Personalized Affective Math Learning Study (PALS)

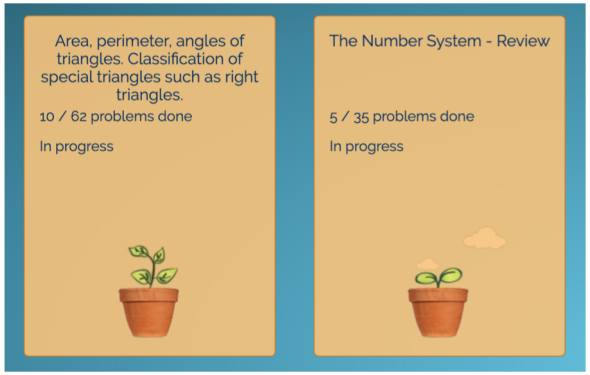
STUDY DESIGN OVERVIEW

Overview

- A large-scale randomized control trial (RCT) efficacy study of MathSpring, an adaptive, personalized math learning platform
- Conducted by WestEd in collaboration with the University of Massachusetts, Amherst
- Funded by the Institute of Education Sciences (IES)
- Goal is to evaluate the impact of MathSpring on student learning and to investigate shifts in student affects and classroom interactions

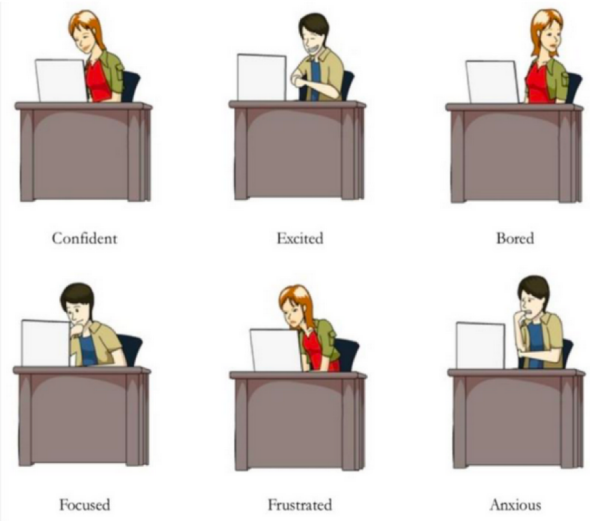
Significance

- Mathematics education continues to be a focus of national education improvement efforts
- More districts are introducing technology to support instruction in classrooms
- Research shows potential in these new education technologies to close achievement gaps
- However, limited research has been conducted on how tailored affective interventions influence student learning and affect, and how affect change mediates math learning outcomes


Area, perimeter, angles of triangles. Classification of special triangles such as right triangles.
10 / 62 problems done
In progress
The Number System - Review
5 / 35 problems done
In progress

MathSpring

Ugh! I often get discouraged when struggling with a math problem.

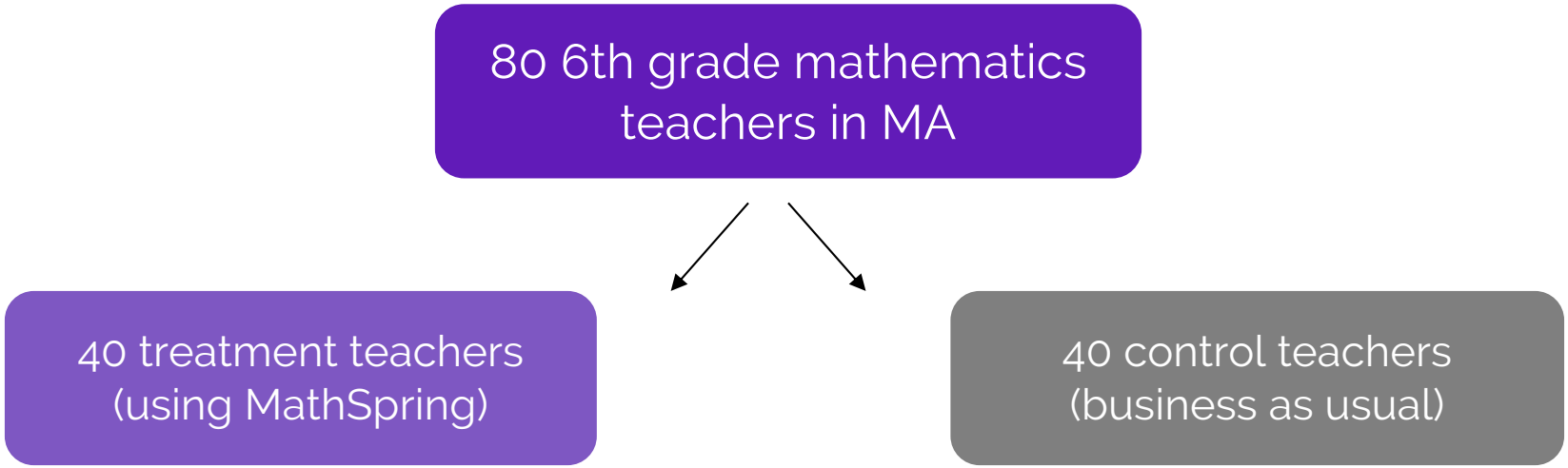

Confident
Excited
Bored
Focused
Frustrated
Anxious

MathSpring Features

- Personalized content that is customized to a student's performance level and affect.
- Multimedia help for students as they practice problem-solving.
- Students work with learning companions and receive affective support.
- Students reflect on their progress regularly and receive growth mindset messages.
- Diagnostic reports for teachers on student progress performance.

Research Questions and Study Design

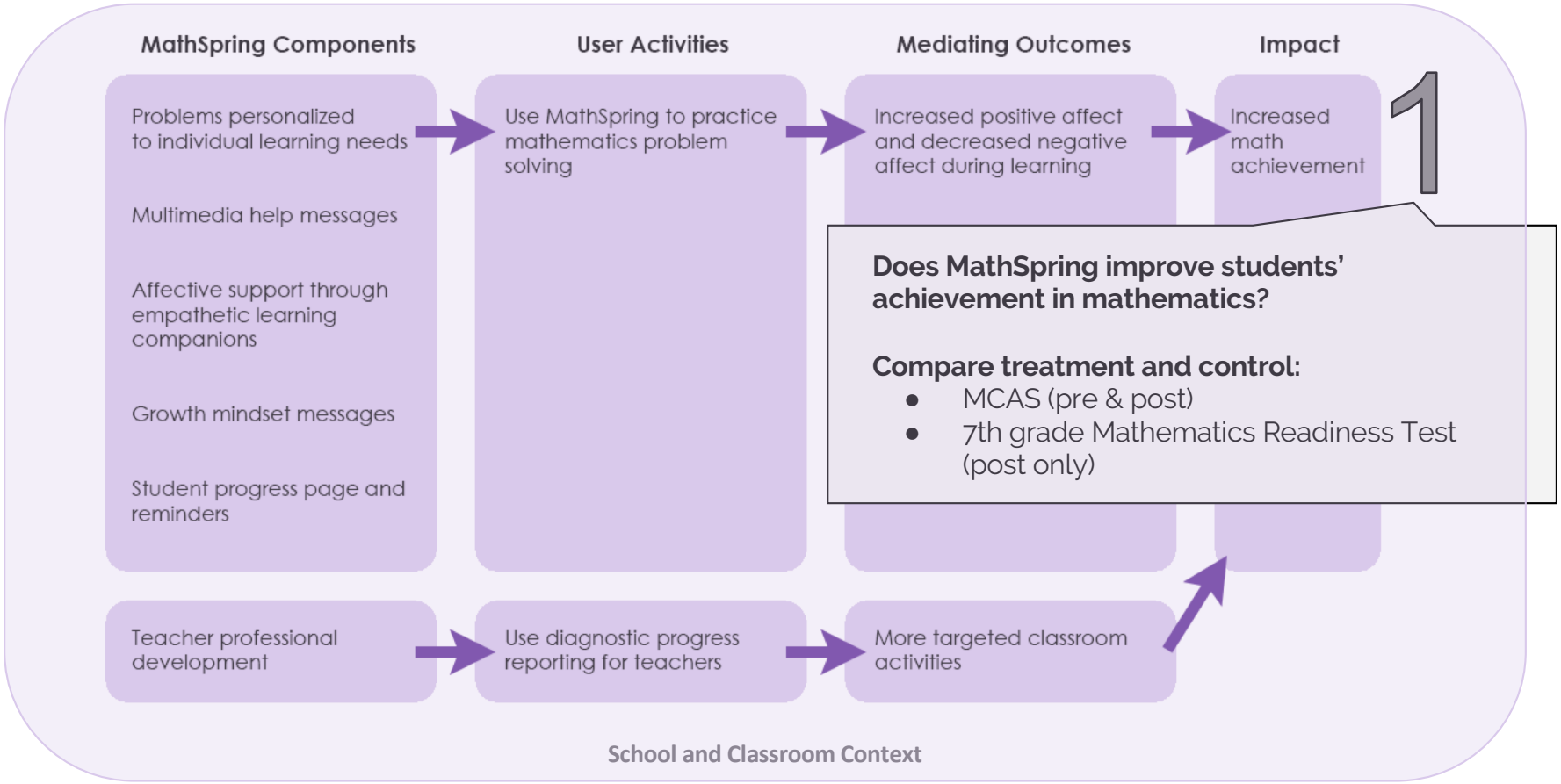
Study Design: Participants



All students in participating teachers' classrooms will be included in the study

➔ ≈4000 students across ≈160 and ≈40 schools

MathSpring Logic Model



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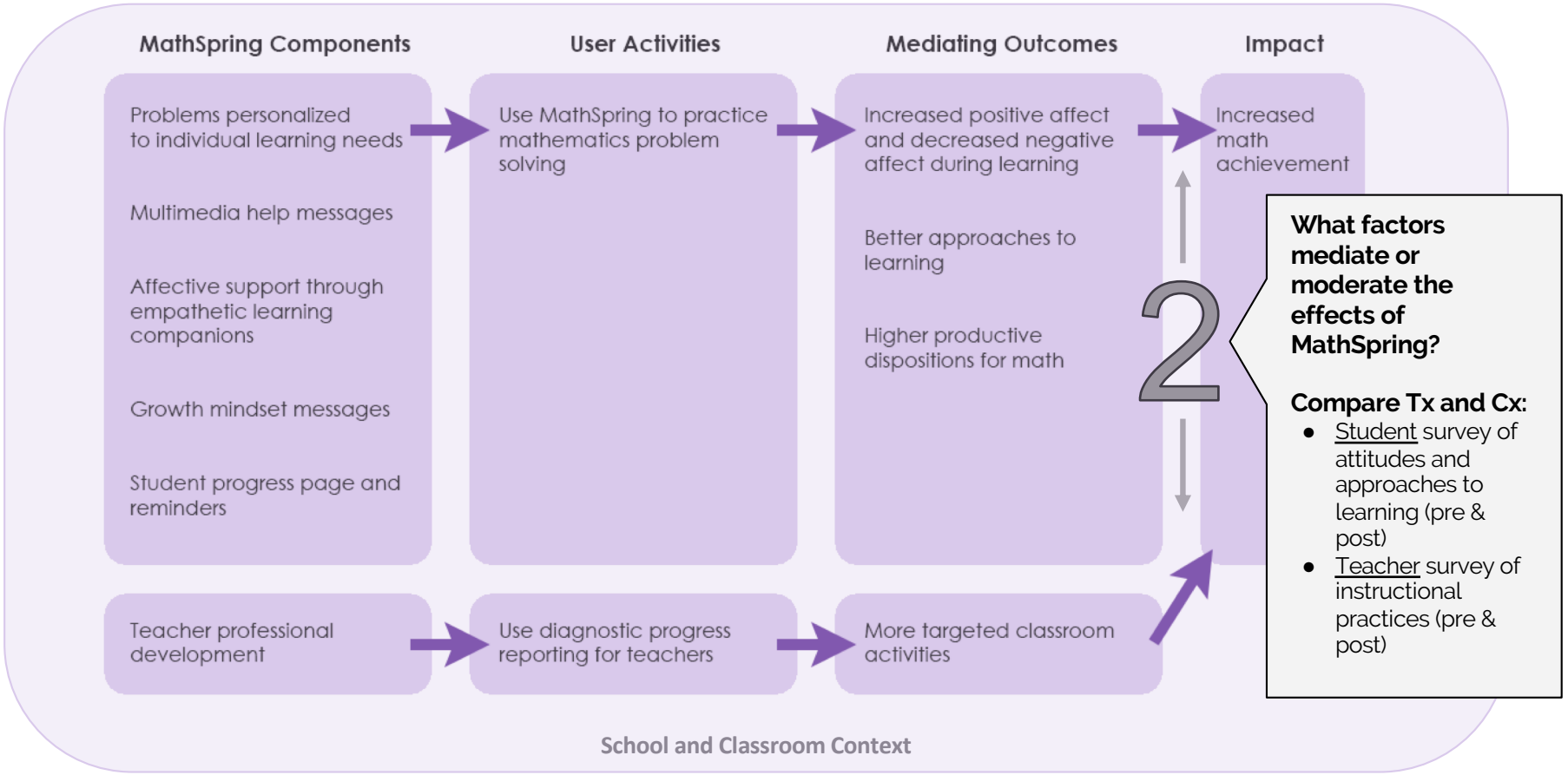

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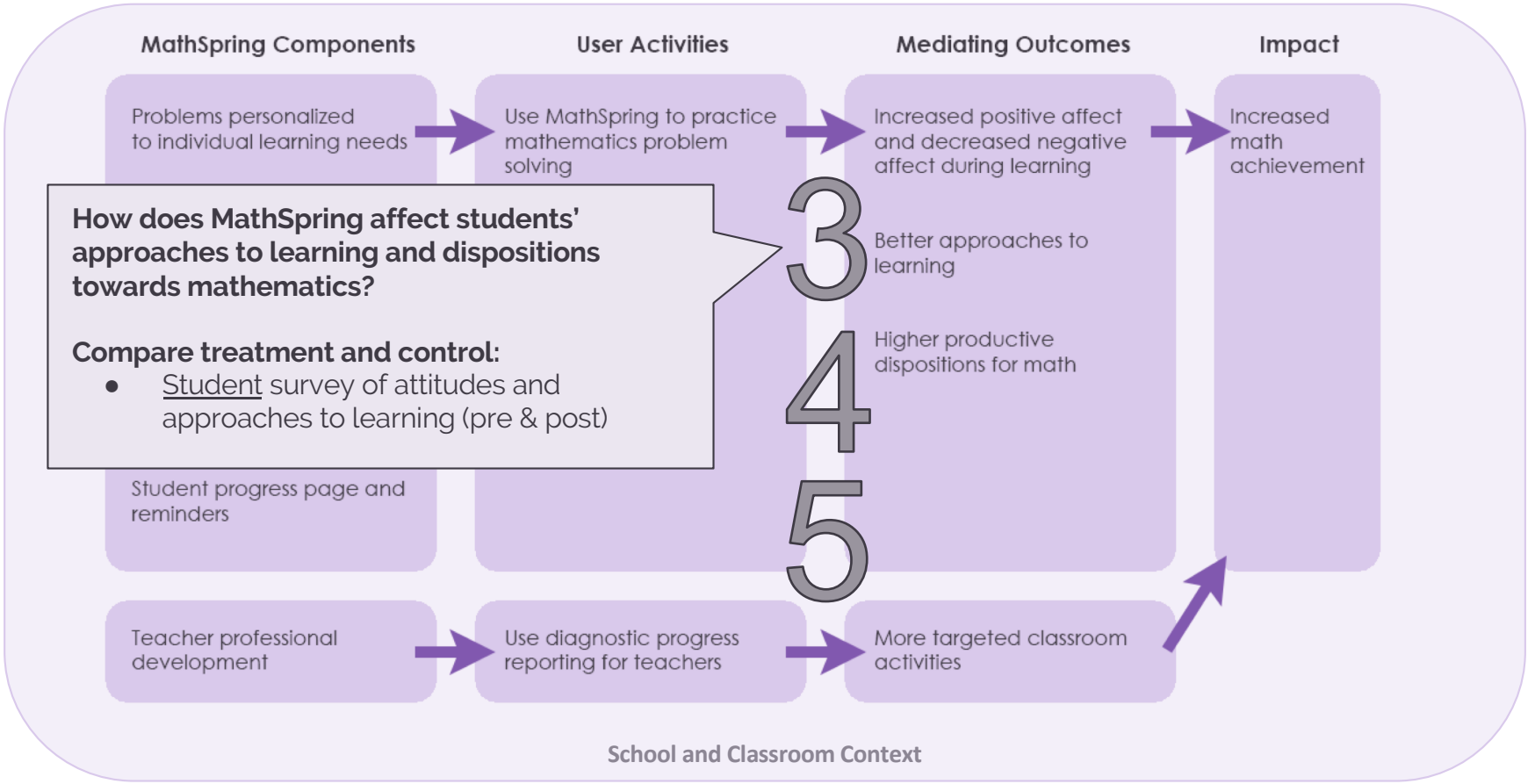
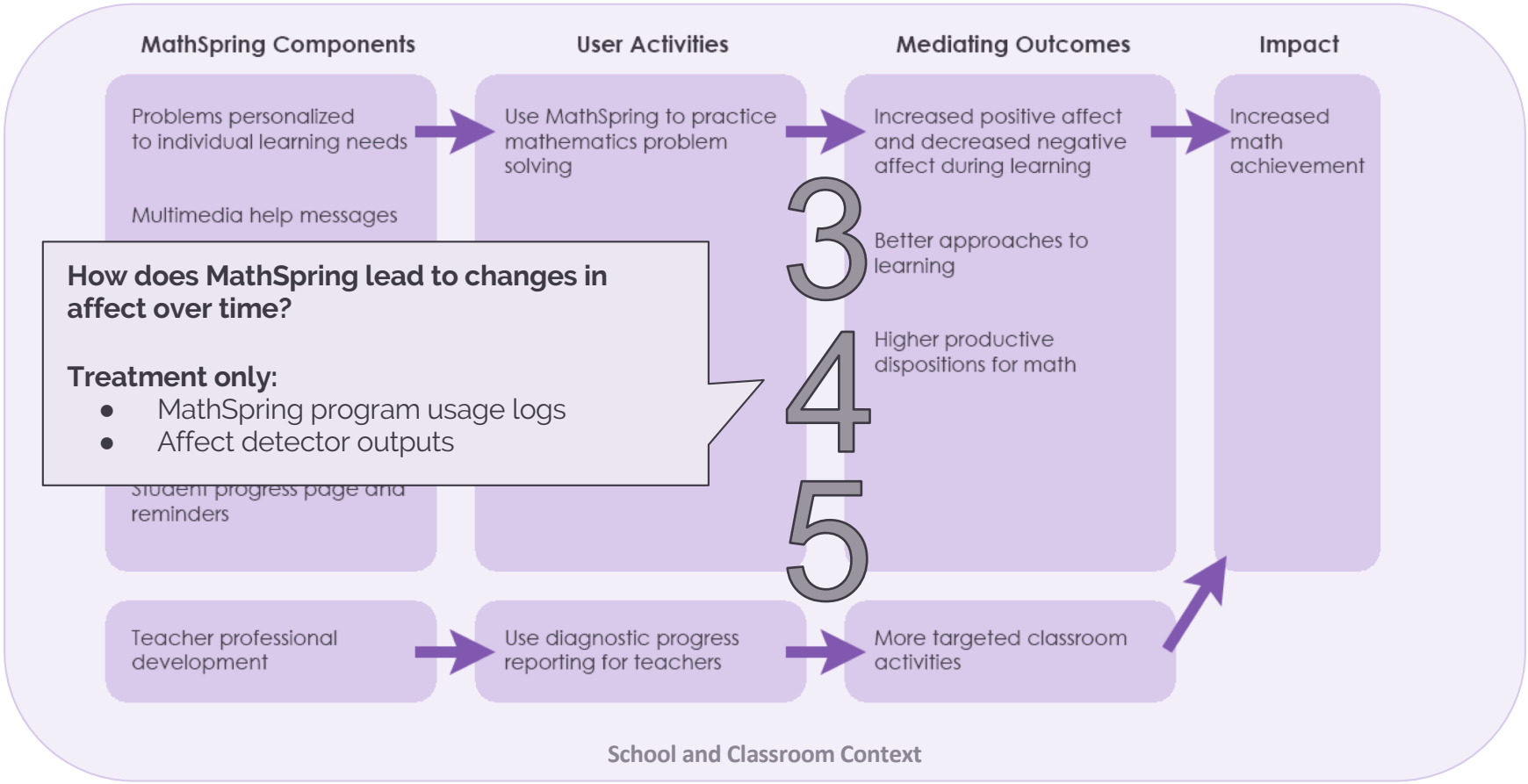
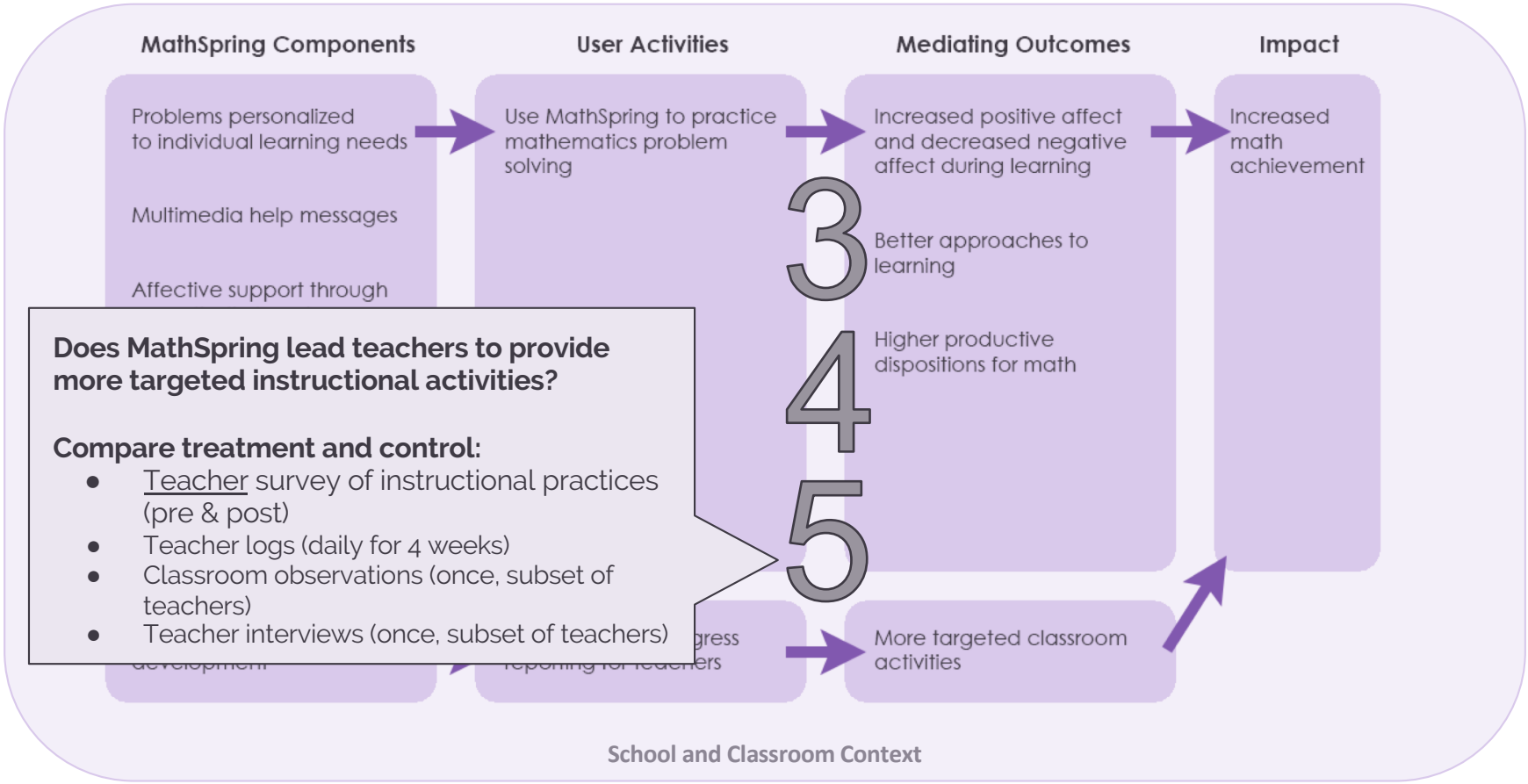


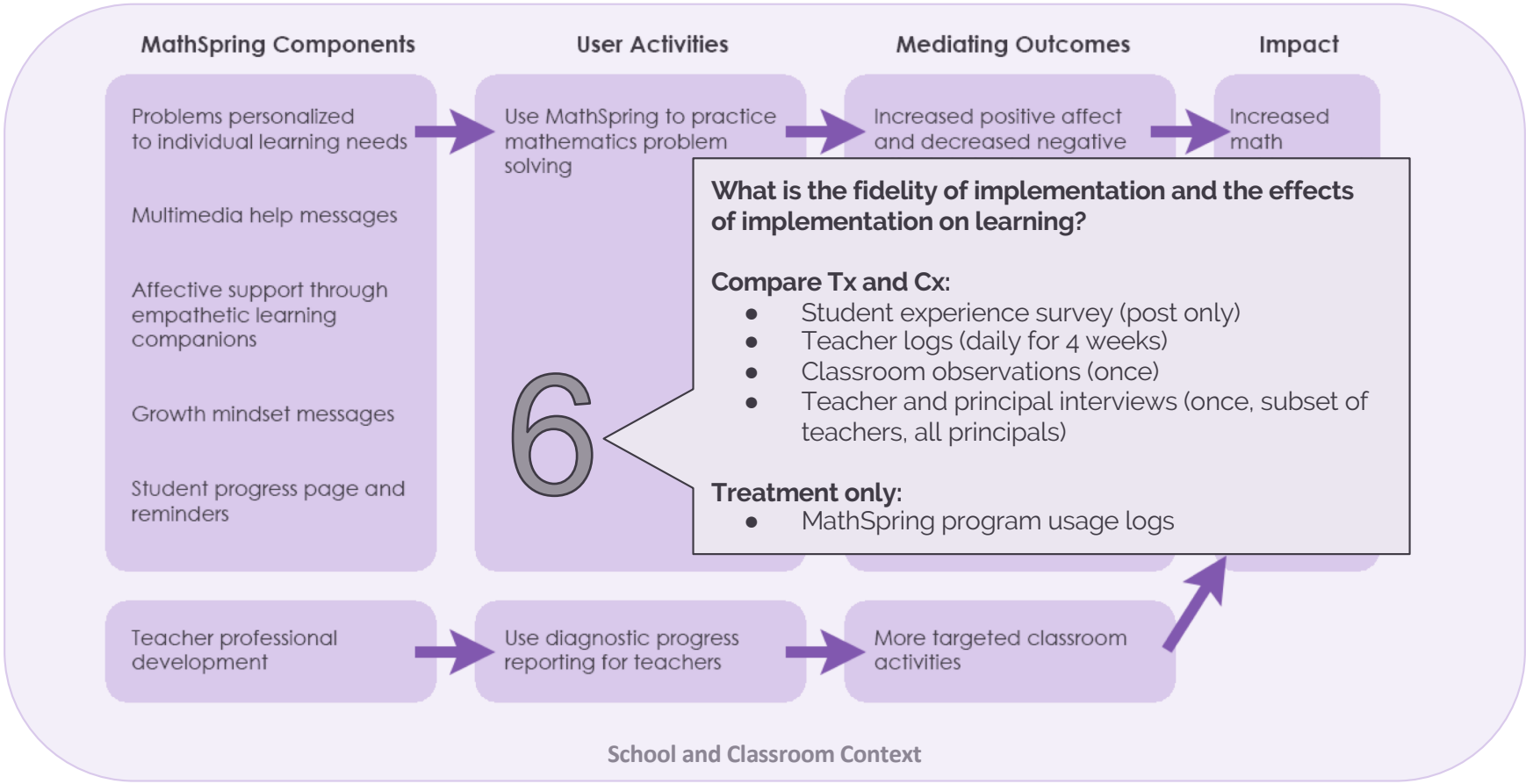
MathSpring Logic Model



MathSpring Logic Model



MathSpring Logic Model

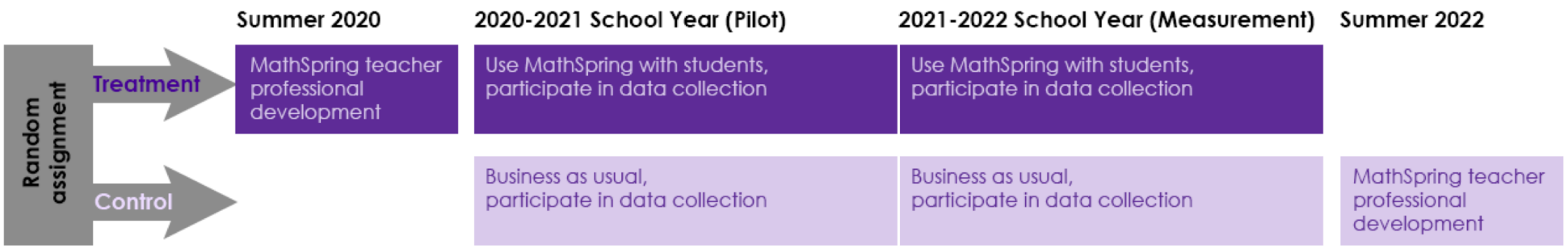


Data Collection and Analysis Summary

#	Research Question	Instruments	Data Analysis
1	**Does MathSpring improve students' achievement in mathematics?**	**Treatment and control** • MCAS (pre & post) • 7th grade MRT (post only)	Hierarchical linear modeling (HLM)
2	**What factors mediate or moderate the effects of MathSpring?**	**Treatment and control** • Student survey of attitudes and approaches to learning (pre & post) • Teacher survey of instructional practices (pre & post)	HLM and/or structural equation modeling (SEM)
3	**How does MathSpring affect students' dispositions towards mathematics?**	**Treatment and control:** • Student survey of attitudes and approaches to learning (pre & post)	HLM and/or structural equation modeling (SEM)
4	**How does MathSpring lead to changes in affect over time?**	**Treatment only:** • MathSpring program usage logs • Affect detector outputs	Exploratory learning analytics

Data Collection and Analysis Summary

#	Research Question	Instruments	Data Analysis
5	**Does MathSpring lead teachers to provide more targeted instructional activities?**	**Treatment and control:** • Teacher survey of instructional practices (pre & post) • Implementation logs (daily for 4 weeks) • Classroom observations (once, subset of teachers)) • Teacher interviews (once, subset of teachers)	
6	**What is the fidelity of implementation and the effects of implementation on learning?**	**Treatment and control:** • Student experience survey (post only) • Implementation logs (daily for 4 weeks) • Classroom observations (once) • Teacher and principal interviews (once, subset of teachers, all principals) **Treatment only:** • MathSpring program usage logs	
...	**Understand the contexts in which MathSpring is used**	• Teacher and principal interviews (once, subset of teachers, all principals)	

Study Procedure

Delayed treatment design