Research on Intercultural Teaching for RE

Proposal for a Multi Case Study

Andrea Herrmann Herrmann & Ehrlich Stuttgart, Germany herrmann@herrmann-ehrlich.de Anne Hoffmann Software Engineering Institute Rijksuniversiteit Groningen Groningen, The Netherlands a.hoffmann@rug.nl

Rüdiger Weißbach Business Department Hamburg University of Applied Sciences (HAW Hamburg) Hamburg, Germany ruediger.weissbach@haw-hamburg.de

Abstract—Intercultural aspects are important aspects in software engineering in teaching as well as in practice. In the requirements engineering context, these topics are not so well addressed by research, and if they are, then in the meaning of national cultures. We expect that, besides this, the diverse "professional cultures" of the participants in the requirements engineering process are an equally important aspect.

This paper provides a first proposal for a research collaboration on intercultural aspects in requirements engineering teaching. We are searching partners for this study. *Index Terms Intercultural, interdisciplinary, research outline*—.

A. Introduction and Motivation

Software engineering (SE) is a multi-step transformation of ideas into artifacts. In this process, Requirements Engineering (RE) is the first step, in which the ideas of the future users or their representatives (managers etc.) will be transformed in a more or less formalized representation. Not all participants in this process are trained or experienced in methods of formalization (modeling, developing of algorithms etc.). The teaching of RE deals with methods of elicitation, documentation and validation (see for instance the syllabus of the IREB Foundation Level [20]). The important intercultural aspects, however, are regularly not treated.

In the research on SE, we find studies about intercultural aspects in international cooperation (e.g. [22],[28]), enforced by the trend to international software development outsourcing, for example to India/Bangalore or Russia. These studies partly emphasize the aspects of different national cultures that influence the handling of requirements, for example in the aspect of the non-critical acceptance of the requirement documents, even if they contain unrealistic requirements.

Cultural differences are listed as one of many sources of challenges in distributed development, e.g. in [5], [10], [11], [12], [23]. Cultural differences lead to misunderstandings that happen when the communicating parties make tacit

assumptions that are not shared by the others because it is not part of their cultural background. This includes misunderstandings about the meaning of software requirements and about work processes, and finally leads to software that does not conform to what the stakeholders really wanted. This causes re-work, suboptimal project results and also negative emotions among the parties.

Despite this importance of culture for RE, we find only little research on the intercultural differences in RE training.

There are approaches to teach such socio-technical aspects within the RE education [8], [15], [29], but research on the different training needs in different cultures is missing. A training concept which works well in one cultural context might work less well in another context. In our definition, "culture" is not limited to national cultures, but also refers to professional and organizational cultures. In addition, differences between different learning contexts like university teaching, a workshop at a conference, or an in-house training in a company are considered different cultures.

To investigate such differences is important because the quality of RE is known to be critical for the success of software projects [25]. This emphasizes the importance of the education of software practitioners [21] – regardless of whether RE is conducted in a formal RE process in heavyweight software development processes or conducted in a less formal way in agile processes. We plan a study which will test the hypothesis that there are differences between learners from different cultures in terms of the learning success achieved or fun experienced. Depending on culture, some training concepts might work well in one culture and less in another.

This paper presents an initial outline for setting up a research study that is open for interested colleagues – teachers, trainers and researchers. During the REET workshop, we want to receive feedback concerning the planned study and its internationalization. Moreover, REET gives us a unique

opportunity to meet and discuss with potential cooperation partners especially outside Europe.

B. Definition: Culture

The term "culture" is understood differently. According to Hofstede [16], culture is characterized by six factors:

Power distance, Individualism vs. collectivism, Uncertainty avoidance index, Masculinity, Long-term orientation vs. short term orientation, Indulgence versus restraint [16].

Hofstede defines culture as "the collective programming of the mind distinguishing the members of one group or category of people from another" [17]. However, we also (at least informally) talk about different cultures when talking about cultures of companies, cultures in different professional disciplines, types of teaching environments (e.g. university versus on-the job training), etc. In some disciplines, stereotyped archetypes of persons and their character behavior exist. This is for instance reflected in the assumption all information scientists being bad communicators and bad team workers, or in jokes that address the brevity of students in technical topics.

A previous study on communication problems in distributed software development has found cultural differences not only between countries, but also between different organizational cultures, between younger and older people, and between different professional cultures (like software developers versus managers or customers) [26]. Another study within India showed that even within one country, one can find large cultural differences [3].

1) Interculturality: International aspects

Hofstede defines that "The category can refer to nations, regions within or across nations, ethnicities, religions, occupations, organizations, or the genders." [17] This dimension of interculturality is widely accepted and discussed in science and in practical work and trainings.

2) Interculturality: Organizational Cultures

Organizational culture is – according to [24] – "the pattern of basic assumptions, that a given group has invented, discovered, or developed in learning to cope with its problems of external adaption and internal integration". The organizational culture focuses on the internal relationships in an organization. The learning experiences of a company, its strategy and its tradition are important aspects. Hofstede [19] lists the following dimensions of organizational culture: meansoriented vs. goal-oriented, internally driven vs. externally driven, Easygoing work discipline vs. Strict work discipline, Local vs. Professional, Open system vs. Closed system, Employee-oriented vs. Work-oriented, Degree of acceptance of leadership style, Degree of identification with your organization.

These dimensions will affect the process of Requirements Engineering.

3) Interculturality: Professional Cultures

There is not as much literature on professional cultures as on national or organizational cultures. Herkenhoff measures differences between professional cultures using the Hofstede dimensions [13]. She points out the relationship between the professional cultures and the national cultures: "Just as Hofstede notes that national culture is not genetically shared but is passed down between groups, the same holds true for professional culture." [13] One aspect for example is the longterm vs. short-term orientation of professions [2]. In this dimension, computer programmers and other people engaged in project work may be short-term focused.

Herkenhoff [13] developed a Professional Culture questionnaire (PC08) based on Hofstede/Bond as a tool for measuring along the dimensions of Power, Time, Risk, Service and Team. In her study, she compares professional culture rankings of people working in accounting, IT support, sales and science. Referring to the five dimensions of professional culture (Power, Time, Risk, Service, Team) IT staff shows high ranking values for team orientation and service, but only low values for long term orientation.

PC08 can be used as questionnaire for our study.

The remainder of this paper is structured as follows:

Section II summarizes the current situation in research on intercultural aspects in RE. Section III sets up the research design for our multi case study research project. Section IV discusses the research design and Section V summarizes the paper and the possible next steps.

II. LITERATURE ON INTERCULTURAL ASPECTS IN RE TEACHING

In an initial literature research, we aimed at gathering the basic definitions in our domain of research and to understand the state of research, in order to help us design our study. A more systematic literature analysis will be part of the study.

First of all, we searched for work about basic concepts from outside the RE community (by Hofstede, Herkenhoff and others), especially on cultural aspects in work life.

We analyzed the publications of the workshop "Requirements Engineering in Education and Training (**REET**)", expecting to find information and results close to our questions, as the workshop's theme is closest to our research topic. REET takes place in conjunction with the IEEE conference Requirements Engineering (RE) since 2005. Our approach was as follows: We analyzed all existing REET publications and their abstracts, screened the abstracts for key word such as "intercultural" or "interdisciplinary", and subsequently found three papers relevant for further processing [6],[9],[27]. These papers, we read in depth.

Beyond the REET publications, we gathered further work about cultural aspects in software engineering.

Overhage, Skroch and Turowski [22] developed a method to evaluate requirement specifications. In this context, they analyzed factors in the context of the requirement specification process in offshoring projects. The understanding of the domains, aspects of communication and culture as well as learning relationships had been indicated as relevant.

Gotel et al. [9] conducted an experiment with students from USA, Cambodia, Thailand and India. Their task was to write a requirements document, and the previous knowledge of the participants was unevenly distributed. To cope with these conditions, the trainers applied coaching and requirements reviews. International aspects are not discussed, but rather the students' learning effects.

Svahnberg et al. [27] stated "a large difference between the priorities of Industry Managers and Industry Developers". For industry managers the aspects of product planning should have higher priority, for developers, development and test are the most important. The authors see "a dichotomy between preproject activities and in-project activities, where the managers are more concerned with the pre-project activities and the developers focus more on the in-project activities." This means, the authors observed (role-dependent) different professional cultures.

Gabrysiak et al. [6] worked with students from other faculties without a software engineering background as "virtual stakeholders", in order to introduce a semantic gap between requirements engineer and stakeholders. This showed to be instructive for the RE students. The paper mainly discusses how to instruct the virtual stakeholders in order that they can be authentic.

Bolten [1] suggests intercultural management games to train *functional* and *professional aspects* (p.17).

Herrmann, Hoffmann, Landes, Weißbach [14] describe training experiences from different settings with regard to the Dreyfus levels [4]. In these trainings, different aspects of professional cultures have been emphasized: joint projects of IT and business students respectively of IT and business professors demonstrate different professional demands, role games and improvisation theatre demand and teach empathy to people with different background.

III. PROPOSAL FOR A MULTI CASE STUDY RESEARCH PROJECT

A. Preliminary Research Questions

The planned research will investigate the following research question:

Are there differences in learning success and perception of learning success, depending on the participants' culture and further participant characteristics, the learning context and the trainer characteristics?

B. Research Approach

The research study will investigate courses and Best Practices for RE training and teaching. However, what works well in one cultural context might work less well in another context. We will therefore experiment with different training formats in different cultural context and compare the results, like learning success by the participants, fun, and other quantitative and qualitative criteria. "Culture" here not only means national culture, but also professional cultures as discussed above and also differences between different learning contexts like university teaching, a workshop at a conference, an in-house training in a company.

C. Research Phases

The phases of the study are proposed as follows:

1) Research Project Setup

We search for research partners outside Germany, especially also outside of Europe. These partners can be university teachers, trainers and researchers. The final research design will be a developed among all partners to incorporate specific constraints.

2) Extension of the literature research,

especially by a systematic collection of existing research results and teaching case studies

3) Preparation

In order to control and align the conditions of the multiple case studies, course material will be developed jointly and then translated in the necessary languages. The execution of the course unit will be discussed and optimized in detail. Such course units can be role games, modeling exercises or simulations of whole software engineering projects. We can adapt exercises from our previous courses, and like this use material that was used successfully in courses before. Examples of such RE courses like role games we discussed in a previous publication [14].

The study will demand only simple tools and infrastructures, like office software, meta plans, white boards or a freeware UML tool.

The courses' main objective is to teach RE. Executing the experiment is secondary in importance. Therefore, the additional effort for the participants created by the research must be minimized to a short questionnaire before the exercise and after. A teaching evaluation often takes place in trainings, so this is no large extra effort for the participants.

4) Evaluation of courses

The same course concept (or concepts) will be used in different learning contexts and different countries.

Experiences from each execution (case study) will be discussed in a telephone conference by all participating trainers, and course material will be optimized if necessary.

The learning context is described by the trainer in terms of independent variables like the following: country, language in which the training takes place, context (university, in-house training in a company, external training, workshop at a conference), group size, characteristics of the trainer (age, teaching experience, work experience, Dreyfus level [4]).

In order to characterize the participants, data like the following shall be gathered before the experiment: age and work experience of the participants, their mother language and home country (where they spent their school time). Herkenhoff's Professional Culture survey PC08 [13] is a base for analyzing aspects of professional culture. Hofstede's Values Survey Module VSM 2013 [18] focusses on organizational culture. These surveys could be used in the evaluation of

aspects of professional and organizational culture. Further variables are possible.

In order to measure the learning effect, the following data could be gathered before the course unit: previous knowledge about what has to be learned, practical experience with what has to be learned, Dreyfus level, actual knowledge (measured by a quick test). And after the course unit: actual knowledge (measured by another quick test) and Dreyfus level. Also, the quality of the results of the course unit (e.g. models or documents) shall be quantified.

The course participants are also asked to comment on their own learning success, the fun they had, what they think about the learning method, the type of exercise and the teacher's teaching style – quantitatively on Likert scales and qualitatively as free text remarks [7].

5) Data Analysis

It will be analyzed statistically whether there are differences in learning success and perception of learning success, depending on the learning context, the participant characteristics and the trainer characteristics.

We will test the hypothesis that there are differences between learners from different cultures in terms of the dependent variables we measure, e.g. quality of the result produced or fun experienced.

There will also be a qualitative analysis of the free text remarks of the participants.

6) Development of Best Practices

From our analysis results, best practices for teaching RE in different cultures will be derived and summarized. As we look into intercultural research, we are fully aware that these best practices might recommend different practices for different cultures, i.e. there might not be the one solution that fits all.

Goeken and Patas [10] adapt the idea of an empirical evidence-based framework from medical research to RE research. They criticize a missing re-evaluation of results of RE research. Typically, a research artifact is evaluated by the researchers. This situation should be overcome by the evaluation of results by third-party researchers. In this sense the suggested research project could be a way for improving the research quality.

IV. DISCUSSION

Starting to investigate the importance of culture within RE trainings might be (a little) like opening up a new dimension of RE research. As we have outlined, the cultural aspects offer many dimensions to research. Combined with the multi-faceted domain of RE this leads to many open questions, that can and will not all be answered within our research project.

Thus, even though we outline an interdisciplinary approach towards different aspects of culture in the context of RE trainings, we will need to limit our research to parts of this new dimension. We clearly will not be able to answer all upcoming questions, but will collect ideas and questions that remain unanswered. The proposed design project will not produce a "silver bullet" for RE training, but considering the lack of research on this topic, it will be a first step with impact on research as well as on RE training. The experiences of this first research stage could be used for further international research projects on RE. And it can help trainers to choose and adapt trainings concepts to their audience.

With the Hofstede dimensions for international and organizational cultural aspects and the Herkenhoff dimensions we use proven concepts and tools that allow a reference to other studies.

Threats to validity: Even with the same training material, the same exercise will be executed differently by different trainers. Therefore, we need data from multiple executions of the same course unit in the same culture, if possible by different trainers.

V. SUMMARY

This paper describes a proposal for an intercultural multi case study research project for evaluating RE training courses in different cultural contexts and for discovering differences between these cultures.

Our next steps will be to find research partners and to refine the research design together.

REFERENCES

- J. Bolten, "Was heißt 'Interkulturelle Kompetenz?' Perspektiven für die international Personalentwicklung", in J. Berninghausen and V. Künzer (eds.), Wirtschaft als interkulturelle Herausforderung: Business across Cultures, Berlin, 2007
- [2] M. Bond, "Finding Unusual Dimensions of Individual Variation in multi - Cultural Studies of Values: the Rokeach and Chinese Value Surveys", Journal of Personality and Social Psychology, 55, pp. 1009-1015, 1988.
- [3] S. Deshpande, I. Richardson, V. Casey, and S. Beecham, "Culture in global software development", Global Software Engineering (ICGSE), 2010 5th IEEE International Conference on, pages 67-76, 2010.
- [4] S. Dreyfus, H. Dreyfus: A five-stage model of the mental activities involved in direct skill acquisition, No. ORC-80-2. Univ. Berkeley Operations Research Center, 1980.
- [5] A.H. Dutoit, J. Johnstone and B. Bruegge, "Knowledge scouts: Reducing communication barriers in a distributed software development project", Proceedings of the Eighth Asia-Pacific on Software Engineering Conference APSEC, IEEE, pp. 427-430, 2001.
- [6] G. Gabrysiak, H. Giese, A. Seibel, and S. Neumann, "Teaching requirements engineering with vir- tual stakeholders without software engineering knowledge," in Requirements Engineering Education and Training (REET), 2010 5th International Workshop on, pp. 36–45, Sept 2010.
- [7] B.G. Glaser and A.L. Strauss, "The Discovery of Grounded Theory. Strategies for Qualitative Research", New York, 1967.

- [8] M. Goeken, and J. Patas, "Evidence-Based Structuring and Evaluation of Empirical Research in Requirements Engineering. Fundamentals, Framework, Research Map", in Business Information Systems Engineering, 2010 ; original: "Evidenzbasierte Strukturierung und Bewertung empirischer Forschung im Requirements Engineering", in Wirtschaftsinformatik 52 (2010), No 3, pp. 173-184, 2010
- [9] O. Gotel, V. Kulkarni, M. Say, C. Scharff, and T. Sunetnanta, "Distributing responsibilities to engineer better requirements: Leveraging knowledge and perspectives for students to learn a key skill," in Require-ments Engineering Education and Training (REET), 2009 Fourth International Workshop on, pp. 28–37, Sept 2009.
- [10] J. Grieb and U. Lindemann, "Design Communication in Industry: A Survey Analysis", International Conference on Engineering Design ICED 05, pp. 586-587, 2005.
- [11] R.E. Grinter, J.D, Herbsleb and D.E. Perry, "The geography of coordination: Dealing with distance in R&D work", Proceedings of the ACM Conference on Supporting Group Work (GROUP 99), Phoenix, pp. 306-315, 1999.
- [12] J.D. Herbsleb, "Global Software Engineering: The Future of Socio-technical Coordination", Proceeding FOSE '07 2007 Future of Software Engineering, pp. 189-198, 2007.
- [13] L. Herkenhoff, "Professional Culture, Emotional Intelligence and the Emotional Process Model", in: The Journal of Organizational Leadership & Business, Spring 2010 http://www.tamut.edu/jolb/scholar/2010summer/2010herkenhoff .pdf
- [14] A. Herrmann, A. Hoffmann, D. Landes, R. Weißbach, "Experience-Oriented Approaches for Teaching and Training Requirements Engineering: An Experience Report. Proceedings of the 20th Interational Working Conference, REFSQ 2014, Essen, Germany, April 7-10, 2014, Camille Salinesi, Inge van de Weerd (eds.), Springer, Lectures Notes of Computer Science LNCS 8396, pp. 254-267
- [15] A. Hoffmann, "Reim—an improvisation workshop format to train soft skill awareness", in Cooperative and Human Aspects of Software Engineering (CHASE), 2012 5th International Workshop on, pp. 56–62, IEEE, 2012.
- [16] G. Hofstede, "Culture's Consequences: International Differences in Work Related Values", Beverley Hills, CA: Sage Publications, 1980.
- [17] G. Hofstede, "Culture", <u>http://geerthofstede.nl/culture.aspx</u>, accessed 13 May 2014
- [18] G. Hofstede, Values Survey Module 2013 Questionnaire, http://www.geerthofstede.com/media/2124/VSM%202013%20E nglish.doc, accessed May, 28th, 2014

- [19] The Hofstede Center: "Dimensions", <u>http://geert-hofstede.com/organisational-culture-dimensions.html</u>, accessed May, 28th, 2014
- [20] IREB: IREB Certified Professional for Requirements Engineering Syllabus, Version 2.1, December 20th 2012, http://www.ireb.org/fileadmin/IREB/Lehrplaene/IREB_cpre_syl labus_FL_en_v21.pdf
- [21] T. Lethbridge, "A survey of the relevance of computer science and software engineering education", llth International Conference on Software Engineering, 1998
- [22] S. Overhage, O. Skroch, and K. Turowski, "A Method to Evaluate the Suitability of Requirements Specifications for Offshore Projects", in Business Information Systems Engineering, 2010; original: "Eine Methode zur Bewertung der Eignung von Anforderungsspezifikationen für Offshoring-Projekte", in Wirtschaftsinformatik 52 (2010), No 3, pp. 149-159, 2010
- [23] R. Prikladnicki, J.L.N. Audy and R. Evaristo, "An Empirical Study on Global Software Development: Offshore Insourcing of IT Projects", Proceedings of the International Workshop on Global Software Development, International Conference on Software Engineering (ICSE 2004), IEEE, Edinburgh, Scotland, pp. 53-58, 2004.
- [24] E.H. Schein, "Coming to a New Awareness of Organizational Culture", Sloan Management Review, 25:2, p.3, 1984
- [25] Standish Group: Extreme CHAOS, 2001
- [26] J. Stein and A. Herrmann, "The Origin of Cultural Barriers in Distributed Software Development", DASMA Software Metrik Kongress, pp.143-159, 2013
- [27] M. Svahnberg, T. Gorschek, M. Eriksson, A. Borg, K. Sandahl, J. Borster, and A. Loconsole, "Per- spectives on requirements understandability – for whom does the teacher's bell toll?," in Requirements Engineering Education and Training, 2008. REET '08., pp. 22–29, Sept 2008.
- [28] A. Von Stettn, D. Beimborn, and T. Weitzel, "Analyzing and Managing the Impact of Cultural Behaviour Patterns on Social Capital in Multinational IT Project Teams – A Case Study Approch", in Business Information Systems Engineering, 2012, original: "Auswirkungen kulturspezifischer Verhaltensmuster auf das Sozialkapital in multinationalen IT-Projektteams", in Wirtschaftsinformatik 54 (2012), No 3, pp. 135-151, 2012
- [29] R. Weißbach, "Bridging the Communication Gap in Information System Projects: Enabling Non-IT Professionals for the Requirements Engineering Process", Applied Research in Professional Education. Proceedings from the first CARPE networking conference in Utrecht on 2-4 November 2011, J. Kettunen, Juha et al., Eds., Turku: Turku UAS 2012, p259ff. (julkaisut.turkuamk.fi/isbn9789522162519.pdf)