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Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument

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Abstract

A review of relevant literatures led to the construction of a self-report instrument designed to measure two subtypes of student engagement with school: cognitive and psychological engagement. The psychometric properties of this measure, the Student Engagement Instrument (SEI), were assessed based on responses of an ethnically and economically diverse urban sample of 1931 ninth grade students. Factor structures were obtained using exploratory factor analyses (EFAs) on half of the dataset, with model fit examined using confirmatory factor analyses (CFAs) on the other half of the dataset. The model displaying the best empirical fit consisted of six factors, and these factors correlated with expected educational outcomes. Further research is suggested in the iterative process of developing the SEI, and the implications of these findings are discussed.
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Engagement has emerged as the primary theoretical model for understanding school dropout (Finn, 1989) and as the most promising approach for interventions to prevent this phenomenon (Reschly & Christenson, 2006, in press). Further, engagement is the cornerstone of high school reform efforts (National Research Council & Institute of

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Medicine, 2004) and has been described as a potential "meta-construct" in the field of education (Fredericks, Blumenfeld, & Paris, 2004), bringing together many separate lines of research under one conceptual model.

Although interest in engagement has increased exponentially in recent years, its distinction from motivation remains subject to debate. As one conceptualization, motivation has been thought of in terms of the direction, intensity, and quality of one's energies (Maehr & Meyer, 1997), answering the question of "why" for a given behavior. In this regard, motivation is related to underlying psychological processes, including autonomy (e.g., Grolnick & Ryan, 1987; Skinner, Wellborn, & Connell, 1990), belonging (e.g., Goodenow, 1993a, 1993b; Goodenow & Grady, 1993), and competence (e.g., Schunk, 1991). In contrast, engagement is described as "*energy in action*, the connection between person and activity" (Russell, Ainley, & Frydenberg, 2005, p. 1). Engagement thus reflects a person's active involvement in a task or activity (Reeve, Jang, Carrell, Jeon, & Barch, 2004). To illustrate this distinction as it pertains to reading tasks, motivational aspects include (a) perceptions of reading competency, (b) the perceived value of reading in order to obtain larger goals (e.g., better grades, parent/teacher praise), and (c) the perceived ability to succeed at the reading task, among others (Guthrie & Wigfield, 2000). Engagement aspects include the number of words that were read or the amount of text that was comprehended with deeper processing of the content. This conceptualization suggests that motivation and engagement are separate but not orthogonal (Connell & Wellborn, 1991; Furrer & Skinner, 2003; Skinner & Belmont, 1993). That is, one can be motivated but not actively engage in a task. Motivation is thus necessary, but not sufficient for engagement.

Although motivation is central to understanding engagement, the latter is a construct worthy of study in its own right. Klem and Connell (2004) argued that there is strong empirical support for the connection between engagement, achievement and school behavior across levels of economic and social advantage and disadvantage. Furrer, Skinner, Marchand, and Kindermann (2006) also noted that engagement may be vital within a motivational framework as it interacts cyclically with contextual variables; resultant academic, behavioral, and social outcomes, then, are the products of these context-influenced changes in engagement. In addition, the construct of engagement captures the gradual process by which students disconnect from school (Finn, 1989). Consistent with the understanding that dropping out of school is not an instantaneous event, but rather a process that occurs over time, engagement provides a means both for understanding and intervening when early signs of students' disconnection with school and learning are noted. Finally, engagement calls for a focus on alterable variables, including those that address underlying psychological processes, to help increase school completion rates (Connell, Halpern-Felsher, Clifford, Crichlow, & Usinger, 1995; Doll, Hess, & Ochoa, 2001) and to reform high school experiences to help foster students' achievement motivation (National Research Council & Institute of Medicine, 2004).

Conceptualizing cognitive and psychological engagement

Engagement is typically described as having multiple components. In Finn's (1989) model, engagement is comprised of behavioral (participation in class and school) and

affective components (school identification, belonging, valuing learning). Similar definitions have also been offered by Newmann, Wehlage, and Lamborn (1992) and Marks (2000). Two recent reviews of this literature, however, concluded that engagement was comprised of three subtypes: behavioral (e.g., positive conduct, effort, participation), cognitive (e.g., self-regulation, learning goals, investment in learning), and emotional or affective (e.g., interest, belonging, positive attitude about learning) (Fredericks et al., 2004; Jimerson, Campos, & Greif, 2003).

Based on the theoretical work of Finn (1989), Connell (Connell, 1990; Connell & Wellborn, 1991) and McPartland (1994) as well as implementation of the Check & Connect[1] intervention model over 13 years in varied school settings, we have proposed and refined a taxonomy, or organizing heuristic, not only for understanding student levels of engagement, but for recognizing the goodness-of-fit between the student, the learning environment and factors that influence the fit (Christenson & Anderson, 2002; Reschly & Christenson, 2006, in press). Qualitative comments from students who received the Check & Connect intervention during high school (Sinclair, Christenson, & Thurlow, 2005) influenced our own conceptualization of engagement. In our taxonomy, engagement is viewed as a multi-dimensional construct comprised of four subtypes: academic, behavioral, cognitive, and psychological. There are multiple indicators for each subtype. For example, academic engagement consists of variables such as time on task, credits earned toward graduation, and homework completion, while attendance, suspensions, voluntary classroom participation, and extra-curricular participation are indicators of behavioral engagement. Cognitive and psychological engagement includes less observable, more internal indicators, such as self-regulation, relevance of schoolwork to future endeavors, value of learning, and personal goals and autonomy (for cognitive engagement), and feelings of identification or belonging, and relationships with teachers and peers (for psychological engagement). Our proposed taxonomy is a useful heuristic, but given the myriad of indicators comprising the engagement subtypes and the diversity of contexts that they include (e.g., adults at school, family, community, peers), we contend that the emergence of a single factor comprising each subtype is highly improbable. What is more likely are indicators underlying each subtype that are consistent with important contexts (e.g., relationships with adults at school, support from family members, peer support). Fig. 1 depicts the four subtypes, the contexts influencing them, and examples of their respective indicators.

The majority of research has focused on the more observable indicators that are related to academic and behavioral engagement. Although less research has focused on cognitive and psychological indicators of engagement (in comparison to academic and behavioral indicators), there is evidence to suggest their importance to school performance. For example, a robust relationship has been found between cognitive engagement and both personal goal orientation and investment in learning (Greene & Miller, 1996; Greene, Miller, Crowson, Duke, & Akey, 2004; Pokay & Blumenfeld, 1990), which in turn has been associated with academic achievement (Miller, Greene, Montalvo, Ravindran, & Nichols, 1996). Similarly, psychological engagement has been associated with adaptive

[1] More information may be found at http://ici.umn.edu/checkandconnect/.

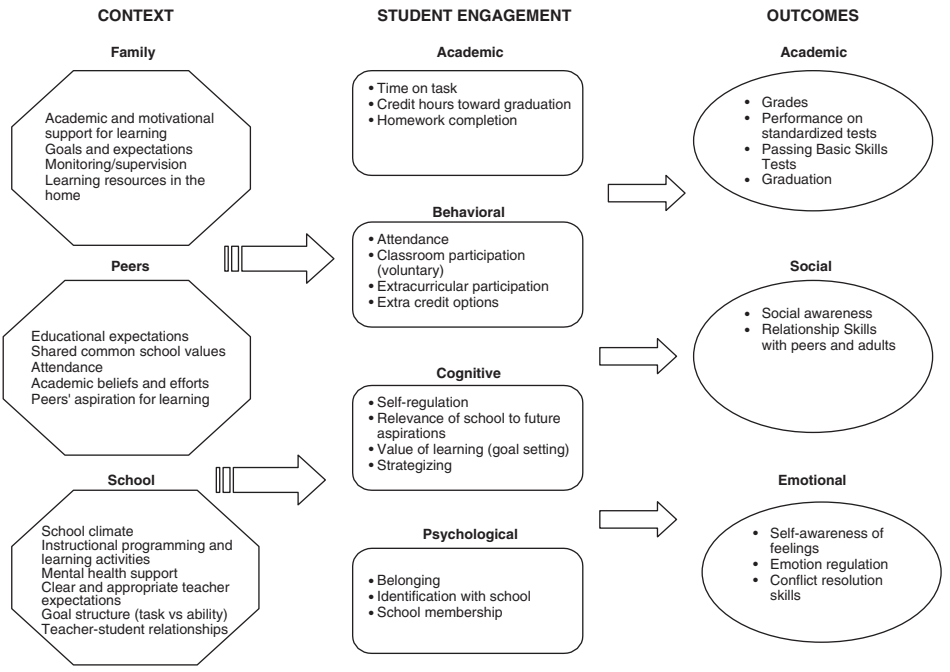

Fig. 1. Engagement subtypes, indicators and outcomes.

school behaviors, including task persistence, participation, and attendance (Goodenow, 1993a). In general, students who feel connected to and cared for by their teachers report autonomous reasons for engaging in positive school-related behaviors (Ryan, Stiller, & Lynch, 1994). Given these findings, it is necessary to move beyond indicators of academic and behavioral engagement to understanding the underlying cognitive and psychological needs of students (see National Research Council & Institute of Medicine, 2004, p. 212 as further support).

Difficulties measuring cognitive and psychological engagement

Engagement is a burgeoning construct; however, limitations have been noted when measuring cognitive and psychological engagement. For example, the same scale items are often used to represent different subtypes of engagement across studies (Jimerson et al., 2003) and subtypes have been examined in isolation (Finn & Cox, 1992), precluding comparison levels of different subtypes with the same participants. Also, survey items are at times extracted from larger, nationally representative databases and subtypes are formed from these studies retroactively (e.g., Reschly & Christenson, in press). This procedure does not provide clarity in the definition of the construct of engagement or its subtypes. Further, items/subtypes drawn retroactively from larger studies run the risk of not having a strong theoretical or conceptual framework. Moreover, the construct of engagement in general, and the identification of subtypes in particular, represents an amalgamation of

isolated studies examining one or two indicators of each subtype, which is contrary to our view of engagement (Reschly & Christenson, in press). Finally, the selection of informants (e.g., teachers, students) varies across studies. We contend that the measurement of cognitive and psychological engagement through observation and rating of student behavior is highly inferential; therefore, obtaining the student perspective results in a more valid understanding of the student's experience and meaning in the environment (Bronfenbrenner, 1992). What is needed to address these limitations are theoretically sound and empirically based measures of cognitive and psychological engagement.

In summary, measuring cognitive and psychological engagement is relevant because there is an overemphasis in school practice on indicators of academic and behavioral engagement. Such overemphasis ignores the budding literature that suggests that cognitive and psychological engagement indicators are associated with positive learning outcomes (Fredericks et al., 2004; National Research Council & Institute of Medicine, 2004), are related to motivation (Reeve et al., 2004; Russell et al., 2005), and increase in response to specific teaching strategies (Cadwallander et al., 2002; Marks, 2000; Reeve et al., 2004). Given that school personnel cannot alter family circumstances (e.g., income, mobility), we must focus on alterable variables, including those related to the development of students' perceived competence, personal goal setting, and interpersonal relationships to offer students optimism for a positive outcome (e.g., Floyd, 1997; Worrell & Hale, 2001). If the conceptualization of the engagement construct, where engagement is hypothesized to be a mediator between contextual influences and academic, social, and emotional learning outcomes (Fredericks et al., 2004) will be advanced, it is our position that the development of a psychometrically sound instrument is a necessary first step.

We contend that specific subtypes of engagement lend themselves to different types of measurement, with psychological and cognitive indicators calling for a student perspective to avoid high and perhaps erroneous inferences about the students' personal competency beliefs, desire to persist toward goals, and sense of belonging. Thus, the purpose of this study was to develop and examine the initial validation of an instrument designed to measure cognitive and psychological engagement from the student perspective.

Method

Participants

Participants were ninth graders in a large, diverse, urban school district in the upper Midwest. Classrooms were randomly selected by the research division of the school district and yielded 2577 students from the population of ninth graders ($N=3104$) in the main high schools. Of those selected for the study, 75% ($N=1940$) of the students completed the engagement instrument. The sample was further reduced due to questionable response patterns ($n=9$), leaving a final sample size of 1,931. The sample was comprised of nearly equal numbers of males and females (51% female). Participant ethnicities were 40.4% African American ($N=780$), 35.1% White ($N=677$), 10.8% Asian ($N=208$), 10.3% Hispanic ($N=199$) and 3.5% American Indian ($N=67$), and in 22.9% of students' homes languages other than English were spoken. Of the students for whom

these data were available, 61.4% were eligible for free or reduced lunch and 7.6% received special education services.

As recommended by Seaman (2001), Chi-square tests were used primarily, and Cramer's V^2 secondarily, to examine differences between participants who completed the instrument and those who were selected but did not complete the scale. Between-group Chi-square tests indicated no differences for gender ($p = .673$) or home language ($p = .054$). Significant Chi-square values and small V^2 values (.015–.031) were obtained for special education service status and ethnicity (with fewer students receiving special education services and fewer students of African-American, Hispanic, and Native American descent completing scales). A significant and slightly more substantive relationship ($V^2 = .156$, $p < .001$) was noted for free or reduced lunch status. These results suggest that the selected students who completed the SEI differed somewhat from those who were selected, but that these differences were substantive only on the free and reduced lunch variable.

Instrument construction

The Student Engagement Instrument (SEI) (Appleton & Christenson, 2004) was developed from a review of the relevant literatures using computerized databases (e.g., Education Full Text, ERIC, and PsycINFO) and hand searches from reference lists for selected articles. Terms including engagement, belonging, identification with school, self-regulation, academic engagement, behavioral engagement, cognitive engagement, and psychological engagement were used in the literature search. Scale construction involved creating a detailed scale blueprint that captured the broad conceptualizations of cognitive and psychological engagement discussed in the literature. These conceptualizations were gathered from empirical studies as well as by reviewing existing scales that were closely related to engagement. Probes (broad queries) and items (specifically phrased questions) were subsequently created to construct a preliminary scale. Following the construction of the initial scale, the researchers continued to monitor the literature, refining or adding items as relevant research and theory suggested. The literature that was consulted when constructing items for the SEI is noted in the References section or listed in the Further Reading section.

The SEI was initially piloted with 31 ethnically diverse eighth grade students randomly selected from four homerooms in a school from a different district (with demographic characteristics similar to the district for the current study). Eighth-grade rather than 9th grade students were selected, as they were thought to be closer in age (late in spring semester) to fall 9th graders (the sample for the main study) than late spring 9th graders. These students examined the scale in two separate groups and provided feedback on the clarity, understanding and perceived relevancy of the items. This feedback led to semantic and structural changes and, on occasion, completely reworded items. The responses of these students were used solely to refine the SEI and were not included in the results described in the next section.

The full version of the SEI contained 30 items intended to measure student levels of cognitive engagement (e.g., perceived relevance of school) and 26 items intended to examine psychological engagement (e.g., perceived connection with others at school) from the perspective of the student. Six reverse-keyed items were intermittently positioned

throughout the scale to reduce response acquiescence. All items were scored via a four-point Likert-type rating (1 = strongly agree, 2 = agree, 3 = disagree, and 4 = strongly disagree). All items were coded (and reversed items were recoded) so that higher scores indicated higher levels of engagement.

District variables

Data on additional variables were obtained from self-report and from the school district's research department database. These variables consisted of gender, ethnicity, free or reduced lunch status, special education status, documented suspensions, and Northwest Achievement Levels Test (NALT) results for both reading and mathematics. NALT results were provided in the form of normal curve equivalents (NCEs), with a mean of 50 and standard deviation of 21.06.

Data collection procedures

Researchers administered the scale to all students in each randomly selected general education classroom. To avoid singling out individual students while ensuring a continuum of student perspectives, passive rather than active consent was used, which was granted by the school district. Steps were taken to control response acquiescence and careless responding. Specifically, and in addition to reverse-keying some items, students were closely monitored by teachers and scale administrators and informed of the purposes of the SEI, the impact their input may have in district policy, the value of their honest opinions regardless of their content, and the ensured anonymity of their responses. The matrix containing all student responses also was examined for suspect patterns.

The SEI was orally administered to control for the differing reading abilities of students. Researchers created and adhered to a standardized protocol to ensure similar procedures during each administration. Students not completing the scale were either unable to be located, absent from the class period, had parents/guardians who refused to consent, or refused to give their own assent.

The completed scales were subsequently scanned into a SPSS data file and examined for missing data. Any SEIs missing five or more data points were located and inspected. Any simple corrections (e.g., the scale was completed but done so in pen rather than the proper type of pencil) were made. Some of these inspections revealed situations where students had provided more than one answer to an item. Since most of these involved seemingly irreconcilable answers (e.g., "agree" and "disagree") and systematically adjusting only those items located in the verification process might introduce bias, these responses were coded as missing. Additionally, 10% of the scales were checked against the data set to verify proper scanning; no errors were found.

Analysis logic and procedures

We followed scale development methods involving initial construction of items according to emerging theory, followed by exploratory factor analyses (EFAs) with a randomly selected half of the dataset to explore the underlying factor structure.

Missing response patterns were first examined, and we found no evidence of systematic reasons for, or patterns in the missing responses. Second, the median values of the respective items were used to replace the missing responses. Of 108,136 expected responses in the dataset (1931 participants * 56 items), 609 responses were replaced. The replaced values represented 609/108,136 or 0.006 of the response data, less than 1%.

Polychoric correlations (Olsson, 1979) were first used to index the association between items since they were variables scored with multiple discrete categories. The MicroFACT (Waller, 2001) program was then used to conduct the factor analyses, which were based on the polychoric matrices. Principal axis factoring was applied to extract the factors. Some researchers (Cliff, 1988; Floyd & Widaman, 1995; Zwick & Velicer, 1986) have expressed concern over using "eigenvalues greater than 1.0" as the sole criterion for determining the number of factors to retain and have recommended the use of scree plots. Therefore, scree plots were used in addition to eigenvalues to determine the number of factors to retain. Once a range of factor models was determined (i.e., the scree plots and eigenvalues determined the most plausible models), separate EFAs were conducted that forced the items onto the number of factors for a particular model. The goal of this method was to refine or optimize each model. During this process items that loaded less than .40 were removed (Netemeyer, Bearden, & Sharma, 2003). For each iteration, the Promax rotation method was used. The first half of the dataset was used to establish plausible factor models.

Following the EFA procedures, the fit of these plausible models was examined using confirmatory factor analyses (CFAs). The other half of the dataset was used for these analyses. Model "fit" was based on a variety of fit indices. Specifically, the Chi-square test was used, although this test often rejects models based on large samples. To address this limitation, the Chi-square to degrees of freedom ratio was also used. In general, χ^2/df ratios up to 5 have been used as general "rules of thumb" to establish reasonable fit (Marsh & Hocevar, 1985). Further, the Comparative Fit Index (CFI), which is less sensitive to large samples, the Tucker–Lewis Index (TLI), which also has shown robustness to sample size (Marsh, Balla, & McDonald, 1994), and the root mean square error of approximation (RMSEA) were also employed. The CFI ranges from 0 to 1 with the conventional value for acceptable model fit at .90 or greater (Garson, 2006). For the TLI, values less than .90 indicate that the model could be substantially improved (Marsh et al., 1994) and those greater than .95 indicate well-fitting models (Hu & Bentler, 1999). Browne and Cudek's (1992) criteria for interpreting RMSEA suggest that values less than .05 indicate close model fit, values between .05 and .08 indicate reasonable fit, those between .08 and .10 indicate mediocre fit, and values greater than .10 indicate unacceptable fit. Finally, because the analyses compared models that were nested, differences in χ^2 tests can be used to compare goodness-of-fit between models.

Results

Exploratory factor analyses

Preliminary examinations of the polychoric correlations between items for the first randomly sampled half of the data set revealed three items that had inter-item correlations

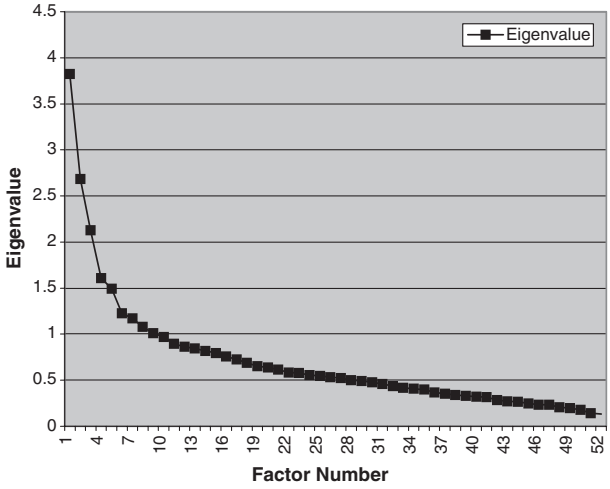

Fig. 2. EFA scree plot with factor 1 removed.

less than .10. These items were removed from further analyses. The remaining 53 items were then submitted to an EFA using principal axis factoring. The resulting "elbow" in the scree plot indicated that between four and six factors should be retained (see Fig. 2). Additionally, an examination of the eigenvalues greater than one supported this decision, with the first six factors well above 1.0 (16.15, 3.83, 2.69, 2.13, 1.61, and 1.50, respectively) while the remaining factors approached the 1.0 criterion and the distance between them was incrementally less (1.23, 1.17, 1.08, and 1.01). Given these results, we decided to conduct further EFAs with the four, five and six-factor models as the most plausible. The separate EFAs used similar procedures to those involved in the initial EFA, with the additional requirement that items load on factors at .40 or higher. The process was iterative, with each model undergoing EFAs until all items loaded at .40 or higher (Netemeyer et al., 2003).

The refined four- and five-factor models with named factors and items that loaded on each cognitive engagement (CE) or psychological engagement (PE) subtype appear below. The items comprising the six-factor model, listed in order of the strength of their factor loadings are depicted in Table 1.

- The four-factor model consisted of the following factors: Control and Relevance of School Work (CE) (13, 10, 14, 17, 12, 15, 16, 27, 28, 36[2], 18), Teacher–Student Relationships (PE) (3, 2, 4, 6, 5, 7, 9, 8), Peer Support for Learning (PE) (19, 20, 21, 24, 22, 23, 45[2]), and Commitment to and Control over Learning (CE) (34, 35, 33, 26, 51[2]).
- The five-factor model consisted of the first five factors specified in the six-factor model, with the same order of factor loadings.

[2] Item Texts: "Schoolwork is important to complete", "I feel like a part of my school" (Goodenow, 1993a, 1993b), and "Most of the time I am capable of doing the work that school subjects require of me" were all dropped in the six-factor solution.

Table 1
Items comprising the six-factor model[a,b]

Item	Component						Item text
	PE 1[c]	CE 2[d]	PE 3[e]	CE 4[f]	PE 5[g]	CE 6[h]	
1	**0.795**	−0.143	−0.074	0.156	−0.063	0.026	Overall, adults at my school treat students fairly.
2	**0.767**	0.118	−0.056	−0.052	−0.044	0.006	Adults at my school listen to the students.
3	**0.762**	0.040	0.008	−0.082	0.085	0.058	At my school, teachers care about students.
4	**0.721**	0.057	0.053	−0.063	0.099	−0.060	My teachers are there for me when I need them.
5	**0.710**	−0.061	−0.053	0.166	−0.065	0.000	The school rules are fair.
6	**0.676**	0.031	0.006	0.081	−0.010	−0.005	Overall, my teachers are open and honest with me.
7	**0.568**	0.092	0.102	−0.021	0.074	0.042	I enjoy talking to the teachers here.
8	**0.486**	−0.058	0.259	0.026	0.065	−0.063	I feel safe at school.
9	**0.465**	0.198	0.092	−0.113	0.083	0.009	Most teachers at my school are interested in me as a person, not just as a student.
10	0.072	**0.691**	0.013	−0.126	−0.115	−0.045	The tests in my classes do a good job of measuring what I'm able to do.
11	−0.074	**0.683**	−0.079	0.027	0.073	−0.042	Most of what is important to know you learn in school.
12	−0.020	**0.648**	0.122	−0.034	−0.168	0.012	The grades in my classes do a good job of measuring what I'm able to do.
13	0.053	**0.601**	−0.125	0.205	0.066	−0.025	What I'm learning in my classes will be important in my future.
14	0.009	**0.588**	−0.011	−0.040	0.054	−0.077	After finishing my schoolwork I check it over to see if it's correct.
15	0.021	**0.549**	0.090	−0.040	0.142	0.032	When I do schoolwork I check to see whether I understand what I'm doing.
16	0.114	**0.524**	0.022	0.079	−0.018	0.047	Learning is fun because I get better at something.
17	−0.064	**0.492**	0.043	0.265	0.073	0.039	When I do well in school it's because I work hard.
18	0.020	**0.451**	0.135	−0.077	0.061	0.072	I feel like I have a say about what happens to me at school.
19	0.094	−0.069	**0.831**	0.033	−0.086	0.002	Other students at school care about me.
20	0.150	−0.051	**0.759**	−0.068	−0.049	−0.041	Students at my school are there for me when I need them.
21[i]	−0.056	0.115	**0.744**	−0.065	0.042	0.042	Other students here like me the way I am.
22	−0.015	−0.020	**0.678**	0.119	0.015	0.010	I enjoy talking to the students here.
23	0.169	0.085	**0.625**	−0.007	−0.059	−0.022	Students here respect what I have to say.
24	−0.244	−0.034	**0.619**	0.165	0.224	−0.009	I have some friends at school.
25	0.057	−0.129	0.068	**0.889**	−0.021	0.024	I plan to continue my education following high school.
26	0.066	−0.082	−0.010	**0.795**	0.016	−0.061	Going to school after high school is important.
27	0.080	0.306	−0.050	**0.653**	−0.013	−0.008	School is important for achieving my future goals.
28	−0.032	0.222	0.060	**0.571**	0.009	0.034	My education will create many future opportunities for me.
29	−0.057	0.264	0.146	**0.443**	0.030	−0.002	I am hopeful about my future.
30	−0.025	0.058	0.027	−0.048	**0.828**	0.018	My family/guardian(s) are there for me when I need them.
31	0.075	0.008	−0.001	−0.005	**0.797**	−0.011	When I have problems at school my family/guardian(s) are willing to help me.
32	0.104	−0.061	0.002	0.076	**0.624**	−0.068	When something good happens at school, my family/guardian(s) want to know about it.

Table 1 (*continued*)

Item	Component						Item text
	PE 1[c]	CE 2[d]	PE 3[e]	CE 4[f]	PE 5[g]	CE 6[h]	
33	0.018	0.033	−0.005	0.252	**0.479**	0.096	My family/guardian(s) want me to keep trying when things are tough at school.
34	−0.043	−0.054	−0.007	0.012	0.016	**0.835**	I'll learn, but only if my family/guardian(s) give me a reward. (Reversed)
35	0.074	0.017	−0.002	−0.033	−0.008	**0.802**	I'll learn, but only if the teacher gives me a reward. (Reversed)

[a] The four- and five-factor models are specified in the text.
[b] Items are renumbered from their original format for clearer presentation.
[c] Teacher–Student Relationships (Psychological Engagement).
[d] Control and Relevance of School Work (Cognitive Engagement).
[e] Peer Support for Learning (Psychological Engagement).
[f] Future Aspirations and Goals (Cognitive Engagement).
[g] Family Support for Learning (Psychological Engagement).
[h] Extrinsic Motivation (Cognitive Engagement).
[i] From Goodenow (1993a).

- Finally, the six-factor model included an additional two items (34 and 35) that initially loaded on the Commitment to and Control over Learning factor in the four-factor solution. These items were given the label Extrinsic Motivation (CE).

Confirmatory factor analyses

Four-, five- and six-factor models were subjected to CFAs using the remaining half of the dataset. Results of the Chi-square test, χ^2/df ratio, $\Delta\chi^2$, CFI, TLI, and RMSEA are reported in Table 2. The Chi-square values for the four- ($\chi^2=3520.508$, $df=428$, $p<.0001$), five- ($\chi^2=2576.336$, $df=485$, $p<.0001$), and six- ($\chi^2=2780.047$, $df=545$, $p<.0001$) factor models were significant, which is a common result when using the Chi-square statistic with large samples. To adjust for sample size, χ^2/df ratios were computed, resulting in a ratio of 8.23 for the four-, 5.31 for the five-, and 5.10 for the six-factor model. The ratios for the five- and six-factor models neared the ratio range of acceptable fit (Marsh & Hocevar, 1985), while the four-factor model differed substantially. The CFI values suggest that all three models attain the value of >.90 typically used for accepting models (Garson, 2006). Nevertheless, the values for the five- and six-factor models fit Hu and Bentler's (1999) criterion for model fit (TLI>.95) while the four-factor model did not. The values of the five- and six-factor models for RMSEA also fit Browne and Cudek's

Table 2
Fit indices for the models

Model	χ^2	*df*	χ^2/df	CFI	TLI	RMSEA	$\Delta\chi^2$	*p*
1. Four-factor	3520.508***	428	8.23	.941	.936	.087		
2. Five-factor	2576.336***	485	5.31	.967	.964	.067	944.17***	<.001
3. Six-factor	2780.047***	545	5.10	.966	.963	.065	203.71***	<.001

CFI=Comparative Fit Index, TLI=Tucker–Lewis Index, RMSEA=Root-Mean-Square Error of Approximation.
***$p<.001$.

(1992) criteria for adequate fit (between .05 and .08) while the four-factor model did not. In general, results suggested that the five- and six-factor models fit the data better than the four-factor model.

In order to determine the best fit between the five- and six-factor models, the change statistics were consulted. The Chi-square difference test was significant ($\Delta\chi^2 = .203.71$, $df = 60$, $p < .001$) suggesting the importance of the sixth factor. Coefficient alphas also were computed for each of the factors in the six-factor model, to determine how well the items on the sixth-factor (in particular) hung together. The reliability of items comprising each factor (and their corresponding label) was as follows: Factor 1 (Teacher–Student Relationships, $r_\alpha = .88$), Factor 2 (Control and Relevance of School Work, $r_\alpha = .80$), Factor 3 (Peer Support for Learning, $r_\alpha = .82$), Factor 4 (Future Aspirations and Goals, $r_\alpha = .78$), Factor 5 (Family Support for Learning, $r_\alpha = .76$), and Factor 6 (Extrinsic Motivation, $r_\alpha = .72$).

In summary, items pertaining to the sixth-factor (i.e., extrinsic motivation) did not have significant cross-loadings on the other SEI factors. Further, both the χ^2/df ratio and the $\Delta\chi^2$ also supported evidence for a sixth factor. Finally, the internal consistency of the sixth factor yielded a respectable value of .72, despite containing only two items. For these reasons, the six-factor model was considered the best of all models examined.

Based on the entire sample, bivariate correlations were conducted between summed scores of the items comprising each SEI factor and the outcome variables of grade point average (GPA) and whether or not students had been suspended (1 = yes, 0 = no). Between 1,741 and 1,734 participants had NALT reading and math achievement scores, which were correlated with normal curve equivalent[3] (NCE) scores. These results are reported in Table 3, but care should be taken in interpreting relationships with factors four and five as the distributions of the summed scores of items on these factors were negatively skewed.

Results supported both the convergent and discriminant validity of the six-factor structure. The factors of Student–Teacher Relationships, Peer Support for Learning, Future Aspirations and Goals, Family Support for Learning, and Extrinsic Motivation (i.e., factors 1, 3–6) each correlated with some academic variables in the expected positive direction (i.e., GPA, reading and math achievement) and other variables in the expected negative direction (i.e., suspensions). Further, the engagement factors related to each other as expected, although the extrinsic motivation factor yielded a slightly lower relationship with the other SEI factors. The relationship between the control/relevance factor (factor 2), GPA and suspension was positive but small, and this factor was negatively related to achievement test scores.

Discussion

Measurement of student cognitive and psychological engagement is central to improving the learning outcomes of students, especially for those at high risk of

[3] Normal curve equivalent scores are useful in this case because they represent achievement in equal-interval units.

Table 3
Correlations between factors and outcomes

	TSR (PE)	C/R (CE)	Peer (PE)	Asp (CE)	Family (PE)	Ext Motiv (CE)	GPA	Susp Y/N	NALT R-nce	NALT M-nce
Teacher–Student Relationships (PE)	–									
Control/Relevance (CE)	.471	–								
Peer Support (PE)	.443	.322	–							
Aspirations (CE)	.353	.506	.284	–						
Family Support (PE)	.389	.462	.344	.469	–					
Extrinsic Motivation (CE)	.158	.182	.073	.285	.199	–				
GPA	.239	.001	.086	.253	.058	.192	–			
Suspension (Y/N)	−.201	.032	−.062	−.131	−.009	−.075	−.492	–		
NALT Reading Normal Curve Equivalent (R-nce) Score	.171	−.287	.075	.135	.032	.161	.576	−.321	–	
NALT Math Normal Curve Equivalent (R-nce) Score	.162	−.249	.079	.141	.009	.136	.598	−.306	.823	–

educational failure. Accurate measurement informs interventions that can be targeted to improve student levels of these subtypes, and in doing so improve deep processing of schoolwork, commitment to education, persistence in the face of challenge, and fulfillment of the fundamental needs of autonomy, belonging, and competence (Baumeister & Leary, 1995; Osterman, 2000; Ryan, 1995; Ryan & Deci, 2000). Effort devoted to these outcomes will help to ensure that students leave secondary schools as competent and committed learners rather than disenchanted casualties.

This study examined the psychometric properties of the Student Engagement Instrument (SEI), which was designed to measure the less overt subtypes of student engagement: cognitive and psychological engagement. Factors conceptualized as underlying cognitive and psychological engagement (e.g., family support for learning, teacher–student relationships) were supported by exploratory methods using one half of the sample, and confirmed using the second half of the sample. We now turn to an explanation of these findings, including the limitations of this study, suggestions for future research on engagement, and potential implications of these findings for practicing school psychologists.

Although both the five- and six-factor models revealed an adequate fit (as determined by the fit indices), the χ^2/df ratio, $\Delta\chi^2$ value, and internal consistency estimates provided support for a six-factor model of engagement (Teacher–Student Relationships, Control and Relevance of Schoolwork, Peer Support for Learning, Future Aspirations and Goals, Family Support for Learning, and Extrinsic Motivation). As noted previously, the study of engagement is relatively new and alternative perspectives regarding the number and type of domains that comprise the engagement construct are expected (see Fredericks et al., 2004; Jimerson et al., 2003). Our model extends the engagement literature by providing empirical support for a self-report scale, based on previous theory (e.g., Finn, 1989; Connell & Wellborn, 1991) as well as our own ongoing work with youth (e.g., Sinclair et al., 2005) that assesses multiple components of cognitive and psychological engagement.

Statistical support for the validity of the SEI was found in numerous ways. For example, analyses of items comprising each SEI factor revealed little cross-loading, suggesting that each factor assesses unique variance attributed to a cognitive or psychological engagement subtype. Further, SEI inter-correlations were positive and moderate at best, suggesting that each factor measured an adequate degree of cognitive or psychological engagement that was not measured by another factor. Finally, the relationship between the SEI factors and various school indicators were in the expected direction, although the degree of variance shared between extrinsic motivation and the other SEI factors was somewhat lower, particularly with respect to peer support. Nevertheless, such findings are also consistent with previous research suggesting the importance of intrinsic (but not extrinsic) motivation on positive peer relationships (see Pittman, Boggiano, & Main, 1992). Positive relationships were noted between most SEI factors and academic indicators such as GPA and reading and math scores, while negative relationships were noted between most of the SEI factors and school suspension.

There were some exceptions to this larger pattern of findings, however. For example, the SEI control/relevance factor was negatively correlated with reading and math scores, and yielded very low correlations with GPA and school suspension. There are some potential explanations for these particular findings. For example, students may be astute at detecting work that is not relevant to larger goals, such as doing well in schoolwork. Thus, the minimal correlation between control/relevance and GPA would be expected. Further, in comparison to classroom tests, where positive results may be associated with expected and anticipated material, standardized tests such as the NALT are not based on specific classroom curricula. Thus, the negative correlations between standardized reading and math scores and this SEI factor may indicate that students cannot anticipate items on such tests (which would indicate loss of control), or perceive that the items do not accurately reflect their actual school learning. Either one of these hypotheses would correspond to the negative correlations reported in this study. Finally, the positive but very low correlation between control/relevance and school suspension may be a methodological artifact; we coded the suspension variable to include any students who had ever received a suspension, regardless of the number of suspensions they had. The extremely small correlation between these two variables could very well be an artifact of this method. Future studies should consider creating multiple categories of school suspension to determine the veracity of this finding.

Future directions for research

To properly frame this study, it is important to remember that instrument development is an iterative process. Our examination of a large and diverse dataset has advanced the effort to create a psychometrically sound scale for measuring cognitive and psychological engagement, but also raised important issues for future research to consider. For example, our study provides promising support for a six-factor scale that assesses specific cognitive and psychological subtypes related to student engagement. Nevertheless, any initial scale construction and validation is contingent on the sample from which the data are derived. In this regard, our sample was quite diverse (e.g., over 90 languages are spoken in the district) and included a high percentage of students receiving free or reduced lunch. Additionally, our sample consisted solely of 9th grade students, and was conducted only in an urban setting.

Given these unique characteristics, data obtained from younger and older youth across multiple environments (suburban and urban locales) are clearly necessary to provide further empirical support for the validity of the SEI, as well as the generalization of the current findings.

Further, although we labeled the sixth factor as "extrinsic motivation", it was only comprised of two items, with both items being reverse-keyed. Given that researchers have debated the meaning of such items in scale development (Chang, 1995), the validity of this factor should be examined in future studies. This recommendation is particularly salient considering the low relationships with the academic variables (e.g., GPA, standardized reading scores) found in this study with respect to some SEI factors. Although we speculated on some reasons for these findings, further empirical studies are necessary to determine their accuracy. The SEI also was specifically designed to assess cognitive and psychological engagement. The relationship of these engagement subtypes to academic and behavioral engagement is necessary to further the nomothetic understanding of engagement.

Also, previous efforts to measure aspects of engagement have focused on specific tasks, classes, or subjects (e.g., Marks, 2000). This scale attempts to measure a more generalized sense of engagement with school. Researchers have speculated on the thresholds of engagement necessary for specific outcomes (e.g., Jimerson et al., 2003), yet whether specific or generalized engagement is more closely linked to important outcomes or whether they interact is an issue for future research to resolve. Finally, the SEI was developed for use with middle and high school students in mind, but engagement is equally relevant for elementary students. Given findings regarding early student disengagement (Barrington & Hendricks, 1989; Lehr, Sinclair, & Christenson, 2004), research to create a developmentally appropriate measure for elementary students is important.

Implications for school psychologists

Trained to understand learning and the educational context, school psychologists are in a unique position to consult and affect student outcomes using findings from the nexus of educational and psychological research. The construct of engagement is positioned in that nexus (Skinner & Belmont, 1993). The multidimensional engagement construct represents a conceptual call away from a strict dependence on monitoring student time-on-task and attendance to the inclusion of important underlying variables such as sense of autonomy, belonging, competence and the extent to which the context provides the nutriments for fulfillment of these needs (Ryan & Deci, 2000).

Moreover, the factor structure proposed in this study provides six specific paths to intervention, based on student outcomes in the areas of teacher–student relationships, control and relevance of schoolwork, peer support for learning, future aspirations and goals, family support for learning, and extrinsic motivation. This six-factor model may enable practitioners to consult the relevant intervention research in these areas and provide the remediation needed.

In sum, the iterative process of scale development for an instrument to validly measure both cognitive and psychological engagement is delineated in this study. Much has been accomplished, yet much remains to fully utilize the potential of the student engagement construct.

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