Examining the Cultural Influence on Peer Ratings of Teammates between International and Domestic Students

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Examining the cultural influence on peer ratings of teammates between international and domestic students
Abstract

Effective teamwork behaviors are considered critical by employers hiring engineers and globally diverse teams have become intertwined in many technical endeavors. Complicating the use or development of team skills in this environment, ethnic and cultural differences influence team interactions and their measurement. This work is an exploratory study of the influence of cultural differences in peer ratings in first-year engineering students in a large Midwestern University. Our analysis applied one of Hofstede’s culture dimensions: Individualism vs collectivism to separate students into different intervention groups. We then examined peer rating data for teams with and without international students as team members. We found significant differences in peer rating behavior among international vs. U.S. domestic students in three CATME dimensions: Contributing to team’s work, interacting with teammates and expecting quality. These findings will guide further quantitative and qualitative researches about what and how cultural factors contributes to teamwork behavior and the potentially the development of interventions that could mitigate the ethnic and cultural influences on peer ratings and teamwork behavior.

Introduction & Literature Review

The United States has become one of the top destinations for international students pursuing higher degrees. According to Institute of International Education, in 2017-2018 school year, there were 1,094,792 international students studying in the U.S and they made up 5.5% of all students in U.S. higher education [1]. Among more than one million international students, three Asian countries: China, India and South Korea are consisting of 33.2%, 17.9% and 4.1% respectively of the international students [1]. Students from these three countries are different from domestic students not just for physical distinction but for their native languages and cultures. Hofstede described cultural differences in six dimensions:

- Power Distance, related to the different solutions to the basic problem of human inequality;
- Uncertainty Avoidance, related to the level of stress in a society in the face of an unknown future;
- Individualism versus Collectivism, related to the integration of individuals into primary groups;
- Masculinity versus Femininity, related to the division of emotional roles between women and men;
- Long Term versus Short Term, related to the choice of focus for people’s effort: the future or the present and past;
- Indulgence versus Restraint, related to the gratification vs control of basic human desires related to enjoying life [2].

Hofstede also provides a cultural index for each of the three countries, which provides us a way of cultural difference measurement.

The Accreditation Board for Engineering and Technology (ABET) requires engineering schools prepare their graduates with teamwork competencies because teamwork skills are rated a most important competency by engineering graduates in their professional practice [3]. Many
technical companies rate the ability to effectively work in team to be valued as a core skill [4], [5]. With the increasing awareness of the importance of teamwork, Team Based Learning (TBL) is implemented in many undergraduate programs in engineering and sciences [6]. 49.8% of international students majored in STEM and 21.3% of that group chose to pursue Engineering disciplines [3].

International students tend to face different but significant academic challenges and they tend to be more actively engaged in educational pursuits compared with domestic students [7] – [10]. Research on student activities outside classes also indicate that there is little interaction between domestic and international students [10] – [14]. The lack of social interaction between domestic and international students is also mirrored by similar divisions between ethnic minority and majority ‘domestic’ student groups [10], [15].

Comprehensive Assessment of Team Member Effectiveness (CATME) is a validated tool that assesses the members in a team on a set of behavioral dimensions by themselves and their teammates in academic teamwork environment and we use it for data collection and analysis purpose [16], [17]. The five CATME dimensions are defined as follows:

- **Having (H)** relevant Knowledge, skills and abilities refers to the base knowledge of individual team members.
- **Contributing (C)** to the Team’s Work is being able to add value to your team’s work/project.
- **Interacting (I)** with teammates refers to the way individuals communicate within their teams.
- **Keeping (K)** the team on track is similar to being a timekeeper.
- **Expecting (E)** quality is taking expectations to the next level and working collaboratively to produce the best possible team outcomes [16].

This paper compares the CATME peer ratings between domestic and international first year engineering students in an introductory engineering course. The research question of this study is: Can differences in peer rating patterns in teams with and without international students be explained by examining cultural differences that are influencing peer rating behavior? If cultural influences effect teamwork and peer rating behavior, then strategies for mitigating these cultural influences on teamwork and peer rating behavior can be developed.

**Research Methodology**

**Data Preparation**

For the analysis for this study, we collected five sections’ peer evaluation data from an introductory engineering course in a big Midwestern University in fall of 2017. Students in the course completed three rounds of peer evaluations including rater practice training for course credit [18], [19]. Among all 2031 students registered for all sections, there were 493 international students, defined as a student who held a temporary visa while studying at an U.S. university. We randomly selected 5 of 16 sections and students from selected sections were assigned into 128 three or four persons’ teams. We removed 13 teams where students either dropped the
course or failed to provide nationality. The final sample contained 510 students including 67 international students, 372 male students, and 122 female students. The research sample consisted of 59 teams that contained all domestic students and 69 teams had at least one international students. Five teams had 2 international students and one team had 3 international students.

**Group Cultural Distance**

Next we separated all the teams for their culture differences based on the Hofstede cultural dimension of Individualism versus Collectivism. This dimension describes the tendency of individuals to integrate or pattern their behavior to be consistent with a primary group. [6].

Hofstede used the individualism index (IDV) as a factor score to present the degree to which individuals are not integrated into their acceptable behavior defined by cultural groups; The higher value of this index for a country, the more individualistic people are in that society [6]. For example, Americans are considered as strong individualistic and have a score of 91 for IDV [6]. As shown in Table 1, South Korea and China have IDV of 20 and 18 respectively, India has IDV of 48, [6]. For a four-person team where three students are U.S. domestic students, there is little cultural difference within the team if the fourth student comes from U.S. or Canada. However, if the fourth team member comes from China or South Korea, there are potentially large IDV differences within the team members.

<table>
<thead>
<tr>
<th>Country</th>
<th>IDV</th>
<th>Country</th>
<th>IDV</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>91</td>
<td>Jordan</td>
<td>30</td>
</tr>
<tr>
<td>Canada</td>
<td>80</td>
<td>Mexico</td>
<td>30</td>
</tr>
<tr>
<td>Netherlands</td>
<td>80</td>
<td>Malaysia</td>
<td>26</td>
</tr>
<tr>
<td>Belgium</td>
<td>75</td>
<td>Kenya</td>
<td>25</td>
</tr>
<tr>
<td>Germany</td>
<td>67</td>
<td>Kuwait</td>
<td>25</td>
</tr>
<tr>
<td>South Africa</td>
<td>65</td>
<td>Bangladesh</td>
<td>20</td>
</tr>
<tr>
<td>Poland</td>
<td>60</td>
<td>China</td>
<td>20</td>
</tr>
<tr>
<td>India</td>
<td>48</td>
<td>Honduras</td>
<td>20</td>
</tr>
<tr>
<td>Argentina</td>
<td>46</td>
<td>Thailand</td>
<td>20</td>
</tr>
<tr>
<td>Japan</td>
<td>46</td>
<td>Vietnam</td>
<td>20</td>
</tr>
<tr>
<td>Morocco</td>
<td>46</td>
<td>South Korea</td>
<td>18</td>
</tr>
<tr>
<td>Lebanon</td>
<td>40</td>
<td>Taiwan</td>
<td>17</td>
</tr>
<tr>
<td>Russia</td>
<td>39</td>
<td>Indonesia</td>
<td>14</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>38</td>
<td>Pakistan</td>
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<td>Turkey</td>
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<td>Colombia</td>
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<tr>
<td>Dominican Republic</td>
<td>30</td>
<td>Ecuador</td>
<td>8</td>
</tr>
<tr>
<td>Iraq</td>
<td>30</td>
<td>Guatemala</td>
<td>6</td>
</tr>
</tbody>
</table>
We define Cultural Distance (CD) as the measure of cultural difference with respect to IDV in a team and it is calculated as the standard deviation of IDV of each team member. 

\[
\text{Culture distance (CD)} = \sqrt{\frac{\sum_{i=1}^{N} (IDV_i - \bar{IDV})^2}{N-1}} = STD(IDV), \quad N = 4 \text{ in our case}
\]

According to Hofstede, Japan scores 46 on the Individualism dimension and its society shows many of the characteristics of a collectivistic society, while India, with a rather intermediate score of 48, is a society with both collectivistic and Individualist traits [6]. Given there is no absolute IDV cutoff to distinguish collectivistic countries, we choose the average IDV (47) of Japan and India to be the cutoff value and calculate CD score to be 22 for the team containing one student has 47 IDV and three domestic students have 91 IDV.

We then defined the following three types of team as interventions:

1. all members are domestic students we assume there is no cultural difference (CD = 0);
2. there is at least one international student but team members have low cultural difference in terms of IDV (0 < CD < 22);
3. there is at least one international student but team members have high IDV difference (CD >= 22).

**Statistical models for evaluating peer rating quality**

Across all the CATME teamwork dimensions, we calculate the standard deviation of the peer rating scores. The larger the standard deviation, the students are better able to differentiate team members across each CATME dimension, which means the rating is in better quality [21], [22]. Though it is possible that a certain person performs at the same level in all dimensions, it is less likely that among all team members that their teamwork performances are similar on all CATME behavioral dimensions [21], [23]. Convergence analysis compares self and peer ratings over multiple peer ratings to see if the ratings that the rater rates himself/herself and the ratings given by teammates converge over multiple peer ratings [24].

We then examined self and peer evaluation variances using the Social Relations Model (SRM), which identifies three different variance components [24] - [27]:

1. Rater Effect (how individuals perceive others) measures how consistently an individual rates his/her teammates. A larger Rater Effect would mean that on average an individual gives all his/her teammates the same rating.
2. Target Effect (how individuals are perceived by others) measures how consistently an individual is rated by his/her teammates. A larger Target Effect would mean that on average an individual receives similar ratings from all his/her teammates.
3. Relationship Effect (the extent to which the ratings given and received by each pair are related to each other) measures the uniqueness of relationships after the rater and target variance have already been accounted for. A larger Relationship Effect would indicate
that ratings are based on personal interaction inside or outside of team activities that may not be experienced by others on the team

Analysis

Table 2 Dispersion Across Dimensions AVONA Analysis

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Peer Review Time</th>
<th>Intervention</th>
<th>Peer Review Time</th>
<th>Difference Mean Rating</th>
<th>P-Value</th>
<th>Effect Size (Cohen’s d)</th>
<th>Difference Dispersion</th>
<th>P-Value</th>
<th>Effect Size (Cohen’s d)</th>
</tr>
</thead>
<tbody>
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<td>CD = 0</td>
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<td>&lt;.0001</td>
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<td>.3306</td>
<td>-.5918</td>
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<td>1.0000</td>
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<tr>
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<td>.1627</td>
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<tr>
<td>0 &lt; CD &lt; 22</td>
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<td>0 &lt; CD &lt; 22</td>
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<tr>
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<td>.09819</td>
<td>1.0000</td>
<td>.4550</td>
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</tr>
<tr>
<td>CD = 0</td>
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<td>3</td>
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<td>1.0000</td>
<td>.3621</td>
<td>.02081</td>
<td>1.0000</td>
<td>.2640</td>
<td></td>
</tr>
<tr>
<td>0 &lt; CD &lt; 22</td>
<td>3 CD &gt;= 22</td>
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<td>.07468</td>
<td>1.0000</td>
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<td>1.0000</td>
<td>.1154</td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 2 there is no difference in the patterns of dispersion or changes in dispersion patterns between the three Hofstede Individualism Index (IDV) cultural groups that we defined. All three Cultural groups also exhibit the same relative dispersion data when comparing peer ratings 1 to 2 or 3 to 3. Further the three cultural groups also show identical dispersion patterns across all five CATME dimensions (p = 1.0) when comparing the three cultural dimension subgroups at each peer rating event.

Table 3 Self-rating and Peer-rating Across Dimension (Convergence) ANOVA Analysis

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Peer Review Time</th>
<th>Difference Mean</th>
<th>P-Value</th>
<th>Effect Size (Cohen’s d)</th>
<th>Difference Dispersion</th>
<th>P-Value</th>
<th>Effect Size (Cohen’s d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD = 0</td>
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<td>.0060</td>
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<tr>
<td>0 &lt; CD &lt; 22</td>
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<td>-.5994</td>
<td>&lt;.0001</td>
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<td>&lt;.0001</td>
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<td>.5693</td>
<td>.0343</td>
<td>-.01860</td>
<td>.7802</td>
<td>.0451</td>
</tr>
</tbody>
</table>
In Table 3, we observe that the patterns of convergence in self versus peer ratings is similar across all three Hofstede Individualism Index (IDV) cultural groups. All three cultural groups converge in self and peer ratings for the second peer rating and stay converged for the third peer rating.

![Figure 1 Across CATME Dimension Social Relation Model (SRM) Analysis](image)

In Figure 1 we see that for an Across CATME Dimensions analysis there are few consistent changes in SRM variance types. The low cultural distance teams (0 < CD < 22) see an increase in rater variance giving the same CATME dimensions rating to teammates and a decrease in target variance less differentiating an individual’s behavior across CATME dimensions. No cultural distance teams (CD = 0) show no consistent patterns or significant variance changes. High cultural distance teams (CD > 22) show only a significant increase in relationship variance in the second peer rating and which is sustained in the third peer rating.
In dimension C (Contributing), low cultural distance teams (0 < CD < 22) see a significant increase in rater variance and decrease in target variance. High cultural distance teams also see a significant decrease in target variance. There is little change in variances in the no cultural distance group.

In dimension I (Interacting), target variance for all cultural distance groups show significant decreases over the three peer ratings. Relationship variance also increases across all three cultural distance groups across the three peer ratings.
Figure 4 SRM Analysis for Individual Dimension (K)

In dimension K (Keeping the team on track), rater variance decreases significantly for the no cultural and low cultural distance groups but not for the high cultural distance group. Target variance across the three peer ratings also increases significantly for the low cultural distance group with relationship variance showing significant decreases.

Figure 5 SRM Analysis for Individual Dimension (E)

In the SRM dimension E (Expecting quality) analysis, no cultural distance groups show no significant change. However, both of the other cultural distance groups show significant changes in rater variance; rater variance is up in the low cultural distance group and down in the high
cultural distance group. Target variance changes are the opposite pattern for these two groups. The low cultural distance group also shows significant relationship variance decreases.

In Dimension H (having required skills or knowledge), Target variance shows significant decreases in low and high cultural distance groups peer rating one compared to peer rating three. The no cultural distance groups also show no significant variance change between peer rating one and peer rating three.

**Summary of Findings**

In the Dispersion and Convergence analyses there are no significant differences in the patterns of peer rating changes across the three cultural distance groups.

In the Across CATME Dimensions SRM Analysis the no cultural distance teams (CD = 0) show no significant patterns or significant variance changes. The low cultural distance teams (0 < CD < 22) showed a significant increase in rater variance and a decrease in target variance. High cultural distance teams (CD > 22) show only a significant increase in relationship variance in the second peer rating and which is sustained in the third peer rating.

For individual dimension C (Contributing), the no cultural distance groups and high culture distance groups show relatively stable variances across peer reviews for each type of variance effect. For the low culture distance group rater variance significantly increases and target variance significantly decreases.

For individual dimension I (Interacting), target variance decreases significantly across all three cultural distance groups and relationship variances increases significantly across all three cultural distance groups.

**Figure 6 SRM Analysis for Individual Dimension (H)**

In Dimension H (having required skills or knowledge), Target variance shows significant decreases in low and high cultural distance groups peer rating one compared to peer rating three. The no cultural distance groups also show no significant variance change between peer rating one and peer rating three.
For individual dimension K (Keeping the team on track) target variances increase significantly for low and high cultural distance groups across peer evaluations and do not increase for the no cultural distance groups.

For individual dimension E (Expecting Quality), and the no cultural distance group, there are no significant changes in any SRM variance. For the low cultural difference group, there are significant increases in rater variance and decreases in relationship variance across the three peer ratings. For the high cultural distance groups there are decreases in rater variance and increases in target and relationship variances.

For individual dimension H (Having knowledge or skills), the high cultural distance groups show significant variance increases in rater variance and decreases in target variance between peer rating one and peer rating three.

Conclusions and next steps

Examining changes on average across all CATME dimensions or by the individual dimensions for the no cultural distance groups did not identify significant differences in the peer rating behavior across the multiple peer ratings rather by examining dispersion or convergence of ratings or through the use of the SRM model’s analysis of variances.

However, when looking at the low or high cultural distance groups defined based on Hofstede’s Individualism versus Collectivism dimension, we find significant differences in SRM variances for the across all dimensions analysis or in the individual dimensions analysis in terms of dimension C(Contributing), I(Interacting) and E(expecting quality). We conclude that the peer rating behavior of low cultural distance groups or the high cultural distance groups is somewhat unique compared to the no cultural distance groups.

Our next steps are to repeat this analysis with much larger samples, isolating specific cultural samples for China, India and Korea, and adding qualitative analysis of peer ratings to understand better the underlying cultural influences that are affecting peer ratings and ultimately teamwork behavior.

Limitations

This paper is an analysis about how cultural differences influence peer rating behavior in an academic environment. We used data only from an introductory engineering course. The size of our data sample is not large. For example, we only have 16 low culture distance teams, which might not fully represent this group type. Secondly, we gathered students’ nationality information based on a college-entrance voluntary survey and it may be incomplete.
Reference


