

# Quality Indicators on Global Software Development Projects: Does “Getting to Know You” Really Matter?

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## Abstract

*In Spring 2008, five student teams were put into competition to develop software for a Cambodian client. Each extended team comprised students distributed across a minimum of three locations, drawn from the US, India, Thailand and Cambodia. This paper describes a couple of exercises conducted with students to examine their basic awareness of the countries of their collaborators and competitors, and to assess their knowledge of their own extended team members during the course of the project. The results from these exercises are examined in conjunction with the high-level communication patterns exhibited by the participating teams and provisional findings are drawn with respect to quality, as measured through a final product selection process. Initial implications for practice are discussed.*

## 1. Introduction

The number of studies examining the communication patterns, techniques and tools of global software development projects continue to grow to reflect the critical role of collaboration and coordination on such projects [8, 11]. Recent attention has involved exposing the social networks underpinning a project to gain an understanding of, for example, who is exchanging data with whom, with what intensity, and where the initiators and receivers of these exchanges lie [3, 9]. Such information can be used to inform team organization, logistics and tooling, to gauge distributed awareness of a project's requirements and even to predict likely failures [1, 10].

However derived, be it through a record of emails, meetings or access to shared artifacts in a project repository, evidence of data exchange or sharing between two parties does not say anything about the effectiveness of the communication. While it is often

feasible to record the number of exchanges and accesses, these need to be correlated with the impact on the process over time and with the quality of the end product, a far more challenging proposition.

At a crude level, one may anticipate a number of indicators that could be examined to assess whether or not communicative exchanges are likely to happen, and be effective and lead to improved quality. For example, if we accept that ‘solidarity’ is a prerequisite for collaboration to happen [2], then we would be interested in identifying all those factors that encourage teams to come together with a single purpose. While there are likely to be many such factors, one would assume that familiarity amongst team members and knowledge of basic locale information would be a building block for initiating and sustaining communication when they are distributed across geographies and cultures. In this paper, we begin to investigate these indicators in the context of a student global software development project.

The paper is organized as follows. Section 2 outlines our project and its research questions. Sections 3 and 4 describe two exercises we undertook and summarize their findings. Section 5 states how communications were recorded and highlights key statistics. It also states how the quality of the end software products was determined. The research questions are re-examined in section 6, and some implications for practice and future research are given.

## 2. Project and Research Questions

Since 2005, we have been running an annual global software development project experience for students [4-7]. One important theme of our work has been socialization, by which we mean organizing activities to enable the students to get to know about each other's countries, traditions and interests. We assumed this to be an essential foundation for

communications and consequently directed much effort on this dimension. However, we did little to assess whether this was an assumption worth spending so much energy on. When an industry leader stated that such socialization activities were not attended to within a leading Indian offshoring company (during question and answers following a RE'07 keynote talk) we decided to explore our assumption in 2008.

In 2008, our project set-up involved five student development teams: one each based in Cambodia, India and Thailand, and two based in New York (one in New York City and one thirty-five miles north in Pleasantville). Each team was put in competition to develop software for a Cambodian client. The client-side comprised a team of five students in Cambodia, each sponsoring one of the five development teams. Each extended team was further supported by a client-side coach and a development-side coach (graduate students from New York City), and by a dedicated team of three auditors (graduate students and banking professionals based in a third location in New York). The overall initiative involved sixty students and seven professors. Details about the project and its set-up can be found in a separate paper [6].

During the course of the project, we only paid attention to encouraging socialization activities within the Pleasantville development team. Two students in Cambodia 'met' with the Pleasantville team on a regular basis to talk about selected Cambodian-specific topics (in Second Life). How much effort the other students put into familiarizing themselves with their fellow students was left entirely up to them.

Our hypothesis was that the more the students knew about the countries of those they were working with, and the more effort they spent in learning who their team members actually were, the stronger the foundations for effective communications. We anticipated more communications would be instigated and reciprocated, and higher quality end products.

### 3. Country Awareness

To assess student awareness of the countries involved in this project, an exercise was designed for all students to complete in a class session. This was undertaken one month into the project and following the release of version one of the requirements. Given that this was the most intensive data gathering period, it was assumed that curiosity would have led to personal exchanges and broader learning.

All students were provided with a map of the world, with no countries labeled, and a set of images: flags for the US, Cambodia, India and Thailand; famous landmarks; and signature dishes of each country. Each student was then asked to:

- Place an 'X' on the locations of New York, Phnom Penh, New Delhi and Bangkok (labeling each);
- Select the appropriate flag for each country, label it and attach it correctly to the map;
- Label the dishes and landmarks and associate them with the correct country by affixing to the map;
- Assume it is 2:00pm in Cambodia and write down the time in the other three countries.

The results are summarized in Table 1. Where blank,

Question	Topic	Cambodia	India	US-NYC	US-PLV	Thailand	US-Coaches	US-Auditors	
Cities - Phnom Penh	Cities	88%	40%	17%	100%	100%	40%	25%	
Cities - New Delhi		76%	100%	83%	67%	25%	70%	69%	
Cities - New York		76%	80%	100%	100%	50%	100%	88%	
Cities - Bangkok		76%	40%	17%	100%	100%	20%	38%	
Flags - Cambodia	Flags	100%	100%	83%	100%	100%	40%	44%	
Flags - India		100%	100%	83%	67%	100%	60%	50%	
Flags - Thailand		100%	100%	83%	100%	100%	70%	38%	
Flags - US		100%	100%	100%	67%	100%	100%	100%	
Dishes - Cambodia	Dishes	100%	80%	67%	100%	100%	60%	75%	
Dishes - India		100%	100%	83%	33%	100%	80%	56%	
Dishes - Thailand		100%	80%	67%	33%	100%	50%	63%	
Dishes - US		100%	100%	100%	33%	100%	100%	100%	
Dishes - Amok		100%	0%			63%	0%	0%	
Dishes - Samosas		59%	100%			50%	50%	13%	
Dishes - Pad Thai		47%	0%			100%	20%	31%	
Dishes - Burger and Fries		100%	100%			100%	90%	75%	
Landmarks - Cambodia		Landmarks	100%	60%	67%	100%	100%	70%	50%
Landmarks - India			100%	100%	83%	67%	100%	90%	100%
Landmarks - Thailand	100%		60%	67%	67%	100%	80%	50%	
Landmarks - US	100%		100%	83%	100%	100%	100%	100%	
Landmarks - Angkor Wat	100%		0%			100%	10%	0%	
Landmarks - Taj Mahal	76%		100%			100%	70%	63%	
Landmarks - Royal Palace	94%		0%			100%	0%	0%	
Landmarks - Statue of Liberty	65%		80%			100%	90%	81%	
Time - Correct in India	Time	88%		17%	67%	25%	0%	13%	
Time - Correct in Thailand		100%		83%	33%	100%	30%	44%	
Time - Correct in US		100%		100%	100%	38%	50%	63%	

Table 1. Consolidated map exercise results.

the question was accidentally omitted or altered.

All of the professors reported that the students enjoyed this exercise and, in the case of the US graduate students (coaches and auditors), their poor performance was humbling given that they were the most senior participants. It resulted in pledges to learn more about these other countries. The US students, in general, had curious map positioning: Delhi being placed in Saudi Arabia, France, Myanmar and Brazil; Phnom Penh being placed in China, Iran, Australia and Indonesia; and Bangkok being placed in Iraq, Taiwan and Europe. The US students also struggled more to identify the flags, dishes and landmarks, with the exception of Pleasantville students knowing about Cambodia's. There was more general difficulty with time zones, despite clocks being provided on the central wiki (<http://atlantis.seidenberg.pace.edu/wiki/gsd2008>), although each development team knew their time difference from the client in Cambodia.

We failed to differentiate Cambodian clients from developers in this exercise, but it can be seen that the entire Cambodian contingent had taken time to learn about the countries involved of their own volition.

#### 4. Extended Team Awareness

To assess student awareness of their extended team members, a 'who's who' exercise was undertaken by all students in another class session. This took place approximately ten weeks into the project, one month before the final software delivery was due. The requirements were now frozen and the development teams were undertaking iterative development with testing cycles involving the clients, coaches and auditors. It was assumed that this late into the project the students would know exactly whom they were working with. Names, roles and photos had been visible on the wiki used to coordinate tasks and disseminate work for weeks.

Each student was given photos of all the participants in the global project and asked, based on their role, to circle and name their extended team:

- *Cambodian/Thai/Indian/US developers* – the other developers on their team, their coach, the client sponsoring their project and their auditors (Fig 1);
- *Cambodian clients* - the other clients, their coaches and the development team they are sponsoring (Fig 2);
- *Auditors* - the other auditors on their team, their manager, the development team they are auditing, the developer and client coaches for that team, and its client project sponsor (Fig 3);

- *Developer coach* - the development team they are coaching, the auditors, the client-side sponsor and the client coach for that team (Fig 4);
  - *Client coach* - the client team, the auditors (they audited the requirements they were helping the clients to prepare), the development team they are involved with and its developer coach (Fig 5).
- They were also to circle and name anyone else they could identify outside of their extended team.

Figure 1. Developer awareness.

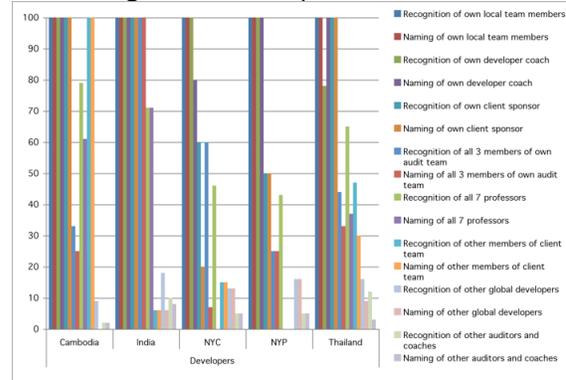
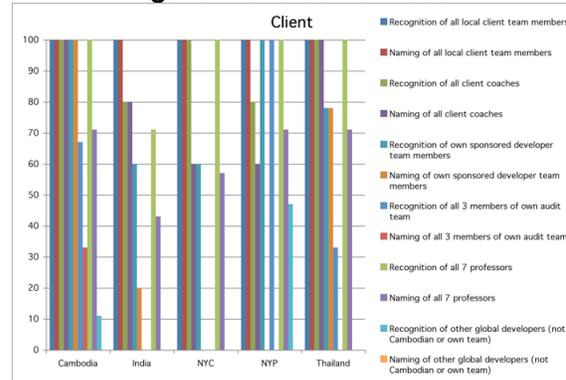
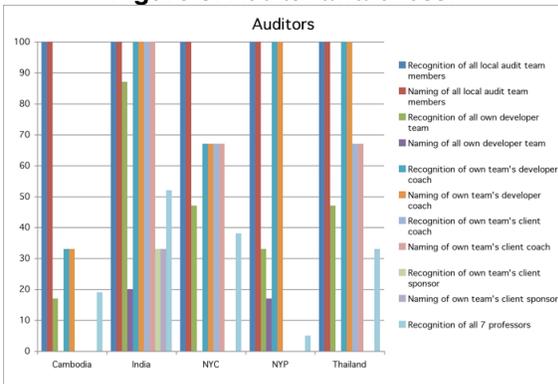


Figure 2. Client awareness.

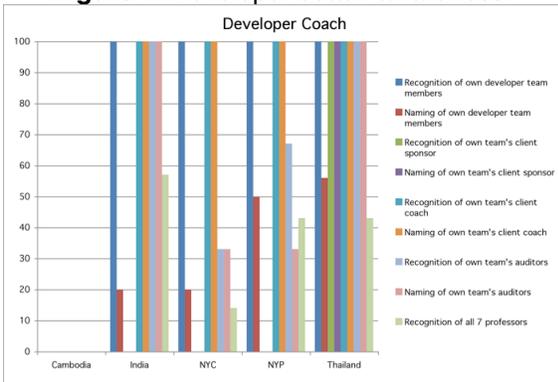


The results indicate that the Cambodian, Indian and Thai development teams had the most extended team awareness. These team members all knew the name and photo of their client sponsor, and the Cambodian client was most familiar with members of the Cambodian and Thai extended development teams. The clients could not name any of the US-based developers. Extended team awareness was also highest with the Indian and Thai auditors, the Thai developer coach and the Indian client coach. This was telling; outside of the extended teams the most well known student was overwhelmingly the developer coach for the Thai team, and each member of the Indian team knew their auditors. The students also enjoyed this exercise and, particularly in the US, many were alarmed that they could not identify or name who they had been working with for ten weeks on a daily basis.

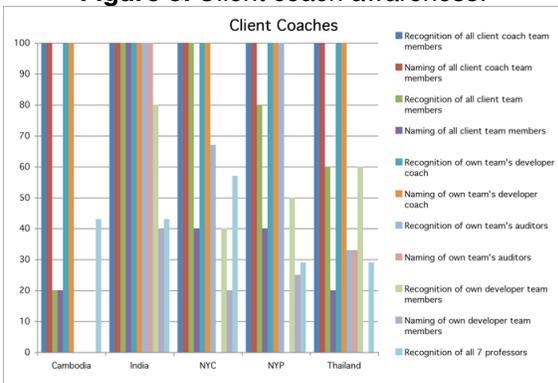
**Figure 3. Auditor awareness.**



**Figure 4. Developer coach awareness.**



**Figure 5. Client coach awareness.**

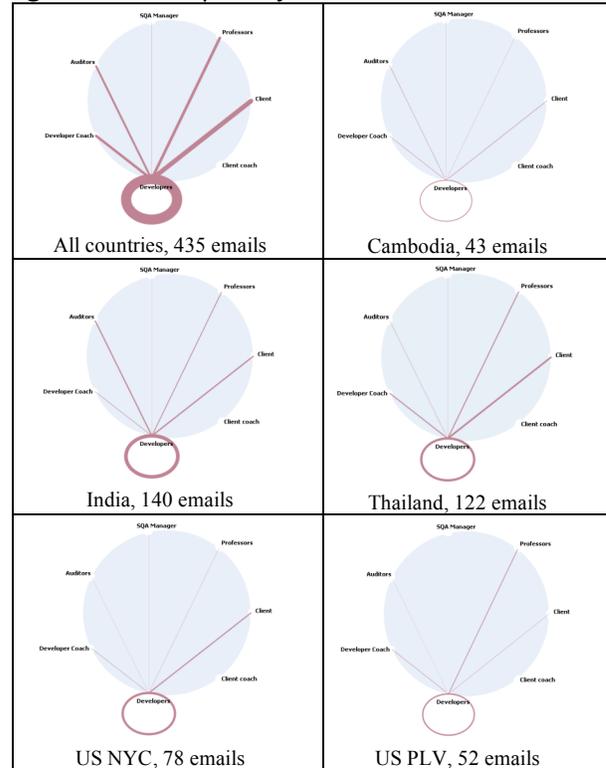


## 5. Communication Patterns and Quality

From initiation to deployment, the project spanned nineteen weeks. Selection of the winning software took place after fourteen weeks and the communication was monitored to this point. All students completed a weekly online survey to maintain a record of their asynchronous and synchronous communications. This comprised a record of emails sent to mailing lists and any online chat sessions. Face-to-face meetings were also recorded. The broad pattern and intensity of the

email and chat communications for the five development teams is shown in Figs 6 and 7.

**Figure 6. Developer asynchronous communications.**

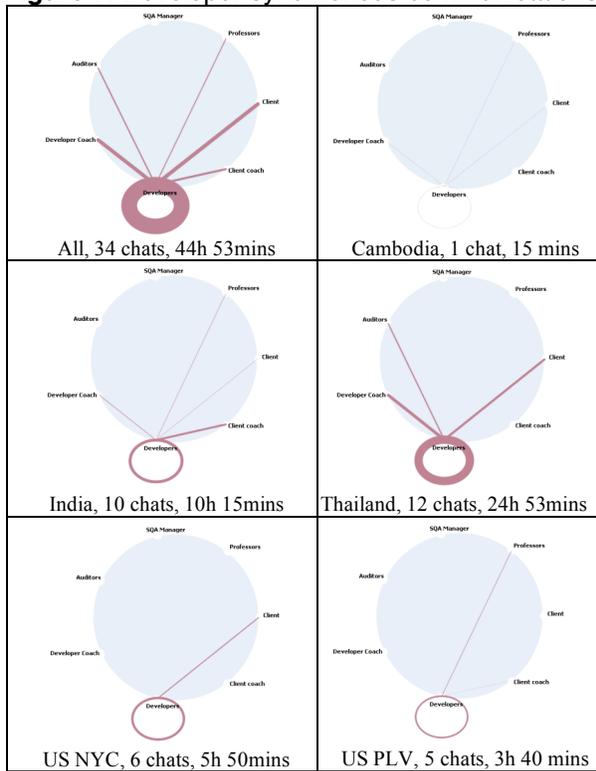


The Cambodian clients judged the quality of the software end products by measuring the total number of requirements demonstrably satisfied via triangulated testing and a prioritization scheme. The Indian and Thai software were assessed of highest quality, and the Indian software was selected for deployment based on platform and long-term maintenance requirements.

## 6. Observations and Implications

The Cambodian, Indian and Thai development teams achieved better results than the US-based teams on general knowledge of the countries involved in the global project. The Indian and Thai teams also had a better awareness of those students they were working with around the globe, along with greater awareness of third parties. These two teams exchanged up to twice as many group emails than the other three development teams, and these exchanges were more likely to extend to their Cambodian client and members of their team's support network (i.e., their US-based auditors or coaches). These two development teams also used more real-time chats to communicate with their extended team members, particularly Thailand.

**Figure 7. Developer synchronous communications.**



Given that this is a single study and that there are obviously many factors that motivate students to work well together, it is not possible to make hard claims. However, it is striking that the two development teams that scored highest in both the socialization exercises communicated more throughout the project and produced the two software systems of highest quality. We suggest that this is a finding worth exploring more carefully as it has implications for emphasis on training and running such projects in a commercial setting.

Three other observations are relevant. First, the effort expended in educating the Pleasantville students about the client's country did not appear to pay off. Rather than enforced, it seems that it needs to be a self-directed activity driven by personal and team belief of value. Second, although the Cambodian developers made an effort to learn about fellow students, they were not comfortable instigating communications; they mostly kept problems to themselves until the last minute, whilst the Indian and Thai teams sought assistance from their support networks, possibly due to their greater familiarity with each other. This situation altered with those Cambodian students acting as clients; the more they knew the client coaches personally, the more likely they were to ask for assistance or raise issues. Third, while the Cambodian clients received more email from the NYC team, they actually sent more emails to the Indian team and

chatted most with the Thai team. One could say this is coincidental or time zone related, but since only the latter two teams shared bi-directional awareness with the client, this suggests a good way to get ones queries answered and is something worth attending to.

## 7. Conclusions

This paper has summarized a couple of exercises undertaken within the context of a student global software development project to investigate whether fundamental knowledge of the people you are working with has any impact on the communications and quality of what is produced. While we cannot prove a causal relationship, our experience indicates that "getting to know you" is an activity that pays off if it occurs naturally. It is an area deserving more study.

## 8. Acknowledgements

This work is supported by a National Collegiate Inventors and Innovators Alliance grant (#3465-06), "Incubating the Next Generation of Global Software Development Entrepreneurs" (2006-2008). We thank all the students who have been a part of this initiative.

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