A Psychometric Investigation of the College Self-Efficacy Inventory

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Abstract

This research examined construct validity evidence for the College Self-Efficacy Inventory by investigating the dimensionality of the measure, assessing the generalizability of the dimensionality, and examining external validity evidence. Four theoretically-based models were first tested using two freshmen samples; none fit. Model modifications yielded an adequately-fitting 15-item, three-factor model. Model-data fit was then replicated in an independent, upperclassmen sample; local misfit was not as problematic. External validity evidence for the CSEI was also gathered by examining the relationships between CSEI subscale scores and theoretically-related criteria. Data supported most hypothesized relationships. Continued refinement of the CSEI and the construct is recommended.

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There has been a growing interest in understanding college student adjustment in order to both increase the satisfaction and well-being of students and reduce student attrition. Adjustment to college has been studied in different contexts such as social or academic and has included a wide range of constructs such as academic, motivational, psychosocial, and personality. One particular construct that has received considerable interest in the domain of college student adjustment has been self-efficacy or "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). Research has suggested that self-efficacy is important to not only the academic and social adjustment of students but to their overall wellness and personal adjustment as well (e.g., DeWitz & Walsh, 2002; Gore, 2006; Solberg & Villareal, 1997).

Self-efficacy, rooted in Bandura's social-cognitive theory (Bandura, 1986), is related to a number of educational and psychological constructs. Specifically, self-efficacy has been linked to motivational constructs such as persistence and goals/goal setting (e.g., Multon, Brown, & Lent, 1991; Schunk & Ertmer, 1999), the use of strategies such as self-regulated learning (e.g., Pintrich & DeGroot, 1990), actual achievement (e.g., Pajares & Miller, 1995), and affective constructs such as stress and distress and anxiety (e.g., Finney & Schraw, 2003; Solberg & Villareal, 1997). Individuals with higher levels of self-efficacy tend to be more motivated, use more strategies, have higher achievement, and experience less stress and anxiety. For this reason, understanding self-efficacy is of utmost importance.

The Specific Nature of Self-Efficacy

One important feature of self-efficacy is that it is domain specific; that is, self-efficacy judgments are specific to certain tasks in certain situations (Bandura, 1977, 1986, 1997).

Individuals do not have a singular, overall sense of efficacy; rather, one's level of self-efficacy depends on the specific task and context in which this task is undertaken. Furthermore, research has shown that the link between self-efficacy and outcomes is strongest when the specificity of the efficacy assessment and the criterion matches (Choi, 2005; Pajares & Miller, 1995). For this reason, self-efficacy has been studied within a variety of specific domains such as academic, social, career, clinical, athletics, and health areas (Bandura, 1997).

Self-efficacy in the academic and social domains in particular has been widely studied with college-aged populations because both are integral components of the college experience. It is important to note that with respect to academic self-efficacy, many researchers study self-efficacy associated within academic sub-domains (e.g., math, writing). Thus, there are relatively few measures of general academic self-efficacy. The Academic Self-Confidence subscale of the Student Readiness Inventory (ASC; Le, Casillas, Robbins, & Langley, 2005) and the College Academic Self-efficacy Scale (CASES; Owen & Froman, 1988) are examples of general measures. Social self-efficacy beliefs of college students have been assessed using measures such as the Scale of Perceived Social Self-Efficacy (PSSE; Smith & Betz, 2000). Recently, a new domain of self-efficacy beliefs has been proposed for the college student population: that of college self-efficacy, or the degree of confidence students have for completing college-related tasks.

The College Self-Efficacy Inventory (CSEI)

Solberg and colleagues were interested in examining the relationship between self-efficacy and college adjustment for Hispanic students (Solberg, O'Brien, Villareal, Kennel, & Davis, 1993). Because they wanted to assess college self-efficacy, or "the degree of confidence students have in their ability to successfully perform a variety of college-related tasks" (Solberg

et al., 1993, p. 82), rather than self-efficacy for only one aspect of the college experience (e.g., academics), they developed the College Student Self-Efficacy Inventory (CSEI). The CSEI would serve as a measure of self-efficacy for the broader college experience.

In reviewing previous psychometric work on the CSEI, Benson's (Benson, 1998; Benson & Hagtvet, 1996) strong program of construct validation was used. This three-step process is characterized by a substantive stage, which involves explicitly conceptualizing the theoretical and empirical domains of the construct, a structural stage, which involves investigating the interrelationships among the variables specified in the empirical domain, and an external stage, which focuses on determining whether or not the construct is related in expected ways (i.e., based on theory and previous research) with other constructs. Following this program allows one to identify the specific stages of the validity process that need further attention.

Substantive stage. The CSEI was developed by Solberg et al. (1993) in order to more fully understand the role of self-efficacy on college adjustment. When constructing an instrument to measure college self-efficacy, they did not specify a theoretical model upon which their conceptualization of college self-efficacy was based; they instead took a bottom-up approach by listing the various tasks that individuals encounter in college settings. They used college self-help manuals to develop a pool of 40 items that addressed various college-related issues. This pool of items was then rated with respect to their clear and specific nature and to their importance to and representation of the college experience. Twenty of the items had high consensus among the raters and were phrased to follow the statement "How confident are you that you could successfully complete the following tasks:…". A 10-point scale was used to rate confidence (see Appendix for scale items). Although the authors of the measure did not have a theoretical model driving the development of the CSEI (they were simply writing items to

encompass the college experience), it is not surprising that when examining the final 20 items, two broad categories emerge: items with an academic focus and items with a social focus. This is not entirely unexpected given that these two areas are at the heart of the college experience.

Structural stage: Dimensionality. Several studies have examined the dimensionality of the CSEI. Initially, the scale authors conducted a principal components (PC) analysis to examine the dimensionality of scores using a sample of 164 second- and third-year, Hispanic university students (Solberg et al., 1993). The authors championed a three-component solution. Because only 19 of the 20 items had pattern coefficients greater than .50, the authors advised the use of a 19-item scale. PC 1, labeled Course Efficacy, consisted of seven items pertaining to course performance ($\alpha = .88$). PC 2, labeled Roommate Efficacy, consisted of four items reflecting aspects of interacting with roommates ($\alpha = .88$). Finally, PC 3, labeled Social Efficacy, consisted of eight items related to interpersonal and social adjustment ($\alpha = .88$). Both the Roommate and Social subscales were social in nature, but the Roommate items were more specific to social interactions with those you live with (e.g., "Get along with others you live with"), whereas the Social items were largely specific to social interactions in the classroom or with university staff (e.g., "Participate in class discussions").

Several years after the CSEI had been developed, Solberg and colleagues (Solberg et al., 1998) reexamined the dimensionality of the 20-item CSEI by conducting PCA with varimax rotation using a sample of 388 first- and second-year students. Here, the authors championed a four-component solution with the first three components represented by Course, Roommate, and Social self-efficacy items ($\alpha = .86, .89, .79$, respectively). The fourth component, named Social Integration Efficacy ($\alpha = .62$), consisted of three items, which the authors suggested reflected "connection to the institution" (see appendix for items). However, when examining the three

"social integration" items, it appears these items may not be applicable to all students (e.g., "Get a date when I want one"). Thus, it seems reasonable that these items function differently than the Social Efficacy items and that the fourth subscale may be simply comprised of poorly functioning items. This is empirically evident by the low reliability and pattern coefficients associated with these items, but needs additional study. Interestingly, the authors reported Cronbach's coefficient for the total scale score ($\alpha = .91$), even though they championed a four-component solution. It is unclear if they were conceptualizing college self-efficacy as unidimesional even though they found a multidimensional structure.

Most recently, the factor structure of the CSEI has been examined using confirmatory factor analysis (CFA). Using a sample of 257 first-year university students, Gore, Leuwerke, and Turley (2006) conducted a CFA to test the two previously identified CSEI factor structures. They tested the 19-item, three-factor model (Solberg et al., 1993), the 20-item, four-factor model (Solberg et al., 1998), and a one-factor model in which all 19 items were hypothesized to be related to a single underlying factor. If supported, this one-factor model would provide strong evidence for computing a total college self-efficacy score. The three-factor model had adequate model-data fit, the one-factor model did not fit the data, and the four-factor model failed to converge. Additionally, the authors reported adequate internal consistency coefficients for the three subscale scores (Course $\alpha = .88$, Roommate $\alpha = .83$, Social $\alpha = .86$). Thus, this study provided additional evidence for the three-factor structure of the CSEI.

These examinations of the dimensionality of the CSEI have several weaknesses. The first two studies (Solberg et al., 1993; Solberg et al., 1998) used PCA, which should not be used to study latent constructs; it assumes that there is no measurement error associated with items (e.g., Benson & Nasser, 1998; DeVellis, 2003). A technique like exploratory factor analysis (EFA)

would have been the more appropriate technique. Second, all three studies reported total scale score reliability (e.g., $\alpha = .92$, Gore et al., 2006; $\alpha = .93$, Solberg et al., 1993; $\alpha = .91$, Solberg et al., 1998). It is unclear why a total score would be computed given that self-efficacy theory dictates that efficacy beliefs are task and domain specific. It would not be appropriate to combine academic, social, and roommate items unless there is empirical evidence that a single factor drives responses to all aspects of college self-efficacy or that the components/factors are highly correlated. Instead, the correlations among two of the three PCs weren't extremely high ($r_{\text{roommate, course}} = .45$, $r_{\text{roommate, social}} = .48$; $r_{\text{course, social}} = .71$; Solberg et al., 1993), suggesting that, although these PCs are related, they may not be representative of a single, underlying construct. On a related note, the second study used varimax rotation, which does not allow the components to be correlated. Given the moderate to large intercorrelations between the three initial components, oblique rotation methods would have been more appropriate. Finally, the sample sizes used in all three studies ($N = 164$, $N = 388$, and $N = 257$, respectively) may not have been adequate and, therefore, raises concern about the stability of the factor solution (Bentler & Chou, 1987). Therefore, although previous research provides preliminary evidence supporting the three-factor structure, it is just that—preliminary.

External stage. When the CSEI was first developed, the authors examined the relationships between the CSEI and various other measures (Solberg et al., 1993) by submitting the correlation matrix consisting of the relationships among the three CSEI subscales (Course, Roommate, and Social) and measures representing a variety of constructs (psychological distress, multicultural stress, social support, and acculturation) to a PCA with varimax rotation. The findings led the authors to suggest that the college efficacy subscales were related to

adjustment (i.e., distress, stress) but were differentiated from non-adjustment constructs (i.e., social support, and acculturation; Solberg et al., 1993).

Gore et al. (2006) correlated CSEI total and subscale scores with scores from measures of college expectations, college performance, and college persistence. It was found that Course Efficacy was positively correlated with cumulative GPA and higher expectations for participation in library activities, for course learning, for general reading and writing, and for scientific and quantitative activities. In addition Course Efficacy was significantly higher for retained students than for non-retained students. Roommate Efficacy was correlated with expectations for course learning, for writing scores, for interacting with faculty, and for establishing student acquaintances. The Social Efficacy subscale was correlated with most of the college expectations, but unlike the two previous subscales, was significantly correlated with higher expectations for using campus facilities, and for joining university clubs, organizations, and service projects. Total CSEI scores were correlated with cumulative GPA and were significantly higher for retained students than for non-retained students.

Although these two studies examined the relationships between the CSEI and several other measures, there are several issues that limit the use of these findings as evidence for external validity. First, until the factor structure of a measure is established and, in turn, appropriate scoring of the measure is identified, investigating the external validity of a measure is premature. This is especially relevant to the use of CSEI total scores in the external validity stage. None of the studies examining the CSEI's factor structure provided support for computing and interpreting a total score. The second, and most significant, limitation of these two "external validity" studies is that the authors provided little or no statement of the expected relationships between CSEI scores and other constructs. According to Benson's strong program of construct

validation (Benson, 1998; Benson & Hagtvet, 1996), the relationships specified and tested should be based on theory. Therefore, although the results provided in these studies can be used loosely to inform our understanding of "what" the CSEI represents, clear theoretically-based hypotheses regarding the relationships one would expect to find are needed to adequately address this stage in the validity process.

Need for Additional Measurement Studies

Despite the previous psychometric work that has been done on the CSEI (Gore et al., 2006; Solberg et al., 1993; Solberg et al., 1998), there is clearly a need for additional measurement studies. First, Gore and colleagues found preliminary evidence for the three-factor solution, but additional studies are needed in order to examine the stability of the factor structure. Second, there is a need for studies that examine the factor structure of the CSEI using *confirmatory* procedures such as CFA with larger, more adequate samples so as to allow more stringent and theoretically-based testing of the competing, one-, three-, and four -factor models. Third, previous studies investigating the factor structure of the CSEI have used different subsets of the college population, and different structures were championed in these studies (three- vs. four-factors); this could be a function of the age or experience of the sample under study. Thus, there is a need for deliberate study of the factor structure of the CSEI for first-year students versus upperclassmen students. Finally, once the factor structure of the CSEI has been studied in multiple samples, additional studies are needed to more thoroughly and more deliberately investigate the external validity of the CSEI by examining the relationships between the CSEI and theoretically-related constructs; this implies stating hypotheses concerning the nature of these theoretical relationships a priori.

In a more general sense, providing evidence of the psychometric soundness of the CSEI is crucial given the paucity of measures that attempt to assess self-efficacy for the college experience. The CSEI was created to serve this purpose, but it must demonstrate adequate psychometric properties in order for researchers to draw valid inferences from its use. This need for additional measurement studies of the CSEI is made more imperative when one considers that the measure is currently being used in applied research (e.g., DeWitz & Walsh, 2002; Gore, 2006; Solberg & Villareal, 1997). Until the measurement properties of the CSEI are more firmly established, the validity of the conclusions made in these studies is compromised.

Purpose of the Current Research

Given the previous work that has been conducted on the CSEI and the need for more studies examining its psychometric properties, the purpose of the current research was to further examine validity evidence for the CSEI. Two studies were conducted to address the purposes of this research agenda. Study 1 focused on examining the dimensionality of the CSEI for freshman students, whereas Study 2 focused on whether the factor structure results would replicate in a sample of upperclassmen students and, if so, on gathering external validity evidence.

Study 1

The purpose of Study 1 was to examine the factor structure of the CSEI using two large samples of freshman students. This was done using CFA procedures, which allows us to examine not only if a specified model fits, but also how well it fits the data relative to alternative models. Three competing, theoretically-based models were tested with the possibility of testing two additional models given results from the testing of the three main models. *Model 1*, specified a one-factor model with all 20 CSEI items representing a single, general factor called College Self-Efficacy (see Figure 1). This one-factor model has been tested previously and was not supported

(Gore et al., 2006). Finding adequate model-data fit would provide support for the use of a total score. *Model 2* specified three correlated factors: Course Efficacy, Roommate Efficacy, and Social Efficacy (see Figure 2). This three-factor model has received some support throughout the literature (Gore et al., 2006; Solberg et. al., 1993). Finally, *Model 3* specified four correlated factors: Course, Roommate, Social, and Social-Integration Efficacy (see Figure 3). This four-factor model divides the Social Efficacy factor into two factors (Social Efficacy and Social-Integration Efficacy). Solberg and colleagues (1998) found this four-factor structure emerged for 388 students, but this structure has not received support since. If none of the three main models fit and if the pattern coefficients for the items representing the fourth Social-Integration factor are low, as have been found in previous studies (Gore et al, 2006; Solberg et al., 1993), these three items would be removed to create a 17-item three-factor model (*Model 4*; see Figure 4). Alternatively, if the four-factor model has adequate fit, a higher-order model, with a second-order College Self-Efficacy factor predicting the four first-order factors, would be tested. This model would also support the use of total scores as it would posit that the relationships between the four first- order factors can be explained by overarching general college self-efficacy factor.

Given that self-efficacy is task- and domain-specific and that previous research has championed the three-factor model over the four-factor model, it is hypothesized that, of the three main competing models tested, Model 2 will fit the data better than Model 1 and will fit as well as Model 3. Additionally, given previous research, and the fact that the three Social-Integration items may not be relevant to all students, it is hypothesized that the these items will have low pattern coefficients in the three-factor model; therefore, these items will be removed to create a 17-item three-factor model, which will provide the best fit to the data.

Methods

Participants and Procedures

CSEI data were collected from 3,562 incoming freshmen students. Each participant completed the CSEI as part of a survey designed by the university to gain information about the incoming class. Cases with incomplete data and duplicate cases were removed to yield a total sample of 3,187. In order to have two independent samples for replication purposes, this total sample was randomly split into two samples. However, to ensure that the samples would remain roughly equal in size, partial data screening was conducted prior to splitting the sample. The data were screened for univariate and multivariate outliers using a SPSS macro written by DeCarlo (1997). There were no univariate outliers, but 14 cases were identified as multivariate outliers and were removed from the dataset, yielding a final total sample size of 3,173. This sample was then randomly split to create two independent samples, referred to as Sample 1 and Sample 2. These two samples were then independently screened for outliers. There was no evidence of univariate or multivariate outliers in Sample 1. Although there were no univariate outliers in Sample 2, two cases were identified as multivariate outliers and were removed. Thus, the effective sample sizes for Samples 1 and 2 were $N = 1{,}586$ and $N = 1{,}585$, respectively. These two samples were of similar demographic composition (See Table 1).

Results

Data Screening

In addition to screening for outliers as described above, several other data screening procedures were conducted. The data were screened for univariate and multivariate multicollinearity. Although there was no evidence of multivariate multicollinearity, some univariate multicollinearity was evidenced by two correlations that were quite large in both samples (all correlation matrices and descriptive statistics are available from the first author).

Items 5 and 6 were correlated $r = .857$ and .854 in Samples 1 and 2, respectively, whereas items 11 and 13 correlated $r = .830$ and .835 in Samples 1 and 2, respectively. These strong relationships indicate that these items may be redundant and may therefore be subject for removal. Univariate and multivariate normality was also evaluated. Univariately, the data for both samples were relatively normally distributed as none of the skewness values exceeded an absolute value of 3 and none of the kurtosis values exceeded an absolute value of 8 (Finney & DiStefano, 2006). Multivariate normality was assessed by obtaining the Mardia's normalized multivariate kurtosis value (DeCarlo,1997). The Mardia's values for Sample 1 and Sample 2 were 123.56 and 120.61, respectively, indicating that there was substantial multivariate non-normality in the data as the values exceeded suggested cutoffs (Finney & DiStefano, 2006).

Confirmatory Factor Analyses

All CFA's were conducted using LISREL 8.72 (Jöreskog & Sörbom, 2005). Because the data for the two samples were non-normal, the Satorra-Bentler (S-B) correction was used in conjunction with maximum likelihood estimation to produce corrected χ^2, fit indices, and standard errors. Model fit was evaluated using the χ^2 in conjunction with several other fit indices: the standardized root mean square residual (SRMR), the Satorra-Bentler adjusted root mean square error of approximation (RMSEA), and the Satorra-Bentler adjusted comparative fit index (CFI). When modeling nonnormal data, Yu and Muthén (2002) recommended that SRMR values at or below.07, $RMSEA_{S-B}$ at or below .05, and CFI_{S-B} at or above .95 typically indicate good model fit. Traditionally, however, RMSEA values of .08 or less (Brown & Cudeck, 1993) and CFI values of .90 or greater (Bentler, 1990) have been used to indicate good fit. Because fit lies along a continuum and because the newer, more strict fit criteria should not be interpreted as absolute cutoffs (Marsh, Hau, & Wen, 2004), there is no clear answer as to what indicates

adequate, good, or excellent fit. Therefore, as recommended by Vandenberg and Lance (2000), these new and old criteria were used as upper and lower bounds of fit. Specifically, an RMSEA value of .05 indicates good fit and a value of .08 was viewed as an upper limit for adequate fit; similarly, a CFI value of .95 indicates good fit and a value of .90 was used as a lower bound for adequate fit. For all models tested, the metric of the latent factors was defined by setting the factor variances to one, and all error covariances were fixed to zero.

All models were first tested in Sample 1 and then re-tested in Sample 2. This was done to determine if model-data fit or misfit would replicate in an independent sample. Furthermore, if there was misfit present in Sample 1 and possible modifications were uncovered, testing these modified models on Sample 2 would help avoid the problems associated with re-specifying and testing modified models on the same sample (MacCallum, Roznowski, & Necowitz, 1992). Specifically, because the fit of the modified models may capitalize on chance (i.e., fitting the idiosyncrasies of the sample), fit may not generalize to other samples. Thus, testing any modified models on Sample 2 would provide the first *a priori* testing of these models.

Model-Data Fit

Theoretical Models. Fit indices for all tested models for both Samples 1 and 2 are presented in Table 2. None of the three, main competing models fit the data adequately. For both samples, the completely standardized coefficients for the three SI items (i.e., items 7, 10, and 12) in the one-, three-, and four-factor models were quite low, and, in turn, the R^2 values, or variance explained, for the items were quite low (i.e., across all three models the R^2 values for items 7, 10, 12 ranged from .12 to .33 for Sample 1 and from .08 to .36 for Sample 2). Therefore, Model 4, the three-factor model in which the three SI items were removed, was tested. It, too, did not fit the data adequately.

Specific areas of misfit were diagnosed by examining the standardized covariance residuals. Because the three social-integration items did not function well, it made the most sense to diagnose misfit for the 17-item three-factor model (i.e., the other theoretical models included these three poorly performing items). Patterns of misfit were very similar across Samples 1 and 2. For both samples, the largest standardized residual was associated with items 5 and 6 (standardized residuals = 18.44 and 21.54 for Samples 1 and 2, respectively), two items that were noted for their extreme multicollinearity. Additionally, Item 1 had numerous large residuals associated with it.

Modified Models. Changes to the instrument were made based on 1) the pattern of standardized covariance residuals and 2) conceptual and/or wording considerations. The following alternative models were tested in succession. The large residual associated with the relationship between items 5 and 6 was most likely due to the fact that these two items correlated so highly. Essentially these items are redundant and, therefore, model was not able to reproduce their relationship well (item 5: "Ask a question in class" and item 6: "Participate in class discussions). Because these items were redundant and because item 6 seemed to encompass item 5 (i.e., if someone is confident they can participate in class discussions, they are most likely to also be confident to ask a question), Item 5 was removed from the scale to create a 16-item three-factor model (*Model 5*). Examination of the fit indices (Table 2) suggested that for both samples, although fit was improved over the four theoretical models, it was still inadequate.

After removing item 5 and testing Model 5, there were still a substantial number of large residuals associated with item 1 ("Make new friends at college"), and additional changes were made to the scale. The two largest residuals for item 1 were associated with items representing the Roommate subscale. Conceptually, this could be explained in that the Social items (item 1

was included on the Social subscale) appear to represent social interactions in class or with professors, whereas the Roommate items appear to represent social interactions with roommates or peers. Item 1 clearly taps into socially interacting with people of one's own age. Thus, item 1 was moved to the Roommate subscale, and an alternative 16-item three-factor model (*Model 6*) was tested. Patterns of misfit were consistent in Sample 2, and this alternative 16-item three-factor model was also tested in this second sample. Again, fit indices suggested an improved but still inadequate fit for both samples (Table 2).

After moving item 1 to the roommate scale, examination of model misfit for Sample 1 revealed there were still several residuals associated with item 1, this time in conjunction with items on the social scale (i.e., items 3 and 6). It could be argued that conceptually, item 1 encompasses a different type of social situation. The Social subscale tends to mainly represent social interactions in class or with professors, and the Roommate subscale tends to encompass social interactions with people one lives with. Item 1 is related more to making friends and socially interacting with peers, which, for some people, could be drastically different than getting along with roommates. Because of the large residuals associated with item 1 and because there are no other social interactions with peers/friends items, it was removed from the scale to create a 15-item three-factor model (*Model 7*) which was then tested. Patterns of misfit were again consistent in Sample 2, so Model 7 was also tested using this second sample. For both freshman samples, this model had the best fit of all models tested (Table 2). Although the RMSEA was still above the recommended cutoff of .05 (Yu & Muthén, 2002), it met the upper bound of .08 and the fit of the model was considered adequate. Despite adequate global fit, the standardized residuals were examined to determine any areas of misfit that should be addressed. There were several residuals greater than 5. In particular, the residuals for items 2, 3, and 4 were especially

large, suggesting that there is some aspect of these relationships not explained well by the model. Despite these areas of local misfit, this model had adequate global fit and reproduced the data better than any other model. Therefore, parameter estimates are presented and interpreted for both Samples 1 and 2.

Parameter estimates. The unstandardized and standardized coefficients, error terms, and variance explained were examined for Samples 1 and 2 (see Table 3). For both samples, all unstandardized path coefficients were significant ($p < .05$). Only five of the items had less than 50% of their variance explained by the factor they represent; thus, five of the standardized error terms were high, suggesting there is either a large amount of random measurement error or unique systematic variance associated with the item. In both samples, three of the five items with low variance explained (i.e., items 2, 4 and 17 for Sample 1 and items 2, 4, and 20 for Sample 2) were items for which there were large standardized residuals, which suggests that there is something about these items and their relationships not explained well by the model.

Factor correlations and reliabilities. The correlations among the three factors were moderate and positive (see Table 3). Reliabilities for the Course, Roommate, and Social subscales were high (C = .89 and .91, R = .82 and .83, and S = .90 and .89 for Samples 1 and 2, respectively). Variance extracted indicates the amount of variance explained in the items by their respective factors. Across both samples, variance extracted was higher than .50. Thus, the three factors were distinct and had adequate reliability and variance explained..

Discussion

In summary, the present study was an attempt to clarify the dimensionality of the CSEI by testing several alternative CFA models. Of the four *a priori* theoretical models (three of which had been tested in previous studies), none of the models adequately fit the data. All

models were fit to two independent samples in order to determine if model misfit was consistent across both samples; it was. Areas of model-data misfit and conceptual/wording considerations were used to inform the derivation of several modified models. The second sample provided the first *a priori* testing of the modified models on an independent sample. As a result of the empirical findings and conceptual reasoning, 5 items were removed from the scale to create a 15-item, three-factor version of the CSEI, which provided the best fit of all models tested.

The 15-item, three-factor model provided adequate global fit to the data and was the most promising of all models tested. However, local areas of misfit remained as evidenced by several large standardized covariance residuals. Additionally, for both samples, there were large residuals associated with the relationships between items 2, 3, and 4. These three items represent different subscales and appear to represent completely different areas of confidence. Thus, these large residuals were somewhat puzzling. One possible explanation lies in the fact that these items were presented in succession, and the strong relationships may have been caused by an item-ordering effect. It has been demonstrated that, especially when expressing attitudes, preceding questions can influence the responses given to subsequent ones (e.g., Schwarz, 1999; Tourangeau & Rasinksi, 1988). That is, it is possible that items 2, 3, and 4 were correlated with one another simply because they were located next to one another on the instrument. However, there were additional, large residuals associated with the model, involving items 2, 3, 4, 8, 18, and 20, and a more in-depth investigation of these standardized residuals may need to be undertaken to determine if a conceptual cause for model misfit can be uncovered. Doing so may lead to the conclusion that the initial stages of scale development should be revisited in order to more clearly delineate the subscales comprising the instrument.

There were two additional areas of concern raised in this study. First, although the modified models derived from the results of Sample 1 were tested on an independent sample (i.e., Sample 2) to guard against capitalization on chance, it might be argued that these samples were essentially the same. In other words, because the two samples were created by randomly splitting a large sample in two, one might argue that any idiosyncrasies of Sample 1 would also be present in Sample 2. Thus, it would be informative to re-evaluate the four theoretical models in addition to the modified models in a completely independent sample. A second limitation of this study concerns the use of samples comprised of incoming freshmen students. Because incoming students have had no experience in college and because mastery experiences inform efficacy beliefs (Bandura, 1986, 1997), it is possible that the college self-efficacy beliefs of these students are misinformed. Although it is not clear if this would impact the factor structure of scores, it prompts the investigation of the factor-structure of the CSEI using a sample of non-freshmen students, who have experienced college.

Study 2

Study 2 was designed to address some of the limitations of the first study. The first purpose of Study 2 was to investigate whether the factor structure championed in Study 1 would replicate in a completely independent sample of upperclassman students. Specifically, all models that were tested in the first study were again tested to see if the pattern of misfit associated with the four theoretical models and the fit of the modified models would replicate in an upperclassman sample. Given that the factor structure championed in the first study replicated, the second purpose was to investigate the external validity of the CSEI by exploring hypothesized relationships between CSEI scores and theoretically-related constructs.

Specifically, the relationships between the CSEI and measures of social anxiety, academic anxiety, self-regulatory processes, and academic achievement were examined.

Hypothesized Relationships with Social Anxiety

Previous research supports a clear, negative relationship between self-efficacy and anxiety (e.g., Bandura, 1977; Cooper, & Robinson, 1991; Endler, Speer, Johnson, & Flett, 1999; Hunsley, 1985). Thus, there should be a negative relationship between CSEI subscale scores and Interaction Anxiousness Scale (IAS: Leary, 1983) scores, but the three distinct CSEI subscales should be differentially related to IAS scores. In particular, because the Social Efficacy subscale is comprised of items involving social interactions, albeit social relations in class or with university staff, and because the IAS represents anxiety for general social situations, the negative relationship between IAS scores and Social Efficacy scores were expected to be the strongest. Additionally, because the items on the Roommate Efficacy subscale involve social situations but in a more specific context, Roommate Efficacy scores should be negatively related IAS scores, but to a lesser extent than Social Efficacy scores. Finally, the items on the Course Efficacy subscale do not involve social situations, and therefore the smallest correlation was expected between IAS scores and this subscale.

Hypothesized Relationships with Academic Anxiety

Two instruments were used as measures of academic anxiety: the Academic Concern subscale of the Student Worry Questionnaire (SWQ Academic Concern: Osman et al., 2001) and the Revised Test Anxiety Scale (RTA: Benson, Moulin-Julian, Schwarzer, Seipp, & El-Zahhar, 1992; Benson & El-Zahhar, 1994). Again, considering the demonstrated negative relationship between anxiety and self-efficacy, negative, but differential relationships between the three CSEI subscale scores and both measures of academic anxiety scores were expected. For the SWQ

Academic Concern subscale, the strongest negative relationship was expected to be that with Course Efficacy. Because the Social Efficacy subscale of the CSEI consists of many situations involving class or faculty interactions, Social Efficacy scores should also be negatively related to Academic Concern, but less so than Course Efficacy. Because Roommate Efficacy does not involve academic or course-related confidences, there should be the weakest relationship between this subscale and Academic Concern scores, if any. The pattern of relationships between CSEI scores and RTA scores was expected to be similar to those between CSEI scores and SWQ Academic Concern scores. However, the CSEI deals with more generalized levels of self-efficacy (e.g., general course confidence for the CSEI Course subscale) and the RTA deals with a more specific level of anxiety (e.g., test anxiety). Because the level of specificity does not align between the two measures, the relationships should be weaker than those involving the more general SWQ Academic Concern subscale.

Hypothesized Relationships with Self-Regulated Learning

Previous research has found not only a significant and positive relationship between self-efficacy and self-regulated learning (e.g., Pintrich & DeGroot, 1990), but also that self-regulated learning strategies predict academic self-efficacy (Zimmerman & Martinez-Pons, 1990). Furthermore, academic self-efficacy has been found to relate positively to regulation of learning and greater use of cognitive strategies (Pintrich & Schrauben, 1992), leading Bandura (1997) to suggest that academic self-efficacy and cognitive/metacognitive learning strategies are reciprocally related to one another. For this reason, CSEI subscores scores were expected to be positively but differentially related to Regulation of Cognition scores (Schraw & Dennison, 1994). Course Efficacy should have the largest positive relationship because this subscale deals explicitly with confidence to complete course-related tasks. Given that students who engage in

more metacognitive strategies may also be the students who participate in class and interact with their professors, the Social Efficacy subscale, which is largely comprised of items dealing with social interactions in class or with professors, is expected to have the next largest relationship with Regulation of Cognition. There should not be a large relationship between Roommate Efficacy and Regulation of Cognition, if any relationship at all.

Hypothesized Relationships with Academic Achievement

The current study used two measures of academic achievement, GPA and SAT total scores. Given that previous research has consistently demonstrated that self-efficacy beliefs predict performance and are related to prior knowledge (e.g., Bandura, 1997; Pajares & Miller, 1994), CSEI was expected to be positively correlated with both GPA and SAT total scores. Specifically, the three subscales were expected to be positively and differentially related to GPA and SAT scores. In particular, Course Efficacy should be the most strongly related to both measures of academic achievement because it explicitly represents confidence for course- and academic-related tasks. Because students who participate more in class or interact with their professors are likely to be those who are most engaged in the coursework and performing the best in class, Social Efficacy should also be related to GPA and SAT scores, but less so than Course Efficacy. Roommate Efficacy does not pertain to academic confidence and should show the weakest relationships with GPA and SAT scores, if a relationship at all.

Method

Sample

The sample for Study 2 consisted of 238 university upperclassmen (i.e., sophomores, juniors, and seniors) who completed the CSEI along with the external validity measures noted above. These participants completed these measures during the Fall 2006 and Spring 2007

semesters, and were recruited through the psychology subject pool; therefore, these students were enrolled in introductory psychology classes, for which they must complete a specified number of experimental credits as a course requirement. Of the 238 students who completed the measures, 237 provided complete data to all measures administered. This sample of $N = 237$, referred to as Sample 3, was used to re-examine the dimensionality of the instrument. For the external validity analyses, only the subset of students that had complete data on all external criteria was used (Sample 3a). Of the 237 students providing complete data to administered measures, only 208 students had GPA and SAT data available. Finally, 17 participants indicated that they did not have a roommate. Because only students having roommates would be included in the analyses involving Roommate Self-Efficacy, these cases were removed in order to keep the sample size the same across all external analyses. The effective sample size for Sample 3a, used only for external validity purposes, was $N = 191$. Demographic information can be found in Table 1.

Procedure

The CSEI and other measures were administered by handing out a manila envelope containing all measures to the participants. Participants completed the measures one at a time and were not allowed to begin responding to the next measure until all participants had completed the measure. This was done as an attempt to slow response rates, in the hopes that it would produce more thoughtful responses. The CSEI was administered first across all experimental sessions, but the remaining measures were counterbalanced across the sessions to account for possible fatigue effects.

External Validity Measures

Interaction Anxiousness Scale. The Interaction Anxious Scale (IAS; Leary, 1983) was used to assess social anxiety. This scale consists of 15 self-report items focused on subjective feelings of anxiety associated with social interactions. Participants were asked to respond by indicating how characteristic each of the statements is of themselves on a scale ranging from 1 (*Not at all characteristic*) to 5 (*Extremely characteristic*). Total scores were computed by summing the responses to each item, with higher scores representing higher levels of social anxiety. The IAS has received widespread use and has a body of validity evidence (see Leary & Kowalski, 1993).

Student Worry Questionnaire, Academic Concern subscale. Participants completed the Academic Concern subscale Student Worry Questionnaire (SWQ; Osman et al., 2001). The SWQ is a 30-item instrument designed to tap multiple dimensions of worry at once. As such, the SWQ is composed of six subscales: Worrisome Thinking, Financial-Related Concerns, Significant Other's Well-being, Social Adequacy Concerns, Academic Concerns, and General Anxiety Symptoms. The Academic Concern subscale of the SWQ consists of five statements describing worries and anxieties related to course performance and was used as a measure of academic anxiety. Participants were asked to rate how characteristic each of the statements was of them on a scale ranging from 1 (*Almost never characteristic of me*) to 5 (*Almost always characteristic of me*). Scores were obtained by summing item responses; thus, higher scores indicate higher levels of academic anxiety. The authors of the scale reported adequate psychometric properties.

Revised Test Anxiety Scale. The Revised Test Anxiety Scale (RTA; Benson, Moulin-Julian, Schwarzer, Seipp, & El Zahhar, 1992; Benson & El-Zahhar, 1994) was used to assess test anxiety (a more specific form of academic anxiety). The RTA is composed of 20-items that

participants rate using a scale from 1 (*Almost never*) to 4 (*Almost always*). Total scores were obtained by summing item responses with higher scores indicating higher levels of test anxiety.

Regulation of Cognition subscale. Participants completed one subscale of the Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994). The MAI is a 52-item self-report measure consisting of two subscales: Knowledge of Cognition, and Regulation of Cognition. Only the Regulation of Cognition subscale was administered in this study. This subscale consists of 35 statements describing various metacognitive, self-regulatory learning-strategies for which participants are asked to indicate how true or false each statement is of them using a scale of 1 (*always false*) to 5 (*always true*). Scores were computed by summing item responses, with higher scores indicating higher levels of regulatory, metacognitive learning strategies.

GPA and SAT Total scores. Participants' grade point averages (GPA) and SAT total scores were gathered from institutional records; by signing the informed consent, they allowed access to both GPA and SAT scores. Because data was gathered in the Fall 2006 semester and at the very beginning of the Spring 2007 semester, students' semester GPA for Fall 2006 was used. Additionally, if students took the SAT more than once, the most recent scores were used.

Additional criteria. In addition, all participants were asked to rate their overall confidence in both academics ("How confident are you in your academics?") and social situations (How confident are you in social situations"). Like the CSEI, students provided these ratings on a scale ranging from 1 (Not at all confident) to 10 (Extremely confident).

Results

Data screening

Data screening procedures indicated there was no evidence for univariate or multivariate outliers. Some univariate multicollinearity was present in the form of a large correlation between items 5 and 6 (r = .855) and between items 11 and 13 (r = .832). These correlations were very similar to those found in the two freshman samples in Study 1. Univariate descriptive statistics indicated that the data appeared to be relatively normally distributed, although the univariate kurtosis value for item 20 (8.45) was a bit higher than desired. Mardia's normalized multivariate kurtosis (36.46) indicated that the data was multivariately non-normal.

Dimensionality of the CSEI

Confirmatory Factor Analyses. All CFA's were conducted using LISREL 8.72 (Jöreskog & Sörbom, 2005). Because the data were non-normal, the Satorra-Bentler (S-B) correction was again used in conjunction with maximum likelihood estimation to produce a corrected χ^2 , fit indices, and corrected standard errors.

Theoretical Models. Fit indices for the four theoretical models are presented in Table 2. Consistent with Study 1, for the one-, three-, and four-factor theoretical models did not fit the data. In addition, the completely standardized path coefficients for the three social-integration items, and, in turn, the R^2 values for the items were quite low (ranging from .17 to .41 across all three models). These items were removed, and Model 4 was tested. Similar to Study 1, this model also did not fit the data. Misfit for Model 4 was diagnosed, and the pattern of standardized covariance residuals for Sample 3 was very similar to that of the freshman samples. The largest standardized residual was associated with items 5 and 6 (i.e., 9.95) and there were a number large residuals associated with item 1. This provided support for the modifications to the scale using the freshman sample; the model-data misfit does not appear to be due to the level of student.

Modified Models. Because none of the four theoretical models fit adequately and because the pattern of standardized residuals was similar to those of the freshman samples in Study 1, all previously tested modified models were tested again. This provided a second *a priori* testing of these models. Fit indices and patterns of residuals for all modified models were very similar to those found in Study 1. Indices indicated that neither Model 5 nor Model 6 fit the data, but Model 7, the 15-item, 3-factor model, did have adequate global fit (Table 2).. Standardized residuals were examined for areas of local misfit and a few moderately sized residuals were found. In particular, there were three residuals above a value of |4|; these were associated with the relationships between items 4 and 8 (-4.19), items 4 and 15 (-5.75), and items 8 and 19 (4.21). Interestingly, these residuals were not found to be extremely large in the two freshman samples. Despite this, on the whole, the standardized residuals were quite small, with values of between 1 and 0 for most items. Interestingly, there were no large residuals for items 2, 3, and 4, as had been found in Study 1. Because the fit of this model was considered adequate, parameter estimates are presented and interpreted for this sample.

Parameter Estimates. The unstandardized and standardized coefficients, error terms, and variance explained are presented in Table 3. All unstandardized path coefficients were significant ($p < .05$). Eight of the items had less than 50% of their variance explained by the factor they represented. Two of these items with low variance explained (i.e., items 4 and 8) were items for which there were large standardized residuals, further emphasizing the fact that something about these items and their relationships is not explained well by the model.

Factor correlations and reliabilities. As in Study 1, the correlations among the three factors were moderate and positive (see Table 3). Reliabilities for the Course, Roommate, and Social subscales were again high (.84, .77, and .88, respectively). The variance extracted for each

of the three factors was 43% or higher. Thus, the items seem to have adequate reliability and are relatively well explained by their factors.

External Validity Evidence

Table 4 includes means, standard deviations, minimum and maximum scores, and reliabilities for each of the scales, as well as correlations among the various external measures. The correlation coefficients were examined as a test of the various hypothesized relationships among CSEI subscale scores and the various criteria. Correlations were tested at the $\alpha = .01$ level.

For social anxiety, the correlations between IAS scores and CSEI subscale scores were all significant and negative, as hypothesized. Also as predicted, IAS scores were the most strongly related to Social efficacy scores, were less related to Roommate efficacy scores, and were the least related to Course efficacy scores.

In terms of academic anxiety, the hypothesized relationships between CSEI scores and the SWQ-Academic Concern scores were partially supported. As hypothesized, the relationships between Academic Concern and CSEI subscale scores were negative. The relationship was strongest (i.e., significant and negative) for Course efficacy. As predicted, Social and Roommate efficacy scores were less correlated with Academic Concern scores, but contrary to prediction, the relationship was *slightly* stronger for Roommate efficacy than that with Social efficacy. However, these correlations were quite similar in value. For RTA scores, the hypothesized relationships were supported; the negative correlation with RTA scores was the largest and significant for Course efficacy, smaller but still significant for Social efficacy, and the smallest for Roommate efficacy (not significant). It should be noted that, contrary to prediction, the

relationships between CSEI subscale scores and RTA scores were not smaller than those between CSEI scores and Academic Concern scores.

For self-regulated learning, it was hypothesized that the relationship between ROC scores would be the largest with Course efficacy, the next largest with Social efficacy, and the smallest with Roommate efficacy and that all of these relationships would be positive. Both the direction and the degree of these hypothesized relations were supported by the data. Furthermore, the relationships between ROC scores Course and Roommate efficacy were significant.

The expected relationships between CSEI scores and measures of academic achievement received mixed support. The correlations between CSEI Course and Social subscale scores and GPA were significant and positive, and the relationship was nil for Roommate efficacy; unexpectedly the relationship between GPA and Social efficacy was the same as that between GPA and Course efficacy. As expected, SAT scores correlated positively with Course and Social efficacy scores, with Course efficacy being more strongly correlated than Social efficacy. Contrary to hypotheses, Roommate efficacy was negatively related with SAT scores. However, it is important to note that the magnitudes of all three of the correlations involving SAT scores were quite low and non were significant at the $\alpha = .01$ level.

The two additional confidence ratings also evidenced differential relationships with the three CSEI subscales. As expected, the relationship for ratings of overall academic confidence was significant and strongest with Course efficacy, was significant and the next strongest with Social efficacy, and was the least correlated with Roommate efficacy (not significant). Similarly, ratings of overall social confidence were differentially related to CSEI subscale scores. Overall, social confidence was significantly and most strongly related to Roommate efficacy,

significantly and the next strongly related to Social efficacy, and the least related to Course efficacy.

Discussion

The purpose of Study 2 was to examine the factor structure of the CSEI and to collect external validity evidence for the CSEI using a sample of upperclassmen students. In summary, additional support was found for the factor structure championed in Study 1, the 15-item, three-factor model. For the sample used in the current study, this model provided adequate global fit and fit better than any of the other models tested. However, there were still a few local areas of misfit. Specifically, there were moderately sized residuals associated with items 4, 8, 15, and 19. Because not all of these residuals emerged in Study 1, it is possible that this misfit is idiosyncratic to this particular sample. Future studies may provide additional insight as to whether this misfit is stable.

Interestingly, for the upperclassman dataset, there were not large residuals associated with items 2, 3, and 4, as there were in Study 1. That is, for this data, it does not appear that these items are sharing variance after controlling for the three self-efficacy factors. One possible explanation for this might be that this study utilized a sample of upperclassman students whereas Study 1 used data from freshman students. It is possible that, for whatever reason, upperclassman students are less likely to respond to successive items similarly simply because they are located next to one another on the instrument. An alternative, and more probable, explanation is the method of administration. In Study 1, the instrument was administered as part of a large-scale survey designed to gather information about the incoming class; therefore, these students completed the surveys on their own time, prior to arriving on campus. In Study 2, the instrument was administered as part of a battery of tests given by the experimenter in a small campus

classroom. In this case, the students were instructed by the experimenter to respond carefully and thoughtfully to all questions and to take their time in answering. This was done in order to slow response rate. It is very likely that the large residuals between items 2, 3, and 4 were not present for this data because these students provided more thoughtful answers to the questions and were not able to simply rush through the questionnaires. This argument gains additional credence when one considers how small the standardized residuals were for most items (much smaller for this upperclassman sample than for the two freshman samples in Study 1). However, because there were two variables that changed between Study 1 and Study 2 (i.e., freshman vs. upperclassman and large-scale vs. structured administration), it is not possible to disentagle which was the cause of the lower residual values. This begs for further investigation.

The second purpose of Study 2 was to gather external validity evidence for the CSEI, given the factor-structure found in Study 1 replicated with the independent sample of upperclassmen students. In general, the correlations with the external criteria supported the hypothesized relationships. In particular, the relationships between the various CSEI subscales and social anxiety, academic anxiety, self-regulatory learning, and overall academic and social confidence were as expected. The hypothesized relationships between the CSEI subscales and Academic Concern scores (i.e., academic anxiety) as well as GPA were only partially supported. Finally, the correlations between CSEI subscale scores and SAT scores did not support the hypothesized relationships.

Interestingly, when the hypothesized relationships were not fully supported, the breakdowns often involved the differential relationship between Social efficacy and the external criterion (e.g., Social efficacy and Course efficacy had approximately equal correlations with GPA; Social efficacy was slightly less correlated with Academic Concern than was Roommate

efficacy, and slightly less correlated with overall social confidence than was Roommate efficacy). This further evidences the fact that the items on the Social efficacy subscale describe situations that are not only social but also academic in nature. If the subscale is to remain in its current form, it needs to be renamed in order to more accurately reflect the content of the items (i.e., Academic Interactions). It also may be of interest to further refine the measure to better and more fully represent the social aspect of the college experience. Specifically, if there was an additional subscale consisting of items that clearly involved social interactions with one's friends and peers, a crucial aspect of the college experience, hypothesized relationships may be more consistently supported. Future work may involve creating new items that distinguish between these two aspects of social self-efficacy and should subsequently examine the differential relationship between these two types of social efficacy and related criteria. Despite this, the fact that the different subscales related to the various criteria in theoretically-supported ways should lend credence to the argument that the instrument measures what it purports to measure: different components of college self-efficacy.

General Discussion

Given the increasing interest in understanding the variables that contribute to a student's adjustment to college, there is a growing need for instruments that represent these constructs. Solberg and colleagues created the College Self-Efficacy Inventory to measure one of these constructs, college self-efficacy (Solberg et al., 1993). The current research gathered needed validity evidence for the scores from the CSEI. Specifically, the dimensionality of the instrument was further evaluated and external validity evidence was gathered.

Dimensionality

Consistent Findings Across Samples and Testing Conditions. Across both Study 1 and Study 2, the reduced 15-item, three-factor model of the CSEI had the most support. Both conceptual and empirical concerns were taken into consideration when making modifications to the instrument that eventually led to this reduced model. When discussing the results of the two studies, it is important to note several consistencies that were found. First, across all three samples, the three items that previously were used to represent the Social-Integration Efficacy subscale functioned poorly, as evidenced by their low standardized factor loadings. This was not surprising given the content of the items. More specifically, all other items described tasks encountered by all students, whereas these three items described tasks that not all students would complete (e.g., join an intramural sports team, get a date when you want one). Therefore, one's confidence to complete these tasks could be contingent on their desire to do them. On the basis of the empirical results and these conceptual issues, it was deemed appropriate to remove these items from the instrument.

A second consistency that was found across both studies was local misfit associated with certain items, as indicated by large residuals for these items. Specifically, the redundancy of items 5 and 6 found in all three samples. Furthermore, the fact that, theoretically or empirically, item 1 did not appear to belong to either the Social or the Roommate subscale resulted in the removal of item 1. Each of the modifications resulted in an increase in fit. Given the consistencies in both model fit and misfit across all three samples, we felt confident in the modifications that led to the 15-item, three-factor structure.

Inconsistent Findings Across Samples and Testing Conditions. Although several modifications were made to the instrument, there were some areas of localized misfit that did not ultimately result in modifications, either due to a lack of conceptual reasoning or due to a lack of

consistency across samples. First, across both Samples 1 and 2 (i.e., the two freshman samples) there were large residuals associated between items 2, 3, and 4. Although this misfit was consistent across both samples, there was no conceptual reason as to why these items, which were written to represent different subscales and when examining the wording appeared to be very distinct, would be related. One possible reason was that the items were correlated simply because they were located next to one another on the instrument and exhibited an item-ordering effect (Schwarz, 1999; Tourangeau & Rasinski, 1988). However, these large residuals were not found in Study 2. As discussed earlier, this could be due to the age of the participants (i.e., freshmen in Study 1 vs. upperclassmen in Study 2) or due to testing condition employed (i.e., large-scale, uncontrolled for Study 1 vs. small-scale, controlled for Study 2). It seems most likely that giving participants explicit instructions to carefully answer the questions and not allowing them to rush through, as was the case in Study 2, eliminated what appeared to be a sort of response style/acquiescence and eliminated some of the dependency of the items on one another. That is, slowing responding in Sample 3 forced participants to think about each question separately and made each item *and* each factor more distinct. However, this should be explicitly tested in the future in order to determine the exact cause of the decrease in these residuals from Study 1 to Study 2.

Two other areas of localized misfit did not result in modifications to the instrument. First, for freshman Samples 1 and 2, there were reasonably large residuals for the relationship between item 4 (“Manage time effectively”) and 18 (“Keep up to date with your schoolwork”). Similarly, for upperclassmen, there were somewhat larger than desirable residuals for the relationship between items 8 (“Research a term paper”) and 19 (“Write course papers”). For both pairs of items, the wording suggests that the items may be considered redundant, but, because this misfit

was not consistent across all samples, no modifications were made on its basis. If future research consistently finds that these relationships are poorly explained by the model, it may be necessary to make additional modifications (eliminate redundancy among items).

Limitations of the Current Studies and Directions for Future Research

There are several limitations of the current research that should be noted. First, the demographic composition of the samples used in this study was far from diverse, consisting of predominately Caucasian, female students attending a relatively selective university. Thus, the generalizability of the findings to other university populations may be limited to the degree that the student body make-up differs from that used for the current research. Because of this, it is important to continue gathering validity evidence for the CSEI using different populations of students.

A second limitation of the current study concerns the fact that it is appropriate to examine external validity evidence for an instrument only after its factor structure has been firmly established. In this research, the 15-item, three-factor structure consistently provided good model-data fit across several samples and was thus used to test the hypothesized relationships among CSEI scores and related criteria; overall, these hypothesized relationships were supported. However, if future study should result in additional modifications to the CSEI, external validity evidence should again be gathered for the revised instrument. Thus, although the gathering of external validity evidence in the current study was an important step in establishing that the CSEI does in fact measure what it purports to measure, the external validity should continue to be examined as additional changes are made to the instrument.

When considering directions for future research, it is important to note that the modifications made in the current research resulted in the removal of several items from the

Social efficacy subscale. However, we believe writing more items to cover this obtuse "social" self-efficacy construct is not the solution. In fact, the number of problems with these items points to the fact that there is an issue with the conceptualization and operationalization of this construct. Specifically, one central aspect of the college experience that is missing from the CSEI is that of making friends and interacting socially with them. Currently, the instrument contains items involving classes and academics (i.e., Course efficacy), items involving living and getting along with others (i.e., Roommate efficacy), and items involving interacting socially *in classes and with professors* (i.e., "Social" efficacy), but it lacks items that involve socially interacting with friends and peers. Item 1 (i.e., "Make new friends at college") *did* pertain to this aspect of college, but it did not function well and was removed from the instrument; this is because it was quite different from the other "Social" items. Essentially, item 1 taps into a *separate* aspect of the college social experience (e.g., social peer relationships), and, because a factor cannot consist of only one item, it functioned poorly. If there were additional items that involved social situations with peers and friends, it is expected that item 1 would correlate highly with these items and that these items would comprise a separate factor pertaining to *peer relationships and interacting socially with peers*. Whereas these empirically-based arguments support the addition of more peer social self-efficacy items, the much more important argument is the need for peer social self-efficacy within the theoretical conceptualization of college self-efficacy. In our opinion, is it suprising that confidence in peer social interactions and relationships isn't a central dimension of the conceptualization of college self-efficacy and, in turn, reflected by several items on the scale. Given the importance of peer relationships to the college experience (e.g., Chickering, 1999; Ferrari & Parker, 1992; Russell & Petrie, 1992; Smith & Betz, 2000), it is imperative that future work pilot items representing peer social interactions. As mentioned above, the items

representing what the original authors labeled the Social efficacy subscale pertain more to social interactions with professors or in class rather than social situations in general. Therefore, it seems more appropriate (and much less confusing) to label this factor "Professor and Class Interactions," reserving the term "Social" efficacy for broader, more accurate measurement of the construct. We recommend that the use of simply "Social Self-efficacy" be avoided for this measure as none of the factors reflect this general construct. More specific labels should be used (i.e., Professor and Class Interactions Self-efficacy) in order to provide more accurate labels for the factors and to help avoid issues of construct under-representation. This, of course, means a return to the substantive stage of the validity process. As Benson (1998) notes, the validity process is cyclical with later stages informing earlier stages; this is exactly the situation here. The substantive stage of the validity process should be revisited in order to expand the conceptualization of the construct to include peer social efficacy, an extremely important, but currently missing, piece.

Conclusions

The current research has made promising steps in gathering validity evidence for the CSEI and, in turn, provided a better understanding of the functioning of this measure. This research provided strong, yet preliminary study of a reduced 15-item scale (i.e., dimensionality as well as external validity evidence). However, building the case for validity for a particular instrument is a never-ending process (e.g., Benson, 1998), and additional work is needed. In particular, it is necessary to revisit the conceptualization of college self-efficacy to ensure that all aspects of the college experience are adequately represented. In particular, the lack of the social peer efficacy dimension is concerning. After defining this aspect of college self-efficacy, items should be written to represent it. Doing so should eventually result in a scale that both covers the

breadth of the college experience and exhibits adequate psychometric properties. Throughout this process, the relationships between the CSEI and external criteria should continue to be examined as a way of gathering external validity evidence. Only after extensive validity evidence has been gathered, can we be confident in the inferences we make regarding the CSEI scores and the conclusions drawn in studies that use it. The current set of studies provides a nice foundation upon which future work can build.

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Table 1
Demographic Information for all Samples

	Sample 1	Sample 2	Sample 3	Sample 3a
N	1586	1585	237	191
Age Range	17+	17+	18+	18+
Year				
% Freshmen	100	100	0	0
% Sophomore	0	0	66.2	69.3
% Junior	0	0	21.9	19.9
% Senior	0	0	11.8	11.0
Gender				
% Female	68.0	67.1	67.1	68.6
% Male	32.0	32.9	32.9	31.4
Ethnicity				
% White	85.1	86.0	84.4	84.3
% Minority	14.9	14.0	15.6	15.7

Table 2

Fit Statistics for Hypothesized and Modified Models for Samples 1, 2, and 3

Sample 1					
Model	$\chi^2_{S\text{-}B}$	df	SRMR	$RMSEA_{S\text{-}B}$	$CFI_{S\text{-}B}$
1) 20-item, one-factor	6530.15	170	0.099	0.15	0.80
2) 20-item, three-factor	2714.49	167	0.074	0.10	0.92
3) 20-item, four-factor	2592.09	164	0.070	0.10	0.92
4) 17-item, three-factor	2135.3	116	0.075	0.10	0.92
5) 16-item three-factor a	1444.85	101	0.075	0.09	0.94
6) 16-item three-factor b	1286.4	101	0.054	0.09	0.95
7) 15-item three-factor	976.92	87	0.051	0.08	0.95
Sample 2					
Model	$\chi^2_{S\text{-}B}$	df	SRMR	$RMSEA_{S\text{-}B}$	$CFI_{S\text{-}B}$
1) 20-item, one-factor	6356.63	170	0.095	0.15	0.84
2) 20-item, three-factor	2479.21	167	0.070	0.09	0.94
3) 20-item, four-factor	2402.51	164	0.067	0.09	0.94
4) 17-item, three-factor	1886.78	116	0.069	0.10	0.94
5) 16-item three-factor a	1282.44	101	0.069	0.09	0.96
6) 16-item three-factor b	1224.22	101	0.055	0.08	0.96
7) 15-item three-factor	820.45	87	0.048	0.07	0.97
Sample 3					
Model	$\chi^2_{S\text{-}B}$	df	SRMR	$RMSEA_{S\text{-}B}$	$CFI_{S\text{-}B}$
1) 20-item, one-factor	955.59	170	0.110	0.140	0.76
2) 20-item, three-factor	508.15	167	0.088	0.090	0.90
3) 20-item, four-factor	479.40	164	0.087	0.090	0.90
4) 17-item, three-factor	349.39	116	0.083	0.090	0.90
5) 16-item three-factor a	223.05	101	0.079	0.070	0.94
6) 16-item three-factor b	225.05	101	0.076	0.070	0.94
7) 15-item three-factor	182.78	87	0.070	0.070	0.95

Note: The 16-item three-factor "a" model item 5 was removed; the 16-item three-factor model "b" item 5 was removed and item 1 was moved to the Roommate subscale; the 15-item three-factor model is the model in which item 1 was removed.

Table 3
Unstandardized (Standardized) Parameter Estimates, Subscale Reliabilities and Variance Explained for Samples 1, 2, and 3

	Sample 1			Sample 2			Sample 3		
Items	Path Coefficients	Error Variance	R^2 Value	Path Coefficients	Error Variance	R^2 Value	Path Coefficients	Error Variance	R^2 Value
Course									
4	1.28 (.67)	2.03 (.55)	0.45	1.27 (.68)	1.85 (.53)	0.47	1.27 (.66)	2.04 (.56)	0.44
8	1.32 (.73)	1.52 (.47)	0.53	1.37 (.77)	1.31 (.41)	0.59	1.04 (.59)	2.03 (.65)	0.35
9	1.25 (.72)	1.44 (.48)	0.52	1.38 (.77)	1.26 (.40)	0.60	1.20 (.71)	1.41 (.49)	0.51
14	1.20 (.69)	1.64 (.53)	0.47	1.19 (.69)	1.54 (.52)	0.48	0.77 (.51)	1.70 (.74)	0.26
17	1.16 (.70)	1.40 (.51)	0.49	1.22 (.74)	1.23 (.45)	0.55	1.08 (.72)	1.10 (.48)	0.52
18	1.27 (.79)	0.99 (.38)	0.62	1.32 (.83)	0.81 (.32)	0.68	1.28 (.74)	1.28 (.45)	0.55
19	1.45 (.83)	0.98 (.32)	0.68	1.49 (.83)	0.98 (.31)	0.69	1.03 (.63)	1.60 (.60)	0.40
Roommate									
2	1.01 (.62)	1.60 (.61)	0.39	1.01 (.61)	1.72 (.63)	0.37	1.17 (.65)	1.84 (.57)	0.43
15	1.12 (.81)	0.66 (.35)	0.65	1.18 (.84)	0.57 (.29)	0.71	0.99 (.71)	0.95 (.49)	0.51
16	1.15 (.79)	0.82 (.38)	0.62	1.22 (.82)	0.70 (.32)	0.68	0.90 (.70)	0.84 (.51)	0.49
20	0.94 (.71)	0.89 (.50)	0.50	0.84 (.67)	0.88 (.56)	0.44	1.01 (.63)	1.50 (.60)	0.40
Social									
3	1.40 (.78)	1.27 (.39)	0.61	1.36 (.76)	1.39 (.43)	0.57	1.38 (.76)	1.40 (.42)	0.58
6	1.57 (.70)	2.57 (.51)	0.49	1.52 (.69)	2.51 (.52)	0.48	1.32 (.58)	3.46 (.66)	0.34
11	1.71 (.93)	0.49 (.14)	0.86	1.68 (.93)	0.44 (.13)	0.87	1.66 (.95)	0.28 (.09)	0.91
13	1.64 (.89)	0.68 (.20)	0.80	1.60 (.89)	0.65 (.20)	0.80	1.50 (.87)	0.71 (.24)	0.76

	Course	Roommate	Social	Course	Roommate	Social	Course	Roommate	Social
Course	1.00			1.00			1.00		
Roommate	0.65	1.00		0.65	1.00		0.53	1.00	
Social	0.63	0.55	1.00	0.64	0.58	1.00	0.58	0.32	1.00
Reliabilities	0.89	0.82	0.90	0.91	0.83	0.89	0.84	0.77	0.88
Var Explained	0.54	0.54	0.69	0.59	0.55	0.68	0.43	0.46	0.65

Note: Standardized path coefficients and error terms were used to calculate reliabilities (Reuterberg & Gustaffson, 1992).

Table 4

Correlations, means, standard deviations, minimum, maximum, and Cronbach's coefficient alpha associated with CSEI and related Criteria

	Course	Room	Social	IAS	AC	RTA	ROC	GPA	SAT	AcCon	SoCon
1. Course	(0.849)[a]										
2. Room	0.435	(0.775)									
3. Social	0.516	0.343	(0.863)								
4. IAS	-0.201*	-0.413*	-0.481*	(0.870)							
5. AC	-0.235*	-0.148	-0.136	0.244*	(0.850)						
6. RTA	-0.293*	-0.175	-0.229*	0.212*	0.608*	(0.905)					
7. ROC	0.454*	0.074	0.277*	-0.060	-0.168	-0.141	(0.898)				
8. GPA	0.199*	0.008	0.202*	0.110	-0.143	-0.190*	0.271*	---			
9. SAT	0.072	-0.069	0.032	0.162	-0.218*	-0.262*	-0.056	0.348*	---		
10. AcCon	0.563*	0.182	0.407*	-0.110	-0.344*	-0.471*	0.413*	0.476*	0.281*	---	
11. SoCon	0.139	0.467*	0.344*	-0.772*	-0.080	-0.050	0.098	-0.207*	-0.261*	0.105	---
Mean	54.40	34.64	31.20	37.17	17.82	38.32	121.79	3.11	1104.97	7.27	7.81
SD	8.37	4.80	6.31	10.17	4.28	10.19	16.91	0.60	133.96	1.41	1.79
Minimum	27	7	15	21	8	22	67	1.00	710	2	1
Maximum	70	40	40	66	25	73	166	4.00	1440	10	10

Note. $N = 191$.

* $p < .01$

[a] Cronbach's coefficient alpha values are on the diagonal.

Course = course efficacy, Room = roommate efficacy, Social = social efficacy, IAS = Interaction Anxiousness Scale, AC = Academic Concern subscale, RTA = Revised Test Anxiety Scale, ROC = Regulation of Cognition, GPA = GPA for Fall 2006 semester, SAT = most recent SAT Total scores, AcCon = academic confidence rating, SoCon = social confidence rating.

Appendix

College Self-Efficacy Inventory (CSEI)

The following 20 items concern your confidence in various aspects of college. Using the scale below, please indicate how confident you are as student at JMU that you could successfully complete the following tasks. If you are extremely confident, mark a 10. If you are not at all confidence, mark a 1. If you are more or less confident, find the number between 10 and 1 that best describes you. Item responses are aggregated across all student respondents in order to better understand how confident the "average" JMU student feels. Levels of confidence vary from person to person, and **there are no right or wrong answers; just answer honestly.**

1	2	3	4	5	6	7	8	9	10
Not at all Confident									**Extremely Confident**

1. Make new friends at college.
2. Divide chores with others you live with.
3. Talk to university staff.
4. Manage time effectively.
5. Ask a question in class.
6. Participate in class discussions.
7. Get a date when you want one.
8. Research a term paper.
9. Do well on your exams.
10. Join a student organization.
11. Talk to your professors.
12. Join an intramural sports team.
13. Ask a professor a question.
14. Take good class notes.
15. Get along with others you live with.
16. Divide space in your residence.
17. Understand your textbooks.
18. Keep up to date with your schoolwork.
19. Write course papers.
20. Socialize with others you live with.

Figure Captions

Figure 1. The one-factor model of the CSEI.

Figure 2. The three-factor model of the CSEI.

Figure 3. The four-factor model of the CSEI.

Figure 4. The 17-item three-factor model of the CSEI.

Figure 1.

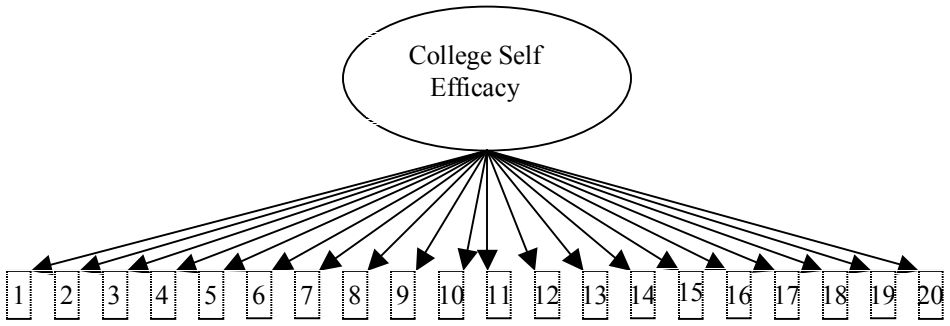


Figure 2.

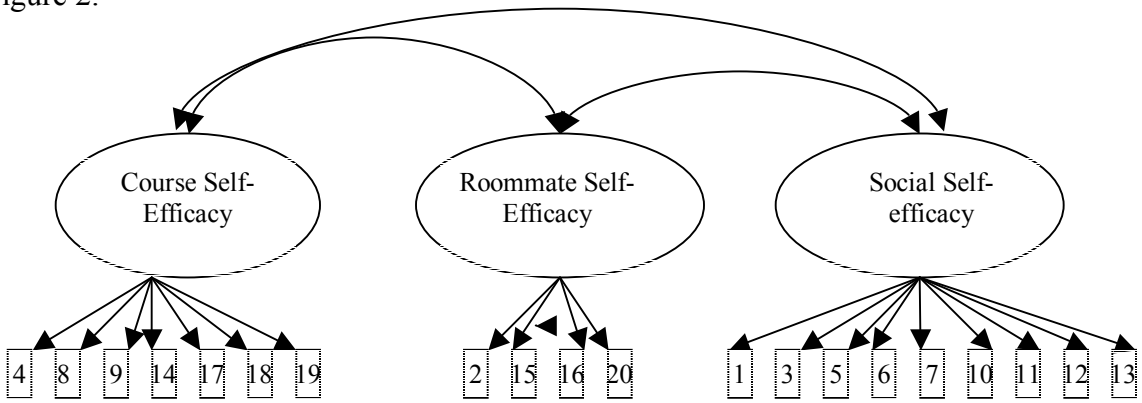


Figure 3.

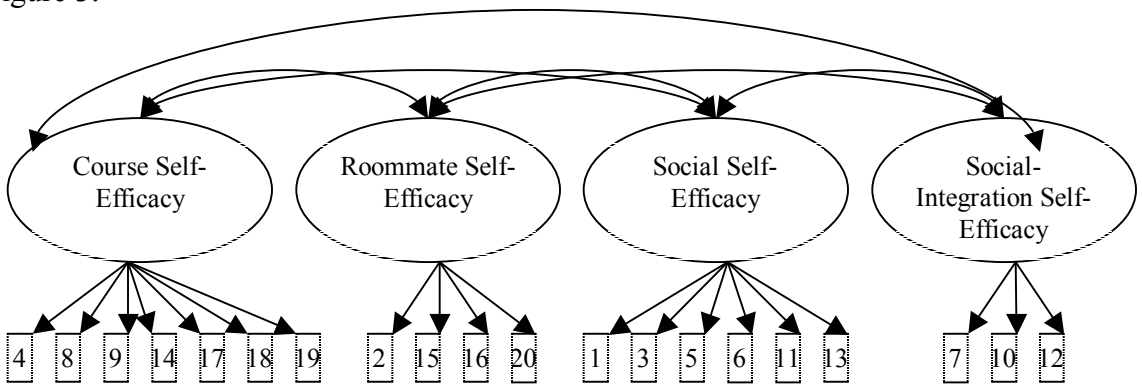
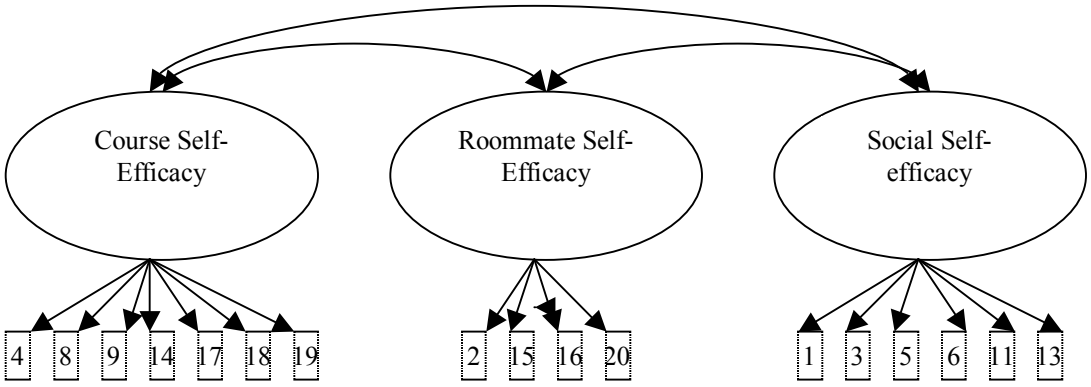


Figure 4.


Course Self-Efficacy
Roommate Self-Efficacy
Social Self-efficacy
4
8
9
14
17
18
19
2
15
16
20
1
3
5
6
11
13