Overarching conception

Recognizing	*Accepting*	*Adapting*	*Exploring*	*Advancing*
● Teacher uses instructional technology for motivation only rather than subject matter development. All learning of new ideas presented by the teacher mostly without technology. ● Technology-based activities do not include inquiry tasks. Technology procedures do not provide space for students to use or make connections.	● Teacher uses instructional technology for subject matter development. However, a larger part of technology use is for teacher's demonstrations, which include presentation of new knowledge. ● Technology-based activities do not include inquiry tasks. Technology procedures, however, provide space for students to use or make connections.	● Teacher uses instructional technology as a way to enhance student learning. This use of technology supports subject matter development. ● Technology-based activities include structured inquiry tasks towards intended ideas. Technology procedures concentrate on mathematical or scientific tasks that use or make connections.	● Teacher plans for instructional technology to be used mostly by students who explore and experiment with technology for subject matter development. ● Technology-based activities include guided inquiry tasks. Technology procedures concentrate on doing mathematics or science while using or making connections.	● Teacher develops instructional technology tasks for students that provide them with deeper conceptual understanding of subject matter. ● Technology-based activities include open inquiry tasks of high cognitive demand. Technology procedures concentrate on tasks that use or develop deep mathematical or scientific knowledge representing connections and strategic knowledge.

Knowledge of student understanding

Recognizing	*Accepting*	*Adapting*	*Exploring*	*Advancing*
● Teacher uses instructional technology in a way that does not support student thinking and learning of new content. ● Digital materials only provide space for student practice and drills.	● Teacher uses instructional technology in a teacher-led student-follow format without focusing on students' thinking. ● Digital materials for students mirror the structure of the traditional textbook presentation of mathematics or science.	● Teacher structures students' use of instructional technology to promote student thinking of mathematics or science. ● Digital materials provide an environment for students to engage in active explorations of mathematics or science with teacher guidance.	● Teacher facilitates students' use of instructional technology to develop thinking leading to conceptual understanding of mathematics or science. ● Digital materials provide an environment for students to deliberately take mathematically or scientifically meaningful actions on objects, but the teacher still guides students to see the meaningful consequences of those actions.	● Teacher facilitates students' use of instructional technology to develop higher order thinking leading to deep understanding of mathematics or science. ● Digital materials provide an environment for students to deliberately take mathematically or scientifically meaningful actions on objects and to immediately see the meaningful consequences of those actions.

Knowledge of curriculum

Recognizing	*Accepting*	*Adapting*	*Exploring*	*Advancing*
● Teacher selects instructional technology that is not aligned with curriculum topics. ● Students' tasks with technology do not support making connections between topics in the curriculum.	● Teacher selects instructional technology that is partially aligned with one or more curriculum topics. Technology use is not at all effective for the curriculum topics. ● Students' tasks with technology support making connections between topics in the curriculum.	● Teacher selects instructional technology that is aligned with curriculum topics, but only replaces non-technology-based tasks with technology-based tasks. Technology use is not fully effective for the curriculum topics. ● Students are given curriculum-based tasks with technology to develop a basic understanding of curriculum topics with teacher guidance.	● Teacher selects instructional technology that is aligned with curriculum topics, and provides an alternative way of topic exploration. Technology use is effective for the curriculum topics. ● Students are given curriculum-based tasks with technology and are asked to expand mathematics or science ideas on the basis of technology explorations.	● Teacher selects instructional technology that is aligned with curriculum topics, but also challenges the traditional curriculum by engaging students in learning quite different topics with technology. Technology use is highly effective for the curriculum topics. ● Students' tasks with technology focus on deepening understanding of mathematics or science concepts, and making connections between topics in and out of the curriculum.

Instructional strategies

Recognizing	*Accepting*	*Adapting*	*Exploring*	*Advancing*
● Teacher focuses on how to use instructional technology rather than how to explore mathematics or science ideas. ● Digital materials are built around drill and practice only.	● Teacher structures lessons without student explorations with instructional technology. The instruction is teacher-led. ● Digital materials are built around delivery of information as well as drill and practice.	● Teacher uses a deductive (teacher-directed) approach to teaching with instructional technology to maintain control of the progression of the exploration activities. ● Digital materials are built around learning objects but do not promote student reflection.	● Teacher uses deductive and inductive instructional strategies that support students' thinking about mathematics or science. ● Digital materials are built around learning objects and explicitly promote student reflection, especially the posing of questions for sense-making.	● Teacher mostly uses multiple inductive instructional strategies that support students' experimentation of the mathematics or science ideas with instructional technology. ● Digital materials are built around learning objects and explicitly promote student reflection - especially the posing of questions for sense-making and reasoning, including explanation and justification.

References:

Lyublinskaya, I. & Tournaki, E. (2012) The effects of teacher content authoring on TPACK and on student achievement in Algebra: Research on instruction with the TI-Nspire handheld. In R. Ronau, C. Rakes, & M. Niess (Eds.*), Educational Technology, Teacher Knowledge, and Classroom Impact: A Research Handbook on Frameworks and Approaches*. Hershey, PA: IGI Global.

Kaplon-Schilis, A. & Lyublinskaya, I. (2021, April 8-12). Analysis of differences in the levels of TPACK: Unpacking performance indicators in the TPACK Levels Rubric [Paper presentation]. *AERA 2021: Accepting educational responsibilities*.