

LOCUS: Levels of Conceptual Understanding in Statistics

LOCUS: Levels of Conceptual Understanding in Statistics is a full research and development project that addresses DR K-12 Program Challenge 1 (How can enhanced assessments of student knowledge and skills advance preK-12 STEM teaching and learning?). As a part of the project, instruments will be developed to assess statistical understanding across three levels of development as identified in the *Guidelines for Assessment and Instruction in Statistics Education* (GAISE). The intent of these assessments is to provide teachers, educational leaders, assessment specialists, and researchers with a valid and reliable assessment of conceptual understanding in statistics consistent with the Common Core State Standards (CCSS).

LOCUS addresses one of the major calls for research and development in the statistics education community – the assessment of students’ conceptual understanding of statistics at various developmental levels. There is intellectual merit in assessing the understanding of statistics in terms of developmental levels (e.g., Watson, 1997; Watson & Callingham, 2003; Watson, Kelly, Callingham, & Shaughnessy, 2003). The intent of the GAISE framework was to use developmental levels to address both assessment and instruction; however authors of the framework acknowledge that the resulting document focused only on instruction. Evidence of this acknowledgement and support for the intellectual merit of LOCUS is underscored by the fact that every author of the GAISE framework as well as the President-Elect of the National Council of Teachers of Mathematics (NCTM) has committed to serving on this project. The instruments to be developed for this project will integrate the two-dimensional model of the conceptual structure for statistics education as described in the GAISE framework with the CCSS to create a valid and reliable assessment of statistical content knowledge.

More broadly, LOCUS will provide a tool to characterize students’ understanding at each of the levels described in the GAISE framework. The dissemination plan for the assessments will include resources for classroom teachers to utilize the assessments in a formative manner with a goal of transforming their instruction of statistics. Furthermore, examples of student thinking will be provided at each level of understanding. These commentaries and direct connections to the GAISE framework will close the assessment gap that is missing from the GAISE document. Once this loop is closed and there is a common understanding regarding the types of thinking that should be developed and assessed in the curriculum, teachers can be adequately prepared to teach statistics at the level described by the American Statistical Association and NCTM. This description is consistent with the recommendations for statistical content in the College and Career Readiness Standards.

One of the obstacles toward teaching statistical understanding as described in the GAISE framework is the way that it is currently being assessed on many large-scale assessments (Friel, Bright, Frierson, & Kader, 1997; Gal & Garfield, 1997, Konold, 1995). Since experts and leading researchers in statistics education will be developing the instruments, these assessments should provide a valid and insightful view into students’ understanding of statistics when they are disseminated to the education community. These assessments will also provide an example of how leaders in the field believe statistical concepts should be tested and thus may have an impact on the types of questions that appear on large-scale assessments.

The dissemination of results from LOCUS will include data on K-12 students’, preservice teachers’, and inservice teachers’ understanding of statistical concepts. Looking at the results across these three categories will help characterize the current status of understanding and will inform future directions aimed at improving statistics education in the United States.