STATISTICAL ANALYSIS OF THE GIBSON TEST OF BRAIN SKILLS COMPARED TO STANDARDIZED ACADEMIC SCORES

INTRODUCTION

The purpose of this analysis is to explore the statistical relationship between the Gibson Test of Brain Skills and measures of academic achievement amongst students in grades two through eight. The academic challenge is to find answers as to why some students are underperforming academically.

Cognitive skill testing is primarily used to evaluate severely academically underperforming students to determine if they qualify for special education programs. Low cognitive skill scores are typically a requisite for acceptance into special education programs. Cognitive skill testing is generally resource intensive to administer and thereby used sparingly by schools.

The Gibson Test was developed to provide schools with an affordable and easily administered online cognitive screening tool to enable broader cognitive skill testing. The goal is to identify students sooner who may need a cognitive skill intervention as opposed to waiting until academic failure is obvious and the student is referred to special education too late in their education process. It is also intended to help identify those students who may not qualify for special education but nonetheless are underperforming academically and not achieving their full potential because of weak cognitive skills.

Two schools agreed to participate in the analysis. One school is a private school and a member of the Association of Christian Schools International. The second school is a public charter school. Both schools tested school wide. Over 900 students were tested. Scores from 2nd grade through 8th grade were used in the analysis. One school used the SAT 10 test and the other the NWEA MAP for the measure of standardized academic achievement.

Three different types of statistical analysis were performed: 1) descriptive statistics, 2) correlation analysis, and 3) simple regression analysis.

SUMMARY OF RESULTS

Descriptive Statistics

The inferential statistics, including the regression and correlation analysis, achieved levels of statistical significance across all variables compared. This means that the results of these analyses are generalizable to the larger population of students, beyond those included in the sample. Descriptive statistics are valuable information related to the specific students within the two schools participating in this study. These results describe the performance of students who took the various assessments. Because they are descriptive statistics they relate only to the students included in the study. For example, 97% of students who scored in the bottom quartile (lower 25%) of academic performance on the SAT 10 reading test, also scored in the 25% or lower on at least one Gibson subtest. Therefore, scoring in the 25% or less on at least one Gibson subtest proved to be a very high indicator of low academic performance in the critical area of reading as measured by the SAT 10 within the school included in this study. The NWEA revealed similar patterns. Of the

students scoring in the bottom quartile (lower 25%) of reading, as measured by the NWEA, 88% scored in the 25th percentile or lower on at least one Gibson subtest. Among these students, scoring in the 25% or less on at least one Gibson subtest related to low scores in reading achievement. Complete descriptive information related to performance of students in the lowest quartile of reading on the SAT 10 or NWEA is outlined below:

Descriptive Information

Of the students with reading achievement scores in the lowest quartile of performance, or the bottom 25%, as measured by the SAT 10:

- 97% scored below the 25th% on at least 1 Gibson subtest;
- 90% scored below the 25th% on at least 2 Gibson subtests;
- 80% scored below the 25th% on at least 3 Gibson subtests;
- 64% scored below the 25th% on at least 4 Gibson subtests;
- 58% scored below the 25th% on at least 5 Gibson subtests;
- 49% scored below the 25th% on at least 6 Gibson subtests;
- 33% scored below the 25th% on at least 7 Gibson subtests.
- 17% scored below the 25th% on at least 8 Gibson subtests.
- 13% scored below the 25% across all 9 Gibson subtests.

Of the students with reading achievement scores in the lowest quartile of performance, or the bottom 25%, as measured by the NWEA:

- 88% scored below the 25th% on at least 1 Gibson subtest;
- 65% scored below the 25th% on at least 2 Gibson subtests;
- 45% scored below the 25th% on at least 3 Gibson subtests;
- 33% scored below the 25th% on at least 4 Gibson subtests;
- 18% scored below the 25th% on at least 5 Gibson subtests;
- 7% scored below the 25th% on at least 6 Gibson subtests;
- 5% scored below the 25th% on at least 7 Gibson subtests.

Results of simple regression and correlation analysis:

Interpreting correlation coefficients (the first row of values in the chart below) is context dependent. In some applications a smaller value of the coefficient is sufficient evidence of a correlation. In other applications a larger correlation coefficient is desirable in demonstrating the strength of a relationship. Within social sciences correlations between .4 and .6 are interpreted, technically, as moderate yet considered solid evidence of a linear relationship. A perfectly correlated relationship is represented by the value of either +1 or -1. When a correlation coefficient between two variables achieves significance we conclude that the relationship between the two variables was not due to chance.

All measures included in the correlation analysis reached levels of statistical significance. This means that these results can be generalized to students beyond those included within this study. The range .3 - .5 is considered a moderate correlation. The Gibson Test and either the NWEA or the SAT 10, however, are independent measures. The achievement measures are distal to the cognitive measure that is the Gibson Test. They were designed independent of one another, developed by different organizations, and are comprised of different components and exercises designed to target different skills. The scores of correlation achieved in the analysis are technically considered moderate, yet due to the independence of the achievement assessments from the Gibson cognitive evaluation, these correlation coefficients can be considered strong indicators of a linear relationship.

There are nine different Gibson subtests, so no one test likely explains the underlying reason why a student scored poorly on a standardized achievement test. The Gibson test reached the highest level of correlation with the SAT 10 assessment on Auditory Processing, Word Attack, and Working Memory. On SAT 10 measures of math achievement, the highest levels of correlation were reached with Gibson Auditory Processing, Word Attack, and Working Memory subtests.

Similar results of correlation were reached between the NWEA reading and language measures and the Gibson test. The Gibson test is most highly correlated with NWEA reading and language in the Word Attack, Logical Reasoning, and Visual Memory subtests.

The charts below document both the correlation coefficient and a coefficient representing the predictive strength of the Gibson subtest on selected measures of academic achievement. The bullets following the tables highlight the 3 subtests within each table which demonstrate the strongest predictive relationship, as indicated by the highest R Squared value, between the Gibson Test and measures of academic achievement. The R Squared value, when converted to a percentile (shifting the decimal two places to the right) indicates the percentage of the achievement assessment that is explained by the specific Gibson subtest. For example, the first R Squared value reported in the first table is R squared = .045. This means that 4.5% of the score on the SAT 10 reading assessment can be explained by performance on the Gibson Processing Speed subtest. In

other words, the Gibson Processing Speed subtest can predict 4.5% of the score on the SAT 10 reading achievement assessment. Although all R Squared values reached levels of statistical significance, the most noteworthy predictive relationship was found between scores on the NWEA language assessment and the Gibson Word Attack subtest. The Gibson subtest predicts 24.5% of the language composite score, as measured by the NWEA language assessment. All the predictive relationships, along with correlation coefficients are included in the tables below:

Simple Regression Analysis of Private School SAT10 Reading Composite Score and Gibson Subtests

	PS	WM	ML	MA	VM	WA	VP	AP	LR
R (correlation)	.212	**.312**	.228	.280	.103	**.317**	.249	**.402**	.229
R Squared	.045	**.097**	.052	.078	.011	**.100**	.062	**.162**	.052

Simple Regression Analysis of Private School SAT10 Total Math Composite Score and Gibson Subtests

	PS	WM	ML	MA	VM	WA	VP	AP	LR
R (correlation)	.237	**.277**	.184	.183	.194	.218	**.308**	**.337**	.230
R squared	.056	**.077**	.034	.033	.038	.047	**.095**	**.113**	.053

Simple Regression Analysis of Charter School and NWEA Reading Composite Score

	PS	WM	ML	MA	VM	WA	VP	AP	LR
R (correlation)	.201	.266	.192	.320	**.339**	**.407**	.180	.289	**.349**
R squared	.040	.071	.037	.102	**.115**	**.166**	.032	.084	**.122**

Simple Regression Analysis of Charter School and NWEA Language Composite Score

	PS	WM	ML	MA	VM	WA	VP	AP	LR
R (correlation)	.230	.251	.208	.296	**.334**	**.495**	.208	.329	**.384**
R squared	.053	.063	.043	.088	**.111**	**.245**	.043	.108	**.147**

The simple regression analyses suggest the following predictive relationship between Gibson subtests and reading achievement, as measured by the SAT10:

- The Auditory Processing subtest is predictive of, or explains, 16.2% of the variance in composite reading scores.
- The Word Attack subtest explains 10% of the variance in composite reading scores.
- The Working Memory subtest explains 9.7% of the variance in composite reading scores.

The simple regression analyses suggest the following predictive relationship between Gibson subtests and math achievement, as measured by the SAT10:

- The Auditory Processing subtest is predictive of, or explains, 11.3% of the variance in composite math scores.
- The Visual Processing subtest explains 9.5% of the variance in composite math scores
- The Working Memory subtest explains 7.7% of the variance in composite math scores.

The simple regression analyses suggest the following predictive relationship between Gibson subtests and reading achievement, as measured by the NWEA:

- The Word Attack subtest explains 16.6% of the variance in composite reading scores
- The Logical Reasoning subtest explains 12.2% of the variance in composite reading scores.
- The Long Term Memory subtest explains 11.5% of the variance in composite reading scores.

The simple regression analyses suggest the following predictive relationship between Gibson subtests and language achievement, as measured by the NWEA:

- The Word Attack subtest is predictive of, or explains, 24.5% of the variance in composite language scores.
- The Logical Reasoning subtest explains 14.7% of the variance in composite language scores.
- The Long Term Memory subtest explains 11.1% of the variance in composite language scores,