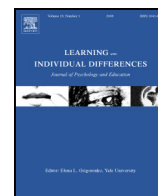




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# Q4 Q5 Predicting academic performance and trajectories from a measure of successful intelligence<sup>☆</sup>

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## Q0 A R T I C L E I N F O

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Whereas there has been extensive use and study of standardized assessments to predict academic performance at the high school, college and graduate school level, there is little research on the predictive power of assessments at the middle school level. The current study investigates the Aurora Battery, an assessment based on Robert J. Sternberg's theory of Successful Intelligence, comprised of analytical, practical, and creative cognitive abilities, to predict middle school grades and their growth over a school year among a sample of 145 middle school students. Assessments based on Sternberg's model have been used successfully to predict academic performance at multiple levels of education. Using latent growth curve models of grades in four subject areas and grade point average (GPA) across three grading periods, our findings indicate that the indicators of performance on the Aurora Battery predicted a substantial amount of overall academic performance (GPA) one year following the battery's administration as well as their growth the subsequent year, evidencing Aurora's predictive validity. Further, our results highlight the differential contribution of each of the abilities measured by Aurora in different subject areas. Implications are discussed regarding the development of targeted educational provisions tailored to children's cognitive profiles.

Standardized assessments of ability and achievement are used at many levels of education. One of the reasons for the widespread use of these assessments is their purported ability to predict academic achievement. As a result, these tests are used as part of the admission process at the undergraduate and graduate levels, as well as at some selective high schools. The literature is replete with studies regarding the predictive validity at higher and professional levels of education of such assessments as the SAT (formally known as the Scholastic Assessment Test; Bridgeman, McCamley-Jenkins, & Ervin, 2000; Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008; Shaw, Kobrin, Patterson, & Mattern, 2012), ACT (formally known as the American College Testing; Noble & Sawyer, 2002), Graduate Record Examinations (GRE; Kuncel, Hezlett, & Ones, 2001), Graduate Management Admission Test (GMAT; Talento-Miller & Rudner, 2005), and Law School Admission Test (LSAT; Stilwell, Dalessandro, & Reese, 2011). The literature is far more scarce on the predictive validity of assessments used in the high school admission process (Grigorenko et al., 2009). Whereas the use of standardized tests in admission processes mostly begins in high school, these assessments may be informative well before high school admission. In particular, standardized assessments can be used to help identify students' strengths and weakness in various intellectual abilities, and to make projections about students' future performance, allowing for appropriate educational provisions tailored to student's needs, to be made based on both the current achievement and probable

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performance. The earlier such provisions can be made, the better the student's academic outcomes may be.

Although the literature on the use of standardized assessments to predict performance at the elementary and middle school levels is seemingly nonexistent to date, theoretical models underlying assessments that have accurately predicted academic performance at other levels of education may be extended to the middle school level in a straightforward manner. In particular, Sternberg's (1985, 1988, 1996; 1999, 2005) theory of Successful Intelligence has been used as the theory grounding standardized assessments at the graduate (Hedlund, Wilt, Nebel, Ashford, & Sternberg, 2006), undergraduate (Sternberg, 2006, 2009, 2010), as well as high school levels (Grigorenko et al., 2009).

## 1. Sternberg's Successful Intelligence model and academic achievement

Since Spearman (1927) proposed his g-based theory of intelligence, there have been many attempts to better define and measure human intelligence (for a comprehensive review of these theories see Sternberg, Jarvin, & Grigorenko, 2010). One such attempt is represented by Robert J. Sternberg's (1985, 1988, 1996, 1999, 2005) triarchic theory of intelligence, also known as the theory of Successful Intelligence. Successful intelligence is defined as the integrated set of abilities needed to attain success in life however an individual defines it, within his or her socio-cultural context. Successfully intelligent people adapt to, shape, and select environments through a balance in their use of analytical, creative and practical abilities. According to this view, intelligence and success are defined beyond what happens in school to the broader context of what happens in life. Therefore, early recognition of and training to these component abilities of intelligence can set children on a road to success that will last well beyond their time in school.

Analytical abilities are involved in analyzing, evaluating, judging, and comparing and contrasting. These abilities are exhibited in reasoning and logical thinking as they are exercised in activities such as debating, research, and mathematical problem-solving. Creative abilities are reflected in the capacity to generate new ideas, create and design new things. Such abilities are particularly well assessed by problems highlighting how well an individual copes with relative novelty. Practical abilities are involved when individuals apply or adapt their abilities to the kinds of problems that confront them in daily life, such as on the job or in the home. These abilities are also exercised in leadership and other social interactions. A successfully intelligent person does not necessarily have to possess high levels of each of these abilities to be considered intelligent; rather one must recognize one's own strengths and weaknesses and develop compensatory strategies that rely on those strengths.

Assessments based on Sternberg's model have been able to accurately predict academic performance at the undergraduate, graduate and high school levels. In the Rainbow Project (Sternberg, 2006, 2009; Sternberg, The Rainbow Project Collaborators, & The University of Michigan Business School Project Collaborators, 2004), Sternberg and his colleagues developed measures based on his theory of intelligence to supplement the SAT. These measures were administered to almost one thousand students from 15 schools across the United States. This new measure broadened the assessed abilities from the traditional analytical abilities overrepresented on the SATs, to also include measures of creative and practical abilities. This study found that the inclusion of these measures almost doubled the amount of explained variance in grade point average (GPA) over the SAT alone. In the Kaleidoscope Project (Sternberg, 2009, 2010; Sternberg, Bonney, Gabora, & Merrifield, 2012), which included a measure based on the Successful Intelligence model used in an optional supplement to the admission application to Tufts University, it was found that students who were admitted using this Kaleidoscope measure performed academically as well as their peers who were admitted using traditional measures such

as the SAT, but they were engaged in more extracurricular and leadership activities. The Kaleidoscope Project was also able to demonstrate that the use of this model in designing assessment can help reduce ethnic group differences, which has long been an issue in college admissions (Kaufman, 2010; Sternberg & Coffin, 2010). At the graduate level, Sternberg and his collaborators at The University of Michigan Business School (Hedlund et al., 2006; Sternberg et al., 2004) developed measures of practical intelligence (an ability included in the Successful Intelligence model) to augment the GMAT used in the graduate school admissions process. The results revealed that scores on the measures of practical intelligence were able to predict academic success in business school, above and beyond what the GMAT and GPA alone could. Finally, at the high school level, Grigorenko et al. (2009) were able to predict GPA and its growth using a measure based on Sternberg's model as well as Secondary School Admission Test (SSAT) scores. Additionally, self-report measures of Successful Intelligence were able to account for approximately 67% of the variance that was accounted for by the SSAT. In other work we have explored the overlap and differences in the identification of giftedness by a standardized achievement measure and Aurora (Mandelman, Barbot, Tan, & Grigorenko, 2013). In the current study, we extend these previous finding in the context of middle school by evaluating the predictive power of the Aurora Battery, a tool currently being developed using Sternberg's theory for students in grades four through six.

The benefits in predicting GPA are twofold. Firstly, the inherent value in predicting academic performance lies in the capability to offer academic provisions appropriate for a student, based on projected performance, either in terms of remediation or enrichment. Going beyond immediate utility, predicting GPA can allow us to estimate effects for what GPA can predict. Specifically, whereas there is seemingly no literature on predicting middle school GPA nor on what middle school GPA predicts, there is research at the high school level as to what GPA predicts. A recent analysis by French, Homer, Popovici, and Robins (2014) demonstrated that a one point increase in high school GPA significantly increases the probability of finishing college and that it translates into a significant increase in adult earnings. Other studies (Betts & Morell, 1999; Cohn, Cohn, Balch, & Bradley, 2004) have shown the impact that high school GPA can have on academic achievement in college.

## 2. The Aurora Battery

The essence of the Aurora Battery is to provide a multifaceted view of a child's intellectual profile, as expressed through a range of abilities (Chart, Grigorenko, & Sternberg, 2008). It is designed to meet the needs of parents, teachers, counselors, or schools who are interested in better understanding a child's intellectual profile, and individual differences among students.

The Aurora Battery is composed of multiple modules that involve multiple informants, including a group administered maximal performance assessment (Aurora-a and -g; for Aurora-a, -g, -i, and -r, see Chart et al., 2008), a parent rating scale or an interview (Aurora-i), a teacher rating scale (Aurora-r), and a self-report rating scale (Aurora-s; Mandelman, Tan, Kornilov, Sternberg, & Grigorenko, 2010). The Aurora Battery measures abilities as exemplified by analytical, creative and practical thinking in dealing with words, numbers, and images. By presenting a broad array of subtests that target types of thinking across three different domains, which are the areas that are most common domains that children deal with and are widely represented on other cognitive assessments, the Battery reflects the theoretical construct of successful intelligence and provides the child with an adequate set of opportunities to demonstrate different facets of their intelligence (Chart et al., 2008). Additionally, particularly in the area of creativity, the possibility of exhibiting domain-specific strengths is open. Each module of the battery is structured on the grid of abilities and domains depicted in Table 1. Thus, each module is composed, in a balanced manner, of items

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