STUDENT CONCEPTUALIZATION OF THE INTERPRETATION OF THE CONFIDENCE INTERVAL AND THE CONFIDENCE LEVEL: IDENTIFYING SIMILARITIES AND DIFFERENCES IN STUDENT CONCEPT IMAGES OF CONFIDENCE INTERVALS

by

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ABSTRACT

A world beyond $p < 0.05$ requires researchers to be mindful of reporting their statistical results. Confidence intervals are one of several ways to improve communication of inferential results. While initial research of the (mis)conceptions of confidence intervals published researchers and students hold exists, little research has focused on the cognitive development required to understand confidence intervals robustly. This dissertation study aimed to identify similarities and differences among aspects of individuals' concept image of confidence intervals, focusing on the interpretation of confidence intervals and interpretation of confidence levels.

Initial concept images (Tall & Vinner, 1981) and developmental clouds (Thompson et al., 2014) for the concept of confidence intervals were developed to guide the creation of the interview protocols used in this dissertation study. Participants took part in task-based interviews focused on conceptualizations of the interpretation of confidence intervals and the interpretation of confidence levels. A thematic analysis of

eleven participants' interviews was conducted using the hypothesized concept images and methodology proposed by Powell et al. (2003).

In addition to confirmation of (mis)conceptions reported in the literature, three new conceptualizations of the interpretations were found: 1) using the capture/not capture explanation or 2) using the long-run interpretation of the confidence level as the interpretation of the confidence interval, and 3) discussing the connection between the confidence level and the width of the confidence interval. While five dimensions of an individuals' concept image of confidence intervals were identified as aspects of similarities and differences that may lead to different conceptualizations of interpretations, this dissertation study focused on two: 1) the word confident and 2) the concept of the confidence level. Themes among the participants' conceptualizations of confident and confidence level were identified. Frameworks were proposed for classifying conceptualizations of the interpretations, the word confident, the concept of confidence level, and the concept of confidence interval.

Future research is needed to identify productive and nonproductive paths for development of a robust concept image for confidence intervals. Implications for teaching include a proposed method for introducing confidence intervals that focuses on developing the concept of coverage probability.

INDEX WORDS: Statistics Education, Confidence Intervals, Interpretation of Confidence Interval, Interpretation of Confidence Level, Confident, Confidence Level, Concept Image, Developmental Cloud