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Precision Education Initiative: Moving Towards Personalized Education

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President Obama recently unveiled the Precision Medicine Initiative (Collins & Varmus, 2015; The White House, 2015). I argue that the fundamental idea behind this initiative, individualizing treatment and prevention based on genes, environment and lifestyle, should not be limited to only biomedical disease. The precision medicine approach would be ideal to classify and treat learning disabilities as well, and could be used in the everyday practice of education. Learning disabilities, a variety of psychiatric disorder (American Psychological Association, 2013), are complex disorders with remarkable similarity to biomedical disease. Biomedical disease and learning disabilities are characterized by a quantitative pattern of psychological, genetic and environmental risk factors, which act not only independently but in an interactive fashion (Bishop, 2015; Pennington, 2006). For both, treatment is complicated by individual differences in etiology and response to treatment (Caspi & Bell, 2004; Connor, Morrison, & Petrella, 2004). There are some important differences; for example biomedical research has a better understanding of the mechanisms of disease progression. Notwithstanding, I argue that with more time and funding for educational research, these knowledge differences will close. Precision education would provide educational researchers and practitioners the tools to better understand the complex mechanisms underlying learning disabilities, allowing for a more effective approach to education. Mirroring the precision medicine initiative, there are both near-term and longer-term goals that we can move towards.

I suggest a near-term focus on creating data specifically for gaining a better understanding of the classification of learning disability at the individual-level, with high sensitivity and specificity. As a field we struggle without a clear definition of learning disability (LD), although it is likely that it is best classified as a hybrid model defined by a constellation of information processing deficits, emotional factors, and/or risk factor indicators (Fletcher, Stuebing, Morris, & Lyon, 2013; Pennington et al., 2012; Spencer et al., 2014). Through various mechanisms of support (Connor et al., 2004; Miller, Vaughn, & Freund, 2014), thousands of children have been well characterized, often longitudinally. Using contemporary statistical methods (e.g., Curran & Hussong, 2009), these datasets can be combined. These data, plus new data collection with exact assessment of possible risk factors, will provide a “knowledge network” which can be used for exploratory testing of the indicators of LD (Collins & Varmus, 2015). One likely important indicator is a family history of LD (Carroll, Mundy, & Cunningham, 2014; Thompson, et al., 2015; Vogler,

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DeFries, & Decker, 1985). Children with a first-degree relative with dyslexia show a higher risk of being diagnosed with dyslexia (Scarborough, 1990), and parental dyslexia status contributes unique variance to child outcomes (van Bergen, Bishop, van Zuigen, & de Jong, 2015). This is just one of a list of possible indicators of LD. It is likely that they are not all uniquely important, but some differing combination will be important for each individual. As research grows with methodological and technological advancements, we will need to continually update the model of the classification of LD with this new knowledge.

Turning towards longer-term goals, we should take the knowledge gained from the near-term research, and begin experimental testing of individual-centric interventions for LD (Collins & Varmus, 2015; Moreau & Waldie, 2016). With these interventions the goal will be to classify an individual as LD early using combinations of the indicators, and provide a personalized, or differentiated, intervention with the goal of remediating, or at least accommodating, LD. The education literature has shown success differentiating the time spent on and intensity of the intervention given to a child based on cognitive traits (Connor et al., 2004; Fiorello, Hale & Snyder, 2006; Fuchs, Mock, Morgan, & Young, 2003). This work can be expanded to include all of the LD indicators. It is likely, and more feasible, that the best differentiated interventions will not actually be different for each child. Instead subgroups of children will likely be identified because of combinations of indictors that make them more susceptible to a specific intervention approach. This work will not be easy or quick, and the next generation of educational researchers will need to be trained in multidisciplinary approaches to measure and analyze the factors important in understanding precision education, including behavioral, practical, methodological, genetic, and environmental.

I predict that it will be difficult for effective small-scale educational interventions to scale-up, as the successful individualized interventions for LD will likely be resource-heavy and time-intensive. Therefore, the public needs to be engaged in this work, as there will need to be a fundamental shift in how we educate children. Teachers will need to be given knowledge (Thomas, Kovas, Meaburn, & Tolmie, 2015), skills and resources to provide the differentiated instruction, assessments will need to be created with high sensitivity and specificity towards targeted classification of LD, families will need to provide information and support, and new money needed for research and practice. To help engage the public, precision education will need to support open data practices, mirroring precision medicine.

The present educational system of uniform instruction, broad assessment and inconsistent classification of learning disabilities needs to be updated based on current evidence. I believe that a precision education approach is fundamental to do this, for both educational research and educational practice.

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