

**Nonverbal Aptitude and Academic Achievement at a Diverse Parochial
Secondary School – A Correlational Study**

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Abstract

The Naglieri Nonverbal Aptitude test (NNAT2) is designed to test a student's general aptitude through sequence patterns avoiding the use of language. This helps it to avoid language bias while testing for aptitude. Private schools may use it in their admissions process to capitalize on this fact and use it to properly place students into its programs in conjunction with other criteria established by the school as its results have been shown to have a correlation with student academic achievement, including those that are still English language learners as demonstrated by this study.

Overview

Admission directors in independent private schools serve an important function. They are tasked with screening applicants for admission in order to help fulfill the mission of the school and place students into appropriate classes and programs. In performing this function they must consider students' past records, recommendations, academic potential, personal interviews, financial capabilities, and their potential fit within the school and its culture. Admission directors work in conjunction with the administration of a school to set standards and goals for what a student demographic profile should reflect in accordance with the ultimate objectives determined by the school's governing body.

Admission directors must be familiar with the population they serve. This will help to ensure that their practices are non-discriminatory and that they effectively place students into appropriate programs within their schools to encourage both social and academic growth in its student population. This includes knowledge of the general population, the private school market, area competition, the school's mission, and the defined student profiles (SSATB).

Through the admissions process, applicants must be scrutinized in order to best predict their ability to fit within the school's culture as well as their ability to perform at a satisfactory academic level. The school's ultimate function should be to support the students. If a student stands out in opposition to the values of the school or is not academically prepared to meet the academic standards as defined by the school, enrollment of that student can have an adverse effect on both the student and the school.

When a private school works to serve a diverse student population and provide excellence in education, academic aptitude is important to evaluate to ensure the student will be provided an education that is appropriately leveled. As regions within the United States are becoming more and more diverse, schools are serving students from a variety of backgrounds. This includes students from all over the globe, students with primary languages other than English, and cultures that vary tremendously.

Numerous tests are available to quantify a student's academic ability. These tests range from those that test a student's Intelligence Quotient (IQ) or intelligence across a broad range of skills and subjects, multiple intelligences, non-verbal tests for general aptitude, or tests that combine general aptitude and specific skill and knowledge sets. Each of these tests may be used to predict academic achievement. Admission administrators must identify the test that will best

serve its student market. The most commonly known tests are “IQ” tests and the Scholastic Assessment Test (SAT).

IQ tests are often times used to predict academic achievement. In fact, IQ tests have been found to correlate with academic achievement between .5 to .6 and become more accurate as students get older (Brody, 1997). IQ tests are offered in numerous languages as well. Research has indicated, however, that IQ scores are often lower for minority groups (Rushton & Jenson, 2003) and those of a lower socio-economic status and do not necessarily gauge their intelligence in an effective manner (Ceci et al., 1998). Based upon the communication style and differing types of knowledge that are stressed by different cultures, IQ tests can be biased (Sternberg, 2002).

The SAT is a college admissions test, generally administered in the 11th or 12th grade, used to predict academic achievement in college often times correlated to a student’s freshman grade point average (fGPA). The SAT scores were found to be able to predict fGPA with 8-15% accuracy, independently of the College Board that is responsible for creating and administering the test, while the College Board itself reported higher predictability statistics (Ford et al., 1977). The SAT, like the IQ tests, are seen as having biases to include differing predictability rates among different races (McDonald et al., n.d.). IQ tests also generally underestimate academic achievement in college by women (McDonald et al., n.d.).

Independent school admission officers came together in 1957 to discuss issues with the current tests and their ability to predict academic success. They identified a need for a common test amongst private schools. They formed the Secondary School Admission Board (SSAB) and worked with Educational Testing Services (ETS) to create the Secondary School Assessment Test (SSAT). ETS and the SSAB suggest that a high correlation between the SSAT and the SAT exist although they do not publish this correlation or the correlation between the SSAT and academic achievement (SSATB). Like the SAT, the SSAT includes both English language dependent sections and quantitative sections (SSATB).

Due to the growing diversity of student populations within schools and the desire to increase diversity in private schools to be more reflective of American demographics, use of IQ tests and the SSAT need to be reconsidered in light of their recognized biases. The Wechsler Intelligence Scale may be utilized to test students for this purpose. It attempts to remove cultural bias (Verney et al., 2005). The test attempts to downplay cultural bias by testing four areas: verbal reasoning, perceptual reasoning, working memory, and processing speed. Language only represents a fraction of the overall score (Wechsler, 2003). Despite this downplay of language, it does still rely on it and may put students of different cultures at a disadvantage in our schools. ETS identifies nonverbal test as being useful for testing students whose primary language is not English to avoid bias (Non-Verbal Aptitude, 1990). Nonverbal tests are already utilized in numerous schools to identify students for gifted programs (Giessman et al., 1990). Nonverbal tests, however, have not been fully evaluated to determine fairness in application (Lakin, & Lai, 2012). For this reason, a nonverbal test should be identified and studied for use in private schools for secondary students that accurately predict academic achievement while at the same time avoiding recognized biases in tests such as IQ tests and aptitude tests.

The Naglieri Nonverbal Ability Test, Second Edition (NNAT2) was developed to measure general ability through the use of nonverbal measurements. This was done to promote

fairness regardless of gender, race, and ethnicity (Technical Information, 2011). The NNAT2 has also been found to predict academic achievement independent of socio-economic status (Balboni et al., 2009). The test is based upon geometrical shapes and patterns and their identification. Language is avoided entirely, from its samples that provide the directions for the test, to the last problem posed. Student ability is estimated based upon the comparison of results to other students of similar age (Technical Information, 2011).

Problem Statement

Admission administrators require a predictive assessment to better identify a student's potential to find success in a rigorous academic environment. Many schools utilize prior academic achievement as identified by previous grades. In a diverse school that serves students with varying background that have come from numerous educational systems around the world, comparing previous grades proves problematic. The utilization of an aptitude test, the SAT, was shown to have equivalent predictive ability as prior academic achievement by McDonald et al. in their literature review of the SAT (n.d.). Despite this, bias remains. The testing of nonverbal aptitude (general ability) in the NNAT2 in regards to academic achievement could satisfy the need of the administration to identify a student's potential for success if the NNAT2 is shown to provide predictive ability.

Overview

The objective of this study was to determine whether higher results on a nonverbal aptitude test, namely the NNAT2, predict academic achievement as determined by second semester grade point average (GPA) in a secondary private school setting while controlling for English as a Second Language (ESL) level. The second semester GPA will be utilized to identify academic achievement. By using the second semester GPA instead of the cumulative GPA, time is given to allow students to transition into a new school culture before evaluating their academic achievement. Strides toward successful transition into the new school should have taken place by this point as support from parents, teachers, and peers should ease this transition (Grolnick et al., 2000). The data for this study was collected over the course of the summer leading up to, and during the 2012-2013 school year. The correlational study was performed shortly after the end of the second semester. The study and its interpretations may be used to modify future admissions practices within the school and to provide data to other private schools looking to modify their admissions practices to reflect growing diversity.

Research Questions

1. Is there a relationship between student's nonverbal academic ability (NV) and academic achievement (AA) while controlling for ESL level? Does a student's nonverbal academic ability predict academic success?
2. Is there a relationship between the multiplicative of ESL level (ESL) and nonverbal academic ability (NV) with academic achievement (AA) while controlling for the additives? Does a student's ESL level in conjunction with their nonverbal aptitude predict student success?

Hypothesis:

Student scores on the NNAT2 will accurately predict academic achievement as determined by second semester GPA.

Null Hypothesis:

Student scores on the NNAT2 will not correlate with academic achievement as determined by second semester GPA.

Full Model for General Linear Regression:

$$AA = a_0U + a_1(NV) + a_2(ESL) + a_3(ESL * NV)$$

Method

Availability sampling was utilized for this study, as all new students accepted into the school were included from the period of the study. It included a total of fifty-nine students. Two of them did not take the NNAT2. Because of this, a total of fifty-seven students were included in the statistical reports of this study. The current demographics of the student population include 95% Hispanic, 2% black non-Hispanic, 2% white non-Hispanic, and 1% Asian. New applicants are anticipated to roughly follow the current demographic make-up of the current student body based upon current community demographics as identified by the United States Census Report that reflect the school's make-up (2012).

For this study, the α level was set at .05. A one tailed test was utilized to look for a positive correlation between a student's nonverbal academic aptitude and academic achievement. A correlational design is appropriate for this study because it shows whether or not a positive correlation exists. If a positive correlation exists, then students' nonverbal academic aptitude can be used to predict academic achievement levels.

Data analysis was conducted by utilizing the general linear regression model on the hypotheses addressed with SPSS to identify correlations and statistical significance. Attention is paid to the adjusted *R Square* to identify the percentage of variation in the dependent variable that is explained after adjusting for sample size and the predictors given.

Operational Definitions

Academic Achievement (AA) – The student's AA is gauged by the second semester GPA that they earn in their coursework.

Nonverbal Academic Ability (NV) – This ability level is based upon the NNAT2 Naglieri Ability Index (NAI). Using inferential norming and conversions to standard scores, the mean score on the NNAT2 or the NAI is 100 with a standard deviation of 16 and a range of 40-160.

English as a Second Language level (ESL) – This indicator identifies standard ESL rankings as measured by the school's ESL program. The ESL levels range from 1-6. 1 is preproduction, 2 is early production, 3 is speech emergence, 4 is intermediate fluency, 5 is fluent, and 6 is native speaker.

Instruments

The data was collected for this study using the NNAT2 for each appropriate grade level. The NNAT2 utilizes its own scoring mechanism, the NAI, to quantify student's Academic Aptitude for the purpose of this study.

Reliability and Validity

The NNAT2 utilized the split-half reliability method to evaluate internal consistency reliability. The average for all ages was .90. Internal Consistency was verified using Kuder-Richardson Formula 20 (KR20). The coefficient average of the KR20 for all ages was .88.

The NAI scores, when correlated with the Wechsler Nonverbal Scale of Ability when administered to the same students was .73.

Results

Hypothesis: Student scores on the NNAT2 will accurately predict academic achievement as determined by second semester GPA.

Null Hypothesis: Student scores on the NNAT2 will not correlate with academic achievement as determined by second semester GPA.

A multiple regression analysis was utilized to evaluate how well the full model predicted student academic success as determined by the second semester GPA. The predictors were ESL level, NAI, and the multiplicative of the student's ESL level and score on the NAI. The linear combination of these predictors demonstrated a high correlation to the second semester GPA. The sample multiple correlation coefficient was .48, and the R square was .23. The significance level reported is .008, well below the established alpha level for this study of .05. Based upon these results the null hypothesis can be rejected. The adjusted R square of the full model demonstrates a predictability of academic achievement.

Utilizing a 1-tailed test to test each of the additives significance, only the NNAT2 scores on the NAI are significant. The remaining additives cannot be considered significant as their significance exceeded the alpha level of .05. Since the NAI results are the only significant results the correlation results of just the NAI to GPA are given. The correlation coefficient of only the NAI results and GPA are .394 with an R square value of .16 with a significance level of .001, again well below the established alpha level.

Implications and Discussion

The adjusted R square of .16 shows a predictive ability in the NAI to predict academic success as defined by the second semester GPA. The predictability results of this study had similar results to the SAT in predicting fGPA (Ford et al., 1977). When it is taken in conjunction with additional objective and subjective analysis as defined by the school's administration, it can be a valuable tool in the admission process. On its own, however, it leaves a wide margin for error. As in a study by Lakin, the study does not support exclusive use of the NAI in predicting academic achievement (2012).

Other predictors may be identified for use in the admissions process such as self-efficacy or motivation predictors to provide examples. In recognition of the diversity of applicants the admissions team should continue working towards avoiding bias during the admissions process. This may not remove testing in language completely, but may minimize the scope of language scores. These scores may be better served for placing students in programs and courses rather than to exclude students.

References

- Balboni, G., Naglieri, J. A., & Cubelli, R. (2010). Concurrent and Predictive Validity of the Raven Progressive Matrices and the Naglieri Nonverbal Ability Test. *Journal of Psychoeducational Assessment, 28*, (3). 222-235.
- Brody, L. R. (1997). Gender and emotions: Beyond stereotypes. *Journal of Social Issues, 53*, 369-393.
- Ceci, S. J., Rosenblum, T. B., & Kumpf, M. (1998). The shrinking gap between high- and low-scoring groups: Current trends and possible causes. In U. Neisser (Ed.), *The rising curve* (pp. 287-302). Washington, DC: American Psychological Association.
- Ford, S. F., & Campos, S. (1977). Summary of Validity Data from the Admissions Testing Program Validity Study Service. *New York: College Entrance Examination Board.*
- Giessman, J. A., Gambrell, J. L., & Stebbins, M. S. (2013). Minority Performance on the Naglieri Nonverbal Ability Test, Second Edition, versus the Cognitive Abilities Test, Form 6: One Gifted Program's Experience. *Gifted Child Quarterly, 57*, (2), 101-109.
- Grolnick, W. S., Kurowski, C. O., Dunlap, K. G., & Hevey, C. (2000). Parental resources and the transition to junior high. *Journal of Research on Adolescence, 10*, 466-488.
- Lakin, J. M. (2012). Assessing the Cognitive Abilities of Culturally and Linguistically Diverse Students: Predictive Validity of Verbal Quantitative, and Nonverbal Tests. *Psychology in the Schools, 49*, 8, 756-768.
- Lakin, J. M., & Lai, E. R. (2012). Multigroup Generalizability Analysis of Verbal, Quantitative, and Nonverbal Ability Tests for Culturally and Linguistically Diverse Students. *Educational and Psychological Measurement, (72)*, 1, 139-158.
- McDonald, A. S., Newton, P. E., Whetton, C., & Benefield, P. (n.d.) Aptitude Testing for University Entrance: A Literature Review. *The Sutton Trust.*
- Non-Verbal Aptitude. (1993). Annotated Bibliography of Tests (p. 132). Educational Testing Service. Princeton, NJ.

Rushton, J. P., & Jensen, A. R. (2003). African 0 white IQ differences from Zimbabwe on the Wechsler Intelligence Scale for Children – Revised are mainly on the *g* factor.

Personality and Individual Differences, 34, 177-183.

Sternberg, R. J. (2002). Intelligence is not just inside the head: The theory of successful intelligence. In J. Aronson (Ed.), *Improving academic achievement* (pp. 227-244). San Diego, CA: Academic Press.

SSATB: Home. (n.d.). Retrieved from <http://www.admission.org>

Technical Information and Normative Data: Naglieri Nonverbal Ability Test Second Edition. (2011). NCS Pearson, Inc.

United States Census: States and Local Areas. United States Census Bureau. (2012). Retrieved from <http://www.census.gov/compendia/databooks/>

Verney, S. P., Granholm, E. Marshall, S. P., Malcarne, V. L., & Saccuzzo, D. P. (2005) Culture-Fair Cognitive Ability Assessment: Information Processing and Psychophysiological Approaches. *Assessment, 12*, (3), 303-319.

Wechsler, D. (2003). *WISC-IV; Wechsler Intelligence Scale for Children* (4th ed.). San Antonio, TX: Psychological Corporation.