

Appendix A

Brief Summary of Initial Study

To inform the direction of the current study, an initial study was conducted using extant data and items from the High School Longitudinal Study: 2009 (HSLS:09) (Ingels et. al, 2011). In the initial study, we used a four-factor model that was based on Jolly, Campbell, and Perlman's (2004) model entitled *Engagement, Capacity and Continuity: A Trilogy for Success* and Boykin and Noguera's (2011) text entitled *Creating the Opportunity to Learn: Moving from Research to Practice to Close the Achievement Gap*. There was some overlap and some unique components of both models, thus the commonalities and unique components of both models were combined to form a four-factor model that consists of engagement, capacity, continuity, and guiding functions.

First, we defined engagement as students' interests and attraction to mathematics or science, eagerness to learn, and persistence. Both Jolly, Campbell, and Perlman's (2004) and Boykin and Noguera's (2011) model emphasize the importance of engagement. As described in the literature review, they both espoused key sub-components of engagement to include cognitive, behavioral, affective engagement. In addition, Jolly and colleagues emphasized the importance of vocational engagement. Second, we defined capacity, a component of Jolly and colleagues' model, as acquired knowledge and skills to advance to rigorous quantitative content. Third, we defined continuity, another component of Jolly and colleagues' model, as the institutional and programmatic opportunities, resources and guidance that support advancement to rigorous content in science and other quantitative disciplines. Although continuity is not named in Boykin and Noguera's model, institutional and programmatic opportunities are indeed addressed through concepts such as teacher expectations, teacher-student relationship quality, opportunities for collaboration, alignment between teacher and student values, interests, and priorities. Fourth, we defined guiding functions, which are unique to Boykin and Noguera's model, as student beliefs and adaptive learning postures such as self-efficacy, self-regulated learning, and incremental ability beliefs. Accordingly, we used the four-factor model to guide the development of the initial study.

After identifying the four-factor model as the theoretical framework for our study, we selected survey items from the High School Longitudinal Study: 2009 (HSLS:09) (Ingels et. al, 2011) to assess the reliability and validity of our proposed model. We identified 104 items that seemed to fit our theoretical framework. Thereafter, members of the research team from the initial study completed surveys to assess the level of agreement regarding whether the content of the selected items matched one of the four factors. Disagreements were discussed and items were retained if a sub-group of the research team reached 75% agreement (e.g. 3 of 4 members agreed).

Thereafter the research team used a model generation approach (Joreskog, 1993) that consisted of principal components analysis for data reduction and confirmatory factor analysis to

assess how well the data fit with our proposed model. Results indicated that a 13-item, five-factor model fit best with our data rather than the original four factor model. The retained factors were engagement, capacity, continuity, and guiding functions. Yet, continuity was divided into two factors, teacher interactions with other teachers and teacher interactions with students. We also faced challenges when trying to confirm the capacity variable using the data provided in the HSLS:09 survey. Thus, we created an item by using a weighting procedure to multiply the student's eighth grade math course by the associated grade earned in the eighth-grade math course. Thereafter, we were able to retain the capacity variable. Since our initial study was limited by existing data, we used findings from the initial study to develop the survey used in this current study.