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Development and Initial Validation of a Measure of Academic Behaviors Associated With College and Career Readiness

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Abstract

In this cross-validation study, the authors examined the psychometric properties of a measure of academic behaviors associated with college and career readiness intended for high school students. An exploratory factor analysis (EFA) was conducted with a randomly selected portion of the sample ($n = 413$) and resulted in four reliable factors: Goal-driven Behaviors, Persistence, Study Skills, and Self-Monitoring. A confirmatory factor analysis was conducted with the remaining sample ($n = 610$). Goodness-of-fit indices indicated acceptable model fit. Follow-up analyses revealed significant differences in factor scores among 9th grade students according to gender and race but no significant differences between students in grades 10 through 12, showing the measure functions similarly across students for the most part and particularly for students approaching graduation. Implications for use as a value-added assessment in secondary environments are discussed.

Keywords

college readiness, assessment, study skills, self-monitoring, secondary-to-postsecondary transition

While the number of high school graduates pursuing postsecondary school continues to increase, the number of college freshmen requiring remedial education ranges from 30% to 60% (National Center for Education Statistics [NCES], 2004). This discrepancy suggests a gap between what is taught in high school and what students are expected to know and do in college. A student may be *college-eligible*—able to meet college admissions requirements—without being *college ready*—able to enroll and succeed in credit-bearing general education courses at the postsecondary level without remediation (Conley, 2005, 2007, 2010). Efforts to measure college readiness include college admissions and placement test scores, grade point averages, high school achievement exam scores, and academic rigor of high school courses. While some studies have demonstrated predictive

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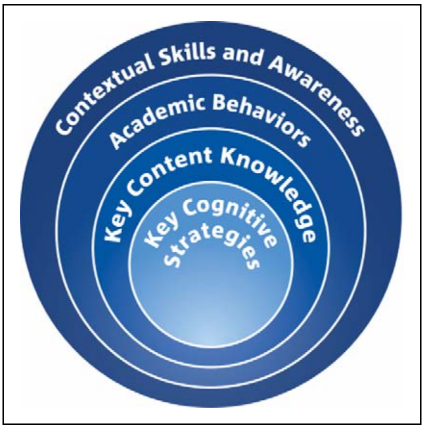

Figure 1. The four dimensions of college and career readiness.

validity of college admissions and high school achievement tests to college grade point average (Camara & Echternacht, 2000; Cimetta, D'Agostino, & Levin, 2010; Coelen & Berger, 2006; McGee, 2003; Noble & Camara, 2003), some of these commonly used college readiness indicators have shown a lack of alignment between high school academic content and the necessary knowledge and skills pertinent for postsecondary success (Achieve, Inc., 2007; Brown & Conley, 2007; Brown & Niemi, 2007; Conley, 2003).

Efforts to address these flaws and adequately measure the knowledge and skills associated with college and career readiness have lead to the development of new standards (Conley, Hiatt, McGaughy, Seburn, & Venezia, 2010) and instruments (Conley, Lombardi, Seburn, & McGaughy, 2009; Conley, McGaughy, Kirtner, van der Valk, & Martinez-Wenzl, 2010). In an attempt to address the growing problem of high school graduates requiring remediation, states such as Texas have developed and adopted career and college readiness standards meant to guide educators in developing curriculum and assessments with the underlying goal of college and career readiness for all graduating students (Conley, Hiatt, et al., 2010). Meanwhile, other sets of college and career readiness standards have been developed and promoted through nationwide education organizations such as the National Governors Association Center for Best Practices and the Council of Chief State School Officers. In both cases, standards are not only subject-specific but also cross-disciplinary, meant to define the necessary skills and behaviors of successful students. In light of these newly developed standards, the flaws of the current college readiness indicators, and the need for better defined "best practices" around college readiness (Tierney, Bailey, Constantine, Finkelstein, & Hurd, 2009), new measures are needed that will assess college and career readiness behaviors and skills among students. Additionally, such measures should inform high school administrators, counselors, and teachers of what they can do to better prepare their students for the rigor of college courses. Finally, these measures must include the assessment of cross-disciplinary skills and behaviors that are not necessarily content specific.

A Comprehensive College Readiness Model

A growing body of research suggests that the development of college readiness skills is facilitated by student awareness and planning around key areas such as cognitive strategies, content knowledge, contextual skills and awareness, and academic behaviors (Conley, 2007, 2010). Figure 1 represents this comprehensive model of college readiness.

Key cognitive strategies refer to the intentional behaviors that enable students to learn, understand, retain, use, and apply content from a range of disciplines, and include the ability to make inferences, interpret results, analyze conflicting source documents, support arguments with evidence, solve complex problems that have no obvious answer, reach conclusions, offer explanations, conduct research, engage in the give-and-take of ideas, and generally think deeply about what they are being taught (Conley, 2003, 2005; National Research Council, 2002). Key content knowledge is the foundational content knowledge necessary to understand the academic disciplines, including overarching reading and writing skills, and core academic subject area knowledge and skills, including English/ language arts, mathematics, science, social sciences, world languages, and the arts. Contextual skills and awareness refers to the privileged information necessary to navigate the college admissions and financial aid processes and to understand how college operates as a system and a culture. Finally, academic behaviors are self-management skills, attitudes, and habits necessary for students to meet the challenges of college workload and rigor.

Of the four areas, high schools students are perhaps the least commonly assessed in academic behaviors. These behaviors tend to be independent of a particular content area and consist largely of self-monitoring and study skills. Examples include the ability to self-monitor, manage time, take notes, set goals, persevere in the face of obstacles, collaborate, self-evaluate, and self-advocate (Bransford, Brown, & Cocking, 2000; Conley, 2007). Evidence shows students, particularly first generation students, who participated in structured study skills programs that promote academic behaviors during high school reported feeling confident in their abilities to manage college coursework (Reid & Moore, 2008; Watt, Johnston, Huerta, Mediola, & Alkan, 2008).

Potentially, increased awareness of academic behaviors associated with college and career readiness may help students to feel more engaged with their schoolwork. Students who are more engaged in school tend to have higher academic motivation and achievement (Fredricks, Blumenfeld, & Paris, 2004). According to Fredericks et al. (2004), school engagement is comprised of behavioral, emotional, and cognitive engagement and there is an impending need to further define and measure the interrelation of these concepts. Importantly, school engagement is malleable. If provided with the appropriate information, teachers can adjust instruction, strategies, assignments, or other course variables to enhance the learning environment for their students. Essentially, adequate measures of academic behaviors are important to develop and validate in consideration of the potential for change in school engagement, which may in turn positively impact academic motivation and achievement.

Measures of Academic Behaviors

Currently there are measures available to high school administrators and teachers who wish to assess the academic behaviors of their students in a psychometrically rigorous fashion. One assessment is the Learning and Study Strategies Inventory (LASSI; Weinstein & Palmer, 1990), which has 10 subscales: Anxiety, Information Processing, Self-Testing, Selecting Main Ideas, Time Management, Motivation, Concentration, Study Aids, Test Strategies, and Attitude. For the most part, the LASSI subscales measure study skills, not self-monitoring. Further, there are some limitations with the LASSI regarding psychometric qualities, including highly correlated subscales (Stevens & Tallent-Runnels, 2004).

Other measures of academic behaviors include facets of self-monitoring within larger measures of self-regulation, such as the Motivated Strategies for Learning Questionnaire (MLSQ; Pintrich, Smith, Garcia, & McKeachie, 1991) and the Patterns of Adaptive Learning (PALS; Midgley et al., 2000). The MLSQ has four subscales relevant to academic behaviors: meta-cognition, effort management, time and study environment, and test anxiety. Similarly, the PALS contains six relevant subscales: academic efficacy, academic self-handicapping, academic skepticism, mastery goal orientation, performance-avoidance goal orientation, and performance approach goal orientation. Both the MLSQ and PALS show evidence of positive associations with achievement (Abar, Carter, & Winsler, 2009; Pintrich & DeGroot, 1990; Vrugt & Oort, 2008).

These are subscales of larger instruments that measure the overall construct of self-regulation, which has overlapping qualities with academic behaviors, but is more associated with self-monitoring than study skills. Mainly, self-monitoring is more intrapersonal, where the focus is on the individual and not as much on the interaction with others within the social learning context. Similar to self-regulation, there is less focus on the interaction with others (e.g., peer groups, tutoring, and teacher support) as a learning mechanism. Study skills have been proven effective in aiding college student learning (Crux, 1991; Reid & Moore, 2008; Reis, McGuire, & Neu., 2000; Watt et al., 2008). Typically, these strategies are more interpersonal and include technical devices and social supports (Ruban, McCoach, McGuire, & Reis, 2003). Further, self-regulation behaviors have been found difficult to operationalize and measure because of the degree of construct-overlap (Boekaerts, 1996; Boekaerts & Corno, 2005; Zimmerman, 1989). Similarly, study strategies have overlapping definitions with self-regulation and the research field lacks a consensus agreement on operational definitions (Crux, 1991; Ruban et al., 2003).

In sum, the existing measures related to academic behaviors focus on self-regulation or study skills. An assessment is needed that measures both areas so that high school teachers, counselors, and administrators do not have to rely on multiple measures. Further, previous validity studies on existing measures have shown a high degree of factor intercorrelations (Boekaerts, 1996; Boekaerts & Corno, 2005; Stevens & Tallent-Runnels, 2004; Zimmerman, 1989), indicating a need for more precise operationalization of these constructs. Finally, there is preliminary evidence that self-monitoring and study skills aid college student learning (Reid & Moore, 2008; Watt et al., 2008) and that academic behaviors are a necessary dimension of college readiness (Conley, 2007, 2010; Conley, McGaughy, et al., 2010). There is a need to measure self-regulation and study skills in the greater context of college and career readiness. In this study, we examine the psychometric properties of the academic behaviors dimension of the College & Career Ready School Diagnostic (CCRSD), where both self-monitoring and study skills are measured. We examined initial reliability and validity evidence by conducting a cross-validation study, where the sample is split so that an exploratory and confirmatory analysis is conducted. Finally, we examined group differences based on student race, gender, first generation status, and grade level to determine if demographic characteristics have an effect on perceived importance of academic behaviors and if perceived importance increases as students progress through high school. Particularly, we wanted to determine if differences exist between first and continuing generation students on academic behaviors in light of prior evidence that first generation students felt better prepared for college courses because they learned specific academic behaviors in high school (Reid & Moore, 2008; Watt et al., 2008).

Method

Sample

The sample consisted of 10 high schools in California, Colorado, Connecticut, and Oregon that participated in the 2009–2010 pilot test of the CCRSD. Of the total student sample ($N = 1023$), 28% were in 9th grade, 23% were in 10th grade, 27% were in 11th grade, and 22% were in 12th grade. The high schools were selected because they had high enrollment rates of minority and potential first generation college students (70%) and were implementing programs to improve the college and career readiness of their students. First generation status was defined as those students with no parents who had completed any type of postsecondary degree (e.g., Associate's degree, Bachelor's degree, etc.; Chen, 2005). The racial group with the most participants was Hispanic/Latino (44%), followed by White (18%), African American (14%), Asian/Pacific Islander (11%), Mixed Race (8%), American Indian/Alaskan Native (2%), and decline to respond (3%). There were slightly more female participants (55%) than males (45%).

Measure

The academic behaviors dimension of the CCRSD contains 37 items with response options ranging from 1 (*not at all important*) to 4 (*very important*), with a "don't know/not applicable" option. Students rate the items according to their perceived importance of demonstrated successful college readiness behaviors. The items were written based on a previous study of 38 high schools that demonstrated exemplary practices in terms of college readiness of first generation and underrepresented students (Conley, 2010; Conley, McGaughy, et al., 2010). These practices were categorized and operationalized into four overarching dimensions (as shown in Figure 1). Within each dimension, aspects and components were identified based on qualitative data analysis, which guided item development (for a full study description, see Conley, McGaughy, et al., 2010). As such, the items were based on exemplary practices associated with college and career readiness, and the intent is for students to rate their level of perceived importance of these exemplary behaviors. If students do not rate certain items as important, or indicate they do not know, they are less aware of successful college readiness practices and behaviors. As previously mentioned, the academic behaviors dimension is one of four parts to the comprehensive college readiness model (Conley, 2010). This study focuses solely on initial validation of the academic behaviors dimension.

Procedures

The CCRSD is administered online. Student participants were selected by each participating high school so that there were approximately 100 students per grade. Selected students took the online CCRSD during a designated class period. Student participation was voluntary and students received no compensation. Participants completed an online consent form prior to the start of the survey. If participants responded "no" to the consent form, they were unable to proceed with the survey and were redirected to the end page.

Data Analyses

An exploratory factor analysis (EFA) was conducted using student responses from a randomly selected 40% of the sample and the remaining responses were saved for a confirmatory factor analysis (CFA). The reason for splitting the sample accordingly (as opposed to 50% for each method) was to ensure the CFA sample was large enough to meet more stringent sample size requirements (Kline, 1998). The CFA was used to determine whether the factor structure obtained in the EFA could be confirmed on student responses from the remainder of the sample. Structural equation modeling methods (Kline, 1998) were used to estimate the CFA models.

In addition to the EFA and CFA, we conducted further analyses to examine reliability and group differences. Internal consistency of the scores for the full instrument and within factors was examined with Cronbach's α. Multivariate analysis of variance (MANOVA) and *t* tests were conducted to examine group differences. Two types of software were used for analyses, PASW 18.0 (SPSS Inc., 2010) and AMOS 7.0 (Arbuckle, 2006).

Results

EFA

An EFA was conducted on student responses of a randomly selected 40% of the sample ($n = 413$). The case-to-variable ratio was 11:1. Principal axis factoring and oblique rotation were used because it was assumed that the factors would be intercorrelated. We used only completed surveys for all data analyses, and therefore no missing data treatment was necessary. However, there was a "don't know/not applicable" response option for all items. We treated these responses with three different methods: (a) listwise deletion, (b) imputation with the E/M algorithm, and (c) coding "don't know/not applicable" responses as the lowest level on the scale. We compared results and determined that treating "don't know/not applicable" responses with casewise deletion or imputation would substantially reduce or remove the number of noncompleters (those respondents who selected "don't know/not applicable" at least once) included in the sample. This could be problematic, as our sample had a substantial number of first generation students (70%) many of whom were noncompleters (for full study results, see Lombardi, Seburn, & Conley, 2011). Essentially, the unique needs of first generation students could be overlooked if "don't know/not applicable" responses were treated with casewise deletion or imputation. Because the CCRSD items were based on a validated college readiness model (Conley, McGaughy, et al., 2010), we determined "don't know/not applicable" responses indicated the lowest level of awareness and perceived importance of a successful academic behavior. Students who respond "don't know/not applicable" indicate they either do not know about the specified behavior or do not think it is important. In either case, it is appropriate to categorize these responses at the lowest level on the scale because this lack of knowledge indicates they are least aware of identified successful behaviors associated with college readiness.

Multiple criteria were used to determine the number of factors to retain (a) examination of the scree plots, (b) Velicer's minimum average partial (MAP) test, (c) parallel analysis (O'Connor, 2000), (d) a minimum of three items loading on the factor (Costello & Osborne, 2005), and (e) the theoretical plausibility of the item groupings. Parallel analysis suggested a five-factor solution, whereas MAP criteria suggested retaining three factors. Because the MAP test tends to underextract and parallel analysis tends to overextract factor solutions (O'Connor, 2000), and in consideration of the most interpretable constructs, we determined a four-factor solution was best. In this solution, a total of 8 items were removed because of (a) cross-loadings of .35 or greater on two or more factors or (b) weak loadings across factors (no loadings of .35 or greater). This solution accounted for 60% of the variance in responses. The variance accounted for by individual Factors 1–4 was 44%, 7%, 5%, and 4%, respectively. The pattern matrix for this solution is presented in Table 1.

Factor 1 (7 items), labeled "Goal Driven Behaviors," relates to setting and accomplishing goals ($\alpha = .87$, $\bar{X} = 3.40$, $SD = 0.71$). These items include not only the perceived importance of setting goals but also the necessary steps in accomplishing those goals. Factor 2 (7 items), labeled "Persistence," relates to help-seeking and time management behaviors ($\alpha = .90$, $\bar{X} = 3.43$, $SD = 0.72$). Factor 3 (6 items), labeled "Study Skills," relates to group work with peers, and test- and note-taking strategies ($\alpha = .86$, $\bar{X} = 3.12$, $SD = 0.81$). Factor 4 (5 items), labeled "Self-Monitoring," relates to self-awareness of effective strategies, resources, and ways to improve ($\alpha = .83$, $\bar{X} = 3.01$, $SD = 0.90$). As expected, the four factors were moderate to highly correlated, ranging from .56 to .72, and suggesting the presence of a second order factor.

Structural Models

To test whether the four-factor solution obtained in the EFA could be replicated, we conducted a cross-validation study where a randomly selected 60% of the responses ($n = 610$) were subject to a CFA using maximum likelihood estimation of the sample covariance matrix. Each item was associated with one of the four first-order latent variables that emerged in the EFA (Goal-driven Behaviors, Persistence, Study Skills, and Self-Monitoring) via a single path, and each first-order latent variable was associated with the second order construct of Academic Behaviors via a single path. We set the first measurement path for each latent variable to 1.0 so that a scale could be established for the remaining variables.

Two models were tested to investigate the factor structure. The first model was a second order factor model with four first-order factors based on the results of the EFA. Model 2 was a

Table 1. Pattern Matrix of Four-Factor Solution

Item	F1: Goal-Driven Behaviors	F2: Persistence	F3: Study Skills	F4: Self-Monitoring
i2. I can identify steps I need to take to reach my educational goals	.92			
i1. I can identify steps I need to take to reach my career goals	.83			
i3. I discussed with my guidance counselor the plans I have for after graduation	.59			
i9. I participate in study groups outside of class.	.58			
i32. I have researched educational option(s) that match my strengths or interests.	.55			
i23. I am able to identify resources needed to complete a task or project	.44			
i17. I take complete, organized, and accurate notes during class	.42			
i42. I allow enough time to complete multiple drafts of an assignment if necessary		.77		
i56. I refer to the syllabus or class website to prepare for and complete course assignments		.61		
i40. I complete assignments even when they aren't collected or graded		.55		
i20. I ask my teachers for help outside of class[a]		.45		.39
i29. I talk to adults when I have concerns about school		.43		
i43. I balance schoolwork with my other activities and commitments		.37		
i41. I use unstructured time during the school day to complete assignments			.83	
i36. I try to predict the possible test questions in preparation for exams			.80	
i37. I spend enough time studying for exams to learn the material well			.75	
i39. I analyze the questions on a test to plan my approach prior to answering			.69	
i34. I journal or blog about what I learn			.53	
i33. I have identified specific classes in high school that are a good match to my strengths			.52	
i15. I take notes when I am reading class materials[a]			.40	.37
i10. I work in small groups during class time			.38	
i53. I know the best environment and time of day for me to study				.65
i51. I complete my projects and assignments without being reminded				.63
i6. I figure out what score I need on tests or assignments in order to get the grade I want in a class.				.58
i18. I enjoy challenging myself in school.				.50
i28. I review materials ahead of time that will be discussed in class.				.48
i52. I use to-do lists to keep track of tasks[a]		.43		.46
i30. I find out what I missed on exams to make improvements				.42
i8. I take a leadership role while studying with peers[a]				.34

[a] Removed from CFA Model 2.

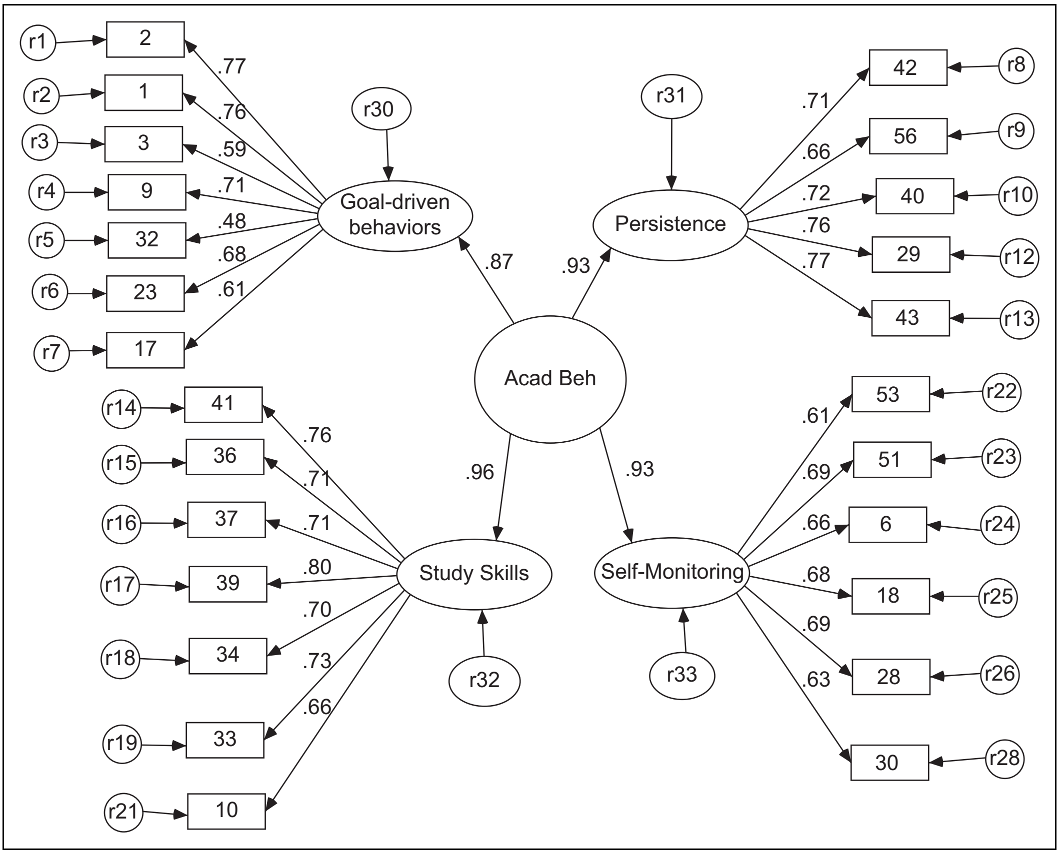

Figure 2. CFA model with standardized parameter estimates.

modification of Model 1, where 4 items were removed based on the EFA results. Three items had cross-loadings of .35 or greater on two factors, and one item had a low factor loading (< .35) (these items are noted in Table 1). Model 2 had the best fit, which was the modification model that included four first-order factors, a second order factor, and 25 items. This model is depicted in Figure 2.

Table 2 shows unstandardized parameter estimates resulting from the CFA. All estimates are positively and statistically significantly different from zero, indicating each item is positively related to the latent construct. The standardized parameter estimates ranged from .48 to .95 (shown in Figure 2).

Model fit was evaluated using the minimum fit function χ^2. As χ^2 values are potentially inflated by large sample sizes, we also examined the χ^2/df ratio, where a value of 5 or less is considered an acceptable fit between the hypothesized model and the sample data (MacCallum, Brown, & Sugawara, 1996). In addition, model fit was examined using three goodness-of-fit indices: the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root mean square residual (SRMR). In this study, we used the following cutoff points to evaluate good model fit: RMSEA $< .08$ (Browne & Cudeck, 1993), SRMR $< .08$, and CFI $> .90$ (Hu & Bentler, 1995). The obtained χ^2 value for Model 2 was $\chi^2(271) = 1164.2$, $p < .001$, which was a significant improvement of model fit over the first model, $\Delta\chi^2(102) = 425.6$ $p < .001$. The obtained RMSEA values for both models was .07 and the obtained SRMR values for both models was .06, indicating no change in model fit for these two indices between Models 1 and 2. However, the obtained CFI value improved from .87 to .89 between Models 1 and 2, and

Table 2. CFA Model Parameter Estimates

Pathway	Unstandardized Estimate	*SE*	*t*
Academic behaviors			
Goal-driven behaviors	1.00		
Persistence	1.50	0.11	12.81**
Self-monitoring	1.09	0.09	11.58**
Study skills	0.98	0.07	12.40**
Goal-driven behaviors			
i17. I take complete, organized, and accurate notes during class	1.00		
i23. I am able to identify resources needed to complete a task or project	0.97	0.07	13.68**
i32. I have researched educational option(s) that match my strengths or interests	0.74	0.07	10.39**
i9. I participate in study groups outside of class	0.91	0.06	14.05**
i3. I discussed with my guidance counselor the plans I have for after graduation	1.02	0.08	12.25**
i1. I can identify steps I need to take to reach my career goals	1.02	0.06	14.86**
i2. I can identify steps I need to take to reach my educational goals	1.03	0.06	14.99**
Persistence			
i42. I allow enough time to complete multiple drafts of an assignment if necessary	1.00		
i56. I refer to the syllabus or class website to prepare for and complete course assignments	0.93	0.06	15.41**
i40. I complete assignments even when they aren't collected or graded	0.97	0.05	16.73**
i29. I talk to adults when I have concerns about school	0.91	0.05	17.63**
i43. I balance schoolwork with my other activities and commitments	0.95	0.05	17.77**
Study skills			
i10. I work in small groups during class time	1.00		
i33. I have identified specific classes in high school that are a good match to my strengths	1.30	0.08	15.83**
i34. I journal or blog about what I learn	1.44	0.09	15.35**
i39. I analyze the questions on a test to plan my approach prior to answering	1.36	0.08	17.06**
i37. I spend enough time studying for exams to learn the material well	1.10	0.07	15.44**
i36. I try to predict the possible test questions in preparation for exams	1.30	0.08	15.52**
i41. I use unstructured time during the school day to complete assignments	1.25	0.07	16.49**
Self-monitoring			
i53. I know the best environment and time of day for me to study	1.00		
i51. I complete my projects and assignments without being reminded	1.28	0.09	13.66**
i6. I figure out what score I need on tests or assignments in order to get the grade I want in a class	0.97	0.07	13.26**
i18. I enjoy challenging myself in school	1.11	0.08	13.60**
i28. I review materials ahead of time that will be discussed in class	1.22	0.08	13.71**
i30. I find out what I missed on exams to make improvements	1.07	0.08	12.78**

**$p < .001$.

change of .02 or greater is considered significant improvement in model fit (Cheung & Rensvold, 2002). Therefore, Model 2 had significantly improved model fit over Model 1 and met the criteria for good model fit, with the exception of the CFI, which fell below .90. Despite this and in consideration of the combination of all fit indices, the model shows an overall acceptable fit to the data.

Table 3. Factor Means, Standard Deviations by Student Group and Grade Level

		Goal-Driven Behaviors		Persistence		Study Skills		Self-Monitoring	
	N	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*
9th Grade	283	3.26	.77	2.88	.97	3.31	.81	3.03	.88
Hispanic/Latino	138	3.10*	.84	2.77	1.03	3.20	.87	2.95	.95
White	43	3.23	.89	2.83	1.06	3.27	.89	2.96	.95
Females	148	3.28*	.78	2.83	.98	3.33*	.80	2.99	.89
Males	135	3.25*	.77	2.94	.97	3.28*	.82	3.09	.87
Continuing generation	69	3.48	.50	3.08	.76	3.52	.51	3.26	.64
First generation	214	3.20	.83	2.82	1.03	3.24	.87	2.96	.93
10th grade	238	3.37	.69	2.86	.96	3.35	.73	3.05	.80
Hispanic/Latino	120	3.31	.72	2.87	.95	3.31	.78	3.05	.81
White	39	3.43	.58	2.71	.99	3.33	.70	2.88	.78
Females	129	3.39	.72	2.96	.91	3.39	.68	3.13	.75
Males	109	3.34	.72	2.75	1.00	3.31	.78	2.95	.86
Continuing generation	66	3.53	.46	3.07	.78	3.53	.49	3.24	.62
First generation	172	3.31	.75	2.78	1.01	3.28	.79	2.97	.86
11th grade	275	3.43	.63	3.05	.86	3.41	.72	3.13	.73
Hispanic/Latino	114	3.37	.74	3.05	.86	3.34	.77	3.09	.76
White	53	3.36	.50	2.81	.83	3.38	.67	3.04	.63
Females	138	3.51	.53	3.14	.81	3.49	.64	3.19	.65
Males	137	3.35	.71	2.95	.90	3.33	.78	3.07	.79
Continuing generation	96	3.45	.60	3.01	.90	3.40	.78	3.13	.77
First generation	179	3.41	.65	3.07	.84	3.41	.69	3.14	.71
12th grade	227	3.49	.57	3.09	.83	3.50	.65	3.12	.76
Hispanic/Latino	79	3.56	.52	3.26	.70	3.55	.57	3.28	.70
White	49	3.32	.53	2.68	.91	3.35	.77	2.84	.79
Females	123	3.55	.57	3.23	.74	3.55	.61	3.22	.72
Males	104	3.43	.56	2.92	.91	3.43	.69	3.01	.80
Continuing generation	81	3.42	.63	2.91	.95	3.41	.78	2.99	.81
First generation	146	3.54	.58	3.18	.74	3.54	.57	3.19	.73

*$p < .05$.

Measure Reliability

Internal consistency was evaluated on the full instrument and within subscales by calculating α reliability coefficients for the combined EFA and CFA samples. These coefficients were calculated based on Model 2, where 4 items were removed (25 items total). Cronbach's α for the full scale and Factors 1–4 were .95, .84, .90, .89, and .83, respectively. These results suggest excellent reliability in the final version of the measure (Nunnally, 1975).

Group Comparisons

To examine group differences, we conducted separate MANOVA tests for each grade level. Race, gender, and first generation status were the predictors and the four factor scores were the outcomes. We used the combined EFA and CFA samples ($N = 1023$) for this analysis. Race was coded as two separate dichotomous variables where students were coded as (a) Hispanic/Latino (1) or not Hispanic/Latino (0) and (b) White (1) or not White (0). We chose to code race accordingly because Hispanic/Latino students represented the largest racial group (44%) in the sample, and although white students were less prevalent in the sample (18%), we wanted to determine if these students responded differently compared to the other ethnic minority students. Table 3 shows the means and standard deviations by student group and grade level.

For the MANOVAs, homogeneity of variance was tested using Box's Test of Equality of Covariance Matrices. Examination of Box's M shows there was heterogeneity of variance across all grade levels: 9th grade, $F(110, 7240) = 1.89$, $p < .001$; 10th grade, $F(100, 7893) = 1.33$, $p < .05$; 11th grade, $F(110, 14897) = 1.87$, $p < .001$; 12th grade, $F(110, 4961) = 1.87$, $p < .001$. These results indicate the observed covariance matrices of the dependent variables differ to a statistically significant degree across groups. Since heterogeneity of variance was found, a more conservative p value of .025 was used in the MANOVAs.

In the first MANOVA, race, gender, and first generation status were the predictors and the four factor scores were the outcomes for 9th grade students. Results indicated a statistically significant difference in the multivariate combination of the subscale scores based on Hispanic/Latino status, Wilks' $\Lambda = .956$, $F(4, 268) = 3.05$, $p < .025$, $\eta p^2 = .04$, and gender, Wilks' $\Lambda = .952$, $F(4, 268) = 3.38$, $p < .025$, $\eta p^2 = .05$. Results of the univariate tests indicated that 9th grade Hispanic/Latino students rated goal-driven behaviors as less important $F(1, 272) = 6.38$, $p < .025$, $\eta p^2 = .02$ than 9th grade students of other races and that 9th-grade females rated goal-driven behaviors, $F(1, 272) = 4.06$, $p < .05$, $\eta p^2 = .02$, and study skills, $F(1, 272) = 4.30$, $p < .05$, $\eta p^2 = .02$, as more important than did 9th-grade males.

Three more MANOVAs were conducted for 10th, 11th, and 12th grade students using race, gender, and first generation status as the predictors and the four factor scores as the outcomes. No statistically significant differences resulted in these MANOVAs. These findings show demographic characteristics are not significant predictors of the four academic behaviors subscale scores.

To further examine differences according to grade level, we conducted t tests between 9th- and 12th-grade mean scores on the four factors. We found 12th-grade students had significantly higher levels of perceived importance than 9th-grade students in goal driven behaviors, $t(2, 508) = 3.82$, $p < .001$, persistence, $t(2, 508) = 2.52$, $p < .05$, and study skills, $t(2, 508) = 2.90$, $p < .05$. There were not significant differences between 9th- and 12th-grade students in self-monitoring. Figure 3 shows a graph of the subscale score means by grade level.

Discussion

In this study, we examined the psychometric properties of the Academic Behaviors dimension of the CCRSD, a measure intended for schools to determine their level of college readiness (Conley, 2010). EFA results showed four factors emerged: goal-driven behaviors, persistence, study skills, and self-monitoring. Items were written to measure practices associated with study skills and self-monitoring, which were constructs identified in an earlier study of best practices associated with college readiness in high schools (Conley, 2010; Conley, McGaughy, et al., 2010). These results clarified that self-monitoring and study skills are not the only overarching constructs in the academic behaviors dimension of the comprehensive college readiness model.

To summarize, the EFA found four first-order factors that were moderate to highly correlated, suggesting the presence of a second-order factor. We replicated this factor structure by conducting a CFA with a separate sample and tested two models, each with a second-order factor. The CFA results showed parameter estimates were all statistically significant, indicating the latent constructs explained significant variance in the items and demonstrating significant relationships among the measured variables and latent constructs. Further, these parameters are consistent with the four factors that emerged from the EFA. Model goodness-of-fit indices indicated the best fit with four additional items removed based on cross-loadings or low factor loadings in the EFA results. The final instrument contained 25 items with all α coefficients greater than .80, showing excellent reliability (Nunnally, 1975). While the final version of the instrument has considerably fewer items than the original (12 items were eliminated based on EFA and CFA results), content domain coverage

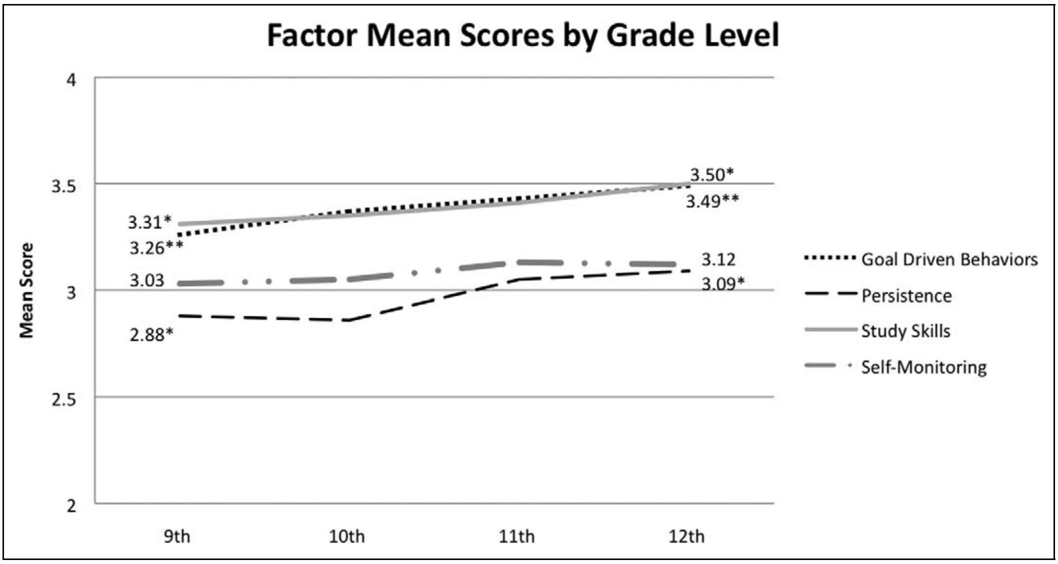

Figure 3. Factor mean score differences by grade level. Statistical significance is indicated for score differences between 9th- and 12th-grade students (*$p < .05$).

remains adequate because each factor has a minimum of 6 items (Costello & Osborne, 2005; Kline, 1998).

Group comparisons were examined by conducting four MANOVAs, one for each grade level, where student race, gender, and first generation status were entered as predictors and the four factor scores were outcomes. There were no statistically significant differences between students in grades 10 through 12, however there were significant differences in 9th-grade students in gender and for Hispanic/Latino students. These findings suggest that students may begin high school with varying awareness and perceived importance of college readiness behaviors. However, as they progress through high school, they tend to see the importance of these behaviors similarly regardless of race, gender, and first generation status. Further research is needed to determine more precise reasons for significant differences among 9th-grade students, particularly for gender and Hispanic/Latino students and especially given the needs to assess emerging academic behaviors in middle school students. Most importantly, these differences do not persist throughout high school, suggesting that *all* students, regardless of race, gender, and first or continuing generation status will benefit from the integration of academic behaviors into curriculum and instruction. Further, there were significant differences in factor mean scores of 9th- and 12th-grade students, indicating students are learning more about and have higher levels of perceived importance of academic behaviors as they progress through high school.

The results of this study should inform instrument revision, particularly of certain items that were dropped in the EFA or CFA. Because a cross-validation study was conducted, the four-factor structure was confirmed and items can be revised with confidence based on this new model structure. Importantly, the confirmation of the second order factor shows further evidence of the highly intercorrelated nature of the constructs. Previous studies have similar findings, where self-regulation, a concept similar to self-monitoring, has proven difficult to operationalize (Boekaerts, 1996; Boekaerts & Corno, 2005), and therefore presents a need for validated self-regulation assessments (Cascallar, Boekaerts, & Costigan, 2006). Other literature describes self-monitoring as intrapersonal and therefore distinct from study skills, which are more interpersonal (Ruban et al., 2003). Our findings show some evidence of discriminant validity in that self-monitoring and study skills are indeed separate latent constructs represented by different sets of items. However, we found evidence of convergent validity in that factors were highly correlated and the presence of a second-order factor indicated the best model fit. Essentially, our findings confirm the difficult nature of disentangling these constructs and also contribute to better construct definition and operationalization. Overall, our findings validate the internal structure of the instrument and will inform further refinement of the CCRSD. Validity is most important to consider in the interpretation and use of scores, including social consequences based on score values (Messick, 1995). Our findings show evidence of structural validity, bring further meaning to the four factor scores, and ultimately will help teachers to develop more targeted classroom interventions in these specific skill areas.

These findings contribute to the literature on school engagement. This study shows preliminary reliability and validity evidence of a measure that addresses some needs in the area of school engagement assessment. Facets of behavioral and cognitive engagement are measured in the academic behaviors dimension of the CCRSD. Persistence is included in the behavioral engagement definition; meanwhile self-monitoring, study skills, and goal-driven behaviors encompass facets of the cognitive engagement definition (Fredricks et al., 2004). Measuring school engagement is particularly important because multiple studies have shown a strong association between behavioral and cognitive engagement and academic achievement (Abar et al., 2009; Connell, Spencer, & Aber, 1994; Marks, 2000; Pintrich & DeGroot, 1990; Vrugt & Oort, 2008; Zimmerman, 1990). Better, more adequate measures of school engagement are needed so that skill deficits can be identified, targeted interventions can be implemented and ultimately academic motivation and achievement will increase. Also, facets of school engagement are typically not tracked longitudinally (Fredricks et al., 2004). These findings show the academic behaviors dimension of the CCRSD has the potential to fill a void identified in the literature by measuring facets of school engagement over time and with psychometric rigor.

Limitations

While this study shows promising initial evidence of reliability and validity, there are some limitations to consider in the interpretation of the results. First, this is a self-report instrument and there is a potential for respondent bias. Further research is needed that focuses on establishing the predictive validity of the CCRSD so that positive associations can be made about those students who exhibit high awareness and understanding of academic behaviors and high achievement. Second, the extent to which these findings generalize across high schools is somewhat limited since the sample included high minority population, particularly for Hispanic/Latino students, and a high number of potential first generation college students.

Implications for Practice

The academic behaviors dimension of the CCRSD has the potential to inform teachers, counselors, and administrators of the current college and career readiness opportunities their school provides to students. Further, as part of a larger instrument, the CCRSD yields reports and recommendations that describe specific actions a school can take to prepare more students for college. The diagnostic shows administrators, counselors, and teachers where instruction could be made more effective, and suggests ways to prioritize the use of their limited resources. Longitudinal use of this assessment will allow schools to understand and increase the effectiveness of their college and career readiness strategies over time.

The CCRSD is the first step in creating a data-driven solution framework that allows high schools to make systematic and deliberate additions and modifications to the content of their programs of study, their organizational structure, and their culture so that these are all more explicitly aligned with the attributes of college and career readiness. The academic behaviors dimension is one of few assessments available to schools that measures skills across content areas that are shown to make a difference in college courses. Teachers and counselors may use the academic behaviors dimension of the CCRSD as a diagnostic tool to gain a greater understanding for how study skills, self-monitoring, goal-driven behaviors, and persistence could be woven into the curriculum. For example, our findings showed no significant differences between 9th- and 12th-grade students in self-monitoring, but did show significant differences in the other three areas. Ideally, teachers may use these results to target instruction and modify curricula so that self-monitoring is better integrated. Then, teachers could assess students again later in the year to determine the effectiveness of their instruction in the targeted area. Ultimately, this assessment allows teachers and counselors to recognize skill deficits early enough to make meaningful differences in preparing students for college.

The CCRSD has the potential to be used as a value-added assessment, where school personnel may assess student growth in the four college readiness dimensions over one or more school years. This utility will allow schools to understand how to better allocate resources and assign personnel accordingly. The CCRSD certainly should not replace traditional and well-established achievement assessments such as grade point averages and college admissions exams. However, the CCRSD provides teachers, counselors, and administrators with valuable information on student learning that may not be provided with a GPA or SAT score and may span across multiple content areas. Ultimately, schools need access to better assessment tools that will enable them to prepare students for the rigors of college; no high school graduate should require remedial college courses. Access to validated assessments that focus on measuring college and career readiness skills are the first step in making sure schools have the necessary tools to help their students.

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