Enhancing the Teacher-Curriculum Relationship in Problem-Based Mathematics Classrooms by Connecting Teacher and Student Digital Collaborative Environments
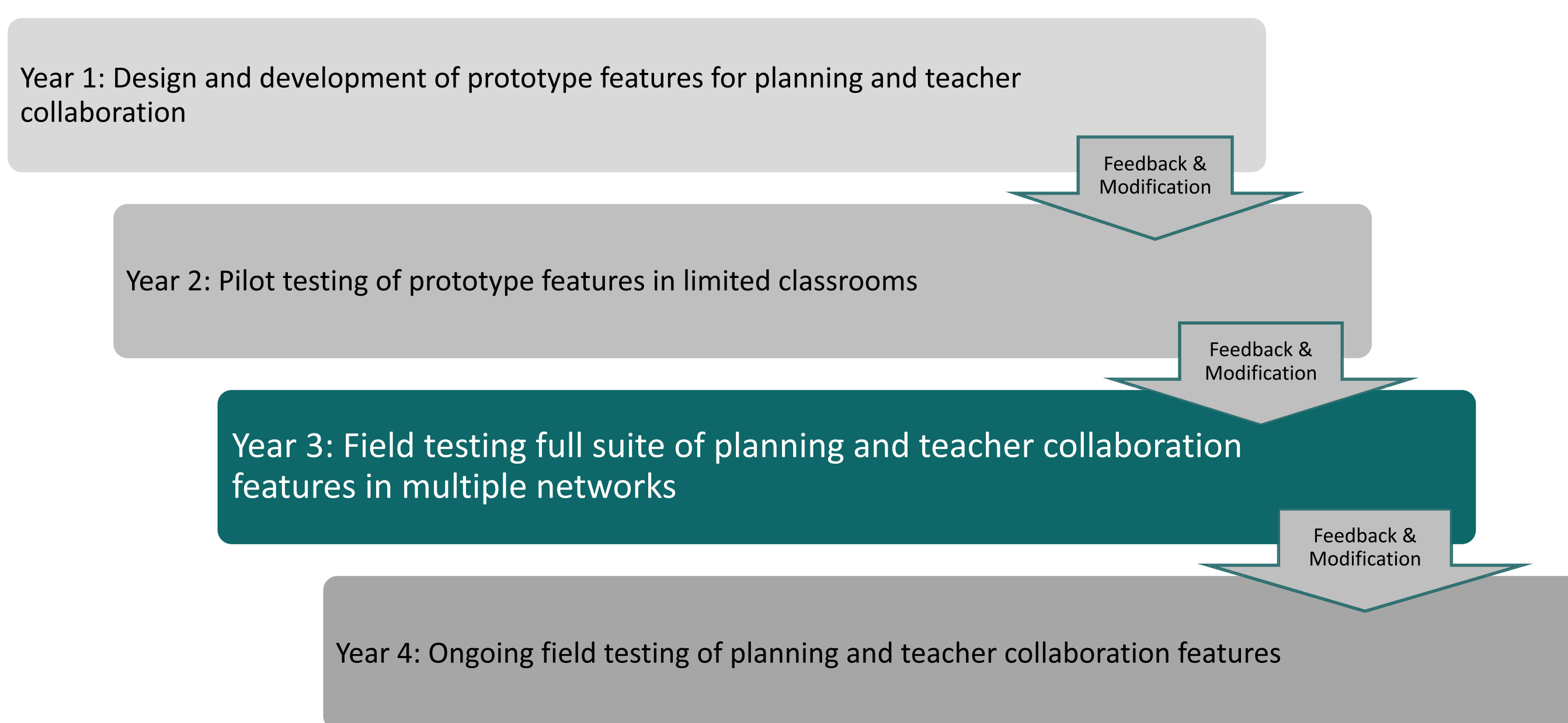
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Overview of Study

- Major goal is to design and develop a digital collaborative platform for networks of teachers to create, use, and share teaching resources for planning, teaching, and reflecting on student thinking.

- The teacher platform links to a student collaborative environment embedded with a problem-based middle-grades curriculum.

- With more classroom resources being created online, the project will help understand how digital mathematics teaching can be best supported.

- **Research question**: How do teachers in networks access, generate, use, and share teaching resources (including classroom artifacts) to support mathematics teaching (planning, enactment, and reflection of student thinking)?

Project Timeline: Design-Based Research

Year 1: Design and development of prototype features for planning and teacher collaboration

Feedback & Modification

Year 2: Pilot testing of prototype features in limited classrooms

Feedback & Modification

Year 3: Field testing full suite of planning and teacher collaboration features in multiple networks

Feedback & Modification

Year 4: Ongoing field testing of planning and teacher collaboration features

Participants and Data Sources

Participants
- Networks of 7th grade teachers and/or coaches
- Year 3: 5 networks which include 16 teachers/coaches and their students
- Networks are teachers and coaches from the same district
- Range in size from 2 teachers up to 2 coaches/5 teachers
- Variety of organization and structures, e.g., daily shared planning time vs. monthly grade-level meetings

Data sources
- Baseline electronic survey
- Teacher interviews
- Weekly reflection survey
- Data log files for teacher events in the digital platform

Analysis
- Data log files (i.e., teacher "button clicks" in the digital platform) are used to identify patterns of resource use for planning, teaching, and reflection.
- Analyze development over time and relationships across teachers and networks

Teacher Collaboration in Network
Case 1: A Teacher Duo In-Person

The two teachers met daily during shared planning time and projected the digital platform on the classroom wall.
- **Reflection:** they viewed students' digital work for that day's problem and discussed student thinking
- **Planning:** they viewed future CMP problems and identified mathematical learning goals and ways to support students

Co-creating teaching resources: During shared planning time they co-created digital problem documents for students. These documents typically contain:
- Materials copied or modified from the CMP curriculum
- Student or class work on prior problems
Documents were published to students, who could each create their own copy.

Ex. Viewing group work

The teachers copied this table and graph directly from the curriculum, to support students in reasoning about rate of change.

The teachers modified this text from the curriculum.
1. Increased blank space beneath questions "to give students room to explain"
2. Additional questions to help students compare multiple patterns of change

Shared digital space: The two teachers created a specific planning class in which they were co-teachers. They co-created teaching resources in this planning class, then used the digital platform to copy or publish them to any classes they chose to use them with students.

Teacher Collaboration in Network
Case 2: Teacher and Coach Asynchronously

The teacher and coach worked together virtually over three 7th grade units, via the digital platform, email, and Zoom.
- **Planning:** They focused on the CMP Teacher Guide to consider possible student thinking and ways to support their mathematical development over the unit.

Organization for asynchronous collaboration: All comments on shared curriculum materials were organized in a menu that navigated users directly to the content for each comment. The teacher and coach also communicated via email to determine problems and units for collaboration.

Asynchronous planning discussions: The teacher and coach used the the threaded discussion tool to place comments on specific content in the Teacher Guide for discussion. This included:
- Key mathematical ideas for the current unit
- Implementation suggestions for supporting students to develop key ideas
- Sharing relevant past teaching experiences

Shared digital space: The teacher and coach used the CMP Problems and Teacher Guide as a shared digital space in the collaborative platform where they both had access to the same curricular problems, mathematical inscriptions for students, and pedagogical suggestions for implementation.

Teachers' Individual Resource Use: Insights from Data Log Files

- Analysis of Year 2 log files suggests teachers typically access multiple types of resources (e.g., digital student work, Student Edition, Teacher Guide, colleagues' planning document) during work sessions in the digital platform.

Number of Resource Types Accessed per Work Session (n = 1355)

■ 1 ■ 2 ■ 3 ■ 4 ■ 5 ■ 6 ■ 7+
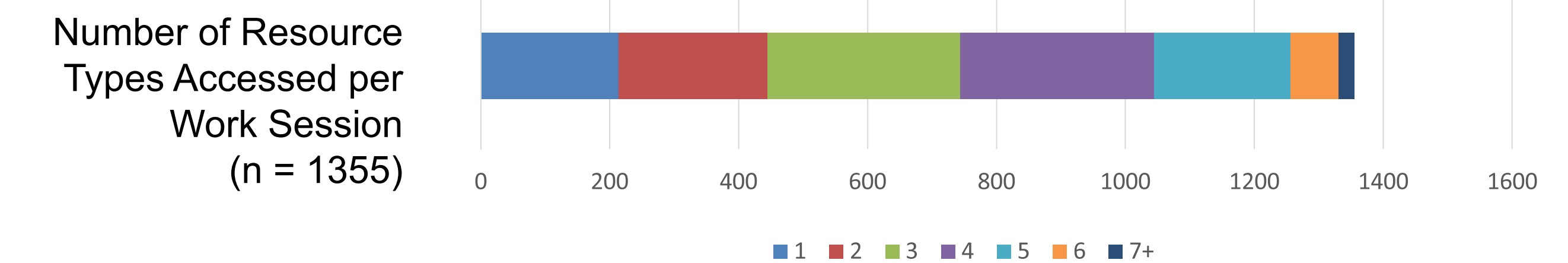
- Teachers also used the digital platform to look across multiple classes (~14.7% of sessions) and multiple problems (~17.0% of sessions).

- Whereas in non-digital planning and teaching it might be difficult to switch between multiple resources, in the digital platform teachers often switch back and forth between multiple resources during a work session.

Resource Use Over Time for Work Session 1081

Resource Use Over Time for Work Session 620
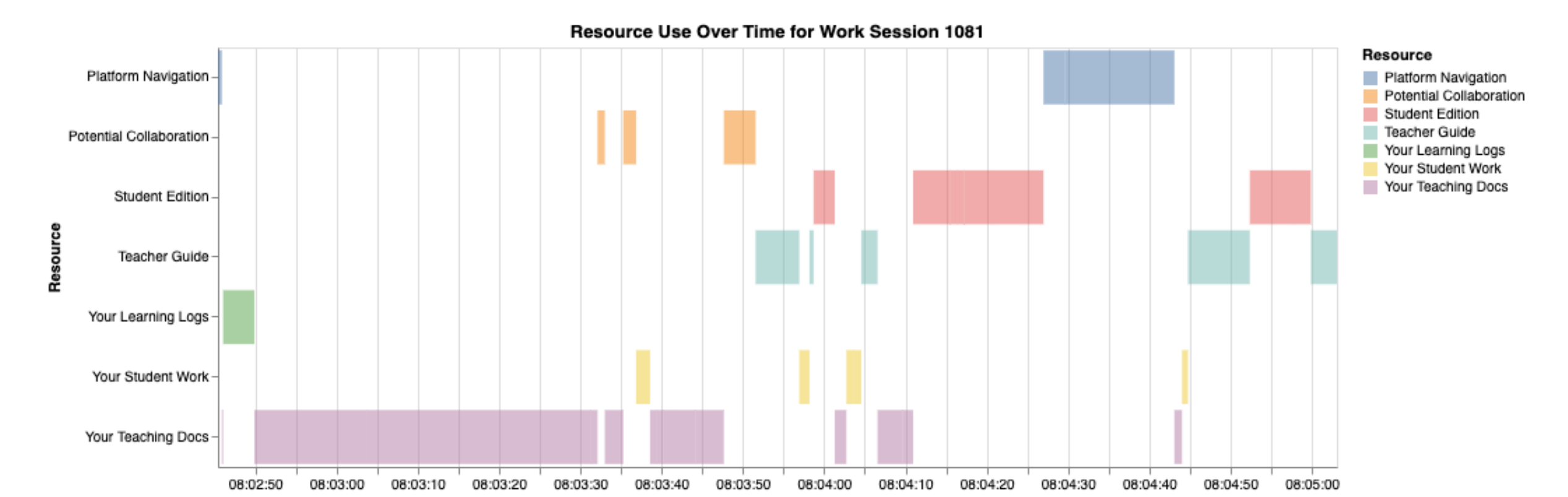
- We've observed that teachers might show different patterns of resource use depending on their purpose (e.g., planning vs. teaching) or over time as they engage students with different mathematical concepts.

Next Steps and Open Questions

- Year 3 data collection and analysis are ongoing, including digital log files and classroom video to capture teachers' collaborative practices.

- To better support teachers, our ongoing work includes how professional development for teachers can be provided in multiple formats to meet the needs of a variety of teaching networks.

- What factors influence teachers in networks to decide how to use digital resources?

- In what ways can the analytics data be used to illustrate different teacher networks' digital resource use and collaboration?