A Framework for Training Skills for Global Software Development
PhD Research Proposal

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Researh Area— **Global Software Development Education, Virtual Training Model**

Researh Proposal— **A framework (methods and tool) for training and developing skills needs in global software development.**

I. INTRODUCTION

The practice of Global Software Development (GSD) entails confronting certain drawbacks, caused principally by the difficulty entailed in communication, since traditional face-to-face meetings are no longer common and the use of non-native languages and interaction with different cultures frequently causes misunderstandings [1].

These factors influence the way in which students and software engineers must be trained to confront these new challenges, which are not currently part of their conventional education [2]. However, preparing students in this field is not easy, as it requires new training schemas, along with new theoretical contents and tools to support them [3].

The goal of this PhD thesis consists of developing a framework that will allow the required skills to be taught.

II. BACKGROUND AND RELATED WORK

Recent graduates' lack of training in the skills needed in GSD environments is usually reported by project managers, especially when cultural and language problems arise. These needs are dealt with by several proposals in literature:
- academic courses, some of which take place in collaboration with distant universities [2].
- Training experiences in the classroom, in which students learn by doing and develop software in collaboration with students from distant universities [3].
- Training courses in companies, in which inexpert engineers learn concepts and practices in real scenarios [4].
- Blended learning environments that present collaborative platforms offering support to the development of real projects [5].
- e-Learning approaches, which consist of web-based applications oriented towards delivering online courses [6].

However, each approach involves specific problems such as: a high workload for the instructors, the large amount of coordination needed with other institutions, the difficulty of reproducing the complexity of real environments, the risks of involving inexpert engineers in real projects, the high economic costs or lack of learner motivation.

It is therefore desirable for instructors to have appropriate tools, methods and course materials at their disposal with which to teach the skills required for GSD, thus providing learners with experiences which are as close as possible to the actual work.

III. RESEARCH FOCUS

Our future work will be focused on supporting GSD training and education in order to avoid the aforementioned problems, and by considering the following hypothesis:
Hypothesis: It is feasible to minimize the impact of GSD problems by applying appropriate training methods and tools.

A. Research Goal

The main goal of this PhD work consists of developing a framework with which to improve students' and software engineers' performance in GSD activities.

This framework must be focused on tackling cultural and language differences, since these are some of the main problems confronted during the interaction of international teams. This will lead us to study the skills that a software engineer should have in order to carry out an effective development. We shall also study how these skills can be taught, and finally, we shall propose a framework and a virtual training environment which will be valid for any stage of GSD.

This environment will place learners in simulated scenarios in which they will solve typical GSD problems by carrying out meetings with Virtual Agents (VAs) using common communication and collaboration tools.

The advantage of using VAs is that they can interact with learners without schedule and coordination problems

with distant members. VAs will play a specific role in the project and will be characterized by a specific culture.

With regard to our goal, we shall work with the following research questions:

1. What training and educational models focused on GSD education exist?
2. How could cultural and language differences be best trained?
3. How could a GSD education environment be modeled by avoiding the problems of traditional methods?
4. Can a training environment be useful in all the stages of GSD? What would its limitations be?

IV. PROPOSED FRAMEWORK

This PhD study follows the Action Research method [7], which would appear to be appropriate for our goals as regards the following steps:

1. **Planning**: Identify and define the problems and the lines of work to follow that will serve to define a proposal.
2. **Action**: Experimentation and simulation of the framework proposed.
3. **Observation**: Gather information from the experiments through surveys and interviews that will permit a quantitative analysis of the application of the framework.
4. **Reflection**: Analyze the results in order to gain new knowledge in the subject that can serve to improve the method and to adapt the model.

This is an iterative process, in which the experimental settings are modified according to the aforementioned observations. This method will be used to propose a set of improvements and techniques that will be validated in various real projects.

V. RESULTS ACHIEVED

This research was initiated with a systematic literature review on GSD training and education, which allowed us to obtain a vision of the main proposals and their drawbacks. It also allowed us to study the main skills that learners should have, and to obtain an initial definition of the requirements that a framework for training GSD should meet.

As a result, we are currently in the process of defining and modeling our training environment. After this phase, our immediate future work will be focused on the development of this environment based on extensibility and usability criteria. We shall be simultaneously working on the development of our first training scenario. Although we aim to develop several training scenarios for any stage of software development, the first stage will be focused on a requirements elicitation interview, since this is one of the most highly communicative processes.

VI. EXPECTED CONTRIBUTIONS

As a final result of this research, we shall develop a virtual training environment and we shall also obtain a set of best practices, training methods and training scenarios that will be part of the framework.

This research aims to avoid the risks involved in involving inexpert engineers in real projects. Since VAs will simulate real members who will be available at any time, the tool proposed will minimize the instructors' effort, the costs of the infrastructure needed and the need for coordination with other members and institutions. This will allow learners to easily play different roles during the training and to be aware of different kinds of problems and cultural differences. The framework developed will mainly ease learners' proactivity and their training in informal communication.

Finally, this study will also quantify the teams' performance by monitoring their tasks, and will provide opportunities for self-reflection and self-correction, since the VAs will explain the consequences of incorrect actions.

VII. EVALUATION METHOD

The evaluation of the results obtained will be carried out by comparing the performance of members of a company involved in actual GSD projects.

It is therefore necessary to compare members trained through our framework with members who have not followed it. These members must have similar skills, knowledge level, culture and language, and they must be involved in projects with comparable characteristics of distribution and difficulty. A process for the selection of members and projects will therefore be necessary.

The measurement of improvement is not easy, since even projects in the same company generally have different characteristics. Some issues that we are considering compare are: communication flows, misunderstandings, and feelings of trust in a working group. However, this will be analyzed and planned in the medium term.

It will first be necessary to define a set of measures that will allow us to quantify the members' performance, which could also be complemented with questionnaires, surveys and interviews with both engineers and managers.

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