# Developing an Instrument of Classroom Social Engagement

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**Developing an instrument of classroom social engagement: A work in progress.**


## Abstract

Student engagement plays a pivotal role in the formation of engineers because it is central to many significant predictors of the academic and career success of engineering students. Research has shown that the kind of social interactions that students maintain with peers and instructors within their academic community influence their connectedness and social capital. Students' social capital impacts their access to resources that are vital to academic success, and may eventually affect their sense of belonging, resilience and grit, and the need to put in the effort needed for academic career success. Besides the importance of social networks and capital to students' engagement and academic achievement, research on social engagement has received renewed interest lately due to advances in methodologies of social network analysis. These studies are enabled by measurement instruments that purport to assess indicators of social engagement in the classroom.

Although increased interest in social engagement is commendable, the data driving this research has been mostly reliant on analysis of the frequency of social interactions observed among students. While such analyses provide useful metrics for understanding social engagement, they are limited in helping researchers understand the underlying reasons for these engagement activities. To fill this gap, we are developing an instrument of social engagement that uses constructs of social capital, engagement and social networks to explicate the richer context of student social engagement as it relates to their interpersonal interactions with peers and faculty. In the current proposal, we present a psychometric study of a section of the instrument.

Five hundred and thirty-four participants completed a social network instrument that assessed their interaction with peers, graduate assistants, and instructors based on 11 items created to assess three constructs of social engagement: value, reciprocity and conduit of belonging. Exploratory and confirmatory factor analyses were conducted to examine the structural validity and reliability of the hypothesized construct.

An initial factor analysis showed that our data did not support the three factor-model we hypothesized (CFI = .841, RMSEA = .161). The final model indicates that the data from students' responses only supported a 2-factor model with 7 items (CFI = .986, RMSEA = .089). Internal reliability of the two scales were .94 and .89 Cronbach's alpha. The full paper will discuss scale revision.



Keywords: social engagement; social capital; social network; psychometric property;

## Introduction

Student engagement plays a pivotal role in the formation of engineers because it is central to many significant predictors of academic and career success (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006; Pascarella & Terenzini, 2005). For example, student engagement has been associated with persistence on learning tasks, academic achievement and a satisfying student experience (Flynn, 2014; Filak & Sheldon, 2008; Carini, Kuh, & Klein, 2006; Fredricks, Blumenfeld, & Paris, 2004). Although student engagement has positive impact on positive learning outcomes, the student's quest for achievement is often inspired by a need for feeling that one belongs within her academic or career community – an accomplishment of which is often measured by academic achievement. Hence the need for belonging propels adaptive behaviors such as cognitive and behavioral engagement in school, which precedes academic success (Voelkl, 2012). However, most forms of student engagements in school are predicated on their social interaction with peers and instructors – which indicates that social engagement is often precursory to other adaptive learning behaviors that predate academic achievements.

Research has shown that the kind of social interactions that students maintain with peers and instructors within their academic community influence their connectedness and social capital (Wellman & Frank, 2001). Students' social capital impacts their access to resources that facilitate academic success (Lin, 1999; Wellman & Frank, 2001). Failure to succeed in academics may eventually smother their sense of belonging, resilience and grit, and the need to put in effort towards achieving further successes in their academic career. As students engage with others in their social network, they expand their social capital, i.e. they are afforded increasing levels of access to resources that are crucial for success within their academic community. As a result, we may infer that social capital is a proxy for the degree of students' social engagement within their social network.

Students build social capital because of their engagement with members of their social network (Lin, 1999; Portes, 1998). Studies in social network research indicate that social capital is marked by two fundamental indicators: repository and trust (Torche & Valenzuela, 2011). Reciprocity refers to the act of returning a positive gesture with another positive gesture in fostering symbiotic relationships with others in the social network (Torche & Valenzuela, 2011; Wasko & Faraj, 2005). Taking the classroom as the social network for example, a student who extends a positive action to another student will expect a return in kind. When this expectation is met, fledging social interaction is strengthened. As such reciprocity is suggestive of mutual exchange and engagement within the social network.

Similarly, social capital is forged by the sense of mutual trust shared by players in the networks (Putnam, 2000). Like reciprocity, the likelihood of social interaction between players in the social network is associated with the sense of trust shared among members of the community. On the contrary however, a lack of mutual trust and emotional distance within the social network could indicate that a student is not productively engaged with other members of their academic community. In view of these foregoing, we argue that measures of social capital may be construed as indicators of social engagement within an academic community. We further

propose that the drive to build social capital with one's social network stems from the need to feeling belonging within that community. Hence, each player in the social network serve as a conduit of such belonging.

Researchers have developed instruments to measure different types of student engagement – emotional, cognitive and behavioral engagements etc. (Fredericks & McColskey, 2012). Although studying various forms of engagement are essential to understanding predictors of learning and academic achievement, we argue that other forms of engagement are well subsumed within student social interactions or engagements in with others in their academic community. Because there has been less focus on the construct of social engagement compared to other forms of engagement, there has been little concern for developing measures of social engagement using the framework of students' social network.

As part of a larger study investigating the relationship between students' social capital on learning and academic achievements, we developed an 11-item instrument intended to assess social engagement based on indicators social capital within a social network framework. In the current study, we report our initial efforts to evaluate the reliability and validity of the social engagement instrument we developed.

## Method

### *Development of the Social Engagement Instrument*

As indicated earlier, our motivation for developing the instrument was to capture students' social engagement as the function of their interaction with members of their social network. The instrument comprises three constructs associated with social capital in social networks: trust, reciprocity, and conduit of belonging. A panel of experts on social capital, faculty change, and adoption of teaching practices and psychometric analysis constructed eleven items to capture these constructs. Responses were based on a 5-point Likert-type scale ranging from 1 (being "strongly disagree") to 5 (being "strongly agree"). The 11 items are shown in Table1 below. Furthermore, we hypothesized that items on the survey will load unto factors as illustrated in Fig. 1 below:

*Table 1: Description of Survey Items*

| **Item #** | **Coding** | **Item Description** |
|---|---|---|
| | | *Trust(Value)* |
| Question 1 | VAL 1 | I receive the benefit I intended when I communicate with this classmate |
| Question 4 | VAL 2 | Interactions with this classmate are not productive/useful. **(Reversed)** |

| | | |
|---|---|---|
| Question 7 | VAL 3 | My interactions with this person are valuable/helpful. |
| Question 11 | VAL 4 | I achieve what I wanted faster than I would have alone. |

*Reciprocity*

| | | |
|---|---|---|
| Question 3 | RECI_1 | I only help this classmate, even though they don't help me. **(Reversed)** |
| Question 6 | REC_2 | When we help each other, we receive mutual benefit |
| Question 9 | REC_3 | I help this person because they help me. |
| Question 10 | REC_4 | We understand each other without effort. |

*Conduit of Belonging*

| | | |
|---|---|---|
| Question 2 | COND_1 | Communications with this classmate are pleasant. |
| Question 5 | COND_2 | I enjoy spending time with this classmate. |
| Question 8 | COND_3 | I find interactions with this classmate to be irritating **(Reversed)** |

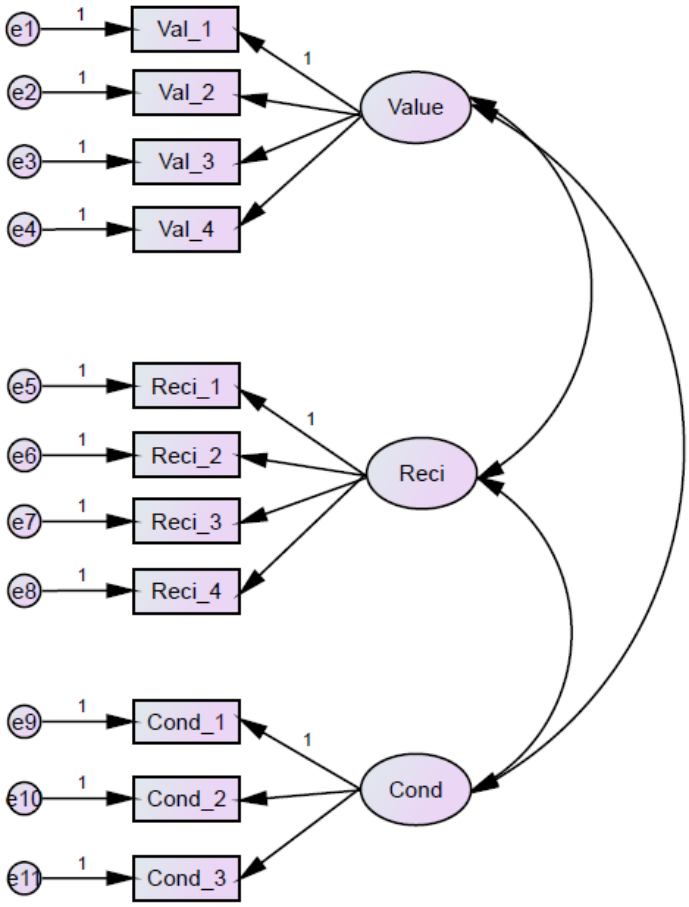


*Fig. 1: Hypothesized Factor Lading*

**Participants & Data Collection**

The survey was administered online via Qualtrics to 671 undergraduate engineering students across three institutions. Because the survey was administered in the context of studying students' social connected in their social network, we embedded a register of classmates into the survey using a name generator to enable students provide response to the survey for up to five classmates as members of their social network. Because students could identify up to five classmates in their network, some students had multiple responses to capture each of their friends. Of all invited to complete the survey, 534 students responded, yielding a 79.58% response rate. Males represented 58%, females 41% and other 1% of the study participants. Most of the study respondents self-identified as White (75%). The analysis was based on 534 unique responses per participants, and the total responses for all participants (1478 responses).

**Data Analysis & Result**

Participants' responses were analyzed in three phases: Using a subset of the data, we: (i.) conducted an initial confirmatory factor analysis (CFA) to examine the validity of our hypothesized model; (ii.) conducted an Exploratory Factor Analysis (EFA) to explore the structure and construct validity of the instrument. Both analyses were conducted using 534 unique responses per participant on the survey. Using the entire data set, we; (iii.) conducted CFA to examine the reexamine the outcome of the EFA analysis.

*Preliminary Analysis*

In other to test the validity of the proposed model using students' data we conducted a CFA analysis via structural equation modelling (SEM) modeling of the hypothesized model. The analysis was conducted on using SPSS AMOS® using the responses of 534 participants. The goodness-of-fit statistics of the three-factor model was less than ideal: the goodness-of-fit index (CFI) was .84 and the root-mean-square error of approximation (RMSEA) was .161. The results indicate participants' response patterns on the survey did not support the hypothesized model. Theorists recommend that good models should goodness-of-fit CFI statistics exceeding .95 and RMSEA less than .06 (Rigdon, 1996). Besides, the associated reliability coefficients were unacceptable (in Table 2 below).

*Table 2: Reliability of Indices*

| | Cronbach's Alpha | N of Items |
|---|---|---|
| Trust | 0.456 | 4 |
| Reciprocity | 0.668 | 4 |
| Belonging | -0.499 | 3 |

### *Exploratory Factor Analysis*

Considering the result of the initial CFA analysis, we conducted an EFA ($n$ = 534) to examine the structural validity of the instrument. We extracted factors from the dataset using Principal Axis Factoring and rotated extracted factors using Oblimin rotation in SPSS®. Kaiser-Meyer-Olkin measure (KMO) was .91 suggesting the data was sufficient for EFA. The Bartlett's test of sphericity $\chi 2$ (55) = 3590.56, $p < 0.001$ indicated that patterned relationships existed between items. A two-factor model that explains 79% of the cumulative variance in participants' response was obtained based on an eigenvalue cut-off of 1.0. Factor loading is shown in Table 3 below. The correlation metrics from the EFA indicated that two items (RECI_1 and VAL_2) were poorly correlated with most of the other variables. Removing items that are poorly correlated with most other items ($r$ < +/- .30) is recommended in improving scale (Yong & Pearce, 2013).

*Table 3: Factor loading derived from EFA analysis*

| | Factor 1 | Factor 2 |
|---|---|---|
| Cond_2 | 0.835 | |
| Val_3 | 0.776 | |
| Reci_4 | 0.772 | |
| Reci_3 | 0.761 | |
| Cond_1 | 0.752 | |
| Val_1 | 0.751 | |
| Reci_2 | 0.728 | |
| Val_4 | 0.703 | |
| Reci_1 | | 0.705 |
| Cond_3 | | 0.687 |
| Val_2 | | 0.607 |

### *Confirmatory Factor Analysis*

Finally, we conducted a CFA using the entire data of participants' responses ($n$ = 1478) to validate the EFA results on the AMOS SPSS®. Confirmatory factor analysis is conducted to examine the structure of the latent factors underlining items on a scale when examining construct validity of an instrument (Harrington, 2009). Initial CFA indicated the model based on the factor structure derived from EFA was not ideal, CFI = .87; RMSEA = .14. We conducted the CFA

based on the model derived from the EFA (see Fig. 2 below). Using modification indices suggested in the AMOS outputs, we deleted items to improve the factor structure of the instrument. The final model yielded an acceptable fit statistic, CFI = 0.978; RMSEA = .08. The resulting final model is shown in Fig. 3 below. Items on the remaining factors are described in Table 4 below.

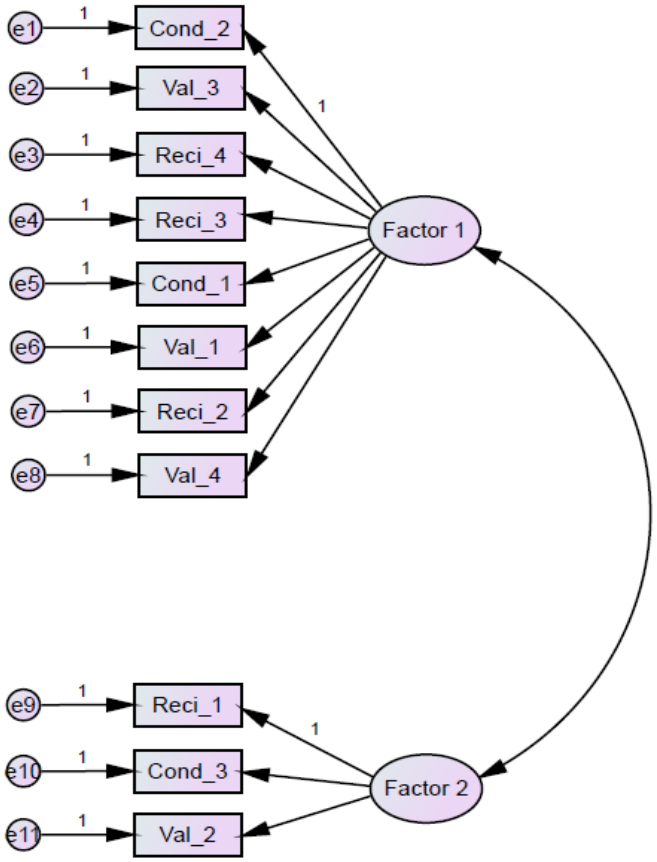


*Fig. 2: Two-factor model resulting from EFA analysis*

*Table 4: Final item loading*

| **Item #** | **Coding** | **Item Description** |
|---|---|---|
| | *Factor 1* | |
| Question 1 | VAL 1 | I receive the benefit I intended when I communicate with this classmate |
| Question 7 | VAL 3 | My interactions with this person are valuable/helpful. |
| Question 11 | VAL 4 | I achieve what I wanted faster than I would have alone. |

| | | |
|---|---|---|
| | *Factor 2* | |
| Question 6 | REC_2 | When we help each other, we receive mutual benefit |
| Question 9 | REC_3 | I help this person because they help me. |
| Question 10 | REC_4 | We understand each other without effort. |
| Question 5 | COND_2 | I enjoy spending time with this classmate. |

***Reliability Analysis***

Finally, we conducted reliability analysis to determine the internal reliability coefficient of items that loaded on two-factor model derived from the final factor analysis. Scales are considered reliable when Cronbach's α of internal reliability of the scale reaches .70 (Tavakol & Dennick, 2011). Both factors exceed the threshold, Cronbach's α was .88 and .85 for Factor 1 and Factor, respectively.

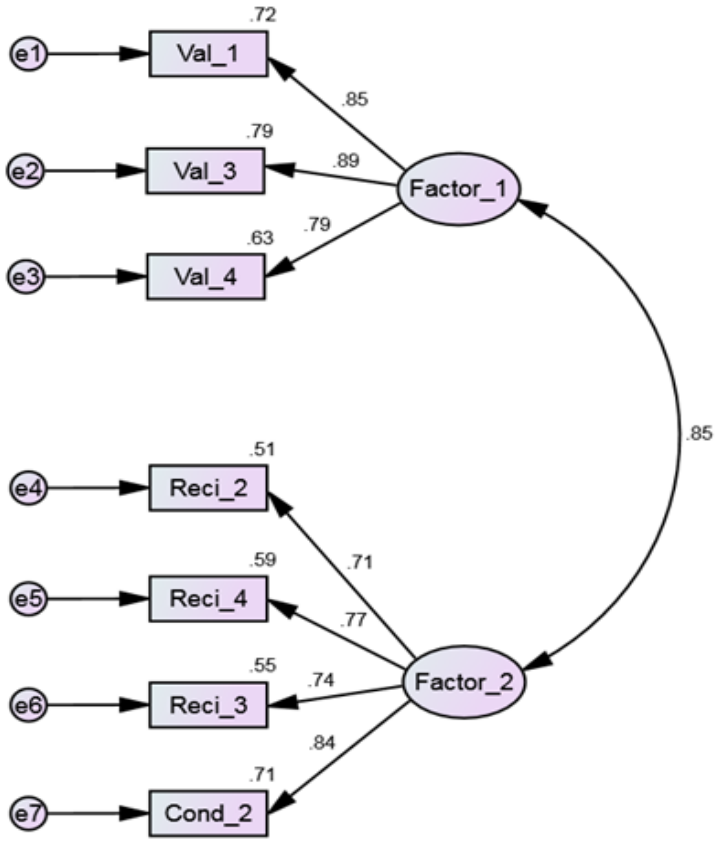


*Fig. 3: Final model based on recommended modifications*

**Discussion and Conclusion**

In the current study, we examined the psychometric properties of an 11-item instrument intended to assess social engagement based on social networks framework. We hypothesized that the 11

items we developed should load unto three factors indicative of social capital as illustrated in Fig. 1. We conducted three stages of modelling analyses to test the viability of our hypothesis using students' response to the survey. In this section, we discuss our findings and plans to improve items on the instrument going forward.

In the first stage our analysis, we conducted a CFA to test our hypothesized factor loading. Students' responses to items on the survey did not seem to support the model however. Hence, we resorted to conducting an EFA to determine how many latent factors explains participants' responses to items on the survey in the second stage of our analysis. The correlation matrix from our EFA analysis showed that a variable each designed to assess Repository and Value (Trust) sub-scales were correlating poorly with other items on the survey. Theorists recommend deleting items that are poorly correlated in with most other items (Yong & Pearce, 2013).

In the third stage our analysis, we used the model derived from the exploratory analysis (Fig. 2) to determine whether the same factor pattern could be established with a larger pool of students' response (n = 1478). The fit statistics derived from the model was unsatisfactory. Hence, we revised the model by using modification indices suggested in the summary output of both factor analyses. Based on recommendation from the correlation matrix from the initial EFA, we deleted 2 items (Reci_1 and Valu_2) because they have low correlation (< +/– 0.3) with most of the other variables on the instrument. A repeated CFA without those items also indicated that Cond_1 and Val_4 are redundant. Deleting the item Cond_1 improved the reliability of Factor 1. Furthermore, the item Cond_3 was deleted to attain an acceptable scale reliability.

Although we had proposed a 3-factor model of social engagement using social networks framework, the factor structure from participants responses to the survey seem only to have supported a two-factor model that retains most of the reciprocity and trust (value) items. Items on these two factors were developed based on the literature. Because we were unable to find empirical support for a 3-factor model, we do not consider the instrument ready for use as intended at this iteration of its development. Rather, we look to revamp the instrument by modifying the items that performed poorly on the survey. In this effort, we intend to reevaluate the way we operationalized the construct of belonging by conducting extensive review the construct within the social network framework. In a follow-up study, we intend to re-administer the instrument and reevaluate the psychometric properties of the instrument. In future iteration of this instrument development, we envisage that some items might cross-load just as Cond_2 cross loaded with RECI items on Factor 2 in Fig. 3. As such, considerations about factor labels will be made after subsequent factoring of the instrument. Our overall research goal is to have an instrument that can assess student social engagement as they develop social capital within their social network.

*Limitations*

There are two notable limitation to the analysis we have reported in this study: (1) the EFA was based on the randomly selected unique responses of participants. Some students had responded for each of the classmates they identified as belonging in their social network. However, only

one response was chosen per respondent. Despite the fact we randomly selected one unique response per participants, we are not sure how differences in how students responded about other players in their network could impact the factor structure derived from our analysis, given that we cannot assure that the random choices for each students are consistent with how they responded about other members of their social network; (2) similarly, we had used the entire responses in our CFA analysis – meaning that some of the responses had multiple respondents. We are also unsure of the statistical implication of such redundancy on the pattern structure observed in our analysis. We will examine the implication of the methodological choices we made in this study could impact the perceived psychometric property of an instrument using statistical simulation in the future. We anticipate this could make a notable contribution to field of measurement in engineering education, and as well inform the social network research community.

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