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### Establishing Effective Global Virtual Student Teams

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## Teaching Case

### Establishing Effective Global Virtual Student Teams

—ROBERT M. DAVISON, NIKI PANTELI, ANDREW M. HARDIN, AND MARK A. FULLER

**Abstract—Research problem:** *In the educational arena, virtual teams made up of students who are located in more than one country are becoming increasingly commonplace. However, studies of the technological, social, and organizational factors that contribute to the success of these global virtual student teams (GVSTs) have yet to be systematically identified and discussed. In this article, we seek to address this gap in our knowledge, drawing on several years of experience with GVSTs and addressing the following research question: How can university instructors establish effective GVST projects?* **Situating the case:** *The cases that we explore in*

*this paper involve GVSTs with team members located variously in Hong Kong (all four cases), the USA (two cases), the UK (one case) and Singapore (one case). Students are a mix of undergraduate and graduate. **How the case was studied:** Our pedagogical purpose for running the GVST projects was to expose students to international communication and negotiation practices. The case designs involved situations where the student team members had to work collaboratively on a variety of tasks. We collected observational data and survey data, and also required the team members to submit individual reflective reports about their learning experiences. **About the case:** We examine cultural differences among teams. We also note how issues of time and space vary across these teams, and consider how sufficient trust may be developed between team members to ensure productive work. **Conclusions:** From the four cases, we elicit 10 pertinent operational factors that should be of value to educators planning GVST projects.*

***Index Terms*— Global Virtual Student Teams, International Communication & Collaboration, Cross-cultural Differences; Critical Success Factors**

The phenomenon of global virtual teams (GVTs) emerged in the early 1990s, following earlier work on computer supported cooperative work (CSCW) and group support systems (GSSs). While the organisational adoption of this phenomenon has formed much of the mainstream literature, growing attention has been paid to the potential value that GVTs could offer to the educational sector, that is, with respect to student learning. Such an application is not new, since GSS technology has already been applied to what was formerly termed technology-supported learning (TSL). It is not our intention to review this historical literature, though readers interested in these historical antecedents could usefully examine the work of Vogel et al. [1]. Our interest in the application of GVTs to the educational domain has developed over many years, with a

number of international projects organised between the authors of this paper, as well as with other colleagues [2]-[4].

The purpose of this article is to identify the technological, social, and organizational factors that contribute to the operational success of global virtual student teams (GVSTs). We are thus writing primarily for instructors, and our research question reflects this focus.

**RQ:** How can university instructors establish effective GVST projects?

We suggest that identifying these factors is of particular value to readers of the journal and educators more generally who may be considering whether to engage their students in GVST projects. In the following sections, we review the relevant literature on GVTs and GVSTs. We then describe our involvement in four GVST projects and explore the key themes that we have encountered in these projects, illustrated by student comments and insights. Finally, we identify what we consider to be the salient issues for organising successful GVSTs.

## **SITUATING THE CASE**

In this section we review the relevant literature in the domain of GVTs and GVSTs to situate the four GVST projects that make up this case. The literature that we review was identified by means of a rigorous search and selection process. We first searched for our key terms, “global virtual teams” and “global virtual student teams,” in scholarly databases such as ABI Inform, Google Scholar, and the IEEE Xplore. We selected those references that are both representative of the broader literature and that involve teams that cross cultural and country boundaries, given the nature of our own case context that involves teams located across the USA, UK, Hong Kong, and Singapore.

**Global Virtual Teams** Research on Virtual Teams (VT) emerged in the early 1990s, with several major contributions made since the late 1990s [5]-[11]. A substantial amount of literature has simultaneously been developed in the area of distributed work [12]-[14], with some noticeable overlap between the two. These two domains have developed out of earlier areas of work including GSS and CSCW [15]-[17], technology-supported virtual learning [1], and studies of the effectiveness of teams themselves [18].

With the development of the VT literature, there has been some confusion over the use of terms, which we clarify here. Lipnack and Stamps [19] defined a VT as a “group of people who interact through interdependent tasks guided by common purpose ... (and work) ... across space, time and organizational boundaries with links strengthened by webs of communication technologies.” However, while some other authors [7] refer to VTs as teams that never meet face-to-face, most authors accept that communication in a VT is primarily mediated through technology, with some face-to-face interaction [20].

Where GVTs are concerned, we note that membership frequently crosses national and cultural boundaries [10], [21]. The authoritative definition of a GVT comes from Maznevski and Chudoba [10] who suggest that

global virtual teams are groups that (a) are identified by their organization(s) and members as a team; (b) are responsible for making and/or implementing decisions important to the organization's global strategy; (c) use technology-supported communication substantially more than face-to-face communication; and (d) work and live in different countries. (p. 473)

**Global Virtual Student Teams** In addition to the studies undertaken in organisations, GVTs

have also received wide-spread attention in the educational context of student learning [22]. Many instructors engage their students in various forms of virtual learning experiences, some of which are restricted to within-country designs [23], [24], while others involve students from universities that are based in two or more nations [2], [3], [25]-[27]. It is important to recognise that GVSTs differ from their organisationally located counterparts in a number of ways, resulting in some potent criticism [28]. This criticism includes the lack of power differentials between participants: clearly students are not going to lose their jobs because they perform poorly or their team fails to deliver the goods! Furthermore, all students are generally of more or less equal status, although some may attempt to dominate others.

Nevertheless, GVSTs do experience many of the same difficulties as “real world” teams, notably in terms of language, time management, and culture, as well as in terms of coping with technology-mediated collaboration. In this respect, GVSTs are suitable exemplars of ad hoc teams that lack any prior experience of working together or otherwise engaging in technology-mediated interactions. Furthermore, GVSTs are often characterised by participants who do not share a common first language. English may be used as a common working language, but it is likely to be a first language for some and a second or third language for others. This difference is critical because first language users are not always tolerant of the inferior communication ability of non-first language users. The non-first language participants may in their turn revert to their mother tongues for private discussion, which they alone can understand, to the frustration of everyone else [25].

While language-related issues are undeniably important for GVSTs, cultural similarities and differences between group members may prove to be of greater salience to a team’s evolution and ongoing success. Cultural similarities and differences may include factors such as leadership,

risk tolerance, uncertainty, power distance, pre-planning of activities and assertiveness [29], [30]. It is likely that these differences will be less noticeable when the faultlines between team members are weak (i.e., when they share more cultural similarities) and more noticeable when the faultlines are strong, when the cultural differences are more obvious [30]. It is also important to point out that team members, even though from different national and professional cultures, can nevertheless establish a team culture for the duration of the project [31]. These emerging norms can constitute a powerful form of “glue,” promoting cohesiveness and a shared intention to achieve team goals.

Nonetheless, cultural sensitivities do come to the surface from time to time, particularly in situations of stress, such as when deadlines are looming or when some team members are not pulling their weight. It follows that cultural and linguistic differences deserve close attention if successful GVST interactions are to be achieved with the development of useful GVST skills. Despite these challenges, such interactions are valuable for student learning as evidenced by a recent GVST study [32], which found that cultural awareness among student participants increased as a result of being involved in such projects.

Further, time differences should also be considered, in particular time zones. When a GVST spans several time zones, it is almost inevitable that the day time of some members will be the night time of others. If the team members insist on synchronous meetings, then some will need to work at inconvenient times of day (or night). The alternative is to develop an asynchronous style of work, and use the technology as a collective team memory. Differences also exist with respect to roles and responsibilities, notably of team leaders’ tolerance and respect for personal idiosyncracies [33]. These kinds of issues may not surface in regular face-to-face, single culture, physical team contexts, but they are very often encountered in GVST contexts.



Virtual working is clearly not an activity that many students experience with any degree of frequency during the course of their regular studies. In consequence, and given the human preference for proximal communication [34], students may try to subvert the virtual process by finding ways to work synchronously and interactively, in a face-to-face mode where possible. This goal can be achieved if there are at least two collocated team members, with the formation of what is termed a “sub-group.” In these situations, the members of the subgroup often engage in private discussions about the task and then report back to the team as a whole. Conceptually, the construct of “subgroup strength” has been defined as “the degree of overlap across multiple demographic characteristics among a subset of team members” [35, p. 202]. A strong subgroup is one with considerable overlap in the demographic characteristics of the team members, especially with respect to physical proximity [3]. The organisational literature is divided on the usefulness of subgroups, some asserting that they strengthen teams with multiple sources of support [36], [37], others asserting that they increase conflict and lead to a deterioration in performance [24], [38] or diffuse responsibility and weaken cohesion [39].

The issue of trust between members of virtual teams is also an area of focus in GVT research [7], [8], particularly in the context of temporary, zero-history, artificial teams such as those made up of student members. Indeed, we found that many of the studies on trust and virtual teams have been based on students {e.g., [7], [21]). The findings from these studies have increased our understanding of the challenges involved in developing trust in teammates in virtual environments. Using student-based teams provides access to vital information on how team members communicate and collaborate virtually. With some exceptions [3], [40], [41], access to virtual team interactions taking place in organizationally-based teams is limited.

As humans, we often work best with people whom we trust, though the propensity to trust or

distrust is very likely a cultural construct. Considering the “Uncertainty Avoidance” (UAV) dimension of culture [3], individuals from lower UAV cultures (e.g., Denmark, Hong Kong, the United Kingdom) may find it easier to trust unknown others than individuals from higher UAV cultures (e.g., Greece, Japan, France). However, this is necessarily a stereotypical view: the typical individual from one culture will act according to the norms of his/her culture, but each individual will nevertheless exhibit personal characteristics as well, which will be more or less similar to the norm.

Given the difficulties associated with establishing trust between people who cannot see one another, the concept of “swift trust” has also been identified and considered [7], [34]. Swift trust refers to a fairly shallow level of trust that is deliberately built up quickly between individuals as a basis for their cooperative working together. Swift trust is often premised on shared needs, goals, rewards and mutual dependence. To this extent, there are useful parallels between swift trust and social presence theory; that is, group interaction is to some extent determined by initial expectations of individual member involvement and performance [42], [43]. Swift trust is not as profound or supportive as “real” trust and may not be able to withstand major disagreements or conflicts, but it is sufficient for the purpose of initiating virtual work, particularly in the specific context of GVSTs.

## **HOW THE CASE WAS STUDIED**

In this section, we describe our research methods pertaining to the four GVST projects. Our purpose was to identify the technological, social, and organizational factors that contribute to the operational success of GVSTs. Our research question was to determine how university instructors can establish effective GVST projects. The first two projects involved students in

Hong Kong and the USA: e-Negotiations Across the Pacific I and II. These were followed by two projects involving Hong Kong and UK students, and Hong Kong and Norwegian students, the latter on an exchange programme in Singapore.

In all projects, we collected data through two channels. First, as instructors, we observed the interactions of the student team members as they communicated through Blackboard, a virtual learning environment and course management system that was purposefully set up to support team-based communication. Each team had its own private Blackboard (accessible only by team members and instructors) with all contributions automatically identified with the real name of the contributor. Blackboard's functions include communication and content management, file sharing, and synchronous and asynchronous discussions. The asynchronous discussion forum provides a threading option so that team members can organize messages in a structure of their choice. Secondly, we asked the students to submit both a joint group report and an individual reflection on their experience of being part of a GVST project.

To answer the research question, we analysed data thematically, individually reviewing the individual reports and our observational notes to identify themes that are salient to our research question. In all four projects, students attended a regular class in which the principles of virtual team work were introduced, including cross-cultural communication, distributed work (including the management of distributed writing and time), the importance of ice-breaking, the creation of trust, and team culture. The essential details of all four projects are summarised in Table I, and a more detailed description of each project's circumstances follows.

**e-Negotiations Across the Pacific I** This study involved two classes of students: an undergraduate class (n = 161) of e-Commerce majors in Hong Kong and an MBA class (n = 39)

in the USA, with a nine-hour time difference between them. Most of the 38 teams had 4 Hong Kong members, though a few had 3 or 5. Each of the teams was assigned one US member as a consultant (one team had two US students). The Hong Kong students self-selected their team members and they were assigned a US student. The task in this project was for each team to build a simulated e-business website, with the Hong Kong students handling the technical side of content creation and website development, and the US students acting as consultants to the project, advising on such issues as e-business selection, interface design, functionality and user friendliness. Students were essentially free to choose any topic they liked, with some legal restrictions. Thus, while e-businesses for the selling of Chinese embroidery, baby products, Coca-Cola collectibles/paraphernalia, interior design, and business logos were reasonable, e-businesses promoting the sale of blood or the transplanting of body organs began to push the edge of what was reasonable, while escort services and sex toys were considered unacceptable by the instructors (despite their likely commercial viability).

**e-Negotiations Across the Pacific II** This study was considerably more complex in its design and involved three classes of students ( $n = 127$ ), two in Hong Kong and one in the USA. The US students ( $n = 32$ ) were a mix of full time and part time MBA students, while the Hong Kong students included full time business undergraduates studying Fundamentals of e-Commerce ( $n = 63$ ), and part-time social science undergraduates ( $n = 35$ ) studying Introduction to Information Systems. A total of 32 teams were formed, each with one US MBA student, one Hong Kong social science student (three teams had two) and two Hong Kong business undergraduates (one team had one). The teams were randomly formed by instructors, except that the two Hong Kong students in each team were self-selected. All of the Hong Kong social science students were working full time in the property management sector in Hong Kong. The task was a multi-

faceted one, involving both cooperative and conflicting elements: planning, negotiating and creative problem solving. The final deliverable from the project was a website that would help US-located executives relocate to Hong Kong.

The task specified that the website should focus on providing information about residential property and services. The MBA students acted as consultants in this project, representing clients, and negotiating content and functionality of the web site. The social science students, as experts in the property market, negotiated with the consultants in terms of what was available, achievable, and realistic, and provided content to the business undergraduates who acted as the website developers and in turn had to negotiate what was functionally possible. All three groups of students thus had clear roles to play with the opportunity to negotiate, electronically, with each other.

**UK and Hong Kong Project** This project was a collaboration between two universities in the UK and in Hong Kong, with eight hours difference between them. In both universities, students were asked to work on a group project as part of their assessment. In total there were 47 students involved, 23 in the UK and 24 in Hong Kong. All the Hong Kong students were business postgraduates, while at the UK university there was a mix of business postgraduate and final year undergraduate students. In addition, while the dominant nationality of the UK students was British, each team had at least one student from a different nationality: Greek, Norwegian, Russian, French, Singaporean, Malaysian, and Venezuelan. There were eight teams and most consisted of six students, 3 from Hong Kong and 3 from the UK (2 undergraduates and 1 postgraduate). The teams had no prior working experience together and were not expected to work together again in the future.

All the teams were given the same task to complete, which involved a case study analysis on the use of a knowledge-based system within a global consultancy firm. The task mandated a cooperative effort on the part of all team members who were assessed as a group. Random grouping was adopted in the formation of the GVSTs, as our intention was to expose students to the challenges of working in diverse teams where there was limited familiarity with other team members.

**Hong Kong-Singapore/Norway Project** This GVST project involved 31 postgraduate students in Hong Kong and 21 undergraduate students from Norway who were participating in a one-semester exchange programme in Singapore. As in the other three projects, none of the team members in one country had any prior contact with their counterparts from the other country. Eight teams were formed with four HK students (one team had three) and two or three Norwegian students. The teams were formed randomly. The task required that the teams decide where in the Asia-Pacific region a global consulting firm should set up new branch offices and which functional areas the firm should focus its expertise on. All communication between the students was mediated by the web-based Blackboard software. In this team, although the students were physically non-collocated, they did share the same time zone, facilitating communication between the two sides.

#### **ABOUT THE CASE**

Our description of the case is designed to reveal the worlds inhabited by the student team members and their experiences as GVST members. We first provide a thematic description of the key findings of the four cases. These are not organised case by case but rather integrate common material across all four projects to reduce repetition and redundancy, and so simplify our later

discussion of the material.

**Overview** For all students in the four GVST projects, this was the first time that they had worked on a virtual project in collaboration with other students in different countries. In their individual reports, where they were asked to reflect on this team experience, they all acknowledged that despite the problems and difficulties experienced, they had gained a better understanding of the issues associated with virtual team success. Indeed, student feedback about the GVST experience has generally been very positive, and even though some students admitted that the extended technology-mediated teams created more challenges and at times conflicts than they had expected, they still enjoyed the exercise and gained a lot from it.

These feelings were also reflected in their course evaluations: some students described it as “the most practical and worthwhile course” they had undertaken during their studies. It is appropriate to observe that achieving this kind of positive commentary from students has much to do with providing students with the opportunity to have a stimulating and realistic learning experience. These positive outcomes reinforce earlier studies on the impact of the use of GVSTs on learning, attitude and overall performance [44]. However, providing this opportunity is not cost-free, as there is a very clear tension between the realism of the experience and the controls that instructors impose on the virtual process [45], which we discuss here and later.

**The Importance of Icebreaking** One of the key lessons learned, which was reflected in students’ individual reports, is that it is essential to dedicate sufficient effort at the start of a project to build team identity, trust, and cohesiveness. The process of ice-breaking—getting to know each other, understanding each other’s backgrounds, and engaging in a bit more social interaction—acted to lubricate the team culture and communication process. As a UK student

observed,

We used Blackboard to facilitate interaction between the team members before any issues were discussed. People would chat and talk about current events, home life, and their families. This was important as it meant that a certain amount of trust was built up between members of the group.

However, instructors need to consider if they should mandate the ice-breaking process (a form of control) or simply give the students free rein over their actions. Icebreaking styles varied widely. While most students limited themselves to simple and inoffensive descriptions of their hobbies, likes and dislikes, one American student revealed that she was divorced, in a relationship with another man, and a practicing lesbian. The rather more conservative Hong Kong students were duly shocked by these revelations. But do instructors need to control how students introduce themselves? In a free society, people do and say what they like, irrespective of cross-cultural norms. It seems unlikely that the American student intended to offend; she just didn't realise. It is also important that students understand they may encounter these types of revelations in the workplace. Nevertheless, this was not an easy process. One UK student remarked, "The challenge of working as a team, especially divided in two locations, was to build a sense of team. Virtuality made it extremely difficult to create synergy between all the team members. Indeed, progressively we faced the issue of having two groups within the team."

**Communication and Trust Issues** Some of the most significant problems that have emerged from our GVST experiences relate to communication and trust. While some students responded to email or Blackboard messages within minutes, others took hours, days, or weeks. In some teams, the consultants felt left out of the process, as the developers preferred to make their life



easier by ignoring the consultants, assuming what the requirements would be and designing accordingly. For instance, one US consultant wrote in his personal reflection, “My group seemed to think they did not need my assistance to complete the project. The communication between the group and myself was almost non-existent. I finally received the website address after their project was due.”

Communication problems typically involve a mix of technology and cultural issues: the technology is unfamiliar and seen as a poor substitute for face-to-face interaction; cultural issues involve different values about work, time, and in some cases, behaviour. The way students reacted to the technology to some extent reflected their individual efficacy [3], but also indicated their willingness to try new things. As a UK student remarked,

Throughout the project, I felt resentment toward the HK team members. They didn't put as much effort into the project as me and they seemed to be unable to understand the question. However, in hindsight, I would say that we did not communicate as much as we should have done. We did not develop personal relationships, so there was little trust between us.

In similar vein, a Hong Kong student wrote,

Another communication problem was the contact with our overseas consultant. We only received a response from him on the last day before our interim report was due. I realize that our consultant got angry while waiting so long for our response. I can now understand why the lecturer said trust building on the web is so important and so difficult to establish.

Occasionally, frustrations between team members boiled over. On one occasion, a Greek student in the UK complained that her Hong Kong counterparts were “behaving like wild animals,” reflecting her inability to get them to do what she wanted. On another occasion, a Norwegian student in Singapore verbally abused her HK team member: “What the \*\*\*\* are you talking about? ... I don’t care about the issue of face; that pisses me off.” This choice of words led to an entirely predictable reaction (not to mention considerable animosity between the two “sides” of the team), did nothing to promote cross-cultural sensitivity, and eventually required instructors in both Singapore and Hong Kong to intervene in order to calm the situation.

Though students nowadays, as digital natives, have had extensive exposure to digital technologies, they may not be familiar with the use of these technologies for professional and business-type interactions. Being required to learn to use a range of online technologies in a professional manner was certainly a painful process for some. Doing so with people from another culture whom they would never meet again and with whom they would never have a chance to build up any kind of traditional relationship complicated the situation further. The importance of relationships, particularly in Chinese societies, should not be underestimated. For many traditional Chinese, trust emerges very slowly from a continuous process of socialising and relationship building [46]. To develop trust in a matter of hours is utterly unnatural.

In our experience, one solution for the identified problems is to build up some level of swift trust, as already discussed. Socialisation is an effective way of achieving this, even in the relatively impoverished medium [28] of virtual communication. In the projects that we organised, students were asked to introduce themselves to their fellow members, but this process was not monitored. In retrospect, we suggest the importance of a formalised trust-development phase in GVSTs with an explicit requirement for a warm-up or ice-breaking activity (e.g., a short

description of their favourite food, the place where they live, pictures of family members, etc.) during the first two weeks of the project. In our experience, however, students generally need to be motivated (with grades) to so engage; otherwise, they may perceive that this is time wasted. This socialisation is also culturally determined to some extent. Shyer team members are likely to say very little about themselves other than name, type of work, and perhaps some hobbies; the more open students may reveal an alarming amount of information (marital status, sexual preference, consumption of drugs, etc.) that may in turn cause more cultural/social discomfort, especially if the information is seen as gratuitous or irrelevant to the context.

Team members, however, should also be cautioned against developing unconditional trust. In the Hong Kong-UK project, one Hong Kong sub-group did not question or critique the source of material injected into project documents shortly before the project deadline, material that turned out to be plagiarised from the work of another project group. The problem only emerged at the project presentation, where two groups presented remarkably similar material. The “accidental” plagiarists (the real plagiarist was a team member in the UK) in Hong Kong were suitably embarrassed by the situation and reflected privately to the instructor that in setting specific tasks for the Hong Kong and UK sub-groups, they had “trusted” that the UK team members would follow a basic if unwritten code of ethical practice, which would certainly proscribe plagiarism. They felt that their trust had been violated but also recognised that the sub-group division of labour had had an unexpected negative side.

**The Management and Coordination of Time** When we introduce the notion of virtual teams to students and enable the virtual environment, we refer to the possibility of “round-the-clock” work or “following-the-sun” (i.e., where one team passes on its work to a second team located several time zones away, and then to a third team before returning to the first team) [47].

Students may initially find this idea attractive, but fail to realise that the coordination required to make such work possible is considerable. We observed that most teams preferred to try to arrange synchronous meetings, even though doing so meant that some members had to wake up at night time to participate.

Only a few teams realised that they could work asynchronously, using the technology as a team memory to manage their interactions. A UK student wrote,

Using the discussion board and the data exchange feature on Blackboard, it was possible for work to be done on several sections of the document in HK during their daytime (the night and early hours of UK time) and then the document sections could be finished and consolidated as soon as the UK members of the team woke up. Because of the time difference there was no need to wait for a day for the production of a section of the report.

Coordination problems may be exacerbated in GVST projects, where some students work full time before attending courses in the evening and so work on the project could conceivably go late into the night, resulting in inefficient and frustrating project hand-offs. One Hong Kong student wrote, “The expectations for contribution are different. The UK students expect everyone to read and contribute more within a short period of time; however, those in HK often find it difficult to devote too much effort to the project since we have daytime jobs and evening classes to deal with.”

## **DISCUSSION: OPERATIONAL COMPONENTS OF SUCCESS IN GVSTs**

In drawing this article to a close, we now turn to the issue of the operational components that we

suggest are indicative of a GVST project's success. These factors are summarised in the bulleted list at the end of this section. Fundamentally, GVSTs are premised on extensive and quality student-student communication and collaboration. However, for this to occur successfully, it is important that effective communication and collaboration between the instructors takes place well before the commencement of the project. While an instructor's personal enthusiasm in setting up such a project is not enough to ensure successful implementation, it is certainly important. Explaining why such virtual interactions are of value is an important component of an instructor's role. Further, the instructor's acknowledgement of the complexities of such interaction is also important. Such acknowledgements should certainly occur after the virtual experience, but in some cases, it may be useful to highlight potential pitfalls prior to the students' interactions, if this fits with the learning goals. Different university systems, class sizes, schedules, assessment requirements, technology infrastructure, and even different holidays are factors that may create complex interactions for such teams; thus, instructors need to factor in ways to educate students regarding these issues.

Our experiences have shown that setting up GVSTs is frequently a lengthy process that needs to start several months prior to the beginning of the project. Preparations involve extensive communications and negotiations with the parties involved, both external (e.g., overseas university/collaborator) and internal (e.g., ICT technicians, university e-learning unit, departmental administrators). This early preparation process should not therefore be undermined, as it is vital for the smooth running of the project when it finally starts. Similarly, it may be necessary to adequately prepare students, both in terms of technology and project objectives, prior to the project start-date. Issues like technology choice, work style, and necessary skill sets among the participants all need to be attended to in the preparation stage.

Instructors also need to pay very careful attention to the issue of control, with all the tensions and controversies that this entails. While the use of email, Facebook, and other social media, which are very familiar tools for many students, may lower the barrier for interactions and initially increase interactions among students, the use of a single e-learning platform may provide instructors with a higher degree of control over the process. Such a restrictive design will help to ensure that all project-related communications are captured and so made accessible to all group members. While it is likely that email may be used on occasion, discussion boards provide a complete record of the interaction, which may be useful not only to the instructor but also to team-members.

However, the methodological and pedagogical advantages of such a restrictive approach must be balanced against the need for students to engage in a realistic communication process that does not restrict their interactions to any one technology. A realistic design will see students using web-based platforms such as Blackboard in conjunction with email; voice-over-IP applications such as Skype; videoconferencing; social media applications such as Facebook, Twitter, Weibo, Whatsapp, and WeChat; and anything else that they see fit. Clearly there are trade-offs here between technologies that may be easier to use initially but may be less useful in the long term. Part of the instructor's role may be to help make the case for more "useful" technologies, as well as provide training that also increases their ease of use.

It is also important to recognise that instructors need to be competent in the use of the technology so that they can answer the inevitable questions in a way that not only assists the students but ensures that collaborations are useful and fruitful. In addition, instructors must be aware of the features and limitations of the different commercial web-collaboration tools available, and how the tools can be used creatively to facilitate course projects. For example, if multiple deliverables

are required, and the number of teams is large, a specific assignment submission area for each deliverable is beneficial for grading and organizational purposes.

Group discussion areas are an obvious feature needed for group projects; however, such areas are less than optimal for assignment submission purposes. It has been our experience that students often post multiple versions of deliverables within their respective group discussion areas for fear that the student charged with this responsibility may not properly post the assignment. It is then almost inevitable that the version selected for grading by the instructor is not the final or most complete submission, resulting in discontent among the members of the team. Individual assignment submission areas help to curb multiple postings as the software allows only one submission per team. Finally, students may be inhibited from valuable processes like brainstorming on deliverables if discussion areas and project deliverables are not accessible to other teams; thus, having an instructor familiar with how to configure such virtual environments to ease such concerns is critical.

Almost inevitably, there will be technical problems of one kind or another that instructors will need to solve, either alone or with technical support. Responsiveness of the technology is often cited as a problem: the server/Internet is too slow or is simply unavailable. This is a particular problem for GVSTs using web-based platforms such as Blackboard, Moodle, or Canvas because it is likely that a server in one location is used to manage the collaboration of all students, no matter where they are located. While students who are geographically proximate to the server generally do not suffer, those who are in different time zones often do so (e.g., when maintenance is scheduled at a time that may be night locally, but day elsewhere). Such interruptions in service often result in a reluctance to use the technology specified by the instructor, and instead to use other methods for team communication. As discussed previously,

this situation may allow students to feel comfortable with the mode of communication they have selected, but may also make it difficult or impossible for instructors to monitor such communication. As a result, obvious issues of team conflict may not be easily recognized, in turn making early intervention by the instructor impractical.

GVST projects commonly involve substantial numbers of students (at undergraduate or graduate level) studying at two or more universities. The logistical complications involved tend to preclude multi-site GVST projects (i.e., with three or more universities) unless the instructors concerned are prepared to invest considerable amounts of time, energy, patience, and integration skills. Careful management of time by both instructors and students is likely necessary for successful interactions, given the artificially short timeframes within which GVST projects typically operate. On the instructor side, the judicious use of precise (non-extendable) deadlines as milestones for completion of sections of a project (e.g., when interim reports are due) has been found to be helpful in at least ensuring that students do start to work on the project fairly early and continue to do so, not leaving all the work to the last 24 hours. Nevertheless, these deadlines need to be sensitive to time zones, public holidays, reading weeks, term-breaks, and so forth. Some students seem to work in e-time—that is, 24 x 7 x 365, but many others keep to a fairly strict 9:00-5:00 (i.e., 8 x 5 x 252).

The temporal coordination of team activities is also important [48]. A series of scheduled requirements or milestones should be included throughout the project to keep the teams on track towards their final deliverables. In addition to scheduled deadlines, consideration and review of individual positions by the respective teams may also be helpful. For example, teams may be called upon to reflect on individual assignment postings, and to discuss how they may be improved. Such temporal coordination mechanisms have been previously shown to influence



team outcomes [48], [49], consistent with our experience when conducting such projects.

Apart from technology and the skills to use it, students need to have the incentive to collaborate. As a rule of thumb, and considering the amount of time and energy that students are likely to invest in a GVST project, we suggest that no less than 25% of the overall grade for a course be allocated to the project, so as to ensure that there is a sufficient degree of motivation. In some educational cultures, it may be possible to offer students extra credit for participating, which may increase their motivation. In the four projects reported in this paper, no such extra credit was awarded. Naturally, GVST projects not only have assessment objectives, but more importantly, learning outcomes and objectives. We have found it valuable to require students to write a reflective report on their virtual project experience as this ensures that they do think about their experiences and identify lessons learned that they may be able to apply in their daily work or life. Such reports also provide valuable feedback that instructors can use to enhance the design of the GVST project for the future.

We discussed the literature on the formation and mechanisms of trust in virtual teams. In practice, we have found that trust can develop in longer term projects and that this trust is often beneficial to the well-being of the team. In addition, we have found that factors such as team efficacy [3] may influence the formation of swift trust [34] in virtual project teams. Specifically, team member perceptions of the abilities of the team as a whole are often positively related to the formation of team trust. This correlation may be due to the similarity of team efficacy to perceptions of ability, a component of trustworthiness known to precede the formation of trust [8], [50], [51]. In zero-history student teams, it is essential that swift trust be developed, as this should enable the establishment of roles and relationships within the team that promote the completion of the immediate task within a limited time frame.

We have also found team efficacy to be directly related to the success of student virtual teams [19]. Team efficacy has previously been linked to the success of collocated teams [52], and distributed teams [33], [53], where teams with high team efficacy have been proposed as better able to manage team conflict [3], [53]. In practice, we have found team efficacy perceptions do influence team performance through other mediating factors such as increased team effort. For example, during a recent set of virtual projects, we found that teams with higher beliefs in the team's ability to work together virtually (virtual team efficacy or VTE) also used the available communication technology more frequently [3], [50]. We have also found that while perceptions of self-efficacy often differ across cultures (i.e., students from individualist countries reporting higher self-efficacy than students from collectivist countries), perceptions of the teams' *collective* or team efficacy are usually rated more consistently and thus are more predictive of team performance [54]. Such results are consistent with efficacy theory as proposed by Bandura [55], [56] and provide instructors with an additional tool for use in diagnosing student team performance.

The relationship between team efficacy and the performance of student teams is important not only because VTE has a positive effect on performance, but also because it is somewhat malleable. Thus, instructors may influence the efficacy of underperforming student virtual teams using the proposed sources of efficacy information (i.e., enactive mastery, vicarious experience, verbal persuasion, and affective states) [56]. For example, instructors may institute vicarious experience in the form of training initiatives to raise the efficacy of underperforming teams. Verbal persuasion can also be used by instructors to raise the efficacy of student teams through the use of performance feedback mechanisms. Finally, both enactive mastery and affective states may also be the target of instructor led interventions. Enactive mastery information can be

delivered through experience gained during project “practice runs,” while affective states information can be delivered through training targeting the effective management of cognitive states such as team anxiety.

These operational issues associated with the success of GVSTs can be summarised as follows:

- Instructors must pay meticulous attention to project initialisation and preparation when setting up activities in the online space.
- Instructors themselves must be competent in the use of the various technologies available to the virtual team members and be willing to facilitate interactions where appropriate.
- Instructors must have access to technical support in the event that some technologies fail to function as intended.
- Instructors must provide GVST members with a virtual environment that enables effective communication and supports collaboration.
- Instructors should provide GVST members with incentives to participate in the project. Some incentives such as grades may be distributed over the duration of the project or at the end of the project (e.g., overall performance grade, or a certificate for overall team performance).
- Instructors should promote the development of trust (and swift trust) in GVSTs, since this is fundamental to communication and the completion of project objectives.
- Instructors should consider setting both interim milestone and final deadlines to ensure that project work is completed effectively.

- Instructors should encourage GVSTs to develop a sense of team culture and team efficacy, since these factors are correlated with overall team success.
- Instructors must promote awareness of the different time zones in which team members are located, as well as the relevant working hours, holidays, breaks, and so forth. Instructors need to ensure that GVST members have temporal coordination information that they can draw on so as to be able to work effectively.
- Instructors must carefully balance the tensions between a realistic experience for students and the need to ensure an appropriate degree of methodological and pedagogical control over the design of the interaction and learning experience. An overly controlled or restricted virtual environment will constrain students' interactions to the point where they cannot complete their tasks and indeed demotivate team members to participate at all. At the same time, an overly realistic design may render any form of control impossible, with the possible consequence that instructors have no idea what is going on, what problems are occurring, and what interventions might be necessary.

## **CONCLUSIONS, LIMITATIONS, AND SUGGESTIONS FOR FUTURE RESEARCH**

In this paper, we have identified a number of operational issues for GVST success, based on the relevant literature as well as our own experiences in managing GVST projects. Key issues are related to instructor preparation, student motivation, the platform used for team communications, temporal coordination, and the appropriate development of trust. While not strictly a factor, we also recognise the importance of team efficacy, that is, the ability of the team as a whole to accomplish the tasks that have been set. This is partly a function of the skills of the individual team members, partly a function of the cohesiveness of the team, and also to a large extent a

reflection on the appropriateness of the task for the team members.

We recommend that educators treat our suggested operational issues with some caution, as they are based on our own subjective experiences in GVST contexts and almost certainly do not reflect all instances of GVST interactions. We see GVST research as a nascent research area with many unanswered questions. We have required students to use a centrally-provided and standardised technology platform to manage all interactions, but the viability of this arrangement depends on student willingness to use such platforms: in an era of mobile communications via social media (Facebook, Twitter, Wechat, Whatsapp, QQ, Line, Weibo, Kaixin, etc.), it is ever more difficult to restrict student communications to a single platform. Researchers can explore these issues, whether in controlled settings or in more open-ended case analyses.

There is also a need to replicate GVST research across different cultures and language settings. In general, we suggest that contexts where all participants are more or less equally disadvantaged (e.g., all are using a second language) may lead to more equitable experiences from the student perspective. Finally, it will be valuable if the lessons learned in the GVST research can be tested in the non-student context. Global virtual teams in organisations are already becoming more common and can serve as useful test-beds for field research into the effectiveness of the virtual team work arrangement.

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