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Factorial Validity and Reliability of the Sense of Community in Online Courses Scale

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Abstract

The alarmingly high rate of attrition in online courses results in many negative consequences for students, faculty, online institutions, and for society as a whole. One reason theorized for this attrition is a lack of a sense of community in online courses; however, there is much theoretical and empirical debate on what factors contribute to that sense of community. Therefore, in this article, we present a revised version of the Sense of Community in Online Courses Scale, which has 4 components and 16 items, and we provide evidence that the scale is reliable and has factorial validity. We also use structural equation modeling to examine the relationships among the components. It is our hope that this scale will be beneficial to researchers of online learning and to instructors of online courses interested in improving the sense of community, and reducing attrition, in their courses.

Over a decade ago, Lovitts' (2001) seminal work on the causes and consequences of attrition alerted the higher education community to a silent epidemic—about 50% of students who begin doctoral programs do not finish them and most leave in the first year. This proportion has remained stable since the 1960s and shows no signs of abating (Gardener, 2009; Jairam & Kahl, 2012; Lovitts, 2001; National Research Council, 1996).

Nowhere is the problem so onerous as in institutions of online learning (Carr, 2000; Flood, 2002; Patterson & McFadden, 2009; Xu & Jaggars, 2011). Flood (2002) estimated that the attrition rate in some online institutions is as high as 70% to 80%. This is congruent with Carr's (2000) finding that the attrition rate is 10% to 20% higher in online courses than in their face-to-face counterparts. The comparatively higher rate of attrition is especially burdensome for institutions of online learning because it creates uncertainty about the economic value of online education and fosters doubt about the practice of online education itself (Howell, Williams, & Lindsay, 2003).

Not only is attrition a serious concern for institutions, it is known to have devastating economic and psychological effects on students who do not complete their programs. Lovitts (2001) found that

> most graduate students who leave without the Ph.D. have to reconstruct their lives. They have to give up an often deeply held image of themselves as a person with a Ph.D., although some never do. They have to construct a new professional self-image and pursue a career and lifestyle that is often far different from the one they had been envisioning. And they have to do this at a time when they are demoralized, broke and often deeply in debt. (p. 7)

Fortunately, there is a growing body of research on the strategies that faculty and administrators can use to minimize attrition in online courses (Berge & Huang, 2004; Boyles, 2000; Frankola, 2001; Kember, 1989; Muilenberg & Berge, 2005; Tyler-Smith, 2006; Young & Bruce, 2011). Of those strategies, fostering sense of community in online courses emerges as being particularly important. However, there is still much debate about how best to measure sense of community and what factors it comprises (Bolliger & Inan, 2012; Lin, 2004; Randolph & Kangas, 2008; Rovai, 2002a, 2002b; Tu, 2002; Young & Bruce, 2011). Therefore, in this article we present research that we hope will further inform that debate and, in turn, help reduce what Lovitts (2001) calls the *silent epidemic* of attrition. Specifically, the purposes of this study are to (a) refine Randolph and Kangas's (2008) measure of sense of community in online courses, (b) investigate the factorial reliability and validity of that instrument, and (c) use those results to further the theoretical and empirical understanding of sense of community in online courses.

Theoretical Framework

In a review of the theoretical and empirical research on attrition in online courses, Tyler-Smith (2006) attributed the first theory of attrition in online courses to Kember (1989), which itself was based in Tinto's (1975) theory of dropout in higher education. Kember posited that family circumstances, geographic distance from the institution, levels of income, and gender are attrition factors that are especially influential for online students. Boyles (2000) expanded on Kember's theory and created a tripartite model of online attrition that consists of academic variables, environmental variables, and variables related to a learner's background. In turn, Boyles' theory of attrition was refined by Berge and Huang (2004). Berge and Huang divided the variables influencing online learning into three groups, as Tyler-Smith (2006) explained below:

> (1) Personal Variables such as age, ethnicity, gender, income, previous academic experience and personal attributes like self-efficacy for learning, personal organisation and motivation; (2) Institutional Variables such as institutional attitude, values and beliefs, academic characteristics like structural systems and processes, learner support and degree of congruence between the needs of individual students and the philosophical stance of the institution; (3) Circumstantial Variables which include the nature and quality of the institution's interaction with the student; academic interactions, course design and facilitation, as well as the interactions that are specific to the learner's life, work, family, responsibility and satisfaction. (p. 75)

Studies such as Frankola (2001), Muilenberg and Berge (2005), and Young and Bruce (2011) have helped validate Berge and Huang's (2004) three-part theory.

Another theorist, Rovai, independently came to the conclusion that circumstantial variables, such as academic interactions, quality of the institution's interaction with the students, course design and facilitation, as well as other factors, also play a significant role in online

students' course satisfaction and decision to withdraw. Rovai (2002a) argued that sense of community in online courses was an important factor in attrition and claimed that sense of community comprises the seven factors listed below:

- Transactional distance.
- Social presence.
- Social equality.
- Small group activities.
- Group facilitation.
- Teaching styles and learner stage.
- Community size.

For the sake of brevity, we do not go into a description of those factors here; however, they are explained in detail in Rovai (2002a).

Building on Rovai's (2002a) work, Randolph and Kangas (2008) created a pilot Sense of Community Scale based on his seven factors listed above. Analysis of that scale supported only four of Rovai's seven components. Randolph and Kangas (2008) named those four components Instructor Interactivity, Pleasantness and Fairness, Small Group Activities, and Teaching Style and Learner Stage. We based the revised Sense of Community Scale presented in this article on those four components.

Existing Scales

Probably the most frequently used scale for measuring sense of community in online courses is Rovai's (2002b) Classroom Community Scale. Contrary to the seven-factor theory mentioned in Rovai (2002a), a subsequent factor analysis in Rovai (2002b) only showed evidence for two factors—Connectedness and Learning. Rovai's (2002b) descriptions of those factors are explained below:

> Connectedness represents the feelings of the community of students regarding their connectedness, cohesion, spirit, trust, and interdependence. Learning represents the feelings of community members regarding interaction with each other as they pursue the construction of understanding and the degree to which members share values and beliefs concerning the extent to which their educational goals and expectations are being satisfied. (pp. 206-207)

Despite its popularity, the validity of this scale has been brought into question by Barnard-Brak and Shiu (2010).

After Rovai's (2002b) Classroom Community Scale, several follow-up scales have been published that measure combinations of the factors mentioned in Rovai (2002a) (see Bolliger & Inan, 2012; Lin, 2004; Randolph & Kangas, 2008; Tu, 2002; Young & Bruce, 2011). Table 1 summarizes the existing instruments we found for measuring sense of community (or a related construct) in online courses and their factors.

Table 1

Summary of Existing Online Community Scales

Author(s)	Scale Name	Factors/Components	Notes
Rovai (2002a)	Classroom Community Scale	Connectedness, Learning	Validity called into question by Barnard-Brak and Shiu (2010).
Tu (2002)	Social Presence and Privacy Questionnaire	Social Context, Online Communication and Interactivity, and Online Privacy	
Lin (2004)	Social Presence Questionnaire of Online Collaborative Learning	Perception of the Assistance of Group Activity to Learning, Social Comfort of Expressing and Sensing Affect, Social Navigation	The sample size for the factor analysis was only 15. Factor loadings not displayed for other factors.
Randolph & Kangas (2008)	Sense of Community Survey: Version 1	Instructor Interactivity, Pleasantness and Fairness, Teacher Stage and Learner Style, Small Group Activities	Factor analysis only conducted on 33 cases.
Bolliger & Inan (2012)	Online Student Connectedness Survey	Comfort, Community, Facilitation, Interaction and Collaboration	
Young & Bruce (2011)	Online Community and Engagement Scale	Community Building with Instructor, Community Building with Classmates, Engagement with Learning	

Clearly, there is much debate about what are the most important constructs in measuring sense of community. The theory of sense of community in online courses has between two to seven factors depending on what research is read. While there are many similarities between scales and theories, there are also many differences. Therefore, the purpose of this study is to help clarify the debate on just how best to measure sense of community in online courses by further developing and examining the reliability and factorial validity of a four-component scale, which was originally based on Rovai's (2002b) seven-factor theory, piloted in Randolph and Kangas (2008), and subsequently revised based on that pilot. In addition, we use structural equation modeling to test a hypothesis that our four-component theory may be a more granular way of measuring the constructs that Rovai (2002b) calls *connectedness* and *learning*.

Methods

Method of Scale Construction

Eleven items that composed the four components of the previous version of the scale (see Randolph & Kangas, 2008) were retained in the revised version of the scale. To those 11 items, 9 more items were added so that each component of the revised scale would have five items. Those 20 items can be found in the Data Sources section of this manuscript.

Data Sources

The participants in this study were students enrolled in a major online university. This group of students agreed to be actively recruited for faculty and student research at that university. The type of degree programs that the participants may have been enrolled in varied greatly, from doctoral programs to nondegree programs. The academic subjects offered at that university included education and leadership, management and technology, health sciences, and social and behavioral sciences. To protect the anonymity of participants, no identifying data were collected.

The participants were asked to take an online survey comprised of the 20 items below. There were six possible responses for each item: *Strongly disagree, Disagree, Somewhat disagree, Somewhat agree, Agree, Strongly agree*. An item followed by a superscript *a* indicates that the item is meant to be reversed. Items followed by a superscript *b* indicate that the item was retained from the previous (Randolph & Kangas, 2008) version of the scale.

Instructor Interactivity

1. The instructor responded to me promptly.
2. The instructor participated minimally in this course.[ab]
3. I got the impression the instructor was unavailable for communication. [ab]
4. When the instructor responded to me, the answers seemed to be hurried and short.[ab]
5. The instructor was an active user of the course's communication systems. [b]

Civility and Respect

6. The instructor was pleasant to interact with.[b]
7. The instructor treated me fairly.[b]
8. The instructor was respectful to me.
9. The instructor was rude to me.[a]
10. The instructor was difficult to work with.[a]

Congruence of Teaching and Learning Styles

11. The course was taught in a way that was compatible with my learning style.[b]
12. The learning activities were appropriate for how I like to learn.[b]
13. The learning activities motivated me in this course.
14. The instructor taught in a way that I prefer to learn.
15. The learning activities were not relevant to me.[a]

Student Collaboration

16. The instructor encouraged students to work in small groups when possible.[b]
17. Small group activities were an important part of this course. [b]
18. I felt isolated as a learner in this course. [a]
19. I built relationships with other students in this course.
20. It was not necessary to collaborate with others in this course. [a]

Method of Data Analysis

The data were subjected to principal components analysis using the method described in Norušis (2006) and Field (2009) using SPSS 20.0 software. To decide on the number of factors to retain, Kaiser's criterion of accepting components with eigenvalues greater than 1.00 and a visual analysis of a scree plot were used. Cronbach's α was computed for the set of items within each component that were ultimately retained.

To check the assumptions for principal components analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was examined for the data set as a whole and each item. Bartlett's test of sphericity was also examined.

In terms of Rasch analysis, we examined the mean square infit, mean square outfit, their standard deviations, a variable map, and the separation index for each component. We used the methods described in Bond and Fox (2010) and Winsteps 3.73 software.

To choose the items that would be included in the final version of the scale, we used the following criteria:

- Items with strong loadings on the component it was intended to load on and weak loadings on other components were given priority. Our loading threshold was .40.
- Items with the highest corrected-item total reliabilities were given priority for inclusion.
- Items with the greatest degree of separation on a Rasch variable map were given priority for inclusion.
- Items with the least Rasch misfit were given priority for inclusion.
- All other things being equal, items that helped retain a theoretically sound and interpretable component were given priority for inclusion.

To examine the relationships between the components, we tested a measurement model using LISREL 8.80 and followed the guidelines in Schumacker and Lomax (2010). We tested a model in which the four components in our scale are observed variables for two latent variables that we believe correspond with Rovai's (2002a) Connectedness and Learning. Due to the nonnormality of some of the components, we trimmed 5% of the highest and lowest cases as suggested in Howell (2010). The model fit indices included weighted least squares χ^2, the root-mean-square error (RMSEA), the goodness-of-fit index (GFI), normed fit index (NFI), the standardized root-mean square residual (standardized RMR), and the noncentrality parameter (NCP). Additionally, we examined each parameter estimate to see whether the magnitude and direction was as we predicted and whether each was statistically significant.

In terms of the *N* sizes for the analyses in this study, a total of 337 participants completed the survey. Of those, 309 had complete data for all 20 items and 315 had complete data for the 16 items retained. After taking the mean for each item, there were 293 cases after 5% trimming. Of those 293 cases, 278 cases had complete data for the final set of 16 items.

Results

Component Selection

When including the initial set of all 20 potential items in the analysis, we decided to retain four components for several reasons. First, as the scree plot in Figure 1 shows, the point of inflexion occurred at the fifth component, indicating that we should retain the four components before it. Second, only the first four components had eigenvalues greater than 1.00. The first four components accounted for 67.46% of the total variance in the model. Third, the four-component solution was most congruent with theory.

We named these components Civility and Respect, Congruence of Teaching and Learning Styles, Student Collaboration, and Instructor Interactivity. The construct underlying Civility and Respect is the degree to which an instructor is pleasant, fair, respectful, and not rude to students. The construct underlying Congruence of Teaching and Learning Styles is the degree to which the teaching styles and learning activities match the learning style of the student. The construct underlying Student Collaboration is the degree to which students are encouraged to collaborate with other one another. Finally, the construct underlying Instructor Interactivity is the degree to which the instructor is perceived to be interactive and involved with students in the online environment.

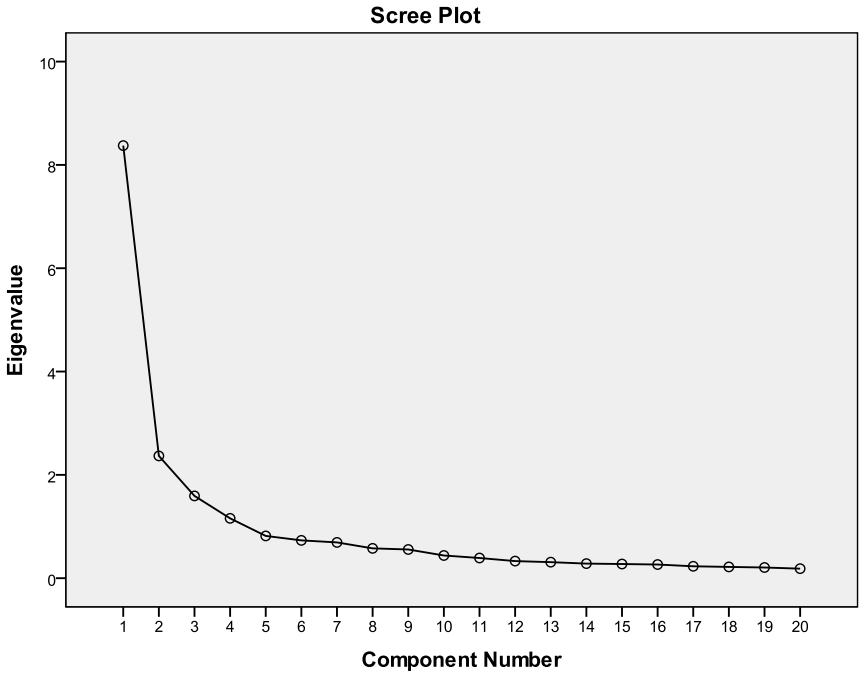

Figure 1. Scree plot of sense of community components.

Rationale for Item Selection

Table 2 shows the component loadings for all 20 items. After analyzing all items, we decided to exclude one item from each component, leaving us with a 4-component, 16-item scale

with four items in each component. The rationale for choosing which item to exclude follows the table.

Table 2

Pattern Matrix of Component Loadings with Direct Oblimin Rotation for All Items

Item	Instructor Interactivity	Student Collaboration	Congruence of Teaching and Learning Styles	Civility and Respect
1	**.70**	.02	.09	.06
2	**.83**	-.01	-.03	.04
3	**.77**	-.04	-.03	.17
4	**.55**	.00	-.10	.35
5	**.84**	.00	-.05	-.05
6	.24	.00	-.10	**.66**
7	.16	-.02	-.13	**.75**
8	-.02	.08	-.04	**.87**
9	-.02	.03	.00	**.86**
10	.24	.02	-.10	**.69**
11	-.10	-.04	**-.85**	.06
12	-.13	-.06	**-.75**	.05
13	.09	.04	**-.74**	.07
14	.13	.08	**-.56**	.31
15	.17	-.07	**-.64**	-.03
16	-.07	**.85**	-.01	.24
17	-.06	**.94**	.11	.05
18	.14	.17	**-.58**	.05
19	.05	**.43**	**-.51**	-.19
20	.28	**.59**	-.13	-.26

Note. Valid $N = 309$. Component loadings > .40 in absolute value are in boldface.

For the Instructor Interactivity component, all items loaded as we had expected them to load. Ultimately, we decided to exclude Item 1 from the final scale because (a) it had a significantly lower corrected item-total correlation than the other items, (b) it had the largest degree of Rasch misfit and, (c) had identical item difficulty to Item 5.

For the Student Collaboration component, it was clear that Item 18 should be excluded. It loaded most strongly on Congruence of Teaching and Learning Styles, rather than on the Student Collaboration component as we had intended. Also, it had the lowest corrected item-total correlation and the greatest degree of Rasch misfit. Item 19 had a negative factor loading of -.51 on the Congruence of Teaching and Learning styles variable, but had a positive factor loading of .43 on the component we had intended it to load on; therefore, we included it in the revised version.

All items loaded as we expected them to on the Congruence of Teaching and Learning Styles component. Of the two items that had the least desirable properties (Item 12 and Item 15), it was difficult to decide which one to exclude because they both had about equal Rasch misfit and corrected item-total correlations. However, excluding Item 15 led to a component structure that was more easily interpretable than the component structure when excluding Item 12. When

excluding Item 15, Item 19 loaded on two components. When excluding Item 12, Item 19 loaded only on the item on which we intended it to load.

Finally, in terms of the Civility and Respect component, when examining a variable map, Item 10 and Item 7 had almost exactly the same item difficulty. Therefore, we excluded Item 10 to increase the separation of items.

Factorial Structure and Statistical Assumptions for Final Version of Scale

Table 3 shows the factorial structure after direct oblimin rotation for the 16 items that were retained. In this model, the four components accounted for 71.43% of the cumulative variance in the model. As predicted, all the other items loaded highly on the components they were intended to load on and did not load highly on the other components; this provided evidence of the factorial validity of the scale.

Table 3

Pattern Matrix of Component Loadings with Direct Oblimin Rotation for the 16 Items Retained

Item	Instructor Interactivity	Student Collaboration	Congruence of Teaching and Learning Styles	Civility and Respect
5	**.88**	-.01	.01	-.05
2	**.87**	-.02	-.02	.04
3	**.79**	-.04	-.01	.17
4	**.62**	.08	.05	.33
17	-.09	**.95**	-.10	.06
16	-.08	**.84**	.01	.27
20	.28	**.62**	.07	-.27
19	.12	**.45**	.40	-.21
11	-.05	-.06	**.90**	.02
12	-.10	-.06	**.79**	.02
13	.15	.07	**.69**	.05
14	.19	.07	**.61**	.26
8	.01	.07	.08	**.86**
9	.04	.04	.01	**.80**
7	.18	-.01	.15	**.74**
6	.29	.00	.09	**.65**

Note. Valid $N = 315$. Component loadings > .40 in absolute value are in boldface.

All of the statistical assumptions for principal components analysis mentioned in Norušis (2006) and Field (2009) had been met. The KMO for the model, .90, was in the range that Kaiser (1979) considered "meritorious." In terms of the KMOs for individual items, 14 of the 16 items were greater than .80. Of those 14 items, 10 had KMOs greater than .90. Item 17 had a KMO of

.68 and Item 17 had a KMO of .69. Bartlett's test of sphericity was statistically significant, $\chi^2(120) = 2924.16$, $p < .000$.

Items in the Final Version of the Scale, Reliability, and Descriptive Statistics

Table 4 shows the items that compose the final version of the Sense of Community in Online Courses Scale. The correlation matrix of items can be found in the Appendix. Table 5 shows the descriptive statistics for each component. The first column of Table 5 shows the reliabilities (Cronbach's α) for each component of the scale, which were in the range acceptable for psychometric scales (Field, 2009). In addition, the scale demonstrated desirable Rasch characteristics; the mean square infit and outfit for items were all around the optimal value of 1.00 and there was a high degree of separation (Bond & Fox, 2010).

Table 4

Items in the Revised Version of the Sense of Community in Online Courses Scale

Item #	Stem
	Instructor Interactivity
2	The instructor participated minimally in this course.*
3	I got the impression the instructor was unavailable for communication.*
4	When the instructor responded to me, the answers seemed to be hurried and short.*
5	The instructor was an active user of the course's communication systems.
	Instructor Civility and Respect
6	The instructor was pleasant to interact with.
7	The instructor treated me fairly.
8	The instructor was respectful to me.
9	The instructor was rude to me.*
	Congruence of Teaching and Learning Styles
11	The course was taught in a way that was compatible with my learning style.
12	The learning activities were appropriate for how I like to learn.
13	The learning activities motivated me in this course.
14	The instructor taught in a way that I prefer to learn.
	Student Collaboration
16	The instructor encouraged students to work in small groups when possible.
17	Small group activities were an important part of this course.
19	I built relationships with other students in this course.
20	It was not necessary to collaborate with others in this course.*

Note. Possible responses to each item are *Strongly disagree, Disagree, Somewhat disagree, Somewhat agree, Agree,* and *Strongly agree*.
*This item is meant to be reversed.

Table 5

Reliability, Rasch, and Descriptive Statistics in the Revised Version of the Sense of Community in Online Courses Scale

Component	α	*M*[a]	*SD*	*SE*	*SEM*	Skew	Infit[b]	Outfit[c]	Sep.[d]
Instructor Interactivity	.89	4.40	1.33	0.07	0.44	-0.81	1.00	0.97	3.43
Student Collaboration	.77	3.13	0.95	0.07	0.46	0.24	0.99	0.98	7.07
Congruence of Styles	.82	4.27	1.07	0.06	0.45	-0.61	1.01	0.91	3.14
Civility and Respect	.90	5.03	0.95	0.05	0.30	-1.35	1.12	1.03	6.03

[a]On a 1-6 scale where 1 = *Strongly disagree* and 6 = *Strongly agree*. [b]Mean infit for items. [c]Mean outfit for items. [d]Separation for items.

As shown in Table 5, one undesirable feature of the scale was that the Instructor Civility and Respect is strongly negatively skewed and some other components are moderately skewed. However, we found that using 5% trimming of the data set (see Howell, 2010) reduces the skew of Instructor Civility and Respect skew to -0.75. Using 5% trimming, a cubic transformation of Instructor Civility and Respect and Instructor Interactivity, a square transformation of Teaching Style and Learning Stage, and no transformation of Student Collaboration brought the skew to -0.17, 0.13, -0.07, and 0.27, respectively. This amount of skew is generally considered to be acceptable for a study of this size (Bulmer, 1979; Doane & Seward, 2011).

Structural Equation Modeling Results

Based on our interpretation of Rovai's (2002a) constructs of Connectedness and Learning, we believed that Instructor Interactivity and Civility and Respect would correspond with what Rovai called Connectedness, which he defined as "connectedness, cohesion, spirit, trust, and interdependence" (2002a, pp. 206-207). Similarly, we believed that Student Collaboration and Congruence of Teaching and Learning Styles would correspond with what Rovai called Learning, defined as

> the feelings of community members regarding interaction with each other as they pursue the construction of understanding and the degree to which members share values and beliefs concerning the extent to which their educational goals and expectations are being satisfied. (pp. 206-207)

To test this hypothesis we used structural equation modeling. The resulting path diagram, with standardized factor loadings, is shown in Figure 2 below. The correlation matrix of components is shown in Table 6.

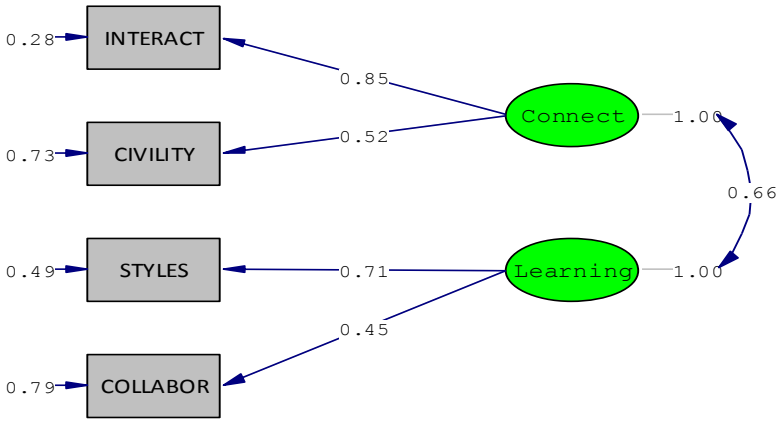

Figure 2. Path diagram of measurement model linking four components to two latent variables. INTERACT = Instructor Interactivity, CIVILITY = Civility and Respect, STYLES = Congruence of Teaching and Learning Styles, COLLABOR = Collaboration, Connect = Connectedness. Standardized factor loadings are shown.

Table 6

Pearson Correlation Matrix between Components, Means, and Standard Deviations for the Revised Scale (5% trimmed)

Component	Interactivity	Civility	Styles	Collaboration
Interactivity	1.00	.68	.39	.27
Civility		1.00	.37	.09
Styles			1.00	.32
Collaboration				1.00
M	4.38	5.10	4.23	3.08
SD	1.22	0.73	0.96	1.20

Note. Listwise *N* with trimmed means = 293. Interactivity = Instructor Interactivity, Civility = Civility and Respect, Styles = Congruence of Teaching and Learning Styles, Collaboration = Student Collaboration.

There were mixed results for the fit of the model. According to Schumacker and Lomax (2010), χ^2 for the model should be not statistically significant and the root-mean-square error (RMSEA) should be between .05 and .08. Our χ^2 results were statistically significant at .05 α level, $\chi^2(1) = 5.51$, $p = 0.019$, and the value of RMSEA was 0.12, which is slightly above the .08 mark indicating a slight lack of model fit. Other fit indices indicated a good model fit however. Schumacker and Lomax wrote that goodness-of-fit index (GFI) and normed fit index (NFI)

values near 1.0 indicate a perfect fit, a standardized root-mean square residual (standardized RMR) less than .05 indicates good fit, and that a noncentrality parameter (NCP) close to zero indicates good fit. Our values for the GFI, NFI, standardized RMR, and the NCP were .99, .97, .03, and 4.51, indicating good model fit. Additionally, the parameter estimates were all of the magnitude and direction we expected (i.e., they were all moderately, positively correlated with Connectedness and Learning) and all were statistically significant at the .05 α level.

Discussion

In this study, we revised the items in the Randolph and Kangas (2008) version of the Sense of Community in Online Courses Scale. The revised version has four components, each of which has four items. The four components are (a) Civility and Respect—the degree to which an instructor is pleasant, fair, respectful, and not rude to students; (b) Congruence of Teaching and Learning Styles—the degree to which the teaching styles and learning activities match the learning style of the student; (c) Student Collaboration—the degree to which students collaborate with one another; and (d) Instructor Interactivity—the degree to which the instructor interacts with the learning community. We demonstrated that each of these components has acceptable internal consistency reliability, has good factorial validity, and has good Rasch characteristics. One downside of the scale is that several of the components are negatively skewed.

Relating these factors back to the first and most frequently used scale to measure sense of community (Rovai, 2002b), we showed that the Instructor Interactivity and Civility and Respect are related to a latent variable we believe corresponds with Rovai's (2002b) definition of Connectedness and that Congruence of Teaching and Learning Styles and Student Collaboration are related to a latent variable we believe corresponds with Rovai's definition of Learning. Relating our components to the most recent scale (Bolliger & Inan, 2012), we hypothesize that our components Student Collaboration and Instructor Interactivity correspond with their component Facilitation. We also hypothesize that our component called Student Collaboration corresponds with Bolliger and Inan's component called Interaction and Collaboration.

Uses of the Scale and Suggestions for Further Research

This scale can be useful to researchers of online learning. For example, they could use the scale to further refine the theory of online attrition or measure the effectiveness of interventions designed to increase student satisfaction and learning in online courses. This scale can also be useful to online instructors. For example, they could use the scale to measure the degree to which students have a sense of community in their courses and adjust their instruction accordingly. We cannot condone the use of this scale for populations besides students in online courses or for other uses, such as summative instructor evaluation.

In terms of further research, we provided evidence for the factorial validity (i.e., evidence on the internal structure of this scale); however, factorial validity is just one of many types of validity that can provide evidence for a given use of a scale (American Education Research Association, 1999). Therefore, more research needs to be done to assess other types of validity evidence for this scale. Also, because of restrictions in data collection, we were not able to gather participant demographic information allowing for differential item analysis.

In summary, as shown in Table 1, the research on what constitutes sense of community and how best to measure it is fragmented, at best. For example, there are many scales in which

components overlap but one scale creator might call the construct Facilitation where another one calls it Learning and another calls it Interaction. We believe that to clarify this line of research, a study that examines the structural relationships between the components in the various scales would do much to help arrive at a productive theory of sense of community in online learning, codify the language involved in the constructs being measured, and perhaps lead to information to develop a comprehensive scale that measures all of the known constructs that are important to building sense of community in online courses.

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Appendix

Interitem Correlations for the Revised Version of Scale

Item	2	3	4	5	6	7	8	9	11	12	13	14	16	17	19	20
2	1.0	.64	.63	.62	.43	.44	.35	.28	.19	.08	.30	.38	.20	.12	.14	.18
3		1.0	.67	.56	.50	.51	.41	.34	.16	.17	.26	.40	.18	.04	.18	.18
4			1.0	.61	.54	.53	.44	.45	.23	.16	.37	.48	.25	.16	.24	.22
5				1.0	.46	.39	.34	.31	.17	.08	.30	.41	.19	.14	.19	.23
6					1.0	.60	.57	.48	.21	.15	.28	.40	.11	-.02	.14	.07
7						1.0	.63	.54	.24	.19	.30	.41	.12	-.02	.09	.04
8							1.0	.51	.19	.11	.19	.33	.14	.05	.07	.03
9								1.0	.09	.12	.23	.22	.06	-.07	-.00	.10
11									1.0	.41	.54	.65	.18	.13	.25	.11
12										1.0	.30	.33	.10	.06	.22	.17
13											1.0	.64	.26	.17	.30	.25
14												1.0	.29	.21	.30	.22
16													1.0	.71	.35	.41
17														1.0	.35	.50
19															1.0	.47
20																1.0

Note. Listwise *N* with trimmed means = 278.