Benefits of the Culture of Inclusion Survey

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Abstract

In the pursuit of addressing critical societal challenges, National Science Foundation (NSF) Engineering Research Centers (ERCs) strive to create a culture of inclusion that will empower individuals to harness their full potential, creativity, and expertise. This *Work-in-Progress* paper will outline the development and implementation of a Culture of Inclusion (COI) survey instrument that was designed to evaluate the inclusivity of ERCs and other large multi-institutional organizations that are education focused.

The COI survey differs from a wealth of other inclusion-related surveys because of this focus, as well as its reliance on social psychological constructs such as identification, commitment, interconnectedness and cultural intelligence. These concepts draw on extensive research in social identity theory, self-efficacy theory, the human need for social connectedness, and research on how cultural intelligence enables people to work more effectively with culturally diverse others.

In addition, the COI survey aligns well with the focus of NSF on cultivating an inclusive professional culture within ERCs. This culture is characterized by open-mindedness, fairness, collaboration, respectfulness, and encouragement of professional growth. These factors echo existing research on inclusive environments and their role in motivating individuals, driving innovation, and fostering creativity in diverse teams. Although we have made improvements in the survey over the years, the core items that comprise an inclusive culture have not changed.

The value of assessing COI in an NSF ERC has already been described in work by the authors [4]. In that paper, too, was a discussion of the added value of reporting back to participants about the survey findings and then discussing them (what was positive, what needs to be improved). Since that time, we have: (i) refined the survey to better understand the underlying factors, (ii) devised a pictorial way to represent, and thus more effectively communicate, what is meant by COI; (iii) explored whether non-respondents to the survey are also more likely to be from groups underrepresented in STEM; and (iv) revised the survey to better capture the myriad ways in which participants behaviorally support COI through their recruitment and mentoring efforts on behalf of the center. Consequently, the survey instrument is now shedding more light on the factors that help, or hinder, the culture of inclusion within a center. It has also opened up avenues by which we can encourage more engagement with creating a culture of inclusion.

Although currently used within only one ERC, our hope is that through collaboration with interested parties and/or widespread dissemination of the survey, it will be more widely used, permitting (1) a better understanding of the underlying factors and (2) an ability to look at COI as a function of the multiple way that people differ in how they identify with various demographic groups. In addition to using the survey to assess COI, however, our findings underscore the significance of increasing discussion about these inclusive factors in center activities to facilitate an environment where diverse perspectives, talents, and energies can be better utilized to tackle our present-day engineering and societal challenges.

Introduction

In the pursuit of addressing significant societal challenges, such as those tackled by National Science Foundation (NSF) Engineering Research Centers (ERCs), fostering a culture of inclusion is critical. The culture within a Center needs to be inclusive so as to inspire individuals from all backgrounds to unleash their full potential, ideas, and talents towards solving the complex problems facing the U.S.

In this *Work in Progress* paper, we build on previously published work to convey some new findings about the survey and the value of using the factors to communicate expectations and to assess behaviors supporting an inclusive culture. Consequently, the survey instrument is now shedding more light on the factors that help, or hinder, the culture of inclusion within a Center. It has also opened up avenues by which we may be able to encourage more engagement with creating a culture of inclusion.

Rationale for the Culture of Inclusion Survey

As a Director of Diversity and Inclusion and an External Evaluator working together on assessing an ERC, we wanted to assess the Center's culture of inclusion (COI) on an annual basis. While there exists many inclusion assessment tools in the literature [1, 2, 3], adapting them to suit the unique characteristics of an ERC presented several challenges.

In a previous article [4], we detail these unique characteristics that distinguish an ERC from other entities and describe some of the challenges involved in creating one instrument that would adequately assess a large multi-institutional entity that is geographically dispersed and with different roles (faculty, staff, and students) and levels of involvement. Many of the engineering education surveys are well suited for students (e.g., asking questions about "being good at engineering is important to who they are"), but don't work for faculty or staff [5]. Conversely, there are scales that make sense for staff, but do not work for students.

As we reviewed the instruments in the literature, too, many surveys were not suitable as they assess whether procedures and processes in place are inclusive. In a multi-institutional entity, there is often discrepant procedures and processes in place that are context-dependent, complicating the use of such surveys. Moreover, the majority of these culture of inclusion surveys were business-related, and so once again, items were not applicable to a research Center.

Finally, none of the instruments that we found aligned closely with the mandate from NSF that an ERC foster a collaborative professional culture, which includes several items (e.g., fostering professional development, being collaborative, and working cohesively across institutions and disciplines). We developed a COI survey instrument, therefore, that would work best in keeping with the general literature on an inclusive culture and that is consistent with NSF's expectation for a professional work environment that is collaborative and encourages professional growth.

This paper builds on initial survey findings and outcomes from 2021 [4] and outlines our experiences with this COI survey as we continued to refine it in 2022. We aim to share insights gained from our efforts to assess, and then ideas to enhance, our Center's culture of inclusion.

Virtual Component

The instrument was developed in 2020. During that time, because of the COVID-19 pandemic, all Center meetings (leadership teams, research thrust meetings, advisors and mentors meeting with their students) were virtual. Because of the virtual nature of all Center interactions, we were interested not only in assessing the culture of inclusion within the Center, but also understanding how Center members communicated virtually (via all the different platforms, such as Slack, Zoom, etc.) and to look more closely at what was working to maintain an inclusive culture.

Items related to virtual communication and the impact of the COVID-19 pandemic were toward the end of the COI survey in 2020 and 2021 but were removed in subsequent surveys. Those items are available for use, however, if a Center moves back to fully virtual activities and can be shared with interested parties.

Survey Sections

Each year the survey is sent electronically to all Center members via SurveyMonkey. In the refined version of the survey, there are five sections:

Section 1: Relationship with the Center: Respondents are asked about their role, their discipline, how long they have been a part of the Center, their university, and the amount of time they dedicate to the Center. This helps us, for example, to look at meaningful interactions by roles that differ in power/status, as well as focus on individuals who are deeply versus more peripherally engaged in the Center.

Section 2: Cross-institutional Interactions: In this section, respondents share how often they interact with Center members at other institutions and their satisfaction with the frequency of those interactions. Again, this section reflects the NSF emphasis on working cohesively across different institutions, disciplines, and areas of expertise to solve large, complex problems.

Section 3. Culture of Inclusion Items: Respondents are presented with 11 items, based on the literature, that measure feelings of inclusion within a group. When we present the visual for communicating about the survey below, we will discuss the evidence in support of using it. In the 2022 survey, these items were presented to each respondent randomly. The reason for this was to determine if these 11 items still fell into two factors as they did in 2021, even when not presented together as sets of items.

Section 4: Recruiting and Mentoring Activities: In previous iterations of the survey, these items asked the respondents to report on their "Engagement with Diversity and Inclusion-related Activities." These items specifically asked about mentoring and recruiting efforts of individuals from underrepresented groups. However, after analyzing the data, it became apparent respondents had varying opinions and definitions of "mentoring" and "recruiting." In the 2022 version, we refined these items to be closed-option items, giving the respondents the most common ways of recruiting and mentoring that were shared in the past so that the respondents could check a box. This methodology also served as an educational tool, helping respondents to understand what constituted "recruiting and mentoring activities." Consistent with theories about the consistency of attitude and behavior [6, 7], and the tendency to avoid dissonance (discrepancies in attitudes

and behaviors) [8], it also creates the expectation that members of the Center should be engaging in such activities as they report out on them annually in the survey.

In addition to the check boxes, respondents had the option to leave an open-ended response and add other recruiting and mentoring activities. Questions specifically asked about recruiting and mentoring underrepresented (UR): high school, undergraduate or graduate students or faculty.

Section 5: Demographics: In this final section, we asked respondents a typical list of demographic items which were of interest to NSF and were aligned with the NSF mandate of broadening representation within ERCs. Survey participants were asked "How do you identify" on questions of gender, race, disability status, veteran status, and first-generation college status. In addition, survey participants were asked if they were a citizen or permanent resident or not. As a final question, participants were invited in the optional comment box to "Describe any other identifiers (socioeconomic background, age, etc.) that you feel are important to your feelings of inclusion in the Center."

The Inclusion Model Adopted by the Center

There were two types of factors that we thought would comprehensively assess inclusion, the first of which rely on "inner" social psychology theories related to social identity, self-efficacy, and social connectedness, as well as the research on cultural intelligence (see Figure 1) [9-13].

Figure 1: How concepts in Factor 1 of the Inclusion Model operate to encourage people to leave or stay.

Together, these concepts are helpful in explaining why individuals, particularly those who are underrepresented (UR), stay and succeed, or leave and fail, at an institution [14]. That is, consistent with research on feeling included, the higher one is on these factors, the more likely one is to counter threats to self-esteem (e.g., stereotyping, lack of role models) and, importantly, both persist and succeed in that institution.

The concepts that NSF [15] focuses on that drives an inclusive professional culture within ERCs maps well onto the concepts in our C factor, indicated the surrounding culture. That is, when the surrounding culture is inclusive, it is perceived as: *Open-minded* (accepting of different ideas

and perspectives), *Fair*, *Collaborative*, *Respectful*, and one that *Encourages Professional Growth* [16, 17]. All of these factors are prevalent in the social psychological literature on inclusion and what types of cultures motivate and inspire individuals and lead to innovation and creativity in diverse teams.

To effectively communicate what we mean by culture of inclusion to everyone in the Center, faculty, staff, and students, as well as visiting researchers, summer students, and those we engage with for recruiting and outreach, we decided to use an image (see Figure 2).

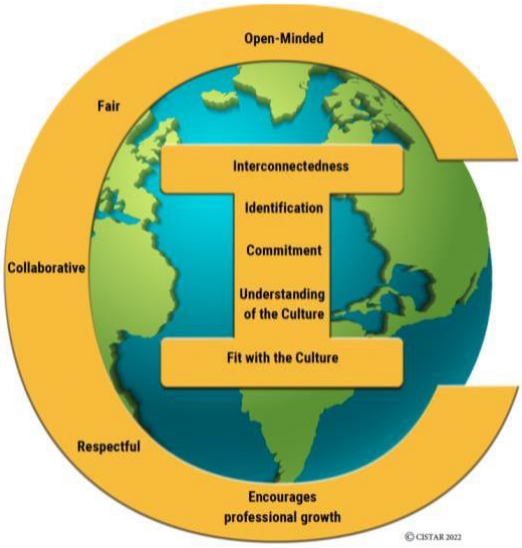

Figure 2: Set against the backdrop of a partial globe representing diversity, the surrounding Culture (C), when inclusive, is open-minded, fair, collaborative, respectful, and one that encourages professional growth; and individuals in that surrounding culture (I), when feeling included, are high in interconnectedness, identification, commitment, and an understanding of, and fit with, the culture.

This pictorial representation is expected to be useful in succinctly explaining the culture of inclusion to Center members, especially those only joining us for a short time—a summer program or semester research class. Moreover, we believe it could help everyone feel more ownership of creating such a culture if they had a better idea of what we mean and what is expected of them.

In 2021, we conducted an exploratory factor analysis using the 2021 survey data. Those findings indicated that in the 11 items assessing the culture of inclusion within the Center, two factors best represented the constructs measured in the survey. Similar to what we proposed, one of those factors, the Individual's Inclusion (I) were items related to how individuals see themselves being included in the Center. The other factor, the Surrounding Culture (C), were items relating to the impact others have on inclusion.

The survey was initially designed with items that were similar theoretically presented together; items related to the external culture were grouped together and those related to the internal culture were also together on the instrument. As mentioned above, when presented to respondents as two distinct sets of questions, a two-factor solution was found within an

exploratory factor analysis (EFA). Those findings indicated that in the 11 items assessing the culture of inclusion within the Center, two factors best represented the constructs measured in the survey. However, in 2022, the following year, the questions were presented randomly to respondents. We wanted to know, "Without the clear distinction between two sets of questions, will the two factors still come to light?"

Sample

In June 2022, 131 people involved in the Center were sent an online invitation to complete an online survey related to the Center's Culture for Inclusion. Those invited included: faculty, staff, postdocs, graduate fellows, and undergraduate fellows. The survey was open for approximately two weeks with multiple reminders sent. Individuals were asked to rate a total of 11 items on inclusivity, commitment, identity, professionalism, and collaboration using a 7-point scale (1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=neither disagree nor agree, 5=somewhat agree, 6=agree, and 7=strongly agree). A total of 77 individuals completed the survey and consented to their responses being used for additional analyses. We reviewed the demographic make-up of respondents to that of the total Center population. In 2021, we found consistent differences that women were over responding and URM faculty and graduate students were under responding. In 2022, when we did the same comparison, we found that responses were more similar to the Center population. We will continue to review this data in future years.

Analysis

There are two main types of factor analyses. An exploratory factory analysis (EFA) "explores and summarizes the underlying correlational structure" in a data set [18]. A confirmatory factory analysis (CFA) "tests the correlational structure of a data set against a hypothesized structure and rates the 'goodness of fit. [17]." A confirmatory factor analysis (CFA) was used to confirm the factor structure of the 11 Culture of Inclusion items. MPlus 8 (version 1.8.6) software was used to conduct these analyses (Muthén & Muthén, 1998-2017). The EFA conducted the previous year suggested either a 1-factor or 2-factor solution. Both solutions were explored using a CFA. Model-data fit, item factor loadings, and interfactor correlations were evaluated to determine the best factor solution.

Results of COI Items

A 2-factor solution was first explored (see Table 1 below that also includes the data in 2021 when the items were in a set order). Six items significantly loaded onto Factor 1 (Inclusion) with five items significantly loading onto Factor 2 (Culture) using the threshold of 0.45. "I feel that I fit in with <Name of Center>'s workplace culture" had the highest loading on Factor 1 with a loading of 0.966. The interpretation for this item on Factor 1 is – when all other items are held constant, if "I understand <Name of Center>'s workplace culture" increased by one unit, we expect Factor 1 to increase by 0.966. "I am treated fairly by those I interact with in <Name of Center>" had the highest loading on Factor 2 with a loading of 0.891. The interpretation for this on Factor 2 is – when all other items are held constant, if "I am treated fairly by those I interact with in <Name of Center>" increased by one unit, we expect Factor 2 to increase by 0.891. It is important to note that the interfactor correlation between Factor 1 and Factor 2 is high (0.952*, See Table 2

below). This suggests a 1-Factor solution may be more appropriate because the two factors highly correlate, indicating they are measuring the same latent variable.

Within the 1-factor solution (see Table 3 below), all 11 items significantly loaded onto Factor 1 using a threshold of 0.45. “I feel that I fit in with <Name of Center>’s workplace culture” had the highest loading on Factor 1 with a 0.958 loading, followed by “I feel interconnected to the people in <Name of Center> (a part of the group)” with a 0.893 loading. The 1-factor solution indicated high reliability as coefficient alpha was 0.931. Being that the 1-factor solution and the 2-factor solution had comparable model-data fit, and the two-factor solution had high interfactor correlations, a 1-factor solution may be the best solution for the 2022 data. Limitations of this CFA include the small N. In future deployments of the survey, we would like to increase the number of respondents.

Table 1

2-Factor Solution

	2021 (set order)		2022 (randomized)	
Item	Factor 1	Factor 2	Factor 1	Factor 2
I identify with <Name of Center> (it is an important part of who I am professionally)	**0.678***	0.227	**0.828***	-
I feel committed to <Name of Center> (I can, and want to, succeed)	**0.774***	0.034	**0.785***	-
I feel interconnected to the people in <Name of Center> (a part of the group)	**0.926***	-0.116	**0.900***	-
I understand <Name of Center> ‘s workplace culture	**0.986***	-0.008	**0.837***	-
I feel that I fit in with <Name of Center> 's workplace culture	**0.840***	-0.146*	**0.966***	-
I believe that <Name of Center> is an inclusive center	**0.585***	0.381*	**0.881***	-
My opinions, skills, and experiences are respected by those I interact with in <Name of Center>	0.270*	**0.656***	-	**0.884***
I feel that <Name of Center> members encourage collaboration	0.301*	**0.598***	-	**0.795***
<Name of Center> helps me grow professionally	**0.452***	**0.468***	-	**0.815***
I am treated fairly by those I interact with in <Name of Center>	-0.013	**0.986***	-	**0.891***
I feel that <Name of Center> members are accepting of people with different perspectives and ideas	0.219	**0.774***	-	**0.843***

Note. Bold items denote significant loading using a 0.45 threshold.

Table 2

2-Factor Solution Interfactor Correlations

	Factor 1
Factor 2	0.952*

Table 3

1-Factor Solution

Item	*Factor 1*
I05 - I feel that I fit in with <Name of Center> ‘s workplace culture	**0.958***
I03 - I feel interconnected to the people in <Name of Center> (a part of the group)	**0.893***
P04 - I am treated fairly by those I interact with in <Name of Center>	**0.880***
I06 - I believe that <Name of Center> is an inclusive center	**0.870***
P01 - My opinions, skills, and experiences are respected by those I interact with in <Name of Center>	**0.866***
I04 - I understand <Name of Center> ‘s workplace culture	**0.832***
P05 - I feel that <Name of Center> members are accepting of people with different perspectives and ideas	**0.827***
I01 - I identify with <Name of Center> (it is an important part of who I am professionally)	**0.821***
P03 - <Name of Center> helps me grow professionally	**0.800***
P02 - I feel that <Name of Center> members encourage collaboration	**0.779***
I02 - I feel committed to <Name of Center> (I can, and want to, succeed)	**0.779***

Note. Bold items denote significant loading using a 0.45 threshold.

Theoretically, and consistent with how we developed the measure, we feel that with a larger sample size, we will find more evidence for the two-factor solution that is consistent with thinking about culture of inclusion as a loci type of phenomena that is capturing the individual’s internal thoughts about their feelings of inclusion versus their observations about how inclusive their surrounding culture is. In addition, although there were very few differences as a function of respondent (demographic) variables, some of these variables have sample sizes too small for differences to be statistically significant.

In the meantime, we are exploring the utility added by using the COI image that has in the background a globe. It has been repeatedly shown to be a useful way to explain all the different ways that individuals can differ around the world. It seems to bring the vague notion around what is an inclusive culture down to concepts that resonate with individuals and reinforce the norms for how we want everyone to be treated in order to maximize our satisfaction with the workplace and collegiality with our work colleagues, all of which helps to improve productivity and creativity in large teams [15, 17].

For example, when talking to some of our Centers’ summer research participants, we showed the pictorial representation to help communicate our expectations for how they would treat others, and how they should be treated. We made it clear to Center graduate mentors, too, and had them think about how they could make their laboratory and research groups be more inclusive. Moreover, when talking to our international partners, it was an easy way to help them think about what we meant by culture of inclusion. In a future test of the pictorial representation’s utility, we hope to find that Center participants who had the pictorial representation explained to them (vs. not shown) will be better able to articulate, and act to improve, the culture of inclusion in their work groups.

Behavioral Reports of Inclusion-related Activities

NSF states about *Team Dynamics* that: a high-quality research program in Years 5-10 is "cohesive, with opportunities for cross-institutional collaboration effectively implemented." The COI survey has questions about "how frequently do you interact (face-to-face, digitally, virtually, etc.) with Center faculty, staff, or students at other universities?" This gives useful estimates about the regularity of contact as well as how satisfied people are with that frequency of interaction.

We revised the final part of the COI survey instrument to make it easier for respondents reporting on *Inclusion-related Activities* to have their activities reported by the types of activities they typically engage in for different underrepresented populations: 1. high school students, 2. undergraduate students, 3. graduate students, or 4. faculty. We are working to better understand the types of mentoring and recruiting activities, and how frequently they occur, so that we can find ways next year to support and facilitate more involvement in frequently occurring inclusion-related activities.

For example, we are creating a database of different mentoring activities that were undertaken by our faculty, staff, and students with high school and undergraduate students. From that database, we may be able to refine categories that could be quickly checked and will capture the events so that respondents won't have to remember and then write them down separately. It will be the ease with which we capture reoccurring and common events that will be beneficial, making the survey more comprehensive and useful for then alerting and organizing others to engage in such behaviors (become a mentor) or attend a single event, such as an on-camp recruiting conference.

Conclusion

The COI image and survey provide an easy and readily understandable way to talk about and assess the Culture of Inclusion at large institutions. It is not only the concepts that underlie inclusion that are captured, however, but also how individuals are putting into practice being inclusive through their recruiting and mentoring behaviors.

We hope in the next year to combine forces with colleagues also interested in such a survey given that with larger Ns, we will have the power to learn more about the scale's underlying factors as well as be able to look at differences across multiple demographic groups to have more confidence that their responses are being adequately represented in any findings.[1] Further, we will be exploring how reporting on one's inclusive-related activities may increase engagement in inclusive behaviors; it may be a powerful mechanism by which to reinforce behaviors to be more consistent with attitudes.

[1] If interested in such a collaboration, please contact the authors: Denise M. Driscoll at driscoll@purdue.edu or Kristin Everett at kristin@everettevaluation.com

Finally, we will be pursuing how using the pictorial representation may highlight how one should be behaving and motivate Center members to act in ways more consistent with expectations that they are responsible, too, for creating a culture of inclusion. In conclusion, the COI survey has helped the Center have a snapshot view of the COI, has made it easy to encourage more inclusive behaviors, as well as respond to varied comments having to do with the individual concepts that are important to growing and maintaining a culture that encourages and supports everyone.

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