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### I know i can, but can we? Culture and efficacy beliefs in global virtual teams

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I Know I Can, But Can We?  
Culture and Efficacy Beliefs in Global Virtual Teams

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Abstract

Given the growing use of *global* virtual teams, one important factor to consider when examining team performance is the cultural backgrounds of the dispersed team members. This research explores the relationship between efficacy beliefs and the cultural dimensions of individualism and collectivism in global virtual teams. Two hundred and forty-three team members from universities in the United States and Hong Kong were administered three survey questionnaires during a series of virtual team projects. Results revealed that regardless of cultural background, team members reported less confidence in their ability to work in virtual team environments than traditional face-to-face environments, and that team members from individualistic cultures reported higher *self*-efficacy beliefs (both group self-efficacy and virtual team self-efficacy) than team members from collectivist cultures. Further, when the reference for efficacy beliefs changed from the individual to the group, the magnitude of change was greater for the collectivist versus individualistic team members. Finally, results revealed that domain-specific efficacy was more predictive of global virtual team outcomes than more general efficacy beliefs, supporting our final research question. Implications and future research are also discussed.

Today's organizations continue to use virtual teams to accomplish work objectives (Jarvenpaa, Shaw, & Staples, 2004; Majchrzak, Malhotra, Stamps, & Lipnack, 2004; Massey, Montoya-Weiss, & Hung, 2003). This trend is predicted to continue (Lipnack & Stamps, 2000) for many reasons, including reduced travel costs, improved synergies by utilizing the best talent regardless of location (Cairncross, 2001), and continued improvements in the technology used to support such distributed work (Boudreau, Loch, Robey, & Straub, 1998; Staples, Hlland, & Higgins, 1999).

One advantage of virtual teams is their ability to bring multiple perspectives to bear on a problem. While this may be true for collocated teams as well, it is particularly notable in global virtual teams — technology-mediated distributed teams with members from different countries — where the additional factor of cultural diversity has the potential to improve performance outcomes (Maznevski & Chudoba, 2000). Consequently, the societal cultural makeup (cf. Hofstede, 2003) of such global virtual teams may have important implications for organizations. Unfortunately, such culturally diverse teams have not always lived up to their expected performance potential (Maznevski & Chudoba, 2000), and therefore a more detailed understanding of how cultural diversity influences the performance of virtual teams is needed.

One factor that may help researchers more precisely understand how cultural diversity may be related to virtual team performance is collective efficacy. Both self-efficacy (Staples et al., 1999) and collective efficacy (Fuller, Hardin, & Davison, 2007; Hardin, Fuller, & Valacich, 2006) have been shown to influence virtual team performance. Given the establishment of self-efficacy and collective efficacy as important predictors of virtual team performance, combined with the growing use of culturally diverse virtual teams, it is important to extend this investigation by considering how underlying cultural factors such as individualism and collectivism may be related to efficacy beliefs in global virtual teams.

While previous studies have investigated the relationship between individualism versus collectivism and efficacy beliefs on outcomes such as performance (Earley, 1993) and job turnover (Schaubroeck, Lam, & Xie, 2000), these relationships have generally been studied using individuals working within a larger organization or in collocated team work. In addition, when studying the impact of individualism and collectivism on efficacy beliefs in teams, previous research has left unanswered how cultural orientation may be related to efficacy beliefs in teams consisting of members from both individualist and collectivist cultures. Thus, we extend prior research by providing an exploratory investigation into the relationship of efficacy beliefs and the cultural dimensions of collectivism and individualism in culturally diverse global virtual teams. Specifically, we ask: Are the cultural dimensions of individualism and collectivism related to efficacy beliefs in culturally *heterogeneous* global virtual teams?

Past research has also examined the form of collective efficacy most predictive of team performance. This prior research has shown that while measures such as group potency (Guzzo, Yost, Campbell, & Shea, 1993) may offer limited predictive power in terms of team performance, more specific measures of collective efficacy have greater predictive powers in such settings (Gibson, Randel, & Earley, 2000; Gully, Incalcaterra, Joshi, & Beaubien, 2002). This research extends this investigation by asking: What measure of efficacy beliefs is most predictive of outcomes in culturally heterogeneous global virtual teams?

This paper is organized as follows. First we present an overview of efficacy beliefs in groups. Next, we discuss how collective efficacy differs in the context of virtual teams. We then briefly explain the concept of national culture and the individualism–collectivism dimension as

suggested by Hofstede (1980). Following, we examine the relationship between individualism and collectivism, and efficacy beliefs. Finally, we evaluate the relative predictive power of a general measure of group potency and a domain-specific measure of collective efficacy. We conclude with a discussion of the results and their implications, the limitations of this study, and future research opportunities.

#### Understanding Efficacy Beliefs in Groups

*Collective efficacy* and *group potency* are two terms often encountered in research involving the efficacy beliefs of groups. While the terms are sometimes used interchangeably, there are important differences in their definitions and thus we clarify them here. *Collective efficacy* is defined as a “belief in the interactive and coordinative abilities of the members of a team or group, where such abilities are suggested to result in the emergent properties of the group which are beyond the capabilities of the individual members” (Bandura, 1997). The separate but somewhat related concept of *group potency* is defined as “a group’s collective belief that it can be effective” (Guzzo et al., 1993).

The terms *collective efficacy* and *group potency* are generally differentiated based on their generality (Gully et al., 2002). While group potency is a measure of a group’s belief in its abilities across multiple situations and contexts, collective efficacy refers to the efficacy beliefs of collectives in general (Bandura, 1997). Thus, collective efficacy as defined by Bandura (1997) does not provide an operational definition that is psychometrically suitable for the development of measurement items. Rather, the application of collective efficacy requires the definition and subsequent development of specific measurement items that can be used for predicting the outcomes of specific types of collectives (e.g., sports teams and organizational groups) (Bandura, 1997; Fuller et al., 2007; Gully et al., 2002; Hardin et al., 2006).

Once the operational definition of a specific collective efficacy construct has been established, and an associated measure has been developed and validated, researchers must next consider the method used to administer the measure. When choosing an appropriate methodology for measuring collective efficacy, a number of factors must be considered (Jung & Sosik, 2003). The first factor is the *level of the outcome of interest* that the researcher is interested in studying (Parker, 1994; Zellars, Hochwarter, Perrewe, Miles, & Kiewitz, 2001). Aggregated methods are recommended when the outcome is focused on group-level outcomes such as objective group performance or aggregated perceptual group outcomes (Baker, 2001; Bandura, 1997). In contrast, nonaggregated methods are recommended when the outcomes of interest are individual-level outcomes, for example, perceptions of group outcomes or satisfaction with the group (Baker, 2001; Bandura, 1997; Zellars et al., 2001)

The second factor to consider when choosing a method to measure collective efficacy is the *nature of the task* (Bandura, 1997). For example, group tasks can be independent (where group performance is largely the sum of the outcomes produced individually) or interdependent (where group performance requires coordinated effort). Aggregating team members’ *self*-efficacy assessments is recommended for tasks requiring the *independent* efforts of team members, while aggregating team members’ *collective* efficacy assessments is recommended for tasks requiring the *interdependent* efforts of team members (Baker, 2001; Bandura, 1997; Earley, 1993; Whiteoak, Chalip, & Hort, 2004).

The third issue to consider when choosing a method for measuring efficacy beliefs is the context being studied (Bandura, 1997; Marakas, Yi, & Johnson, 1998), in essence, how

specifically the efficacy beliefs match the domain of interest (i.e., *domain specificity*). Measures that have higher domain specificity (i.e., more closely match the context) have been shown to be the best predictor of performance (Bandura, 1997; Hardin et al., 2006; Johnson & Marakas, 2000). For example, general measures of computer self-efficacy are predictive of general computer performance (Compeau & Higgins, 1995), while application-specific computer self-efficacy measures are more predictive of application-specific computer performance (Johnson & Marakas, 2000).

A measure's frame of reference (i.e., whether the measure refers to the efficacy of the individual or the group) is also an important consideration in selecting the most appropriate measurement method. When measuring efficacy beliefs in the context of group work (dependent upon the factors discussed above), questions might focus on a group member's confidence in his/her own ability to perform or on his/her confidence in the ability of the group. Regardless of whether questions reference the group or the individual, responses may be used in nonaggregated or aggregated form depending on the research question and/or the outcome of interest (Zellars et al., 2001).

In the current study our *level of the outcome of interest* is the individual-level perceptions of group outcomes measured in terms of outcome quality, outcome satisfaction, and team satisfaction. The *nature of the task* is interdependent. Both the level of the outcome of interest and the nature of the task are held constant in the current study. In contrast, we examine how measures that change *domain specificity* (e.g., contrasting efficacy beliefs related to general group work with efficacy beliefs related to virtual group work) and *frame of reference* (i.e., whether the items refer to the abilities of the individual or the group) operate in the context of global virtual teams. The distinctions between measurement methods, as well as the construct definitions employed in the current study, are illustrated in Table 1.

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### National Culture

One of the most influential theorists on national culture is Geert Hofstede. If culture is "a collective programming of the mind which distinguishes one category or people from another" (Hofstede, 1980), it is entirely reasonable that cultural distinctions at the national level may exert a significant influence on a variety of activities, including the way virtual team members interact. In his seminal study of about 116,000 IBM employees in more than 60 countries, Hofstede found that national culture explained about half of the differences in work-related values. This was far greater than the proportions explained by professional role, age, or gender. Despite the assorted criticisms of Hofstede's study (see (House, Wright, & Aditya, 1997) for an incisive review), it is generally agreed that culture at the national level plays a major role in determining work-related values and attitudes, as well as the behaviors and practices that prevail in a particular business context. In his original analysis, Hofstede identified four cultural dimensions: power distance, individualism–collectivism, masculinity–femininity, and uncertainty avoidance. In later analyses, and working with Michael Bond (Bond, 1987; Hofstede & Bond, 1988), a fifth dimension, known variously as Confucian Work Dynamism and Long-Term Orientation, was identified.

While some clustering of national cultures on these five dimensions has been reported, it is generally accepted that they represent separate theoretical constructs (El-Shinnawy & Vince, 1997). Given the complexity and number of the dimensions, it is rare for a single study to attempt to measure more than one or two at the same time; to do otherwise would result in an unwieldy set of analyses and results (Gibson, 1999). In the current study, we focus on the individualism–collectivism (IND) dimension as it has been used previously to compare subjects from the United States and Hong Kong in studies of culture and efficacy beliefs (Schaubroeck et al., 2000). This dimension has been suggested as being particularly suitable for understanding social differences across cultures (Triandis, 1989).

The IND dimension of culture reflects the degree to which a society values independence versus group membership. Individualistic societies highly value personal goals, initiative, autonomy, and privacy. Managers are encouraged to make decisions without much reliance on group support and tend to give priority to personal rather than collective goals. In addition, individualists have been found to be less cooperative than collectivists in group settings (C. Chen, Chen, & Meindl, 1998).

In contrast, collectivist societies emphasize the importance of group goals and objectives over individual preferences (Triandis, 1989). Collectivist societies also try to forge a consensus by covering up differences, whereas individualistic societies encourage debate and resolve disputes through persuasion. In collectivist cultures, loyalty to the group is important, whereas loyalty to one's individual principles is more important in individualistic cultures. Dissent in collectivist cultures is thus frowned upon and usually avoided or discouraged, but group responsibility and decision making is supported. Commitment to group norms and an extensive involvement in group activities are also highly valued in collectivist cultures. In contrast to most Anglo-Americans, the Chinese tend to be socialized through experiences that shape a collective rather than an individual identity. As a result, they place a comparatively higher value on social harmony and unity and a lower value on individuality (Bandura, 1997; Gibson et al., 2000)

#### The effect of “virtuality” on efficacy beliefs

Global virtual teams face challenges beyond those faced by traditional teams. For example, communication technology must be used to link members across time and organizational boundaries, and the use of such technology comes with its own advantages and disadvantages (Kayworth & Leidner, 2002). While most general definitions of virtual teams include mention of communication technology, other definitions have more specifically described virtual teams in terms of their physical distance, level of technology support, and amount of time spent apart while working on a task (Griffith, Mannix, & Neale, 2003). Thus, virtual teams may contain both co-located and virtual members, and therefore “virtuality” (Northcraft, Griffith, & Fuller, 2005) is a continuum rather than a dichotomy.

In this research we compare team members' group self-efficacy to their virtual team self-efficacy, a more domain-specific form of efficacy belief related to the special context of technology-mediated distributed teams. As Griffith et al. (2003) note, a continuum of technologies can be used to support distributed work, which vary by the level of support they provide for communication, information sharing, and documentation. At the simpler end of the scale, groups may use technologies such as e-mail or conference calls to support their group work. At the other end of the scale, more complex technologies, such as shared file servers (e.g., free ones such as Yahoo Groups), sophisticated groupware, or video conferencing may be used.

Regardless of the technology used, the fact remains that these groups need to coordinate their activities without having the benefit of face-to-face interactions. Because of the additional complexity of using these more sophisticated technology-mediated communication and information-sharing tools, we suggest that efficacy beliefs will differ between these two environments, with team members (regardless of culture) having greater confidence in their ability to work in traditional groups than in their ability to work in virtual environments. Specifically, we ask:

**R1:** Do group self-efficacy (GSE) and virtual team self-efficacy (VTSE) beliefs differ in culturally diverse global virtual teams?

### Understanding efficacy in global virtual teams

While the use of communication technology to overcome geographic dispersion presents one significant challenge for working in global virtual teams, working across diverse cultures presents yet another. Although the positive aspects of cultural diversity in virtual teams have been recognized, the frequent failure of such teams to reach their potential has also been noted (Maznevski & Chudoba, 2000).

Previous investigations of the relationship of the underlying factors associated with the cultural dimensions of individualism, collectivism, and efficacy beliefs have noted that the cognitive evaluation of an individual's life is influenced by his/her salient values (Hampton & Marshall, 2000). Providing a specific example of the relationship between collectivism and individualism and efficacy beliefs, Earley (1993) found a positive relationship between collective efficacy and in-group conditions for those from collectivist cultures, and a positive relationship between self-efficacy and individual performance conditions for those from individualistic cultures. Similarly, Schaubroeck et al. (2000) found that while the three-way interaction of demands, control, and efficacy beliefs on health and coping did not differ across cultural contexts, the nature of the operative efficacy construct (self-efficacy or collective efficacy) did. For example, members from collectivist countries were more likely to rely on the cognitions associated with collective efficacy than self-efficacy when considering their ability to cope with job demands.

Consistent with the discussion above, we propose that those from individualistic cultures, where individual initiative is encouraged and people are more self-oriented (McCoy, Galletta, & King, 2005), may rate their self-efficacy higher than those from collectivist cultures. Correspondingly, members from collectivist cultures, where the group is seen as the main source of identity and where standing out from the crowd is discouraged (McCoy et al., 2005), may rate their self-efficacy lower than those from individualistic cultures. Thus we ask:

**R2a:** Do team members from individualist cultures report higher values of group self-efficacy than team members from collectivist cultures?

**R2b:** Do team members from individualist cultures report higher values of virtual team self-efficacy than team members from collectivist cultures?

As Table 1 describes, measures of computer-related efficacy (computer self-efficacy and computer collective efficacy) and virtual team-related efficacy (virtual team self-efficacy and virtual team efficacy) may differ in their frame of reference (belief in the individual or belief in the group), dependent upon the research question and outcomes being addressed. In the case of individual-focused measures, efficacy beliefs are assessed in relationship to the individual's belief in his/her own ability to perform computer tasks (CSE), work in groups (GSE), or work in



virtual teams (VTSE). In group-focused measures, efficacy beliefs are assessed in relationship to the individual's belief in his/her group's ability to perform computer tasks (CCE), work in groups (GP), or work in virtual teams (VTE).

This difference in frame of reference is important when we consider efficacy beliefs in the context of culturally diverse virtual teams. For team members from collectivist cultures, given their proclivity to rely on collective cognitions for coping with job demands as discussed above, we might expect assessments of efficacy beliefs to be strengthened significantly as these team members change their frame of reference from the individual (CSE and VTSE) to the group (CCE and VTE)<sup>1</sup>. For team members from individualistic cultures on the other hand, we may expect to see little change, if any, given their tendency to focus on the individual and their predilection to weight heavily their own efficacy beliefs when evaluating the collective efficacy of the group (Bandura, 1997). Thus we ask:

**R3a:** When the computer efficacy reference changes from the individual to the group, will there be a difference in the magnitude of that change for team members from collectivist versus individualist cultures?

**R3b:** When the virtual team efficacy reference changes from the individual to the group, will there be a difference in the magnitude of that change for team members from collectivist versus individualist cultures?

#### Determining the best predictor of group outcomes

Efficacy beliefs are typically represented by domain-specific constructs. This implies that the efficacy beliefs most closely aligned with the context being studied will be the most predictive of outcomes, and that (correspondingly) more general forms of efficacy beliefs are often predictive of more domain-specific forms. Discussing the latter point first, within the educational environment, more general self-efficacy beliefs related to students' overall ability to learn were shown to be predictive of more specific self-efficacy beliefs regarding academic achievement (Zimmerman, Bandura, & Martinez-Pons, 1992). Similarly, general self-efficacy beliefs were found to be predictive of more specific exam self-efficacy beliefs (G. Chen, Gully, Whiteman, & Kilcullen, 2000). Within the context of technology-related efficacy beliefs, general computer self-efficacy has been shown to be predictive of more application-specific computer efficacy (Agarwal, Sambamurthy, & Stair, 2000). Finally, both group potency and computer collective efficacy have been found to be predictive of a domain-specific measure of virtual team efficacy at the group level of analysis (Fuller et al., 2007).

The link between collective efficacy and performance has consistently been reported in the literature. As an example, the predictive influence of collective efficacy on group time to completion, group agreement, perceived effectiveness of the group's solution, group satisfaction, outcome quality, and team satisfaction have all been explored (Gibson et al., 2000; Hardin et al., 2006; Jung & Sosik, 2003). Given the relationship between more general and specific forms of efficacy beliefs, as well as the known relationship between efficacy beliefs and group outcomes, we might expect to find that VTE will mediate the relationship of group potency and group outcomes measured in terms of outcome satisfaction, outcome quality, and team satisfaction. Thus:

**R4:** Do virtual team efficacy beliefs mediate the relationship of group potency on group outcomes in culturally diverse global virtual teams?

## Methodology

The data for this study was collected during a series of virtual team projects conducted between universities in Hong Kong and the United States using a multiwave field survey methodology. Using such a methodology has certain advantages, including the ability to measure the efficacy beliefs of culturally diverse team members in as natural an environment as possible.

While projects were varied across the different semesters and courses, tasks were similar in that they required teams to solve business problems consistent with the “choose” quadrant of the McGrath (1984) circumplex. For the current study, tasks were focused on the groups reaching agreement over a preferred answer or alternative, and thus are consistent with decision-making tasks within the “choose” quadrant (McGrath, 1984). Problems to be solved included the development of a project plan based on project management principles, although in some cases the problem also required the development of a web site. Performance on all projects had a significant impact on students’ grades.

The projects were facilitated using two well-known web-based learning environments (i.e., Blackboard and WebCT). Instructions for project deliverables were made available using the web-based learning tool, and each team was provided with a private group discussion area, serving as a central hub for asynchronous communication and the transfer of documents. Discussion areas for communicating with the instructors were also provided. Project deliverables were marked and distributed to the respective teams in the same web-based learning environments.

In all, 243 student (US  $n=119$ , HK  $n=124$ ) responses were analyzed. Gender was approximately equal, with 46% of the participants female and 54% male. The average age was 27. In terms of prior experience, the average number of years using computers was 9.39 and the average number of times participating in virtual team projects was 3.67.

Three electronic surveys were administered during the course of the projects. Survey 1, administered at the beginning of each project, was designed to measure group self-efficacy, computer self-efficacy, virtual team self-efficacy and student demographics. Survey 2, administered later in each project but prior to the submission of any group-related project deliverables, was designed to measure group potency, computer collective efficacy, and virtual team efficacy. Finally, Survey 3, administered at the end of each project but prior to teams’ receiving feedback on the group project deliverables, was designed to measure group outcomes measured in terms of outcome quality, outcome satisfaction, and team satisfaction.

## Measures

Computer self-efficacy (CSE) was measured using a previously validated measure (Murphy, Coover, & Owen, 1989). However, the Murphy et al. (1989) measure consisted of three independent levels and we chose to use only the items associated with level two, as they best reflected the construct of interest. The CSE scale was consistent with Bandura’s recommendations for measuring efficacy beliefs (Bandura, 1997, 2001). Specifically, respondents were first asked to indicate whether they believed they could complete a given task by selecting either yes or no. If they responded yes, they were then asked to indicate on a percentage scale of 10 to 100 how confident they were that they could complete the task. Cronbach’s alpha for the CSE measure was .89.

Computer collective efficacy (CCE) was measured using a previously validated measure (Fuller et al., 2007). A yes/no 10 to 100 percentage scale was also used for the CCE measure. Cronbach's alpha for the CCE measure was .82.

The group self-efficacy (GSE) measure was developed by the authors for the current study. Eight items were developed to reflect an individual's belief in her/his ability to work in groups. For example, item 1 was worded as *I believe I have the ability to work in groups*. A yes/no 10 to 100 percentage scale was used for the GSE measure. Cronbach's alpha was calculated as .98 for the new GSE measure.

Virtual team self-efficacy (VTSE) was measured by adapting a previously validated measure of virtual team efficacy (Fuller et al., 2007). The VTE items were reworded to reflect the individual level of analysis. For example, item 1 was reworded from *I believe my team has the ability to use communications software to collaborate with remote group members...* to *I believe I have the ability to use communications software to collaborate with remote group members*. A yes/no 10 to 100 percentage scale was used for the VTSE measure. Cronbach's alpha was calculated as .96.

Group potency was measured using a previously validated and often used group potency measure (Guzzo et al., 1993). A yes/no 10 to 100 percentage scale was used for the GP measure. Reliability was calculated as .86.

Virtual team efficacy was measured using a previously validated measure (Fuller et al., 2007; Hardin et al., 2006). A yes/no 10 to 100 percentage scale was used for the CCE measure. Cronbach's alpha was calculated as .92 for the VTE measure.

Finally, group outcomes were measured using a previously validated, composite measure of satisfaction with the group, satisfaction with the team deliverables, and perceptions of quality regarding the teams' deliverables (Fuller et al., 2007; Hardin et al., 2006). The scale used for the composite group outcomes measure was a 1 to 7 Likert-type scale anchored by strongly disagree–strongly agree. Cronbach's alpha for the group outcomes measure was found to be .95. Table 2 lists the respective items for each of the measures described above.

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## Results

The demographic variables measured in the current study were compared across the U.S. and Hong Kong teams. There were no significant differences in gender ( $p = .253$ ), age ( $p = .072$ ), computer experience ( $p = .539$ ), or virtual team experience ( $p = .424$ ) across cultures.

### Manipulation Check

There has been some criticism regarding the reliance on national culture as a manipulation in cultural studies (Straub, Loch, Evaristo, Karahanna, & Srite, 2002). Thus, we applied the Hofstede (1991) measure during the first of the group projects ( $n = 127$ ) to evaluate differences along the IND dimension. Results revealed that the U.S. students were higher on individualism (95.71) than were the Hong Kong students (68.85). While there has also been criticism regarding the interpretation of results from the Hofstede measure applied at the individual level (McCoy et al., 2005), the results from our application of the measure support the

differences in the IND dimensions as expected, and thus we are reasonably confident that differences along the IND dimension existed in our sample.

### Instrument development

The eight GSE items developed by the authors were subjected to a principal components analysis (PCA) using SPSS v.11. A single-factor solution was observed during the EFA, and therefore rotation was unnecessary.

Using maximum likelihood estimation (MLE) within AMOS v 4, the GSE measure was next evaluated in two confirmatory models. The first was a single-factor model used to assess convergent validity (Chatterjee, Grewal, & Sambamurthy, 2002). Results revealed that all eight GSE items developed by the authors loaded above .6, reflecting a single latent construct (Salisbury, Chin, Gopal, & Newstead, 2002). However, model fit was observed to be unacceptable. Upon examination of the modification indices, it was evident that several error terms were highly correlated. Eliminating the correlated error terms and associated items resulted in a more parsimonious measure (5 items) and acceptable model fit  $GFI = .97$ ,  $AGFI = .92$ ,  $NFI = .99$ ,  $CFI = .99$ , and  $RMSEA = .10$  (Byrne, 2001).

To establish the discriminant validity of the GSE measure, two chi-square differences tests were conducted (Salisbury et al., 2002). First the model was run with the covariance path between GSE and CSE free to vary. The resultant chi-square statistic was observed as 101.1. Next, a second model was run with the covariance path between GSE and CSE set to 1, which essentially specifies that the constructs are the same. The chi-square statistic from the new model was observed to be 163.7. Given a critical value of 3.84 ( $\alpha = 0.05$ ), and a chi-square difference of 62.6., the chi-squares statistics from the respective models are significantly different, indicating that GSE is discriminant from the CSE measure. This process was then repeated for the VTSE measure where a significant chi-square difference of 140.9 was observed. This result indicates that the GSE measure is also discriminant from the VTSE measure<sup>2</sup>.

### Evaluation of research questions

Research Questions 1 through 3b were evaluated using a series of paired sample and independent t-tests. Research Question 4 was evaluated using regression analyses.

#### Research Question 1

Research Question 1 asked: Do group self-efficacy (GSE) and virtual team self-efficacy (VTSE) beliefs differ in culturally diverse global virtual teams? Paired sample t-test results revealed that GSE ( $M = 83.30$ ,  $SD = 15.44$ ) was significantly greater than VTSE ( $M = 74.74$ ,  $SD = 18.49$ ,  $t(242) = 9.49$ ,  $p = .000$ ). These results appear to indicate that GSE beliefs in culturally diverse global virtual teams may be higher than VTSE beliefs. Table 3 depicts the results of the analyses for Research Question 1.

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### Research Question 2a

Research Question 2a asked: Do team members from highly individualist cultures report higher values of group self-efficacy than team members from highly collectivist cultures? Independent sample t-test results revealed that GSE-US ( $M = 89.10$ ,  $SD = 12.73$ ) was significantly greater than GSE-HK ( $M = 77.73$ ,  $SD = 15.80$ ,  $t(241) = 6.169$ ,  $p = .000$ ). These results suggest that individualistic team members may report higher GSE than team members from collectivist cultures

### Research Question 2b

Research Question 2b asked: Do team members from highly individualistic cultures report higher values of virtual team self-efficacy than team members from highly collectivist cultures? Independent sample t-test results revealed that VTSE-US ( $M = 81.39$ ,  $SD = 16.57$ ) was significantly greater than VTSE-HK ( $M = 68.37$ ,  $SD = 18.04$ ,  $t(241) = 5.85$ ,  $p = .000$ ). These results suggest that individualistic team members may indeed report higher VTSE beliefs than team members from collectivist cultures. Table 4 depicts the results of the analyses for Research Questions 2a and 2b.

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### Research Question 3a

Research Question 3a asked: When the computer efficacy reference changes from the individual to the group, will there be a difference in the magnitude of that change for team members from collectivist versus individualist cultures? Independent sample t-test results revealed that the change from CSE-HK to CCE-HK ( $M = 15.53$ ,  $SD = 19.13$ ) was significantly greater than the change from CSE-US to CCE-US ( $M = 3.25$ ,  $SD = 23.60$ ,  $t(241) = -6.80$ ,  $p = .000$ ). Based on these results there is some evidence that changes from computer self-efficacy to computer collective efficacy are greater for collectivist team members.

### Research Question 3b

Research Question 3b asked: When the virtual team efficacy reference changes from the individual to the group, will there be a difference in the magnitude of that change for team members from collectivist versus individualist cultures? Independent sample t-test results revealed that the change from VTSE-HK to VTE-HK ( $M = 6.59$ ,  $SD = 19.64$ ) was significantly greater than the change from VTSE-US to VTE-US ( $M = -2.86$ ,  $SD = 21.71$ ,  $t(241) = -2.90$ ,  $p = .004$ ). Based on these results, there is some evidence that changes from virtual team self-efficacy to virtual team collective efficacy are greater for the collectivist team members. Table 5 and 6 depict the results of the analyses for Research Questions 3a and 3b.

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 Insert Tables 5 and 6 Here  
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#### Research Question 4

Research Question 4 asked: Do virtual team efficacy beliefs mediate the relationship of group potency on group outcomes? To answer this question it was necessary to evaluate a series of regression equations (Baron & Kenny, 1986). First, GP was evaluated in terms of its ability to predict group outcome perceptions measured in terms of satisfaction with the group, satisfaction with the team deliverables, and perceptions of quality regarding the teams' deliverables. Results revealed that GP was predictive of group outcomes  $\underline{b} = .288$ ,  $\underline{t}(241) = 4.68$ ,  $\underline{p} = .000$ . Next, GP was evaluated for its ability to predict VTE. Results revealed that GP was predictive of VTE  $\underline{b} = .691$ ,  $\underline{t}(241) = 14.83$ ,  $\underline{p} = .000$ . Next, VTE was evaluated in terms of its ability to predict group outcome perceptions. Regression results revealed that VTE was predictive of group outcomes  $\underline{b} = .397$ ,  $\underline{t}(241) = 6.71$ ,  $\underline{p} = .000$ . Finally, VTE and GP were simultaneously evaluated in terms of their ability to predict group outcomes. Results revealed that while VTE remained predictive of group outcomes  $\underline{b} = .377$ ,  $\underline{t}(241) = 4.61$ ,  $\underline{p} = .000$ , GP  $\underline{b} = .028$ ,  $\underline{t}(241) = .339$ ,  $\underline{p} = .735$  GP did not. Thus results from the respective analyses suggest that VTE may mediate the effect of group potency on group outcomes. Table 7 depicts the results of the analyses for Research Question 4.

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#### Discussion

This study addressed two questions. Are the cultural dimensions of individualism and collectivism related to efficacy beliefs in culturally heterogeneous global virtual teams, and what measure of efficacy beliefs is most predictive of outcomes in such teams? More specifically, we examined research questions that explored the relationship of domain specificity and efficacy beliefs, the relationship of individualism and collectivism and self-efficacy beliefs (both group self-efficacy and virtual team self-efficacy), the relationship of individualism and collectivism and increases in efficacy beliefs as the frame of reference changes from the individual to the group, and finally the relative predictive ability of group potency and collective efficacy (in terms of the domain-specific measure of virtual team efficacy) in culturally heterogeneous teams.

Results associated with Research Question 1 suggested that team members, regardless of their culture backgrounds, reported higher GSE beliefs than VTSE beliefs. These results appear to indicate that team members perceive working in technology-mediated distributed environments as more difficult than working in traditional teams. Such a finding is important because it provides conceptual support for previous studies that have noted the greater predictability of domain-specific measures of efficacy beliefs. Specifically, analyses based upon data gathered using more general measures of group self-efficacy may overestimate team members' beliefs in their abilities to work in the more complex environment of global virtual teams, and therefore be less predictive of global virtual team outcomes than more domain-specific measures such as VTSE.

Regarding Research Questions 2a and 2b, independent t-tests suggested that team members from individualistic cultures reported significantly higher CSE and VTSE perceptions than did team members from collectivist cultures. Such results support prior research suggesting a difference in efficacy beliefs based upon the individualistic-collectivist continuum, and as a result, provide support for the findings of Earley (1993), Gibson (1999), and Schaubroeck et al.

(2000). Specifically, team members from cultures valuing individual accomplishments appear to have greater confidence in their *individual* abilities than those from collectivist cultures, where standing out from the crowd is discouraged. In addition, these results serve to inform collective efficacy researchers that even when tasks require the independent efforts of team members, and therefore the aggregation of self-efficacy beliefs is recommended (Bandura, 1997), caution should be exercised in culturally heterogeneous global virtual teams when using this method. In particular, due to the differences in the self-efficacy beliefs of culturally heterogeneous virtual team members, acceptable agreement levels may not be met, and therefore group level effects may be overlooked.

Further, Research Questions 3a and 3b, evaluated using independent sample t-tests, suggested that the change from CSE to CCE and from VTSE to VTE was significantly greater for the collectivist team members than for the individualist team members. Specifically, those members from collectivist cultures (where greater value is placed on group accomplishments than on individual accomplishments) saw a significant increase in their collective efficacy over self-efficacy beliefs. These results also provide evidence supporting the importance of selecting the appropriate method for measuring efficacy in virtual teams. Specifically, while the self-efficacy perceptions for the collectivist and individualist team members were significantly different for both the GSE and VTSE measures, for the three group level measures (i.e., CCE, GP, and VTE), only VTE was found to be significantly different across the cultures ( $t(241) = 2.44$   $p = .015$ ). Thus, calculations of within-group agreement are more likely to meet acceptable metrics when using measures of group-level efficacy beliefs rather than self-efficacy beliefs in culturally heterogeneous virtual teams.

Finally, regression analyses associated with Research Question 4 suggested that the context-specific collective efficacy measure of VTE was more predictive of group outcomes than was GP, and further, that the relationship of GP and group outcomes was mediated by VTE. Such a result provides additional support for the validity of the VTE measure used by Fuller et al. (2007) and Hardin et al. (2006), as the measure was shown to be predictive in the current study using nonaggregated group efficacy responses rather than group-level aggregated measures as was used in the Fuller et al. and Hardin et al. studies.

### Limitations and future research

This study has certain limitations. First and foremost, given the nature of the research methodology, causality cannot be established. Specifically, this research was conducted using a multiwave, survey-based field study and thus did not have in place a design suitable for experimental research. However, our intent was to study the relationship of the cultural dimensions of individualism and collectivism and the reported efficacy beliefs of global virtual team members in as natural an environment as possible. Therefore, a field study design was deemed to be most appropriate. Such a design has the added advantage of exploring the relationships without relying on the use of artificial controls normally associated with experiments. Nonetheless, future research should be designed to replicate our findings in experimental settings where possible.

This research relies on the cultural dimension of individualism and collectivism. As stated in the introduction, this is only one of the cultural dimensions proposed by Hofstede, and thus future research should investigate the relationship of efficacy beliefs and other cultural dimensions in the context of culturally heterogeneous global virtual teams. In addition, while the

Hofstede (1980) measure was applied in this study as a manipulation check—and the results of the measure’s application revealed that the team members differentiated on the IND dimension as suggested by Hofstede — the application of the Hofstede measure on a small group of individuals is generally discouraged. However, it is encouraging that the results from our analyses support the differences in efficacy beliefs along the dimensions of individualism and collectivism as previously reported by Schaubroeck et al. (2000) and Earley (1993). Nonetheless, future research should incorporate emerging measures of culture that are more suitable for measuring individual differences (McCoy et al., 2005).

Finally, the use of student teams may be seen as a limitation in terms of generalizing these results. However, this research utilized teams of students who were performing information systems project management activities who had a substantial stake in their virtual teams’ performance. Further, our intention was not to generalize our results to other settings but rather to provide results that may be later tested for their generalizability in other settings during the course of future research projects (Lee & Baskerville, 2003). Future research should be designed to evaluate our findings within the context of organizational settings.

### Conclusion

This research expands the discussion of efficacy beliefs in virtual teams by including the consideration of differences in the IND dimension among team members of culturally heterogeneous global virtual teams. Overall results suggest that differences in the IND dimension represent an important factor that may need to be accounted for in studies involving the efficacy beliefs of such teams. Based on these results, researchers and practitioners will be better informed as to the potential relationships between the underlying factors associated with the IND cultural dimension and the efficacy beliefs of culturally heterogeneous global virtual teams.

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Table 1  
Research Measures<sup>3</sup>

Measure	Definition	Sample Item	Frame of Reference	Domain Specificity
Computer Self-Efficacy (CSE)	Belief in an individual's ability to use computer technology	<i>I believe I have the ability to troubleshoot computer problems</i>	Self	Individual Computer Performance
Group Self-Efficacy (GSE)	Belief in an individual's ability to work in groups	<i>I believe I have the ability to work in groups</i>	Self	Individual Group Performance
Virtual Team Self-Efficacy (VTSE)	Belief in an individual's ability to use communication technology to coordinate his/her activities with others across time and space.	<i>I believe I have the ability to use communications software to collaborate with remote group members</i>	Self	Individual Virtual Team Performance
Computer Collective-Efficacy (CCE)	Belief in the team's ability to use computer technology	<i>I believe my team has the ability to troubleshoot computer problems</i>	Group	Group-Level Computer Performance
Group Potency (GP)	Belief in the group's general effectiveness	<i>My group has confidence in itself</i>	Group	Group-Level Group Performance
Virtual Team Efficacy (VTE)	Belief in a team's ability to use communication technology to coordinate their activities across time and space.	<i>I believe my team has the ability to use communications software to collaborate with remote group members</i>	Group	Group-Level Virtual Team Performance

Table 2  
Research measurement items

<b>Computer Self-Efficacy</b>	
CSE1	I believe I have the ability to understand terms/words relating to computer software.
CSE2	I believe I have the ability to troubleshoot computer problems
CSE3	I believe my group has the ability to explain why a program (software) will or will not run on a given computer
<b>Computer Collective Efficacy</b>	
CCE1	I believe my group has the ability to understand terms/words relating to computer software.
CCE2	I believe my group has the ability to troubleshoot computer problems
CCE3	I believe my group has the ability to explain why a program (software) will or will not run on a given computer
<b>Group Self-Efficacy</b>	
GSE1	I believe I have the ability to work in groups
GSE2	I believe I have the ability to work with others
GSE3	I believe I have the ability to do group work
GSE4	I believe I have the ability to work collaboratively with others
GSE5	I believe I have the ability to perform in groups
<b>Group Potency</b>	
GP1	My group has confidence in itself.
GP2	My group believes it can become unusually good at producing high quality work
GP3	My group expects to be known as a high performing team
GP4	My group feels it can solve any problems it encounters
GP5	My group believes it can be very productive
GP6	My group can get a lot done when it works hard
GP7	No task is too tough for my group
GP8	My group expects to have a lot of influence around here
<b>Virtual Team Self-Efficacy</b>	
VTSE1	I believe I have the ability to use communications software to collaborate with remote group members.
VTSE2	I believe I have the ability to do teamwork in a distributed environment if I have access to appropriate technology.
VTSE3	I believe I have the ability to share information using technology with remote group members.
VTSE4	I believe I have the ability to use communication technology to do work with people who can't physically get together to meet.

Table 2  
Research measurement items cont'd

<b>Virtual Team Efficacy</b>	
VTE1	I believe my group has the ability to use communications software to collaborate with remote group members.
VTE4	I believe my group has the ability to do teamwork in a distributed environment if we have access to appropriate technology.
VTE5	I believe my group has the ability to share information using technology with remote group members.
VTE8	I believe my group has the ability to use communication technology to do work with people who can't physically get together to meet.
<b>Group Outcome Perceptions</b>	
Outsat1	I am satisfied with the project outcome produced by my team
Outsat2	I am pleased with the quality of work we did in my team
Outsat3	I am satisfied with the final project deliverable submitted by my team
Grpsat1	I was satisfied with my group members
Grpsat2	I was pleased with the way my teammates and I worked together
Grpsat3	I was very satisfied working with this team
Outqual1	The work produced by my team was high quality
Outqual2	The project outcome produced by my team was excellent
Outqual3	The deliverables of my team were outstanding

Table 3  
Research Question 1 results

<b>Efficacy Belief</b>	<b>Mean*</b>
GSE	83.30
VTSE	74.74

\*  $t(242) = 9.49, p = .000$

Table 4

Research Questions 2a and 2b results

<b>Efficacy Belief</b>	<b>Mean*</b>	<b>Efficacy Belief</b>	<b>Mean**</b>
GSE-US	89.10	VTSE-US	81.39
GSE-UK	77.73	VTSE-UK	68.37

\*  $t(241) = 6.17, p = .000$

\*\*  $t(241) = 5.85, p = .000$

Table 5

Research Question 3a results

<b>Change in efficacy belief</b>	<b>Mean*</b>
CSE-HK to CCE-HK	15.53
CSE-US to CCE-US	3.25

\*  $t(241) = -6.80, p = .000$

Table 6

Research Question 3b results

<b>Change in efficacy belief</b>	<b>Mean*</b>
VTSE-HK to VTE-HK	6.59
VTSE-US to VTE-US	-2.86

\*  $t(241) = -2.90, p = .004$

Table 7

Research Question 4 results

<b>Path</b>	<b><u>b</u></b>	<b>t-value</b>
GP to Group Outcomes	.288	4.68*
GP-VTE	.691	14.83*
VTE to Group Outcomes	.397	6.71*
GP to Group Outcomes (with VTE as mediator)	.028	.339
VTE to Group Outcomes (when acting as mediator)	.377	4.61*

\* Significant at the  $p < .001$  level

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<sup>1</sup> Note that for the purposes of these research questions we do not compare GSE with GP, but rather limit our comparisons to CSE and CCE, and VTSE and VTE. While items measuring CSE and CCE, and VTSE and VTE were similar in phrasing, there is a significant difference in phrasing between GSE and GP (see Table 1). We used GP in testing the earlier question because it is an established measure of group-focused efficacy, but for the purpose of comparing individual-focused and group-focused efficacy measures, the differences in phrasing were problematic

<sup>2</sup> GSE was evaluated during the chi-square differences tests using the CSE and VTSE measures. The decision to use the CSE and VTSE measures during the chi-square differences tests was made because all three constructs are measuring different forms of self-efficacy (rather than collective efficacy) and any problems with the discriminant validity of the GSE measure would likely be in terms of constructs measuring similar cognitive processes

<sup>3</sup> When differentiating between the same forms of efficacy measured across different cultures (US and HK), we use the notation (for example) CSE-US and CSE-HK