Title: Developing and Implementing Teacher Inquiry Practice Supports for Remote and In-Person Instruction  
Authors: Amy Adair, Rachel Dickler, & Janice Gobert  
Presenter: Amy Adair  
Abstract: In both in-person and remote settings, it is challenging for teachers to support their students in developing their competencies with science inquiry practices, as defined by the Next Generation Science Standards. To help guide teachers in scaffolding their students’ specific difficulties with the inquiry practices as they are working on virtual labs in an intelligent tutoring system environment, we developed Teacher Inquiry Practice Supports (TIPS). TIPS appear within real-time alerts sent to the teacher on a dashboard connected to the intelligent tutoring system. In this presentation, we will discuss the TIPS development process as well as preliminary results around how middle school teachers have used TIPS in both remote and in-person learning contexts, which will inform future iterations of the TIPS design.

Title: A Comparison of Teaching Efficacy between Paraprofessionals and Special Education Teachers Working with Special Education Students  
Authors: Cristhian C. Altamirano, Dake Zhang, & Joan Hill-Powell  
Presenter: Cristhian C. Altamirano  
Abstract: This study aimed to (1) examine how efficacious paraprofessionals are compared to special education teachers, (2) compare their efficacy in four domains identified to be desired for teaching special education (i.e., academic instruction, behavioral management, assessment, and professional ethics), and finally, (3) to also identify what demographic or background factors are significant to their efficacy in the four domains. We surveyed 41 paraprofessionals and 18 special education teachers using a validated scale (i.e., Student Teachers’ Efficacy in Teaching Students With Disabilities (STETSD) Scale). Results suggest that (a) on average, paraprofessionals are less efficacious than special education teachers in all four desired domains, (b) paraprofessionals are less efficacious in academic instruction and assessment, and (c) paraprofessionals’ age impacts their efficacy in academic instruction and behavioral management.

Title: Cross-sectional Study of a Genetics Learning Progression: Mapping an Understanding of Genetics  
Author/Presenter: Moraima Castro-Faix  
Abstract: Learning progressions (LPs) are descriptions of the pathways that learners may take as they develop more sophisticated ways of reasoning about core ideas and practices over the course of schooling (Smith et al., 2006). LPs take into consideration the prior knowledge and skills of learners to define the lower levels (lower anchor) of their knowledge and skills and aim to help students achieve targeted understandings needed for literacy in the field (upper anchor.). In genetics, there are three learning progressions that have been developed independently. The main differences between these progressions are the assumptions about the ordering of concepts in genetics. To address this gap, we aimed to study a learning progression in genetics with the purpose of studying how learning develops under “status-quo” instruction and describing learning in the domain across several grades (middle school to high school). Additionally, we aim to identify if students’ ideas given status-quo instruction fit better with one of the three hypothetical progressions We found that in genetics, it seems the integration between the ideas in a progression increase over time in the course of schooling with students at the undergraduate and graduate level being more consistent about their ideas but also connecting across constructs.
Title: Using a Teacher Dashboard to Support Students in STEM Remotely
Author/Presenter: Rachel Dickler
Abstract: Teacher dashboards provide real-time data on students’ performance within online environments, which could make them particularly valuable tools during remote learning when teachers have limited opportunities for monitoring student progress. Few dashboards, however, report on students’ critical Science, Technology, Engineering, and Mathematics (STEM) practices. Inq-Blotter is one of the few teacher dashboards that provides data and alerts to teachers on students’ performance on STEM practices within an Intelligent Tutoring System, Inq-ITS. In the present study, I examined the remote use of Inq-Blotter within three high school STEM teachers’ classrooms and the corresponding relationship to students’ STEM practice performance. Findings revealed that students who were helped by a teacher remotely (in response to a dashboard alert) significantly improved on the STEM practice on which they were helped. Implications will be discussed for the future design and use of dashboards in remote STEM education settings.

Title: Students’ Justifications for Epistemic Criteria for Good Scientific Models
Authors: Danielle Murphy, Ravit Golan Duncan, Clark Chinn, Joshua Danish, Cindy Hmelo-Silver, Zach Ryan, Morgan Vickery, & Christina Stiso
Presenter: Danielle Murphy
Abstract: Scientists use epistemic criteria to evaluate products of scientific inquiry, such as models. Engaging students with epistemic considerations as part of scientific practice is a growing focus of science education. Recent research has shown that students are able to identify and describe criteria for good scientific models. However, we know little about how students reason about and justify why specific criteria are important and which criteria may be more important. In this study we explore these questions using data from interviews with 5th grade students. Interviews were conducted after a five-week model-based inquiry intervention and focused on students’ reasoning about a set of criteria for good models developed by the class. Our findings illustrate the array of justifications provided regarding the importance of different criteria in their own right and relative to other criteria. We share implications for supporting students’ use and evaluation of epistemic criteria in scientific practice.

Title: Remote Robotic Telescopes in Education
Author/Presenter: Mariel O’Brien
Abstract: NGSS-aligned investigations center on phenomena, but the limitations of astronomy students’ ability to undertake observations - timing, light pollution, weather, and the need for advanced, equipment and expertise – is a barrier. Therefore, teachers rely on representations, such as images, models and simulations. With the return of astronomy to US schools, there is a pressing need to provide access to authentic phenomena. Advances in technology have allowed students to observe and image astronomical objects through online access to remote telescopes, however, there is no peer-reviewed research as to student learning outcomes when doing so. In collaboration with teachers and astronomers at the remote telescope platform, Slooh, I have designed an NGSS-aligned curriculum, along with assessments. Employing the principles of design based research and the assessment model of evidence centered design, my research will measure students’ competencies as they engage in three-dimensional tasks connected to NGSS Earth and Space Science performance expectations.
Title: Two-Step Q-matrix Estimation (TSQE) Method  
Authors: Chia-Yi Chiu, Hans-Friedrich Kohn, Olasumbo O. Oluwalana, & Jiaxi Wang  
Presenter: Jiaxi Wang  
Abstract: Cognitive diagnosis models (CDMs) classify examinees based on their observed responses aiming to provide information about their mastery and non-mastery of a set of fine-grained attributes required to respond correctly to test items. The Q-matrix (Tatsuoka, 1985) that indicates the item-by-attribute associations is the centerpiece of any CD analysis. Several methods for estimating the Q-matrix are currently available; however, up to date, these methods can only be used with data conforming to the DINA model (Junker & Sijtsma, 2001), which limits their applicability. The two-step Q-matrix estimation (TSQE) method that integrates the factor analysis to a Q-matrix refinement/validation method is proposed in the study to estimate the Q-matrix. The TSQE method can be used with any CDM and is computationally very economical. The simulation shows that it outperforms the existing methods under the studied conditions.

Title: Nonparametric Classification Method for Multiple-Choice Items in Cognitive Diagnosis  
Authors: Chia-Yi Chiu & Yu Wang  
Presenter: Yu Wang  
Abstract: Cognitive diagnostic models (CDMs) aim to estimate the mastery and nonmastery of attributes for examinees. Numerous CDMs have been developed; however most of them can only be used to analyze dichotomous responses. For polytomous data, dichotomization is thus needed to fit the data with these CDMs, which in turn, may cause information loss. Multiple-choice (MC) format commonly used in STEM education is a case in point that potentially useful information underlying the distractors is ignored by dichotomization. In response to this issue, the MC-DINA model (de la Torre, 2009) was proposed. However, the MC-DINA model performs well with large-scale assessments but may become less effective when applied to small-scale data. In this study, a nonparametric classification approach for analyzing MC items (MC-NPC) is proposed. The simulation study shows that the MC-NPC method outperforms the MC-DINA model and the traditional CDMs for dichotomous data when the samples are small.