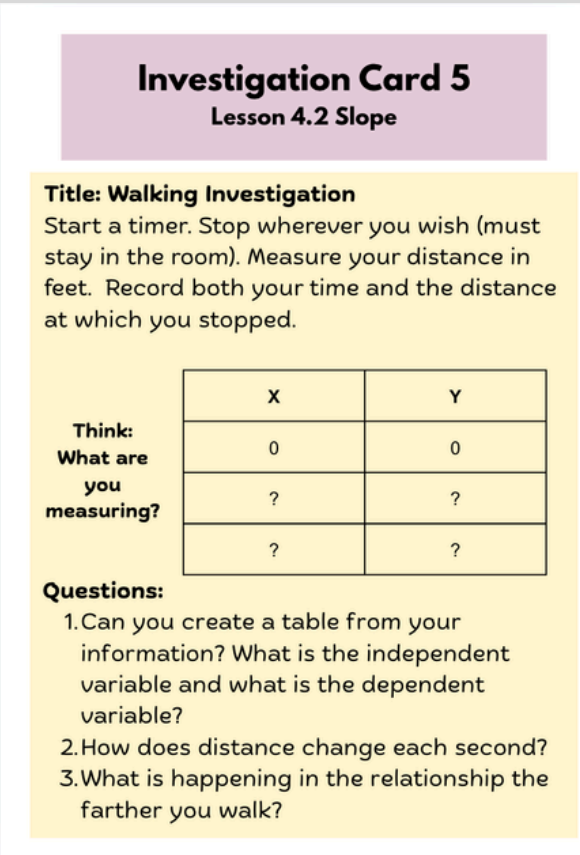
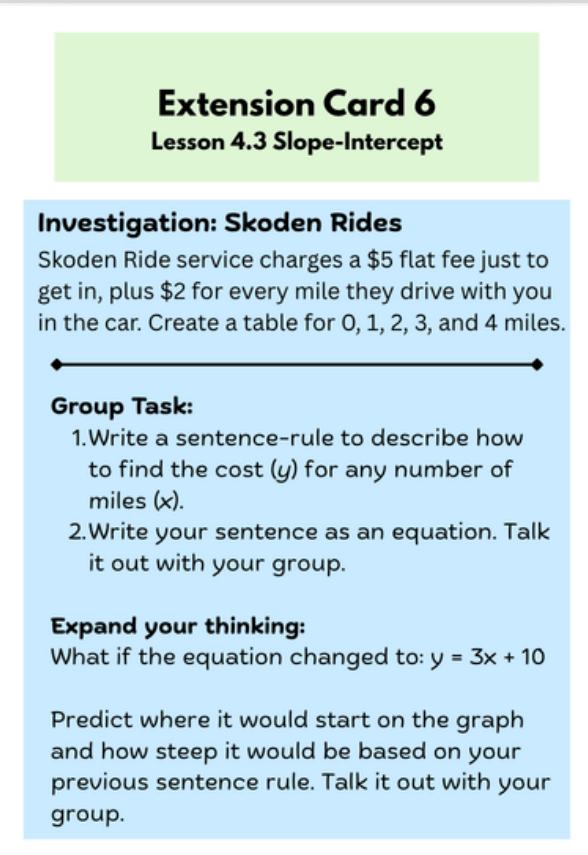
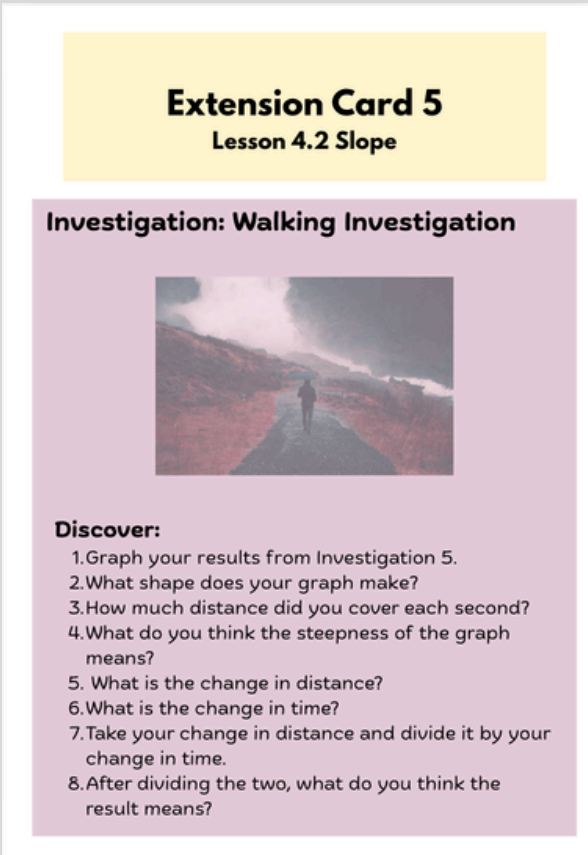


Figure 5 and 6: Teacher-created Investigation Inquiry Cards for a lesson on slope and slope intercept (Explore Phase)



Figures 7 and 8: Teacher-created Extension Inquiry Cards for a lesson on slope and slope intercept (Extend Phase)

Images Source: Rebecca Kennedy, 2026.

References:
1.Schwartz, et al. (2025). Students lose interest in math: Findings from the American Youth Panel. (Research Report. RR-A3988-1). RAND Corporation.
2.Remillard, J. T. (2005). Examining key concepts in research on teachers’ use of mathematics curricula. Review of Education Research, 75(2), 211–246.
3.Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social-development, and well-being. American Psychologist, 55(1), 68–78.

3. INSTRUCTIONAL DESIGN

Daily Lesson Structure:

An active learning classroom routine was created to work with curriculum. This structure aligns to the 5E lesson plan model: Engage, Explore, Explain, Extend, Evaluate

Daily Schedule (45-minute class period)	
Bell Ringer (Practice of previously learned skill)	3 minutes
Hook: Engage (Introduce the question/phenomenon)	2 minutes
Inquiry/Project: Explore (Students actively investigate the topic)	10 minutes
Mini-Lesson: Explain (Introduce the concept/skill)	8 minutes
Group Work/Project: Extend (Students work together applying new skill)	10 minutes
Independent Study: Extend (Practice applying knowledge to problems in workbook)	10 minutes
Wrap-Up: Evaluate (Formative Assessment/Quick Checks)	2 minutes

Figure 9 A teacher-created classroom routine for a 45-minute class

Day 1: Engage & Explore (45-minute class period)	
Bell Ringer (Practice of previously learned skill)	3 minutes
Hook: Engage (Introduce the question/phenomenon)	7 minutes
Inquiry/Project: Explore (Students actively investigate the topic)	30 minutes
Initial Wrap-up: Evaluate (Quick Check of Exploration)	5 minutes
Day 2: Explain & Extend/Apply (45-minute class period)	
Review: (Revisit findings from previous day’s inquiry)	5 minutes
Mini-Lesson: Explain (Introduce the concept/skill)	15 minutes
Group Work/Project: Extend (Students work together applying new skill)	
-AND/OR- Independent Study: Extend (Practice applying knowledge to problems in workbook)	20 minutes
Wrap-Up: Evaluate (Formative Assessment/Quick Checks)	5 minutes

Figure 10. A teacher-created classroom routine for a two-day class

Daily Schedule (90-minute class period)	
Bell Ringer (Practice of previously learned skill)	5 minutes
Hook: Engage (Introduce the question/phenomenon)	5 minutes
Inquiry/Project: Explore (Students actively investigate the topic)	20 minutes
Mini-Lesson: Explain (Introduce the concept/skill)	15 minutes
Group Work/Project: Extend (Students work together applying new skill)	20 minutes
Independent Study: Extend (Practice applying knowledge to problems in workbook)	20 minutes
Wrap-Up: Evaluate (Formative Assessment/Quick Checks)	5 minutes

Figure 10. A teacher-created classroom routine for a 90-minute class

Teacher-Created Resources:

- CRA Mat for scaffolding instruction
- Inquiry-designed Investigation and Extension Cards
- 5E Project-Based Learning Plan (PBL) for Algebra 1: Slopes and Watersheds
- Rubric for Group Work
- Rubric for PBL

4. REASONING AND RELFECTION

Reasoning:

- The CRA mat was created to help students move through three modes of representation. The mat provides the space for students to try an equation at each mode so they can see the progression from concrete to abstract.
- Inquiry investigations provided productive struggle, built critical thinking skills, and fostered knowledge construction in mathematics. This led to authentic learning experiences for students as they applied the concepts to real-world situations.

Reflection:

This instructional design offered a new approach to meeting students’ needs. Using these resources revealed how inquiry can be implemented to create a student-centered, active learning environment. With more implementation opportunities, resources will be refined and extended to cover all Algebra 1 units.