
Resiliency as an Indicator of Academic Success

Examining Success Highways™ Resiliency Assessments ascp'Indicator of Academic Success

.....Dr. V. Scott H. Solberg, Dr. Alan Davis, and Christine McLemore

Overview

Success Highways by ScholarCentric, is a research-based combination of assessment, curriculum, and professional development focused on building critical resiliency skills which have been linked to academic success in middle and high school students. The components of *Success Highways* include:

- **Revving Up** and **Moving On early-warning assessments and reports** which measure students' academic resiliency aptitude in the six areas that are scientifically linked to academic success.
- **My Success Roadmap curriculum** which provides the pedagogical framework for educators to build students' academic resiliency in a universal intervention setting.
- **Professional Development modules** that develop school capacity to actively teach resiliency and increase academic achievement.

These incorporated pieces allow individual students to build academic resiliency through:

- Studying the objective definition of the resiliency skill
- Creating his/her own subjective definition of the resiliency skill
- Listening to the teacher's own personal story about his/her experience with the resiliency skill and how it relates or related to his/her educational goals
- Participating in standards-based classroom activities involving the skill (case study analysis, group discussions, and research)
- Viewing and reflecting on the student's assessed personal resiliency data as compared to a norm sample
- Creating a personal action plan to overcome any resiliency deficiencies and build resiliency strengths

Success Highways Assessments

Data collected and disseminated through the *Success Highways* Revving Up (pre-) and Moving On (post-) assessments have been validated to measure the six resiliency skills areas. Theory and research has established that these interrelated resiliency skills are associated with positive student development and academic success. The resiliency skills assessed include:

- **Importance of education** refers to the degree that students perceive education and college as being valuable to their future success. Importance of education is broken down into the subscales of school importance and college importance.
- **Academic self-efficacy (presented as confidence)** refers to a student's perceived competence in performing a variety of academic tasks. Academic self-efficacy is broken down into the subscales of social, classroom, and test-taking self-efficacy.
- **Social connections** refer to perceived availability of social support. Social connections are broken down into the subscales of perceived support from teachers, family, and peers.
- **Stress and health and well-being management** refer respectively to the degree of difficulty students experience in performing academic tasks and handling levels of psychological and emotional distress. Stress/distress is broken down into the subscales academic, social, and financial. Well-being is broken down into agitation, sleep problems, eating problems, physical symptoms, and feeling down.

- **Intrinsic motivation** refers to the degree to which a student is self-determined. Intrinsic motivation is broken down into the subscales of whether a student attends school because it is perceived as meaningful or enjoyable.

Overview of Research Studies

We conducted three separate studies to evaluate whether students' resiliency scores, as measured by the *Success Highways* Revving Up assessment, could 1) differentiate high from low academically achieving students using several factors (Study 1); and/or 2) identify whether the Revving Up assessment could be further refined to serve as an early warning indicator of potential high school failure (Studies 2 and 3).

Early warning indicators of high school success and failure have been documented as encompassing attendance, behavior incident reports, and course performance. Our Studies, particularly Studies 2 and 3, identified additional early warning indicators. Specifically, while past attendance, behavior incident reports, and course performance can predict future performance, the resiliency measurements provided in *Success Highways* assessments and curriculum provide educators with an additional understanding of what barriers to learning students may be facing. This link should allow educators to use their existing resources to tailor personalized resources and interventions that address specific student needs. For example, resources invested for a student reporting low teacher or peer connections (addressed by classroom/group based activities) will be different than resources for a student reporting health related concerns such as sleeping difficulties or agitation (further individual assessment and potential student support services).

Assessing Early Warning Indicators

For Studies 1 and 2, a single early warning indicator of high school performance was created by averaging the standardized attendance, suspension reports, and cumulative grade point averages for students across each of the three Cohorts. First, each indicator was standardized separately by Cohort. Then the average of the non-missing standardized values was computed in order that all three Cohorts could be combined. Because the indicator for behavior reports is a negative value with higher numbers indicating more incidents, the average for behavior reports was multiplied by -1 in order to create a score that reflected better behavior. Once the average standardized ratings were computed separately for attendance, behavior reports, and grades, the average of these three composites was generated to create a single indicator of high school performance with higher z-scores representing more success. Students from the 2007 Cohort had standardized scores from three academic years averaged, the 2008 Cohort had 2 years of standardized scores averaged, and the 2009 Cohort had one year of standardized scores averaged. Finally, the high school performance indicator was divided into quartiles with the upper 25% of the distribution comprising the High Success Group and students falling in the lower 25% of the distribution comprising the Low Success Group. Dividing the high school success indicator into quartiles resulted in a total of 835 students scoring below the 25 percentile (Low Success Group) and 1,001 students scoring above the 75th percentile (High Success Group).

Study 3 replicated Study 2 with a different early warning indicator. Rather than using attendance, grades, and behavior incidents, Study 3 generated a composite indicator using enrollment status and accumulation of credits towards graduation. Students who had dropped out or who were failing an average of two or more courses per year were classified as Unsuccessful. Students who were enrolled and passing at least 93% of all courses were classified as Successful. Based on these criteria, 46.6% of students were classified as Unsuccessful, and 53.4% were classified as Successful.

Study 1

Do the High vs. Low Success Groups Differ with Respect to the 18 Resiliency Subscales?

The purpose of Study 1 was to evaluate whether the 18 resiliency skills subscales measured in the *Success Highways* assessment instruments were able to differentiate between students identified as making successful high school transitions versus students who were identified as not making successful high school transitions.

Sample

A total of 4,797 students were surveyed during the summer prior to beginning the 9th grade as part of a summer transition to high school program in a large urban school district. The total sample represents three annual Cohorts. A total of 1,214 students participated in Cohort 1 (2009), 1,728 in Cohort 2 (2008), and 1,830 in Cohort 3 (2007). A total of 35% of the students were Latino, 11% were African American, 10% White, 1% American Indian, 2% Asian/Pacific Islander, and the remaining were either not identified or identified as more than one race/ethnicity. For gender, 51% were identified as female.

Results

In order to evaluate whether a student's reported resilience, as measured by the *Success Highways* 18 subscales, was associated with established measures of academic success, a one-way multivariate analysis of variance was conducted using High vs. Low Success Group as the independent variable and the 18 resiliency subscales as the dependent variable. Significant main effects were found (Wilks' Lambda = .835, $F [18, 1817] = 19.88$, $p < .000$, $\eta^2 = .17$), and the univariate tests indicated that students in the High Success Group reported higher resiliency skills for all 18 subscales than students in the Low Success Group.

Compared to students in the Low Success Group, students in the High Success Group reported higher ratings for all 18 subscales:

School Importance

- Importance of School ($F (1, 1833) = 52.18$, $p < .000$, $\eta^2 = .03$);
- Importance of College ($F (1, 1833) = 117.79$, $p < .000$, $\eta^2 = .06$);

Academic Self-Efficacy

- Social Self-Efficacy ($F (1, 1833) = 18.84$, $p < .000$, $\eta^2 = .01$);
- Classroom Self-Efficacy ($F (1, 1833) = 89.13$, $p < .000$, $\eta^2 = .05$);
- Test-taking Self-Efficacy ($F (1, 1833) = 24.10$, $p < .000$, $\eta^2 = .01$);

Social Connections

- Family Connections ($F (1, 1833) = 70.83$, $p < .000$, $\eta^2 = .04$);
- Teacher Connections ($F (1, 1833) = 41.41$, $p < .000$, $\eta^2 = .02$);
- Peer Connections ($F (1, 1833) = 26.73$, $p < .000$, $\eta^2 = .01$);

Academic Stress

- Academic Stress ($F (1, 1833) = 107.08$, $p < .000$, $\eta^2 = .06$);
- Social Stress ($F (1, 1833) = 57.51$, $p < .000$, $\eta^2 = .03$);
- Financial Stress ($F (1, 1833) = 71.19$, $p < .000$, $\eta^2 = .04$);

Psychological and Emotional Distress

- Sleeping problems ($F (1, 1833) = 29.15$, $p < .000$, $\eta^2 = .02$);
- Feeling Blue ($F (1, 1833) = 34.73$, $p < .000$, $\eta^2 = .02$);
- Agitation ($F (1, 1833) = 124.82$, $p < .000$, $\eta^2 = .06$);
- Eating Problems ($F (1, 1833) = 42.322$, $p < .000$, $\eta^2 = .02$);
- Physical Symptoms ($F (1, 1833) = 54.23$, $p < .000$, $\eta^2 = .03$);

Motivation to Attend School

- Enjoy School ($F (1, 1833) = 40.42$, $p < .000$, $\eta^2 = .02$);
- School Meaningful ($F (1, 1833) = 88.41$, $p < .000$, $\eta^2 = .05$);

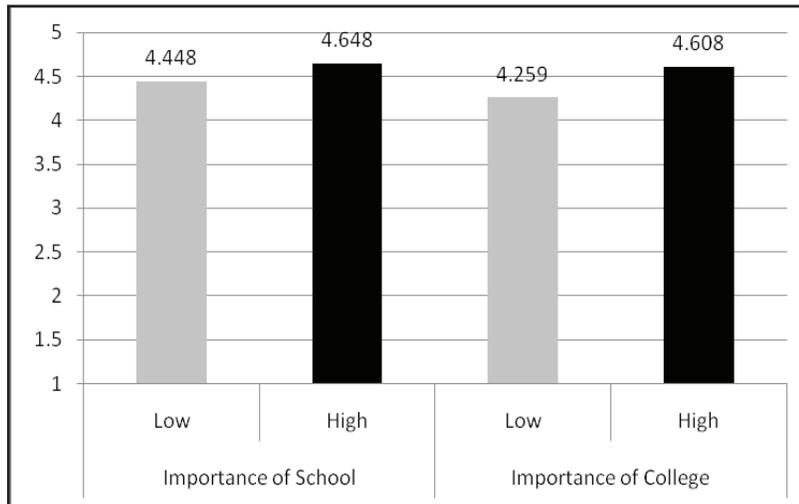
Table 1 reports the means and 95% confidence intervals for each of the subscales, and bar graphs following Table 1 also display the means for the High vs. Low Success Groups. The results provide a method for identifying cut-off scores for students who could be expected to be at-risk for school failure because the lower and upper boundaries for High and Low Success Groups do not overlap. For example, Importance of School ranges from 4.409 to 4.49 for the Low Success Group and 4.61 to 4.68 for the High Success Group.

Table 1: High and Low Performance Groups

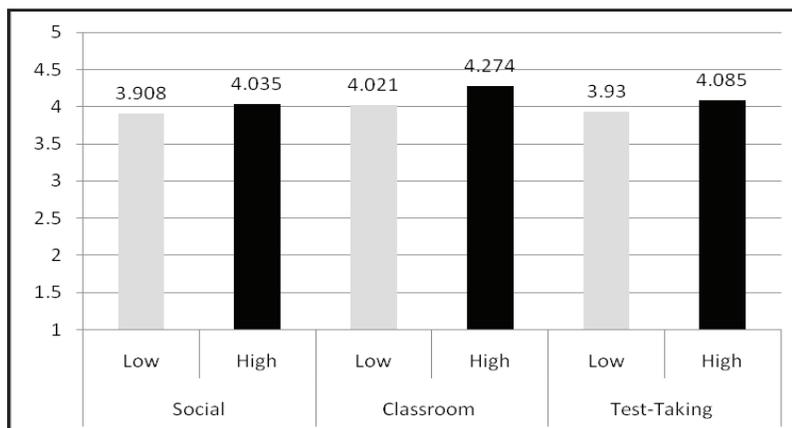
Dependent Variable	Success Groups	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
School Importance					
Importance of School	Low	4.448	.020	4.409	4.488
	High	4.648	.019	4.611	4.684
Importance of College	Low	4.259	.024	4.212	4.306
	High	4.608	.022	4.566	4.651
Academic Self-Efficacy					
Social	Low	3.908	.022	3.865	3.950
	High	4.035	.020	3.997	4.074
Classroom	Low	4.021	.020	3.982	4.060
	High	4.274	.018	4.238	4.309
Test-Taking	Low	3.930	.023	3.885	3.976
	High	4.085	.021	4.044	4.127
Social Connections					
Family Support	Low	4.071	.024	4.023	4.119
	High	4.349	.022	4.305	4.393
Teacher Connections	Low	3.664	.025	3.615	3.714
	High	3.885	.023	3.839	3.930
Peer Connections	Low	4.279	.025	4.229	4.328
	High	4.455	.023	4.410	4.501
Academic Stress					
Academic Stress	Low	2.401	.027	2.348	2.455
	High	2.021	.025	1.972	2.069
Social Stress	Low	2.161	.027	2.109	2.213
	High	1.888	.024	1.840	1.936
Financial Stress	Low	1.884	.029	1.828	1.940
	High	1.557	.026	1.506	1.608
Distress					
Sleeping Problems	Low	2.279	.035	2.211	2.347
	High	2.025	.032	1.963	2.087
Feeling Blue	Low	2.187	.034	2.121	2.253
	High	1.918	.031	1.857	1.978
Agitation	Low	2.283	.029	2.225	2.340
	High	1.838	.027	1.785	1.890
Eating Problems	Low	2.057	.032	1.994	2.120
	High	1.773	.029	1.715	1.831
Physical Symptoms	Low	2.053	.028	1.997	2.108
	High	1.770	.026	1.719	1.820
Motivation					
Enjoy School	Low	3.467	.026	3.416	3.518
	High	3.691	.024	3.644	3.738
Meaningfulness	Low	3.581	.021	3.539	3.624
	High	3.855	.020	3.817	3.894

Means for the High vs. Low Success Groups

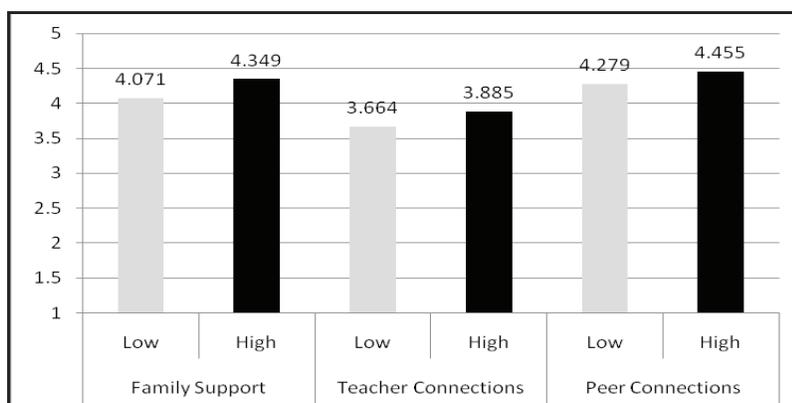
High Vs. Low Success Groups for Importance of Education



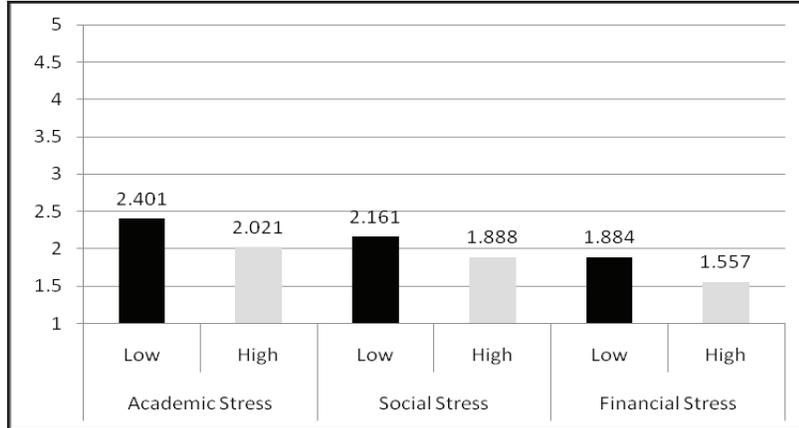
High Vs. Low Success Groups for Academic Confidence (Self-Efficacy)



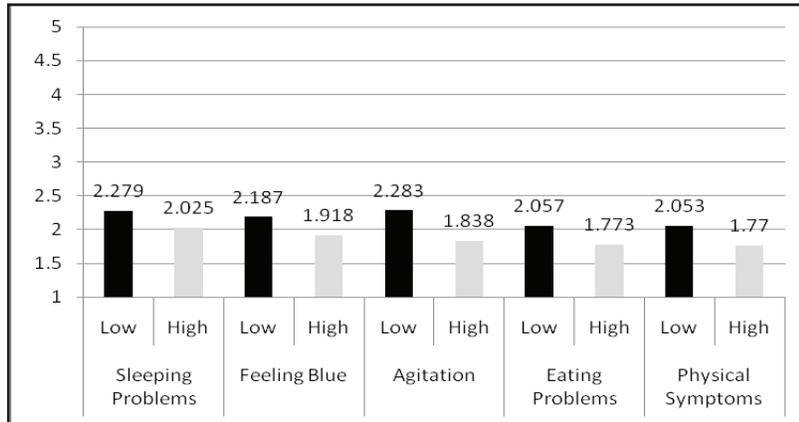
High Vs. Low Success Groups for Social Connections



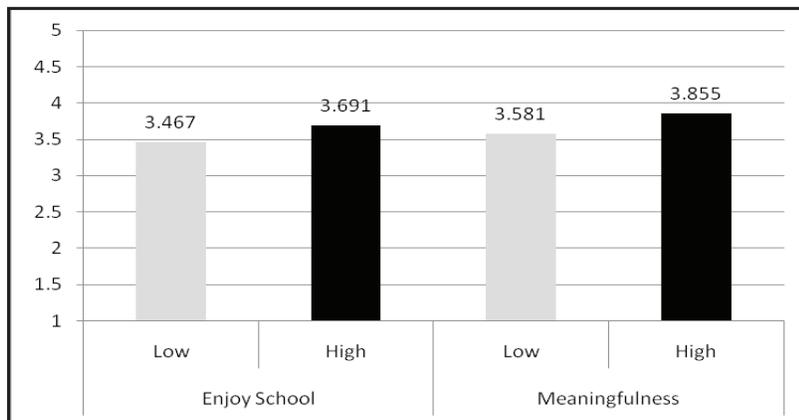
High Vs. Low Success Groups for Academic Stress



High Vs. Low Success Groups for Psychological and Emotional Distress



High Vs. Low Success Groups for Motivation to Attend School



Discussion

Study 1 sought to identify whether the 18 resiliency subscales are able to differentiate students who make successful versus less successful high school transitions. The results indicated that students who demonstrated high academic success (composite of attendance, grades, and behavior reports) up to three years into high school had reported significantly higher ratings for all 18 subscales than students who demonstrated low academic success.

Study 2

Is there a Subset of Resiliency Skills that Differentiate High and Low Success Groups?

The purpose of Study 2 was to determine whether a subset of the 18 subscales could be combined in order to create an early warning of school failure. Discriminant analysis was used to determine whether a subset of resiliency subscales could differentiate the High and Low Success Groups. Discriminant analysis, a statistical technique for predicting group membership from a set of independent variables, was used to evaluate whether a reliable subset of subscales could differentiate High and Low Success Groups. Specific efforts were taken to assure that the independent variables were correlated with group membership but relatively uncorrelated with one another. We used a holdout method by randomly dividing our sample in two and then cross-validating our results from the first sample with the second sample. Once cross-validated, the samples were combined to conduct the final analysis.

Results

One challenge with discriminant analysis is that it does not handle a large number of interrelated predictors due to multicollinearity. In order to reduce the number of predictors, only subscales that correlated .20 and above with the High and Low Success Groups were included in the discriminant analysis. As a result, 5 subscales were entered into the discriminant analysis, and four were found to discriminate between the High and Low Success Groups – importance of college, agitation, academic stress, and motivation to attend school (meaningful motivation). The four subscales were then verified using the second validation sample. The sample was then combined, and the results indicated that the four subscales significantly differentiated between the High and Low Success Groups.

The results are presented in Table 2. A total of 11% of the variance in the High vs. Low Success Groups was accounted for by the four subscales. For the function as a whole, Wilks' Lambda = .89, $F(4, 1679) = 193.97$, $p < .000$, eigenvalue = .12, and $R = .33$. Group centroids were -.38 for the Low Success Group and .325 for the High Success Group.

Table 2: Results of the Discriminant Analysis

Predictor	Standardized Discriminant Function Coefficient	Wilks' Lambda	F(1, 1683)
Importance of College	.453	.940	107.257*
Agitation	-.312	.953	83.282*
Academic Stress	-.377	.954	81.634*
Motivation (Meaningfulness)	.381	.955	79.656*

* $p < .000$

Table 3 indicates that the four subscales effectively classified 65% of the sample with 52% being correctly classified in the Low Success Group and 76% being correctly classified in the High Success Group.

Table 3: Total Sample Classification Analysis

	Predicted Group	
Actual Group	Low Success Group	High Success Group
Low Success Group		
N	406	376
%	52%	48%
High Success Group		
N	213	690
%	24%	76%

Table 4 reexamined the ability of the four subscales to differentiate between the High and Low Success Groups separately by Cohort. This analysis sought to evaluate whether the accuracy rate for predicting High vs. Low Success Groups increased the longer students were in high school. The results indicated that classification for the Low Success Group increased from an accuracy rate of 21% for students in the 9th grade (2009 Cohort) to 89% for students in the 11th grade (2007 Cohort). Interestingly, the High Success Group became less predictable through time with a successful classification of 95% occurring in the 9th grade and by 11th grade only 20% of the students being accurately identified.

Table 4: Classification Accuracy by Cohort

	Predicted Group	
Actual Group	Low Success Group	High Success Group
Low Success Group		
2009 Cohort	21%	11%
2008 Cohort	63%	19%
2007 Cohort	89%	13%
High Success Group		
2009 Cohort	5%	95%
2008 Cohort	30%	70%
2007 Cohort	80%	20%

Discussion

The purpose of Study 2 was to evaluate whether student reported levels of resiliency skills would predict future high school success. A high school success indicator was established using up to three years of attendance, suspension, and grade point averages for the 4,797 students who completed the *Success Highways* resiliency instrument as part of a summer support program. The results indicated that students in the High Success Group were found to have reported higher resiliency skills than students in the Low Success Group.

Two implications are evident from this study: 1) Resiliency skills are able to differentiate High from Low Success Groups of students, which allows educators to tailor support services to specific types of resiliency skills; and 2) Four of the resiliency skills – importance of college, agitation, academic stress, and meaningful motivation – were found to differentiate High versus Low Success Groups. Evidence indicates that these four indicators may be more predictive of students who will experience lower success in their sophomore and junior years in high school.

Study 3

Is there a Subset of Resiliency Skills that Differentiate High and Low Success Groups?

We again used the holdout method described in Study 2 by dividing our data into two random halves. We used the first half to arrive at a prediction formula based on students' results on the Revving Up survey to predict whether they would subsequently be academically Successful or Unsuccessful. Then we used the prediction formula developed from the first half of the data to test how well it could predict the status of students in the second half of the dataset as Successful or Unsuccessful.

The Revving Up survey consists of 6 relatively independent resiliency scales. Each of these is composed of three or more subscales, which are correlated with one another. To arrive at the prediction formula, we first examined a correlation matrix to determine how well each individual subscale predicted academic success or academic failure. Then we selected the one subscale of each set that best predicted academic success or failure, and entered these into the Discriminant Analysis.

The combination of subscales that best predicted academic success or failure were importance of college, meaningful motivation to learn, classroom confidence, physical symptoms of distress, and academic stress.

While all five subscales contributed to the prediction power of the equation, the subscale that was most predictive of academic success was a student's belief in the importance of going to college. The analysis yielded an equation for combining those subscales into a single prediction score, and a score was computed for each student in the data set. A cutoff score of 0.10 was used to divide students into a high group (predictive of success) and a low group (predictive of failure). This cutoff correctly predicted 59.9% of failing students and 59.1% of successful students. The prediction rates are described in Table 5.

Table 5: Predicted Versus Actual Sample 1

			Predicted Status		Total
			Failing	Passing	
Actual Status	Failing	Count	452	303	755
		%	59.9%	40.1%	100.0%
	Pass	Count	386	558	944
		%	40.9%	59.1%	100.0%
Total		Count	838	861	1699

Next, the analysis was replicated with the second data set, and a prediction score was computed for each student. Using the same cutoff of .10, the results were replicated (Table 6). In the second random split of the data set, the prediction formula developed with the first half correctly classifying 60.5% of failing students and 56.5% of successful students, with Chi Square significant at $p < .001$. This provides strong evidence that the prediction formula is stable, and not dependent on a particular sample of students.

Table 6: Predicted Versus Actual for Sample 2

			Predicted Status		Total
			Failing	Passing	
Actual Status	Fail	Count	425	277	702
		%	60.5%	39.5%	100.0%
	Pass	Count	430	559	989
		%	43.5%	56.5%	100.0%
Total		Count	855	836	1691

Finally, we used the combined data set to arrive at a refined prediction formula using the same five subscales to predict academic success or failure:

$$\text{Prediction Score} = (0.680 * \text{Importance of College mean}) + (0.327 * \text{Classroom Confidence mean}) + (-0.543 * \text{Academic Stress mean}) + (-0.246 * \text{Physical Symptoms mean}) + (0.367 * \text{Meaningful Motivation mean}) - 4.070$$

A prediction score was computed for each student, and using a cutoff of .10 as in the previous analysis, predicted status was compared to students' actual academic status. This correctly predicted the academic status of 60% of failing students and 58% of successful students, for a total accuracy rate of 58.7%.

The prediction score explained 5% of the total variance in students' academic status. Although this is not a great deal of variance, when students obtain scores that are unusually low, those scores are highly predictive of academic failure. A table was generated showing the probability of subsequent Academic Success and Academic Failure based on the combined Prediction Score.

Table 7: Probability of Success or Failure

Prediction Score	Probability of Academic Success	Probability of Academic Failure
-4	15%	85%
-3	21%	79%
-2	30%	70%
-1	40%	60%
0	50%	50%
+1	61%	39%
+2	71%	29%

Discussion

Study 3 extended the results of Study 2 by evaluating academic success and failure using an outcome composite of enrollment status and accumulation of credits towards graduation rather than GPA, attendance, and behavior reports. The results indicated that five resiliency indicators were able to differentiate successful students from unsuccessful students. These five resiliency indicators included importance of college, meaningful motivation to attend school, classroom confidence, physical symptoms, and academic stress. Using the weighted formula, a probability of academic failure can be computed for students in the future who complete the Revving Up survey and serve as an at-risk profile indicator. While risk is not as predictive for the middle range of students, the Revving Up survey does appear able to predict the higher risk students with a good probability and could be used by school administrators to identify at-risk students. In addition, the prediction formula can be refined over time as more data become available from other school districts.

General Discussion

Three studies were conducted in order to evaluate whether items from the Revving Up instrument could predict high school success. The Revving Up instrument is completed by students participating in the *Success Highways* curriculum. The *Success Highways* curriculum focuses on helping students learn how to apply six resiliency skills that are known to facilitate academic and life success. As part of the curriculum, the Revving Up results are used to provide each student with a personalized bar chart that compares their results with a norm group.

Study 1 demonstrated that the 18 subscales from the Revving Up instrument were all able to predict future academic success. Three Cohorts of students completed the Revving Up instrument the summer before entering high school. Up to three years of high school outcome data related to attendance, grades, and behavior reports were used to generate a High and Low Success Group. Results indicated that students in the High Success Group reported higher ratings for confidence, connections, motivation, importance of school and lower ratings for academic stress and distress than students in the Low Success Group. One implication of Study 1 is that the average scores for the High Success Group for each of the 18 subscales can be used as the comparison bar graph for students when they receive their personalized charts.

Studies 2 and 3 used discriminant analysis to determine whether subgroups of the 18 resiliency subscales could differentiate High and Low Success Groups. Studies 2 and 3 differed in the criteria used to generate High and Low Success Groups. Study 2 used attendance, grades, and behavior reports while Study 3 used enrollment status and accumulation of credits towards graduation. Study 3 resulted in a more reliable and stable prediction. The results indicated that students are likely to be successful in making high school transitions when they value the importance of going to college, attend school because it is deemed meaningful, are more confident to engage in classroom activities, and report lower academic stress and physical distress. The results of Study 3 are important to the extent that results from the Revving Up instrument can be used to identify students who are likely to be at-risk for school failure.

Footnotes

1. Close, W., & Solberg, V. S. H. (2008). Predicting achievement, distress, and retention among lower income Latino youth. *Journal of Vocational Behavior*, 72(1), 31–42; Solberg, V. S. H., Carlstrom, A. H., Howard, K.A.S. & Jones, J. E. (2007). Classifying youth at-risk for high school non-completion: Role of exposure to violence and resilience on 9th grade outcomes. *Career Development Quarterly*, 55, 313-327
2. Gillis, S.A. & Sidivy, S.K. (2008). Technical Validation Study for *Success Highways* (ScholarCentric 2008).
3. Bandura, A. (1997). Self-efficacy: The exercise of control. New York, NY: Freeman & Co.; Close, W., & Solberg, V. S. H. (2008). Predicting achievement, distress, and retention among lower income Latino youth. *Journal of Vocational Behavior*, 72(1), 31–42.; Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human development*. New York, NY: Plenum; Hobfoll, S. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist*, 44(3), 513–524; Solberg, V. S. H., Carlstrom, A. H., Howard, K.A.S. & Jones, J. E. (2007). Classifying youth at-risk for high school non-completion: Role of exposure to violence and resilience on 9th grade outcomes. *Career Development Quarterly*, 55, 313-327; Solberg, V. S., Howard, K. A. S., Gresham, S. L. & Phelps, L. A. (2010). The Impact of Quality Learning Experiences on Self-Determination Skills: A Path Analytic Study Among Students with Disabilities. Manuscript submitted for publication.
4. M. MacIver, R. Balfanz, & V. Byres, "Dropouts in the Denver Public Schools: Early Warning Signals and Possibilities for Prevention and Recovery" (April 2009).
5. Huberty, C. J., & Hussein, M. H. (2003). Some problems in reporting use of discriminant analyses. *The Journal of Experimental Education*, 71, 177-191.

ScholarCentric
2406 W. 32nd Ave., Suite C
Denver, CO 80211

800-995-8779 • www.ScholarCentric.com