

# MEASURING INCOMING STUDENT SENSE OF BELONGING

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RESEARCH STUDY  
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## Purpose

The goal of this project was to explore alternative ways of assessing sense of belonging in incoming students that have practical implications for program development and assessment. The currently used Bollen & Hoyle Perceived Cohesion Scale (PCS)<sup>1</sup> provides minimal variation in student responses and has limited utility for program planning and assessment (PCS items can be found on the following page).

Incoming students have historically scored high on the PCS, with averages from the last six years ranging from 44 to 46.5 (maximum value is 54). Additionally, incoming students score higher on the PCS than current students. Incoming freshmen in Fall 2023 had a mean of 44 on the PCS while continuing students (sophomores and juniors) in Spring 2024 had a mean of 42.<sup>2</sup> Finally, the wording of some of the questions is such that an incoming student cannot accurately answer prior to being on campus (e.g., I feel I am a member of the JMU community). Thus, we aimed to develop a more nuanced measure to assess sense of belonging in incoming students who are not yet on campus. We also hypothesized, based on response trends and lack of variability, that the PCS was overestimating sense of belonging and that a more sensitive measure would have lower scores.

## Highlights

- The final scale consisted of seven items mapping onto two subscales: Fit & Connection; Belonging Uncertainty. Items can be found in the Detailed Methods section.
- The two subscales performed well across student subgroups (minoritized/majoritized ethnic group; first generation/continuing generation) supporting that scores can be compared across key groups of interest.
- When compared to an external measure of calmness, the measure showed distinct differences between Belonging Uncertainty versus Fit & Connection, supporting the two factor structure.
- When compared to the Perceived Cohesion Scale, this newly developed scale shows a more normal distribution centered around a scaled mean of 0, suggesting the Perceived Cohesion scale overestimated sense of belonging in incoming students.

## Implications

Having a sense of belonging measure developed specifically for incoming students can offer meaningful information for orientation and first year programming. Future work will involve a subsequent study of item wording effect and revising this measure for continuing students to allow for longitudinal exploration of sense of belonging.

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<sup>1</sup> Bollen, K. A., & Hoyle, R. H. (1990). *Perceived Cohesion Scale (PCS)* [Database record]. APA PsycTests. <https://doi.org/10.1037/t46394-000>

<sup>2</sup> 2024 Continuing Student Survey: Preliminary Data Brief; <https://www.jmu.edu/pair/ads/surveys/continuing-survey/css-2024-pdb.pdf>

***Perceived Cohesion Scale (measure on a 9-point Likert scale):***

- |  |   |
|--|---|
| 1. I feel a sense of belonging to JMU          | 4. I am enthusiastic about JMU                    |
| 2. I am happy to be at JMU                     | 5. JMU is one of the best schools in the nation   |
| 3. I see myself as a part of the JMU community | 6. I feel that I am a member of the JMU community |

## **Detailed Methods**

There are two key analyses involved in scale development: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA is a statistical technique that groups related variables into common, hidden “themes,” known as factors. These factors are latent, meaning that you cannot measure them directly, but can infer information about them from the collected data. EFA is exploratory and does not assume a factor structure beforehand and lets the data reveal its own underlying structure. The strength of the relationship between an item and its assigned factor is called a loading. The appropriate number of factors can be determined from an eigenvalue (typically values greater than one indicates the factor should be retained).

Confirmatory factor analysis is a technique that tests whether a pre-defined structure fits the data. In this case, the structure that emerges from the EFA is then tested through a CFA to determine if the structure is sound. There are several model fit indices that indicate if the hypothesized structure is appropriate, and different types of structures can be compared to determine the superior one. In this case, model fit was evaluated using both the chi-square test and several approximate fit indices, including Standard Root Mean Squared Residual (SRMR), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). Using these indices together allowed us to evaluate practical model fit rather than relying only on exact fit. In addition, residual correlations were examined to identify areas of local misfit, or specific item relationships that were not adequately reproduced by the model.

Incoming transfer students (Fall 2025) completing the Transfer Student Survey received 12 newly developed items. The items were developed after reviewing the literature, reviewing existing scales and discussions with campus partners. Exploratory factor analysis was conducted with the transfer student data to identify latent factors. The EFA suggested a two-factor model was appropriate for the data; the factors were respectively labeled Perceived Fit and Belonging Uncertainty. Items with factor loadings less than 0.4 (indicating weak relationship between the item and the latent factor) were removed. This left 7 items to be tested in a confirmatory analysis.

### ***Items***

Please indicate your level of agreement to the following statements.

- A. Strongly disagree
  - B. Disagree
  - C. Somewhat Disagree
  - D. Somewhat Agree
  - E. Agree
  - F. Strongly Agree
- 
1. I have found groups, clubs, or communities at JMU that interest me. (Fit & Cohesion)
  2. I believe I will find people who share my values and interests at JMU. (Fit & Cohesion)

3. I feel connected to JMU through online resources, social media, or orientation activities. (Fit & Cohesion)
4. I worry about feeling isolated when I start at JMU (Belonging Uncertainty) \*
5. I am concerned that I won't fit in socially at JMU. (Belonging Uncertainty) \*
6. I am unsure if I will find a community where I feel comfortable on campus.(Belonging Uncertainty) \*
7. I feel nervous about adjusting to life at JMU (Belonging Uncertainty)\*

\*Indicates item is reverse coded

Incoming first-year students completed the 7-item scale as part of Fall Assessment Day 2025, which was used for the CFA. Students also completed the Perceived Cohesion Scale ( $\alpha = 0.928$ ), which has historically been used to assess belonging in incoming and current students. Earlier in the onboarding, incoming students completed the Incoming Student Skills and Attitudes Questionnaire (ISSAQ).<sup>3</sup> Data from the ISSAQ were used for external validation to establish support for distinction between the two factors. Only students who were over the age of 18 and provided consent for their data to be used for research were included (n = 3,092). All analyses were conducted using the *lavaan* package<sup>4</sup> in R.

## Detailed Results

Table 1: Overall Sample Descriptives

Item	N	Min	Max	Mean (sd)
I have found groups, clubs, or communities at [institution] that interest me.	3092	1	6	4.91 (.96)
I believe I will find people who share my values and interests at [institution].	3092	1	6	5.21 (.77)
I feel connected to [institution] through online resources, social media, or orientation activities.	3092	1	6	4.91 (.92)
I worry about feeling isolated at [institution].	3092	1	6	3.97 (1.4)
I am concerned that I won't fit in socially at [institution].	3092	1	6	4.21 (1.32)
I am unsure if I will find a community where I feel comfortable on campus.	3092	1	6	4.29 (1.26)
I feel nervous about adjusting to life at [institution].	3092	1	6	3.27 (1.37)

## Factor Structure

A subset of data from our overall sample of first-year students was used to assess the two-dimensional factor structure of the measure. The sample consisted of 992 participants. A CFA indicated that the two-factor structure fit the data well and was superior to the one factor structure. A one-factor model assumes that all

<sup>3</sup> <https://www.jmu.edu/academic-success/ssea/issaq.shtml>

<sup>4</sup> Rosseel Y, Jorgensen T, De Wilde L (2025). *lavaan: Latent Variable Analysis*. doi:10.32614/CRAN.package.lavaan, R package version 0.6-20, <https://CRAN.R-project.org/package=lavaan>.

items map to one latent construct. None of the fit indices for the one-factor model met criteria for acceptable model fit. Fit indices for the two-factor model met recommended criteria. SRMR values of .08 or lower, CFI values of .95 or higher, and RMSEA values of .06 or lower were used as guidelines for acceptable fit.<sup>5</sup>

Table 2: Model Fit Indices

Model	Chi-sq	df	Chi-sq diff	df diff	p-value	CFI	SRMR	RMSEA
2F	54.152	13	-	-	-	.988	.038	.060
1F	760.885	14	352.022	1	<.001	.755	.163	.257

The following table shows the factor loadings for each item and their respective factor.

Table 3: Factor Loadings, Variance and Omega

	Dimension Factor Loadings		Variance Explained
	1. Fit & Cohesion	2. Belonging Uncertainty	
sc1	0.674*	0	.48
sc2	0.668*	0	.74
sc3	0.711*	0	.58
sc4	0	1.081*	.61
sc5	0	1.225*	.88
sc6	0	1.137*	.81
sc7	0	0.875*	.41
Variance Extracted	.60	.67	
Reliability Omega	.82	.89	
1.	1	-	
2.	.411	1	

The ‘variance explained’ column indicates the individual item's total variance is accounted for by the latent factor(s) it is intended to measure. Values of .5 or above are considered adequate, meaning the factor explains more than 50% of the variance in the item. The ‘variance extracted’ row indicates the average squared standardized factor loadings (squared multiple correlations) for all items in a construct. In general, the variance explained by the factors exceeds the .50 threshold<sup>6</sup>, with sc1 and sc7 being lower than ideal but not unacceptably low. Reliability omega indicates how consistently the items measure the same thing. Values of .8 or above are considered good<sup>4</sup>.

### Measurement Invariance

This study also examined measurement invariance across different groups, specifically generation status (first-generation students versus continuing students) and self-identified ethnic groups. Testing for measurement

<sup>5</sup> Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, 6(1), 1-55.

<sup>6</sup> Cheung, G.W., Cooper-Thomas, H.D., Lau, R.S. *et al.* Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. *Asia Pac J Manag* 41, 745–783 (2024). <https://doi.org/10.1007/s10490-023-09871-y>

invariance is important as it provides evidence that the factor structure is consistent across groups, that a construct is measured similarly across groups and supports the comparison of latent means across groups.

A subset of the full sample of first-year students was used to evaluate the proposed two-dimensional factor structure of the measure. This subset included 1191 participants. Of these, two groups of 300 students were created to examine measurement invariance by first-generation status. To ensure that these groups reflected first-generation status independent of racial or ethnic composition, each group was evenly balanced with respect to ethnicity, such that 50% (n = 150) identified as minoritized students and 50% (n = 150) identified as majoritized students.

The remaining participants from this subset were used to examine measurement invariance by ethnicity. Two additional groups of students were formed: one consisting of 291 students from the majoritized ethnic group and another consisting of 300 students from a composite of minoritized ethnic groups.

For both groups (race and generation), measurement invariance was tested via a series of model comparisons. If configural invariance (i.e., equivalent factor structure) was supported, metric invariance (i.e., equivalent factor pattern coefficients) was examined. If metric invariance was supported, scalar invariance (i.e., equivalent intercepts) was examined.

The tables below present comparisons of the different models used to test invariance. All models show adequate representation of the data based on the CFI, SRMR and RMSEA. Though there was a significant difference in the fit of the metric and scalar model when comparing by generation, the scalar model was not practically worse than the metric model when assessing change in CFI and RMSEA (CFI change < 0.01, RMSEA change < 0.015).<sup>7, 8</sup>

Table 4: Measurement Invariance Metrics

4a. Race/Ethnicity								
Model	Chi-sq	df	Chi-sq diff	df diff	p-value	CFI	SRMR	RMSEA
Configural	70.045	26	-	-	-	.983	.043	.076
Metric	73.107	31	3.062	5	.690	.984	.046	.068
Scalar	77.155	36	4.048	5	.543	.984	.046	.062

  

4b. Generation Status								
Model	Chi-sq	df	Chi-sq diff	df diff	p-value	CFI	SRMR	RMSEA
Configural	85.234	26	-	-	-	.975	.034	.087
Metric	87.613	31	2.379	5	.795	.976	.035	.078
Scalar	103.989	36	16.376	5	.006	.971	.039	.079

<sup>7</sup> Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural equation modeling: a multidisciplinary journal*, 14(3), 464-504.

<sup>8</sup> Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural equation modeling*, 9(2), 233-255.

Thus, this scale performs similarly in majoritized and minoritized students and first generation vs. continuing generation students.

## External Validity

Because scalar invariance was supported, we examined latent mean differences as known-groups validity evidence. Results generally followed expected patterns: minoritized and first-generation students reported higher Belonging Uncertainty than their comparison groups, and minoritized students reported lower Fit/Connection than majority-group students. Fit/Connection did not differ significantly by first-generation status. Factor correlations were positive across all groups, suggesting the two dimensions were related but distinguishable.

We provided additional external validity evidence by examining relations with the ISSAQ calmness construct. As expected, Belonging Uncertainty was significantly and negatively related to calmness, whereas Fit/Connection was not significantly related to calmness. The two associations differed significantly, suggesting that Belonging Uncertainty and Fit/Connection have distinct external correlates and supporting the two-factor interpretation of the measure.

## Comparison to Perceived Cohesion Scale

After validity was established, we proceeded to explore how students responded to this new measure compared to the Perceived Cohesion Scale. The total derived from the new scale was compared to the Perceived Cohesion Scale. The total sum of each measure was scaled to range from -1 (representing the lowest scores) and 1 (representing the highest scores). The graph below presents their distributions.

The Perceived Cohesion scores trend more positively, while the scores on the newly developed scale are more centered around 0, but still with a positive skew. This aligns with our original hypothesis that the Perceived Cohesion scale overestimated sense of belonging in incoming students.

