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Educational and Psychological Measurement 2008; 68; 443 originally published online Nov 26, 2007;
DOI: 10.1177/0013164407308475

Educational and Psychological Measurement
Volume 68 Number 3
June 2008 443-463

10.1177/0013164407308475
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Self-Efficacy for Self-Regulated Learning

A Validation Study

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The psychometric properties and multigroup measurement invariance of scores on the Self-Efficacy for Self-Regulated Learning Scale taken from Bandura's Children's Self-Efficacy Scale were assessed in a sample of 3,760 students from Grades 4 to 11. Latent means differences were also examined by gender and school level. Results reveal a unidimensional construct with equivalent factor pattern coefficients for boys and girls and for students in elementary, middle, and high school. Elementary school students report higher self-efficacy for self-regulated learning than do students in middle and high school. The latent factor is related to self-efficacy, self-concept, task goal orientation, apprehension, and achievement.

Keywords: *self-efficacy; self-regulation; self-regulated learning; social cognitive theory; academic motivation*

In his social cognitive theory, Bandura (1986) put forth a model of human functioning in which self-regulatory factors are accorded a central role, and educational researchers have provided insights over the past two decades about how these factors operate within learning contexts. Defined by Zimmerman (2002b) as "the self-directive process by which learners transform their mental abilities into academic skills" (p. 65), self-regulation is a metacognitive process that requires students to explore their own thought processes so as to evaluate the results of their actions and plan alternative pathways to success. Successful learners organize their work, set goals, seek help when needed, use effective work strategies, and manage their time (Zimmerman, 1998, 2002b; Zimmerman & Bandura, 1994; Zimmerman & Martinez-Pons, 1986, 1988). Such students act as agents, proactively engaged in their own development and authors of their academic present and future.

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A key determinant of whether learners employ self-regulatory strategies rests in the beliefs they hold about their capabilities to do so (see Zimmerman & Cleary, 2006). Hence, knowing self-regulatory strategies is not enough to ensure their effective use; students must also possess the belief that they can use them effectively. This belief in one's self-regulatory capabilities, or *self-efficacy for self-regulated learning*, is an important predictor of students' successful use of self-regulatory skills and strategies across academic domains (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996, 2001; Bandura, Caprara, Barbaranelli, Gerbino, & Pastorelli, 2003; Bong, 2001; Zimmerman & Bandura, 1994; Zimmerman, Bandura, & Martinez-Pons, 1992; Zimmerman & Martinez-Pons, 1990). Students' self-efficacy for self-regulated learning is also related to motivation and achievement in diverse academic areas and for students at all levels of schooling (see Bandura, 1997; Pajares, 2007). For example, it correlates positively with academic self-efficacy and self-concept, value of school and of particular school subjects, and holding a mastery goal orientation, essay writing, mathematics problem solving, science competence, and overall grade point average, and it correlates negatively with academic and subject-specific anxiety and with performance-avoid goal orientation (e.g., Joo, Bong, & Choi, 2000; Pajares, 1996; Pajares & Graham, 1999; Pajares, Miller, & Johnson, 1999; Pajares & Valiante, 1999, 2002; Usher & Pajares, 2006; Zimmerman & Bandura, 1994; Zimmerman et al., 1992; Zimmerman & Martinez-Pons, 1990).

Gender differences in students' self-efficacy for self-regulated learning typically favor female students (Pajares, 2002). For example, Zimmerman and Martinez-Pons (1990) interviewed students in Grades 5, 8, and 11 and found that girls displayed more goal-setting and planning strategies, and they kept records and self-monitored more frequently than did boys. Girls also surpassed boys in their ability to structure their environment for optimal learning.

Students' reported use of self-regulatory skills also differ as a function of academic level. Zimmerman and Martinez-Pons (1990) found that certain self-regulatory learning strategies (e.g., reviewing texts, help-seeking from adults) declined across the three grade levels. Other strategies (e.g., record keeping, monitoring, organizing) were used more frequently by students in Grades 8 and 10 than by students in Grade 5. Pajares and Valiante (2002) assessed the self-beliefs of students in Grades 3 to 11 and reported that students' confidence in their self-regulatory learning strategies decreased as students progressed from elementary school to high school. This decrease was even steeper than a similar decrease in students' academic self-efficacy beliefs.

Assessing Self-Efficacy for Self-Regulated Learning

In their initial examinations of high school students' use of self-regulated learning strategies, Zimmerman and Martinez-Pons (1986, 1988) factor analyzed results from structured interviews and found that students used various self-regulatory learning strategies that included planning and organizing academic work, structuring a productive study environment, overcoming distractions, and participating in class. This set of strategies in turn became the basis for a self-efficacy for self-regulated learning scale in Bandura's Multidimensional Scales of Perceived Self-Efficacy, now published as a subset of items in the Children's Self-Efficacy Scale (CSES; Bandura, 2006), which is composed of 55 items related to many domains of functioning.

Self-efficacy for self-regulated learning items from the CSES have been used in a number of studies, all of which have relied on Zimmerman and Martinez-Pons's (1986, 1988) early analysis of interview data as a sole indicant of content validity (e.g., Bong, 2001; Pajares, 1996, 2001; Pajares & Valiante, 2002; Zimmerman et al., 1992). Although, according to guidelines put forth by Henson (2001), these items have been found to have acceptable stability and internal consistency across individual studies, their factor structure has not been sufficiently examined.

For example, measures used by Bandura and his colleagues to assess the efficacy beliefs of European middle school students included 37 items from the CSES (Bandura et al., 1996, 2001; Pastorelli et al., 2001). Principal components factor analyses revealed that three factors underlay the items: academic self-efficacy, social self-efficacy, and self-regulatory efficacy (see Bandura et al., 2001, p. 192). The items intended to tap self-efficacy for self-regulated learning did not form a distinct factor. Instead, some were among those representing the academic self-efficacy factor. Choi, Fuqua, and Griffin (2001, p. 482) subjected the CSES items to a principal components and principal axis factor analysis and extracted a "self-regulated learning efficacy" factor comprising 10 items, 9 of which were among those Bandura (2006) designed to assess self-efficacy for self-regulated learning. An additional item from the CSES having to do with resisting the temptation to skip school also loaded on this factor. Similar results were reported by Miller, Coombs, and Fuqua (1999), though no item-specific information was provided. Bong (2001) conducted an exploratory factor analysis on the 11 items identified by Zimmerman et al. (1992) along with 38 other academics-related self-efficacy items and found that the items tapping self-efficacy for self-regulated learning formed a distinct factor.

Findings from these analyses offer equivocal support for a unidimensional factor structure of items tapping self-efficacy for self-regulated learning among middle grades, high school, and college students, in part because the number of items used in the studies has varied. In addition, findings have not shed light on how the factor structure or measures of self-efficacy for self-regulated learning might vary as a function of gender or school level. The theoretical (Bandura, 1997) and empirical (see Pajares, 2002) suggestion that female students report higher levels of confidence in their self-regulatory capabilities than do male students may well be a reflection of latent mean differences, but researchers have not ruled out the possibility that improper specification of measurement models or factor structure may also contribute to this difference. Whatever the case, given that constructs in structural equation modeling are theoretically free of error, structural equation modeling techniques can provide a more accurate test of mean differences than have traditional tests such as MANOVA (Hancock, 1997; Thompson & Green, 2006). Because students rely on different self-regulatory strategies as they progress through school, it also seems important to determine whether self-regulatory self-efficacy is best measured in similar ways across school levels. Determining the sources of variance underlying differences in group scores on an instrument is a necessary step in validating obtained scores. Consequently, a multigroup comparison that tests the factorial equivalence of self-efficacy for self-regulated learning is required to substantiate and extend previous findings.

The purpose of the present study was to test the construct validity of items designed to assess self-efficacy for self-regulated learning by following four sequential steps. First, we assessed the factor structure of self-efficacy for self-regulated learning by examining whether a single factor underlay the items. Next, we aimed to determine whether the measurement model for self-efficacy for self-regulated learning was invariant across gender and school level (elementary, middle, and high). We use the term *measurement equivalence* to refer to the invariant operation of the items across groups. Third, we tested for latent mean differences in self-efficacy for self-regulated learning between boys and girls and students in elementary, middle, and high school. Finally, we sought to test construct and concurrent validity by examining the relationship between scores on the self-efficacy for self-regulated learning scale and scores assessing other motivation and achievement constructs often used in academic research, namely, self-efficacy, self-concept, anxiety, task goal orientation, and grade point average.

Based on the tenets of social cognitive theory and existing research, we hypothesized that the items designed to measure self-efficacy for self-regulated learning would form a unidimensional construct and would demonstrate an equivalent structure for boys and girls and for elementary, middle, and high school students. We hypothesized an equivalent structure because the self-regulatory practices represented by the items used to assess self-efficacy for self-regulated learning were posited by Bandura (1986) to operate beneficially for all students across grade levels and academic domains (and see Zimmerman, 1998, 2002a). These practices were completing homework in a timely fashion, studying when there are other interesting things to do, concentrating on school work, remembering information presented in class and in school books, arranging a place to study at home, motivating oneself to do school work, and participating in class discussions. Because self-efficacy theorists (Bandura, 1986; Zimmerman, 1998) have posited that confidence in self-regulated learning is related to indexes of academic motivation and achievement, and in concert with research findings (Zimmerman, 2002a), we hypothesized that self-efficacy for self-regulated learning scores would be positively correlated with indexes of self-efficacy, self-concept, task goal orientation, and academic achievement and negatively correlated with indexes of academic anxiety. Because gender and grade level differences are typically observed in students' academic self-efficacy beliefs, we similarly hypothesized such differences in self-regulatory confidence.

Method and Data Sources

Data were obtained from 3,670 students (1,849 girls and 1,821 boys) who participated in six studies of academic motivation. They were enrolled in elementary (Grade 3 = 105, Grade 4 = 280, Grade 5 = 282), middle (Grade 6 = 579, Grade 7 = 868, Grade 8 = 592), or high school (Grade 9 = 319, Grade 10 = 267, Grade 11 = 313, Grade 12 = 65). Students were recruited for participation in studies of science, writing, and general academic motivation (Britner, 2006; Pajares, 2001; Pajares, Britner, & Valiante, 2000; Pajares et al., 1999; Pajares & Valiante, 1999; Pajares, Valiante, & Cheong, 2007). Students were predominantly White, attended schools in middle-class socioeconomic settings in the suburban northeastern and southern United States, and ranged in age from 8 to 18 ($M = 12.9$) years. Because of researchers' interest in the development of self-regulated learning skills in middle school, most investigations of students' self-efficacy for self-regulated learning have taken place in middle school settings, hence the large sample size for this subgroup.

Instruments

Instruments were administered in individual classes. Middle and high school students completed the instrument independently, and the researcher was available for questions; elementary school students completed it as a researcher read each item aloud. Although these slightly different administration methods may introduce a method effect, the researchers felt that younger students who are not yet proficient readers would profit from hearing each item read.

The scale used to assess *self-efficacy for self-regulated learning* consisted of items drawn from Bandura's (2006) CSES that were intended to measure this construct (see p. 326). Of the 11 items provided by Bandura (2006) in his original Multidimensional Scales of Perceived Self-Efficacy, Pajares and Valiante (1999), in consultation with classroom teachers, used the seven items that the teachers believed most accurately assessed the self-regulatory strategies their students typically engaged to meet their academic needs across subject areas. Excluded, for example, were items such as "How well can you take class notes on class instruction?" because, in many classes and at lower academic levels in particular, students did not take class notes. Another item, "How well can you use the library for information for class assignments?" was deemed unsuitable because many teachers (mathematics teachers, for example) seldom, if ever, had their students use the library for information on assignments. The seven items used in this initial study were subsequently used in future studies.

Students were instructed to "Read each statement and respond as honestly as you can" by rating from 1, *not well at all*, to 6, *very well*, how well they could carry out the self-regulatory practices identified (see Table 4). Responses thus represent students' judgments of their capabilities to engage specific self-regulatory tasks, which is consistent with guidelines put forth by Bandura (2006) regarding how best to assess self-efficacy. Across studies, scores on these items have proven internally consistent, with alpha coefficients ranging from .78 to .84 (Britner & Pajares, 2006; Pajares & Graham, 1999; Pajares & Valiante, 2002; Usher & Pajares, 2006). The alpha value obtained for the scores used in the present investigation was .83, which is more than the cutoff of .80 considered reasonable for scores in most educational research (see Henson, 2001). Intercorrelations of the items are provided in Table 1.

Other motivation constructs in this study were measured with items previously used (with score validation) in studies of academic motivation. The *Writing Skills Self-Efficacy* scale consisted of 10 items asking students how sure they were on a scale from 0 (*no chance*) to 100 (*completely certain*) that they could perform specific writing skills (see Pajares, 2007, for information on construct validity). For example, students were asked how confident they were that they could "Correctly *spell* all words in a one page story or composition." We obtained an alpha coefficient of .91 for this scale. All other scales used a 6-point Likert-type format in which students provided judgments about how true or false they found a particular statement to be. A five-item measure of *Grade Self-Efficacy* assessed students' confidence that they could obtain a certain grade in writing or in science (sample item: "How confident are you that you will get a grade better than a B?"). An alpha of .90 was obtained for this scale in writing; in science, it was .91.

Self-concept was assessed with six items from Marsh's (1990) widely used Academic Self Description Questionnaire (sample item: "Compared to others my age, I am good at writing"). We obtained alpha coefficients of .87, .88, and .83 for this scale in writing, science, and general academics, respectively. *Writing apprehension* was measured with a scale used by Pajares et al. (1999) that assesses the anxiety students feel when approaching the writing task (sample item: "I am afraid of writing essays when I know they will be graded"). We obtained an alpha of .79 for this scale. Science anxiety was assessed with three items adapted from the Mathematics Anxiety Scale (Betz, 1978). We obtained an alpha of .63. *Task goal orientation* (e.g., "I like writing assignments that really make me think") was assessed using a subscale derived from the Patterns of Adaptive Learning Survey (see Midgley et al., 1996, for validity information). We obtained alpha coefficients of .87 for task goals in writing, .86 in science, and .85 in general academics. The Life Orientation Test (Scheier & Carver, 1985) was used to assess *optimism* (sample item: "I'm always optimistic about my future"). Cronbach's alpha coefficient for this scale was .83.

Table 1
Zero-Order Correlations, Means, and Standard Deviations for Self-Efficacy for Self-Regulated Learning Items by Gender, School Level, and for the Full Sample

	Girls[a] (n = 1,849)									Boys (n = 1,821)	
Items	*M*	*SD*	REG 1	REG 2	REG 3	REG 4	REG 5	REG 6	REG 7	*M*	*SD*
REG 1	4.97	1.18	—	.45	.53	.38	.34	.43	.26	4.77	1.29
REG 2	3.56	1.56	.45	—	.51	.39	.46	.49	.29	3.36	1.58
REG 3	4.68	1.21	.49	.55	—	.45	.43	.57	.36	4.43	1.32
REG 4	4.45	1.28	.33	.43	.50	—	.31	.37	.36	4.47	1.31
REG 5	4.58	1.52	.34	.43	.45	.38	—	.51	.29	4.22	1.67
REG 6	4.53	1.33	.44	.49	.59	.42	.49	—	.39	4.21	1.50
REG 7	4.59	1.37	.24	.28	.33	.36	.27	.38	—	4.61	1.39
	Elementary[a] (n = 667)									Middle (n = 2,039)	
REG 1	5.21	1.10	—	.44	.51	.35	.33	.43	.25	4.84	1.24
REG 2	4.26	1.51	.37	—	.52	.38	.43	.48	.24	3.29	1.55
REG 3	5.11	1.07	.45	.39	—	.47	.43	.59	.34	4.51	1.25
REG 4	4.89	1.11	.36	.39	.36	—	.32	.38	.32	4.43	1.32
REG 5	5.04	1.35	.30	.41	.35	.32	—	.51	.24	4.34	1.63
REG 6	5.05	1.12	.41	.39	.47	.42	.39	—	.38	4.32	1.43
REG 7	5.06	1.10	.28	.26	.29	.36	.28	.35	—	4.57	1.40
	High[a] (n = 964)									Full Sample (n = 3,670)	
REG 1	4.70	1.28	—	.45	.51	.36	.35	.44	.25	4.87	1.24
REG 2	3.27	1.50	.47	—	.53	.41	.45	.49	.28	3.46	1.58
REG 3	4.26	1.32	.51	.55	—	.47	.45	.58	.34	4.56	1.27
REG 4	4.22	1.29	.30	.41	.45	—	.34	.39	.36	4.46	1.29
REG 5	4.08	1.61	.34	.42	.43	.31	—	.50	.28	4.40	1.61
REG 6	4.00	1.46	.42	.49	.54	.30	.46	—	.38	4.37	1.43
REG 7	4.32	1.43	.17	.29	.29	.37	.28	.30	—	4.60	1.38

Note: REG = self-efficacy for self-regulated learning item. Means reflect the 6 points of a Likert-type scale. All correlations are statistically significant, $p < .0001$.
a. Correlations for this group are reported below the diagonal.

Perceived authenticity was assessed with a five-item scale drawn from Clance's (1985) and Harvey and Katz's (1985) scales designed to measure inauthenticity and the impostor syndrome (sample item: "Sometimes I'm afraid other people will discover that I'm not very smart"). Cronbach's alpha coefficient for this scale was .72.

Several achievement measures were used to establish the concurrent validity of the self-efficacy for self-regulated learning items. Grade point averages ranging from 0 to 4 or semester course grades ranging from 0 to 100 were provided by school administrators. In other cases, teachers were asked to rate students' writing competence on a 5-point scale.

Analysis

Descriptive statistics and zero-order correlations were calculated for each of the variables. Confirmatory factor analysis (CFA) was then used to test a measurement model of the seven self-efficacy for self-regulated learning items. This model was tested with six sample groups, one for the full sample and for each subgroup of interest: boys, girls, elementary school students, middle school students, and high school students. Because theory and evidence from past research suggests a unidimensional self-efficacy for self-regulation construct, all items were hypothesized to be a function of a single latent factor, and error terms were hypothesized to be uncorrelated. In each model, the pattern coefficient from the latent factor to the first item was constrained to 1.0 to set the scale of measurement.

Because identical model specification for each subgroup does not guarantee that item measurement is equivalent across groups (Byrne, 1993), we conducted a series of tests for multigroup invariance by examining three increasingly restrictive hierarchical CFA models. Models were run separately by gender and by school level, and the fit statistics described below were used to verify adequate model fit before proceeding to subsequent steps (Byrne, 2006; Hancock, 1997; Thompson & Green, 2006). The first two models were based on analysis of covariance structures; the last model was based on analysis of mean and covariance structures (Sörbom, 1974). The first baseline model tested for equivalent factor structure, not taking into account the factor pattern coefficients. This initial test simply checks the adequacy of model fit in a simultaneous analysis of multigroup data (e.g., boys and girls) and provides a model by which the subsequent invariance model can be compared. In the second model, factor pattern coefficients were constrained to be invariant across the groups. We compared the fit of the two models to determine whether the pattern coefficients were invariant across groups (Byrne, 2006).

Pursuant to our aim to make inferences about latent mean differences, we used a structured means approach to test a third model that examined equivalence of intercepts (see Byrne, 2006; Thompson & Green, 2006). This approach allows for simultaneous estimation of covariance and mean structures associated with both the latent and observed variables. In this model, factor pattern coefficients and observed variable intercepts were constrained to be invariant across groups (Thompson & Green, 2006). Error terms were not constrained, and the factor disturbance was freely estimated in each model. The factor intercept for one group was set to 0, which enabled us to obtain the difference in latent factor means between this reference group and each comparison group. Positive differences indicate that the comparison group reported higher self-efficacy for self-regulated learning than did the reference group. A z-score was then used to test the significance of each latent mean difference. Effect sizes (see Hancock, 2001; Thompson & Green, 2006) for these differences were also calculated.

We did not closely examine invariance of variable intercepts for two primary reasons. First, we believe most researchers and school practitioners likely to make use of this scale would find it impractical to assess students' self-reports at the item level (Bandura, 1997; Pajares, 1997). Second, many researchers have contended, as did Hancock (1997), that "if group differences exist on the observed variables this is presumed to be the direct result of group differences on the underlying construct" (p. 97; see also Millsap, 1998). For this reason we focus our efforts on examining the latent means in students' self-regulatory self-efficacy.

We followed guidelines recommended by Bentler (2005) and Byrne (2006) to assess the fit of all CFA models while aiming for a parsimonious model with substantive meaning. To this end, we relied on four commonly, used fit indexes to determine whether the measurement model was equivalent across groups. We used the chi-square statistic to assess how well the model reproduced the covariance matrix. Because this statistic is sensitive to sample size, significant values need not indicate a lack of fit in large samples (see Kline, 2005). We used the comparative fit index (CFI) to assess model fit compared to a baseline model. Values near 1.0 are optimal, with values greater than .90 indicating acceptable model fit (Kline, 2005). We examined the root mean square error of approximation (RMSEA), for which a value of 0.0 indicates the best fit between the population covariance matrix and the covariance matrix implied by the model and estimated with sample data. Typically, values less than .08 are considered reasonable, with values less than .05 indicating a closer approximate fit (Kline, 2005). We also examined confidence intervals around this index. Fourth, we examined the standardized root mean square residual (SRMR), which represents the overall average size of the residuals between the baseline model and the model tested. According to Byrne (2006), an SRMR value less than .05 suggests a well-fitting model. To assess the invariance of pattern coefficients across models, we reviewed changes in fix indexes and parameter statistics, which have been shown to provide good comparison between nested models (Byrne, 2006). Two specific indicators were used as criteria for measurement invariance: a nonsignificant change in chi-square (see French & Finch, 2006) and a change in CFI of less than .01 (Cheung & Rensvold, 2002).

Results

Means, standard deviations, and zero-order correlations for the seven items assessing self-efficacy for self-regulated learning are reported by subgroup and for the full sample in Table 1. Students reported relatively high confidence (overall $M = 4.39$, $SD = 0.99$) in their self-regulatory capabilities. As have other researchers (e.g., Zimmerman et al., 1992), we found that students rated themselves least confident on the item assessing how well they can "study when there are other interesting things to do" ($M = 3.46$, $SD = 1.58$). Across the five subgroups, correlation coefficients among the items ranged from .17 to .59.

Recall that five separate CFAs were conducted to examine the measurement models of self-efficacy for self-regulated learning for each subgroup of interest. In each model we found evidence of substantial multivariate kurtosis as indicated by Mardia's normalized estimates greater than 5.0 (see Bentler, 2005), hence we opted to base all subsequent decisions on robust chi-square indexes and robust versions of the CFI and RMSEA (readers are referred to Bentler, 2005; Nevitt & Hancock, 2000; Satorra & Bentler, 2001, for further explanation of robust statistics). The self-efficacy for self-regulated learning measurement models showed adequate model fit for girls, Satorra–Bentler (S-B) χ^2 $(14) = 69.93$, $p < .0001$, CFI = .98, RMSEA = .05, SRMR = .03; for boys, S-B $\chi^2(14) = 104.60$, $p < .0001$, CFI = .97, RMSEA = .06, SRMR = .03; for elementary school students, S-B $\chi^2(14) = 20.72$, $p = .11$, CFI = .99, RMSEA = .03, SRMR = .03; for middle school students, S-B $\chi^2(14) = 102.89$, $p < .0001$, CFI = .97, RMSEA = .06, SRMR = .03; and for high school students, S-B $\chi^2(14) = 71.72$, $p < .0001$, CFI = .96, RMSEA = .07, SRMR = .04. Consequently, when testing groups for factorial invariance, we specified the same model for each subgroup.

Fit indexes for the models testing invariance across the measurement models by gender are reported in Table 2. Recall that to assess between-group invariance, we examined change in fit statistics between the configural or baseline model (i.e., no constraints) and the model in which factor pattern coefficients were to be equal or invariant (i.e., constraints imposed). The change in chi-square ($\Delta\chi^2$) statistic is itself distributed as chi-square, but the change in the robust chi-square statistic is not (Bentler, 2005). For this reason, we used the adjusted ΔS-B χ^2 statistic (see Byrne, 2006, p. 219; Satorra & Bentler, 2001). This adjusted value is chi-square distributed and easily interpretable. Our findings suggest that the items measuring self-efficacy for self-regulated learning are invariant for girls versus boys, with an adjusted ΔS-B $\chi^2(6) = 11.48$, $p = .07$ and a ΔCFI of .002. The model with constrained factor pattern coefficients for boys and girls showed a good fit to the data. The model with constrained variable intercepts showed similar fit (see Table 2). To answer the final question of interest, we examined the latent mean difference between girls, whose factor intercept was freely estimated, and boys, whose factor

Table 2
Tests for Invariance of Self-Efficacy for Self-Regulated Learning Measurement Model Across Gender: Summary of Goodness-of-Fit Statistics

Model	S-B χ^2	*df*	CFI	SRMR	RMSEA	RMSEA 90% CI	Model Comparison	Δ S-B χ^2	Δdf	ΔCFI
Model 1, configural, no constraints	174.498	28	.975	.029	.053	.046, .061	—	—	—	—
Model 2, factor pattern coefficients invariant	189.596	34	.973	.034	.050	.043, .057	2 vs. 1	11.481	6	−.002
Model 3, factor pattern coefficients and variable loadings invariant	250.762	40	.973	.034	.051	.045, .058	3 vs. 2	70.314	6	.000

Note: S-B χ^2 = Satorra-Bentler chi-square statistic; *df* = degrees of freedom; CFI = comparative fit index; SRMR = standardized root mean residual; RMSEA = root mean square error of approximation; CI = confidence interval. Robust statistics are reported. The ΔS-B χ^2 represents a corrected value (see Satorra & Bentler, 2001). Girls ($n = 1{,}849$), boys ($n = 1{,}821$).

intercept was set to 0. On average, girls rated themselves 0.17 points higher than did boys ($z = 6.17$, $SE = .03$, $p < .01$). The mean for girls was .23 factor standard deviations higher than that for boys, which can be interpreted as a small effect size (Thompson & Green, 2006).

In the next series of models, we examined multigroup invariance across school level (see Table 3). As in the analyses by gender, results suggest that the self-efficacy for self-regulated learning items are invariant between elementary, middle, and high school students, with an adjusted ΔS-B $\chi^2(12) = 17.68$, $p = .13$ and a ΔCFI of .002. The school level model with constrained pattern coefficients showed an adequate fit to the data, as did the model with constrained variable intercepts. We next examined the latent mean difference between students at each school level. The factor intercept for middle school students was initially set to 0. Elementary school students rated themselves 0.51 points higher in self-regulatory self-efficacy than did middle school students ($z = 7.283$, $SE = .05$, $p < .01$), but high school students rated themselves 0.17 points lower ($z = -2.975$, $SE = .05$, $p < .01$). To contrast high school and elementary school students, we reran the model with elementary school students as the reference group. High school students reported less self-efficacy in their self-regulatory skills (0.68 points lower on average) than did their elementary counterparts ($z = -16.756$, $SE = .04$, $p < .01$). Although effect sizes for the latent mean differences between elementary

Table 3
Tests for Invariance of Self-Efficacy for Self-Regulated Learning Measurement Model Across School Level: Summary of Goodness-of-Fit Statistics

Model	S-B χ^2	*df*	CFI	SRMR	RMSEA	RMSEA 90% CI	Model Comparison	ΔS-B χ^2	Δdf	ΔCFI
Model 1, configural, no constraints	190.698	42	.970	.032	.054	.046, .062	—	—	—	—
Model 2, factor pattern coefficients invariant	211.036	54	.968	.042	.049	.042, .056	2 vs. 1	17.682	12	−.002
Model 3, factor pattern coefficients and variable loadings invariant	281.083	66	.975	.043	.051	.044, .058	3 vs. 2	77.488	12	.007

Note: S-B χ^2 = Satorra-Bentler chi-square statistic; *df* = degrees of freedom; CFI = comparative fit index; SRMR = standardized root mean residual; RMSEA = root mean square error of approximation; CI = confidence interval. Robust statistics are reported. The ΔS-B χ^2 represents a corrected value (see Satorra & Bentler, 2001). Elementary school ($n = 667$), middle school ($n = 2{,}039$), high school ($n = 964$).

school students and their middle and high school counterparts were large (.86 and .91, respectively), that between elementary and middle school students was small (.23).

Given evidence that the measurement model representing the latent self-efficacy for self-regulated learning factor was invariant across gender and school level, we ran a final CFA of the model for the full sample. This final model showed good fit to the data, S-B $\chi^2(14) = 161.39$, $p < .001$, CFI = .98, RMSEA = .05, SRMR = .04. Table 4 lists each item in the self-efficacy for self-regulation subscale followed by its standardized parameter estimate and error term for the full sample and for each of the five subsample CFA measurement models. Note that in all analyses, the standardized estimates were significant at the $p < .052$ level and ranged in magnitude from .41 to .79. Subsample means and standard deviations for the scale are also reported in Table 4.

Finally, to examine the concurrent validity of the self-efficacy for self-regulated learning scale, we examined its correlation with constructs used often in motivation research as well as with students' achievement (see Thorndike, 2005). As illustrated in Tables 5, 6, and 7, for the full sample and for each subgroup, self-efficacy for self-regulated learning showed a strong and positive correlation with self-efficacy ($.34 \leq r \leq .57$), self-concept ($.42 \leq r \leq .67$), and task goal orientation

(text continues on p. 459)

Table 4
Standardized Factor Pattern Coefficients for Self-Efficacy for Self-Regulated Learning Items for Each Group of Interest

		Gender		School Level		
Item		Girls	Boys	Elementary	Middle	High
REG 1 How well can you finish your homework on time?	Coefficient (error)	.598 (.801)	.631 (.776)	.608 (.794)	.612 (.791)	.618 (.787)
REG 2 How well can you study when there are other interesting things to do?	Coefficient (error)	.692 (.722)	.683 (.730)	.609 (.793)	.667 (.746)	.723 (.691)
REG 3 How well can you concentrate on your school work?	Coefficient (error)	.788 (.615)	.768 (.641)	.652 (.759)	.786 (.618)	.780 (.626)
REG 4 How well can you remember information presented in class and in your school books?	Coefficient (error)	.614 (.789)	.568 (.823)	.604 (.797)	.571 (.821)	.547 (.837)
REG 5 How well can you arrange a place to study at home where you won't get distracted?	Coefficient (error)	.608 (.794)	.611 (.791)	.562 (.827)	.598 (.801)	.588 (.809)
REG 6 How well can you motivate yourself to do schoolwork?	Coefficient (error)	.741 (.671)	.733 (.680)	.693 (.720)	.745 (.667)	.682 (.731)
REG 7 How well can you participate in class discussions?	Coefficient (error)	.598 (.888)	.481 (.876)	.485 (.874)	.445(.895)	.414 (.910)
Variance		.50	.66	.45	.58	.63
Mean		4.48	4.30	4.95	4.33	4.12
SD		0.95	1.01	0.80	0.98	0.97

Note: REG = self-efficacy for self-regulated learning item. Models were run separately with no constraints imposed. All coefficients are statistically significant, $p < .05$. Error variances (error) are presented in parentheses next to each standardized estimate. Path between REG 1 and latent variable was fixed to 1 to scale the unit of measure. Means reflect the 6 points of a Likert-type scale.

Table 5
Zero-Order Correlations Between Self-Efficacy for Self-Regulated Learning and Motivation and Achievement Variables in Writing

Variable	Full Sample	Girls	Boys	Elementary	Middle	High
Skills self-efficacy, 10 items, 100-point scale, $M = 77.2$, $SD = 17.0$	.48* ($n = 2{,}008$)	.47* ($n = 1{,}013$)	.48* ($n = 995$)	.49* ($n = 304$)	.51* ($n = 1{,}239$)	.34* ($n = 465$)
Grade self-efficacy, 5 items, 6-point scale, $M = 4.7$, $SD = 1.1$	.51* ($n = 1{,}266$)	.51* ($n = 637$)	.50* ($n = 629$)	.56* ($n = 304$)	.53* ($n = 497$)	.47* ($n = 465$)
Self-concept, 6 items, 6-point scale, $M = 4.4$, $SD = 1.0$	.53* ($n = 2{,}371$)	.52* ($n = 1{,}187$)	.52* ($n = 1{,}184$)	.51* ($n = 667$)	.51* ($n = 1{,}239$)	.42* ($n = 465$)
Apprehension, 7 items, 6-point scale, $M = 2.5$, $SD = 1.4$	−.31* ($n = 1{,}264$)	−.29* ($n = 637$)	−.33* ($n = 627$)	−.42* ($n = 304$)	−.36* ($n = 497$)	−.27* ($n = 463$)
Task goals, 5 items, 6-point scale, $M = 4.1$, $SD = 1.3$	.51* ($n = 1{,}266$)	.49* ($n = 637$)	.52* ($n = 629$)	.40* ($n = 304$)	.50* ($n = 497$)	.47* ($n = 463$)
Teacher rating of competence, 1 item, 5-point scale, $M = 2.2$, $SD = 1.1$	.17* ($n = 1{,}629$)	.15* ($n = 811$)	.16* ($n = 818$)	.21* ($n = 667$)	.30* ($n = 497$)	.05 ($n = 465$)
Writing grade point average, 1 item, 5-point scale, $M = 2.9$, $SD = 1.0$	.29* ($n = 2{,}037$)	.28* ($n = 1{,}019$)	.27* ($n = 1{,}018$)	NA	.29* ($n = 2{,}037$)	NA

Note: Mean and standard deviation for the full sample are reported after each variable description. Sample size for each significance test appears in parentheses next to each correlation. NA indicates that data were not available for this sample on this variable.
$*p < .01$.

Table 6
Zero-Order Correlations Between Self-Efficacy for Self-Regulated Learning and Motivation and Achievement Variables in Science

Variable	Full Sample	Girls	Boys	Elementary	Middle	High
Grade self-efficacy, 5 items, 6-point scale, $M = 4.6$, $SD = 1.2$	.54* ($n = 780$)	.53* ($n = 410$)	.54* ($n = 370$)	NA	.44* ($n = 281$)	.57* ($n = 499$)
Self-concept, 6 items, 6-point scale, $M = 4.0$, $SD = 1.1$	.53* ($n = 780$)	.53* ($n = 410$)	.54* ($n = 370$)	NA	.43* ($n = 281$)	.54* ($n = 499$)
Anxiety, 5 items, 6-point scale, $M = 2.3$, $SD = 1.1$	−.31* ($n = 281$)	−.20* ($n = 142$)	−.41* ($n = 139$)	NA	−.31* ($n = 281$)	NA
Task goals, 5 items, 6-point scale, $M = 3.8$, $SD = 1.2$	.48* ($n = 778$)	.49* ($n = 410$)	.48* ($n = 368$)	NA	.45* ($n = 280$)	.46* ($n = 498$)
Science course grade, 1 item, 100-point scale, $M = 76.5$, $SD = 13.1$	.44* ($n = 498$)	.48* ($n = 267$)	.39* ($n = 231$)	NA	NA	.44* ($n = 498$)
Science grade point average, 1 item, 5-point scale, $M = 2.5$, $SD = 1.3$	.15* ($n = 279$)	.09 ($n = 141$)	.14 ($n = 138$)	NA	.15* ($n = 279$)	NA

Note: Mean and standard deviation for the full sample are reported after each variable description. Sample size for each significance test appears in parentheses next to each correlation. NA indicates that data were not available for this sample on this variable.
*$p < .01$.

Table 7
Zero-Order Correlations Between Self-Efficacy for Self-Regulated Learning and Motivation and Achievement Variables in General Academics

Variable	Full Sample	Girls	Boys	Elementary	Middle	High
Academic self-efficacy, 3 items, 6-point scale, $M = 4.7$, $SD = 0.9$	.57* ($n = 519$)	.58* ($n = 252$)	.57* ($n = 267$)	NA	.57* ($n = 519$)	NA
Self-concept, 6 items, 6-point scale, $M = 4.5$, $SD = 0.9$	.66* ($n = 519$)	.67* ($n = 252$)	.65* ($n = 267$)	NA	.66* ($n = 519$)	NA
Task goals, 5 items, 6-point scale, $M = 4.0$, $SD = 1.1$	.60* ($n = 519$)	.64* ($n = 252$)	.57* ($n = 267$)	NA	.60* ($n = 519$)	NA
Optimism, 12 items, 6-point scale, $M = 4.0$, $SD = 0.8$	.42* ($n = 518$)	.47* ($n = 252$)	.38* ($n = 266$)	NA	.42* ($n = 518$)	NA
Authenticity, 5 items, 6-point scale, $M = 4.4$, $SD = 1.0$	.31* ($n = 518$)	.40* ($n = 252$)	.25* ($n = 266$)	NA	.31* ($n = 518$)	NA
Grade point average, 2 items, 5-point scale, $M = 2.9$, $SD = 0.8$	.38* ($n = 519$)	.38* ($n = 252$)	.37* ($n = 267$)	NA	.38* ($n = 519$)	NA

Note: Mean and standard deviation for the full sample are reported after each variable description. Sample size for each significance test appears in parentheses next to each correlation. NA indicates that data were not available for this sample on this variable.
$^*p < .01$.

($.40 \leq r \leq .60$) across subject areas. Self-regulatory self-efficacy was also positively associated with an optimistic outlook and with feelings of authenticity ($.25 \leq r \leq .47$) and negatively associated with apprehension and anxiety ($-.42 \leq r \leq -.20$). In addition, self-efficacy for self-regulated learning was positively related to achievement in writing, science, and in general academics. All correlations were of magnitude and direction consistent with theoretical expectations.

Discussion

Our objective was to examine the factorial structure and invariance of a self-efficacy for self-regulated learning measure that has been used in a number of investigations but which has not yet been subjected to the more rigorous validation procedures that CFA offers. As we hypothesized, the items used to measure self-efficacy for self-regulated learning formed a unidimensional construct and demonstrated an equivalent structure for boys and for girls, and for elementary, middle, and high school students. Thus, we believe the items provide a sound measure with which researchers can continue to assess students' beliefs about their self-regulatory capabilities. Correlations between scores on this subscale and those on related motivation variables and achievement further demonstrate construct and concurrent validity.

It is likely that, as with other self-efficacy measures, self-efficacy for self-regulated learning will prove maximally predictive when it is measured in a manner that is specific to the academic task at hand. As Zimmerman (1998) pointed out, "self-regulation is no longer viewed as a fixed characteristic of students but rather as context-specific processes that are selectively used to succeed in school" (p. 74). One recommendation for future research would be to tailor self-efficacy for self-regulated learning items to match the academic context under study. This could either be achieved by adding the academic subject to each item (e.g., How well can you finish your *science* homework on time?) or by using only those items that pertain to the particular course under investigation. Modification to these scales would of course require additional evidence of construct validity.

An additional aim of our study was to test whether the latent factor means representing self-efficacy for self-regulated learning differ for boys and girls and for students at different school levels. Our findings corroborate previous findings that students report decreasing confidence in their self-regulatory capabilities as they progress through school. In lower grades, many academic tasks and activities are structured, guided, and closely monitored so as to instruct and instill the self-regulatory habits that will serve youngsters for years ahead. As students approach high school, they face more demanding academic work that is no longer chaperoned by external aids. Older students are often expected to regulate their academic work and study habits on their own, and many lose confidence when their self-regulatory skills are exercised in these new and challenging ways. In fact, high school students reported significantly less confidence in their self-regulatory skills than did middle or elementary school students. We believe that these findings warrant attention from teachers and school practitioners whose task it is to help adolescents learn to organize and regulate their academic lives effectively. Gaskill and Woolfolk Hoy (2002) have warned that lack of self-regulation can prove discouraging to students. Indeed, poor self-regulation can result in learned helplessness, especially for students with physical, emotional, or intellectual challenges.

Continued assessment of students' self-efficacy beliefs for self-regulated learning can provide important insights about students' academic motivation, behavior, and future choices. In many cases, unrealistically low self-efficacy, not lack of capability, can be responsible for maladaptive academic habits and behaviors, as well as for diminishing school interest and achievement. This is perhaps more true in the area of self-regulation than it is in other areas, for self-regulatory processes are essential for effective functioning not only in school but in the world at large (Zimmerman, 1998). Students who lack confidence in their capability to self-regulate their learning are less likely to implement adaptive strategies, and they will more quickly give up in the face of difficulty. In such cases, teachers must work to identify their students' inaccurate self-beliefs and design and implement interventions to challenge them. When problematically low self-efficacy is identified, students can be helped to develop a better understanding of their potential to succeed at regulating their own work. Often, this low self-efficacy is because of an inaccurate understanding of what skills a task or activity demands. In such cases, young people can be helped to better understand what abilities and skills a course of action will actually require. Identifying, challenging, and altering low self-efficacy is essential to successful and adaptive functioning.

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