2015-2016 Novel Clinical and Translational Methods (NCTM) Pilot Program Application

Name(s): Karen Caplovitz Barrett, Ph.D. & Krisztian Jozsa, Ph.D., Dr. Habil.

Department(s) and School/College: Hum. Dev. & Fam. Studies, Colorado State University; University of Szeged, Szeged, Hungary

Project Title: Computer tablet-administered behavioral and physiological assessment of school and learning-related anxiety and self-regulation in early childhood.

Applying for:

- **Phase I (Identify Novel Methodological Development Need)**
- **Phase II (Novel Method Development Plan)**

This application qualifies as:

- Underserved and Minority Investigator
- **Female Principal Investigator**
2. Specific Aims. The proposed project has two specific aims: 1. To develop an android-based computer app version of a set of child-friendly “games” to assess school-related skills—Executive Functions (Working Memory, Mental Set Switching, and Inhibitory Control) and Focused Persistence in the face of challenge; and 2. To enable this app to collect data about success and persistence during the school-related tasks and also video and cardiovascular data both during these tasks and during assessments of children’s responses to video clips of neutral, pleasant, and mildly fear-inducing parts of an animated children’s film (the Lion King). Videorecording children during the tasks will enable us to capture children’s facial expressions and visual attention to the tasks. The cardiovascular data will be exported to a computer program that estimates Respiratory Sinus Arrhythmia (RSA), a physiological measure of parasympathetic influence on the heart. These will provide measures of physiological regulation of school-relevant anxiety during the school-related tasks and of temperamental risk for the development of anxiety disorders based on the mildly fear-inducing video clips, as compared to the other clips from the same movie. It will enable us to identify children who may be at risk for anxiety difficulties. In addition, it will enable us to answer questions about the relations of temperamental anxiety-proneness and school-related anxiety to children’s responsiveness to school-based social-emotional preventive interventions, as well as the role of anxiety-proneness in school readiness and school success. The requesting investigators are Karen Caplovitz Barrett, Ph.D., a professor of Human Development at Colorado State University and Community and Behavioral Health at Colorado School of Public Health, and Krisztian Jozsa, Ph.D., Associate Professor and Deputy Head of the Institute of Education, University of Szeged, Hungary. Also important to the project will be our RSA consultant, Professor Paul Hastings, Ph.D. of University of California, Davis.

3. Rationale. The proposed novel method would address a crucial need—for an inexpensive, easy-to-use tablet app-based assessment of anxiety-proneness and school-related anxiety and performance. This app could provide an individual, objective assessment that could be used to assess the need for intervention, as well as the type of intervention needed (school-related anxiety: more generalized anxiety propensities; and/or school-related skills). It is estimated that the annual public health cost of Mental, Emotional, and Behavioral disorders (MEB) in childhood is almost $250 million (O’Connell et al., 2009). Although problematic anxiety in preschoolers is under-reported by adults (Lagattuta, Sayfan, & Bamford, 2012), it is more common than externalizing problems (Furniss, Beyer, & Guggenmos, 2006; Mian, Godoy, Briggs-Gowan, & Carter, 2012; National Scientific Council on the Developing Child, 2008). Prevalence of such difficulties was approximately 20% in 3 recent preschool samples (Franz, et al., 2013; Hillen, et al., 2012; Paulus et al., 2015). Yet, although anxiety can undermine children’s ability to succeed in school and beyond, few young children showing anxiety difficulties receive appropriate intervention (Egger & Angold, 2006), in part because they are rarely identified. This project would create an affordable computer tablet app to objectively measure 3-8 year-old children's propensity to show anxiety-related cardiovascular and behavioral responses to relevant stimuli. Recent research suggests that Respiratory Sinus Arrhythmia (RSA) suppression to fear is associated with young children’s internalizing propensities and responsivity to intervention (Gatzke-Kopp, Greenberg & Bierman. 2014; Gilissen et al., 2008; Shanahan, Calkins, Keane, Kelleher, & Suffness, 2014). Although tablet-based apps to assess cardiovascular functioning exist, they are either cost-prohibitive for large-scale screening efforts in preschools and schools, or provide only overall indicators of cardiovascular health, rather than measures of cardiovascular reactions to psychological stimuli. Yet, one important mechanism for doing large scale screening for risk for anxiety difficulties would be to do it in preschool and school settings as a part of an assessment of school readiness and school-related skills. A tablet-based assessment would require very little teacher time, and yet would enable individualized assessment, which could form the basis for
individualized intervention to enhance specific school-related skills and/or to teach emotion regulation/anxiety-reduction skills, as appropriate for each child.

This past year, with funding from CSU Ventures, we developed an internet-based tablet assessment for 3 to 8 year-old children, of focused persistence in the face of challenge, executive functions, and letter and number recognition. The assessment is designed to administer an easy level, 1-2 moderately challenging levels, and 1 challenging level of each task to each child, based on the child’s age. We have succeeded in creating tasks that are engaging for children of this age and are reliable and appropriately related to other measures (Barrett & Jozsa, submitted; Jozsa, Barrett, & Morgan, submitted). However, the internet-based application performs poorly when internet connectivity is slow or intermittent, and it is not possible to collect video or heart rate data using the internet-based application. Thus, an android and/or iOS-based app is needed. We hope to eventually develop both, but plan to first develop and test the android app because the computer tablets we are using for this research are android-based and because android is the primary operating system used on tablets in Hungary.

As indicated earlier, tablet-based assessments of cardiovascular activity exist, but they are either very expensive or provide only general screenings for cardiovascular abnormalities rather than cardiovascular responses to psychological stimuli. Two computer-based assessments of executive functions in young children already exist. One, which is part of the NIH Toolbox, is highly influenced by skills that are not central to the EF construct, such as reaction time, for assessments of children over age 3. The other, which is currently being piloted by other researchers, is a much longer battery of EF tasks, making it less practical to combine with other assessment tasks for school assessments of multiple skills. Both of these other assessments are internet-based, and neither includes the other school related skills or video or physiological assessments. Thus, the proposed method is truly novel; to our knowledge, no similar apps exist. We believe the app would provide a cost-effective method for collecting important data for both public health and education research. Moreover, the tablet-based assessment would collect specific information about conditions under which children display poorly regulated emotion (on which types and difficulty levels of the tasks, in response to failure, success, higher challenge, etc.). This would afford the possibility of cost-effective, individualized interventions to prevent mental health and school-related difficulties. It would thus be of great value not only to researchers, but to educators, parents, and public health professionals. Unfortunately, we do not have the needed expertise to develop the app, nor the funding to pay for such expertise. For this reason, we are hoping for support from CCTSI to both connect with collaborators with the needed expertise and to fund the development of the app.