The INK-12 project is investigating how the combination of two technological innovations—pen-based input and wireless communication—can support classroom practices that teach two skills critical to mastering STEM disciplines: 1) creation and manipulation of representations for mathematical and scientific objects, and 2) communication of those representations and associated feedback. We are investigating how these capabilities, via a set of tablet computers, can support teaching and learning key mathematical and scientific concepts in upper elementary school. Pen-based interaction enables creation of inscriptions—handwritten sketches, graphs, notes, etc. which are critical in STEM fields, where context is often most easily expressed as a mixture of text and drawings. Wireless networking enables facile communication of inscriptions, and other representations, among teachers and students and supports formative assessment and classroom discussions directly based on student work.

This diagram illustrates the process by which we hypothesize that INK-12 technology can affect on students’ participation and learning. Students use tablets to write, draw, add graphics, annotate images etc. in an electronic lab notebook; they may use structured vocabularies (palettes) to support their creation. They submit their work to the teacher, who may respond privately to an individual or aggregate student work in order to choose several examples for public display and discussion. Artificial intelligence techniques can help the teacher by interpreting and aggregating student work; the use of structured vocabularies facilitates the interpretation process.

Research Questions

[Q1] How do inscriptions created using pen-based technology differ from those created using pen and paper?

[Q2] How do students’ inscriptions differ when using palettes—and the resulting structured vocabulary—vs not using them?

[Q3] What effect does the process of selecting and sharing student work have on student participation and learning?

[Q4] What tools, including interpretation and aggregation of student work, can help a teacher choose student work for discussion?