Can eLearning contribute to the practical usage of requirements engineering in SMEs?

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Abstract

The application of requirements engineering in business, esp. in SMEs may not be called a "success story". But why do many software developers ignore research results, e.g. from the standish group, that show clearly the risks and disadvantages of unsystematic and incomplete requirements? Maybe the reason is rather a lack of motivation than a lack of information. This short paper describes a web based training approach that delivers basic information about requirements engineering and that takes also into account motivational factors.

Keywords: requirements engineering, small and medium sized enterprises, education, training, web-based training

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1   Situation

Despite many years of discussion about the benefits of systematic requirements engineering, there still seems to exist a gap between theory (science) and practice (business, esp. SMEs): Requirements engineering has been unable to permeate business on a wide scale. This problem of academic discussions and business practice not being simultaneous is not an uncommon phenomenon, and is certainly not limited to technical artifacts. Rather, one might call it the typical destiny of new methods: Things that have worked "somehow" for years are quietly transformed into lived culture and are no longer up for discussion. The possibly existent pressure of suffering from unstructured processes is juxtaposed to the assumed additional effort needed for changing these processes – a comparison that, at first glance, might look like an argument against innovation.

During the past ten years, several attempts have been made to empirically study the difficulty of transferring requirements engineering into software developing companies [1], [2], [3], [4], [5], [6], [7]. In their study, [6] report on four factors influencing the degree to which requirements engineering is adopted in practice: training, complexity, integration into the company's processes, and the company culture. In their survey taken in twelve software companies, [3] confirm that most problems in the context of requirements engineering are of an organizational nature rather than a technical nature.

In their categorization of company-related obstacles to systematic requirements management, communication between developers and inappropriate skills occupy the top positions.

Table 1:   Company-related problems with implementing requirements engineering according to [3]

	Frequency	Percentage
Developer communication	56	24
Inappropriate skills	47	20
Inadequate resources	33	14
Staff retention	29	13
User communication	28	12
Lack of training	19	8
Company Culture	18	8
Total number of organisational problems	230	100

[2] points out that missing competencies do not necessarily affect only the developers. Often, it is the lack of knowledge among decision makers and project managers which leads to excuses and to the rejection of requirements engineering:

- They do not know how requirements are elicited.

- They cannot select suitable requirements and are unable to recognize quality deficiencies of requirements.

- They do not see the risks of inadequate requirements for the success of the project.

The results of this study and others, which are all based on surveys undertaken in companies, clearly show that the transfer of requirements engineering into practice is also a problem of affinity for requirements engineering, and that systematic technology transfer or a massive qualification offensive alone are not enough to solve it.

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2   Web-based Training for Sensitization

In the context of the consortium project "ReQMan" funded by the German Ministry of Education and Research BMBF, a web-based training course on the fundamentals of requirements engineering was developed. This training course is mainly directed at employees in small and medium-sized enterprises and is made available free of charge on the portal "RE-Wissen.de" at http://www.re-wissen.de/Reqman_Kurs/.

The goal of the training course is to teach the major process steps and methods of requirements engineering in a clear and concentrated form. In addition to providing content, the objective is to raise awareness for the necessity and feasibility of requirements engineering.

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3 Setup of the Web-based Training Course "Fundamentals of Requirements engineering"

The introduction to the training course is a three-minute animation in which the users of the training course are informed about the benefits, the prerequisites, and the subject of requirements engineering.

In the course area, the course offers five course modules, which can be worked on independently of each other. Each module takes about 30 minutes to complete.

The content modules present the following phases: elicitation, analysis, specification, verification and validation. A training module offers the possibility to directly check one's level of knowledge.
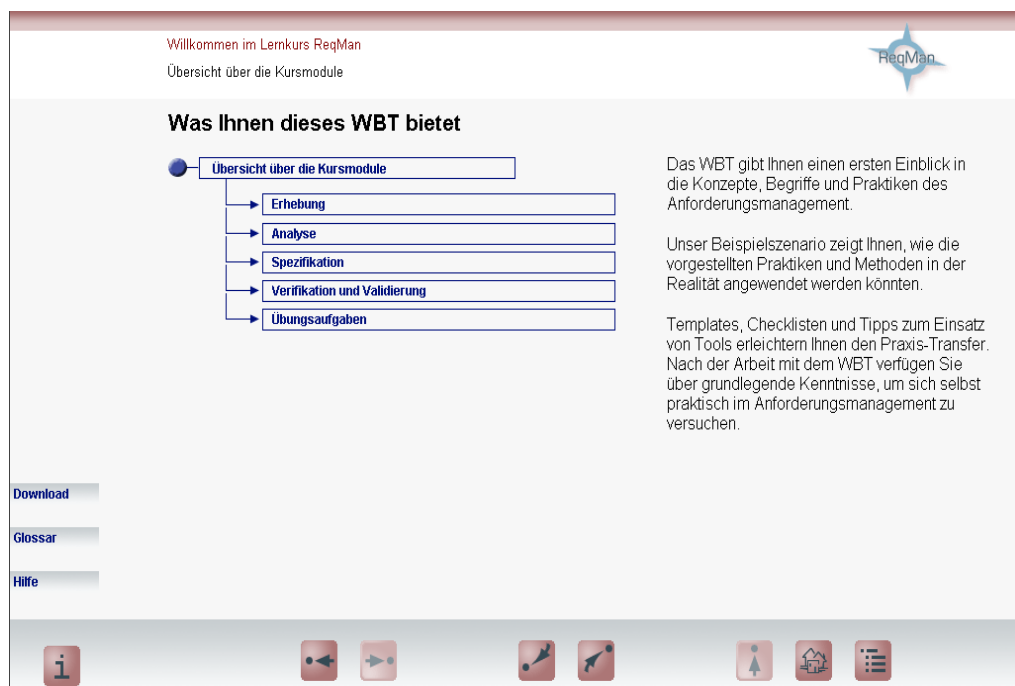

Figure 1:   Overview of the course modules

On the different pages of the course, basic terms are explained in a compact, application-oriented form, and processes are presented. As a complement to this "theory section", illustrations, checklists, templates, and a glossary on central keywords are offered. Especially the printable checklists and templates are

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Setup of the Web-based
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intended to motivate the transfer of the information presented into one's own practice and to show a simple "way of small steps".

Figure 2:   Content pages of the course modules

A continuous sample scenario illustrates the application options of the techniques in a real project, shows the communication interfaces, and emphasizes the social and discursive character of requirements engineering: A fleet control system is to be developed for a taxi company. The software company contracted convinces the customer to perform systematic requirements engineering involving all stakeholders. The scenario shows a possible process flow during the phases elicitation, analysis, specification, and verification and validation.

Wie läuft die Anforderungserhebung ab?

Ziel dieses Workshops ist die Identifikation der Rollen der einzelnen Stakeholder im Taxiunternehmen und die Erfassung ihrer jeweiligen Ziele. Es war nicht ganz leicht, Frau Schnell davon zu überzeugen, dass ihre Mitarbeiter wichtige Informationslieferanten für die Systementwicklung sind. Ausschlaggebend war letztlich das Argument, dass die Berücksichtigung der Ansprüche und Ziele der zukünftigen Systemnutzer hilft, Kosten zu sparen und die Akzeptanz zu erhöhen. Würde man die Sicht der "Betroffenen" eines Systems ausblenden, ergeben sich häufig unnötige Fehler in der Anforderungsanalyse und dadurch natürlich auch Folgekosten in der Entwicklung.

Im nächsten Schritt werden die Stakeholder einzeln interviewt. Der Fokus der Fragen liegt auf den Aufgaben, Tätigkeiten und Handlungsabläufen der Stakeholder, da das zu entwickelnde System genau diese Aufgaben, Tätigkeiten und Handlungsabläufe unterstützen soll.

Figure 3:   The sample scenario

Different types of exercises make it possible to quickly and easily check learning progress:

• Multiple choice exercises

• Free text exercises

• Assignment exercises

• Simulated review of requirements

4   Extension Options

The web-based training courses developed by Fraunhofer IESE are normally not offered as stand-alone solutions, but are rather a part of hybrid learning arrangements combining web-based self-learning elements with classroom training or other forms of synchronous learning (NetMeeting, moderated chats).

This approach of variant-rich, interactive Blended Learning follows the theoretical concept of a Knowledge Layer Model as shown in Figure 4: The self-learning elements refer to the basic knowledge, which is often of a technical nature, but may also contain basic procedural knowledge. The learners can study this basic knowledge at their own pace and time with the help of the web-based training course. Transfer of the manifested knowledge content into real application contexts is done in two steps:

In classroom training sessions, knowledge is applied and deepened through the use of real problems and project documents, if possible, from the learners' area of work.
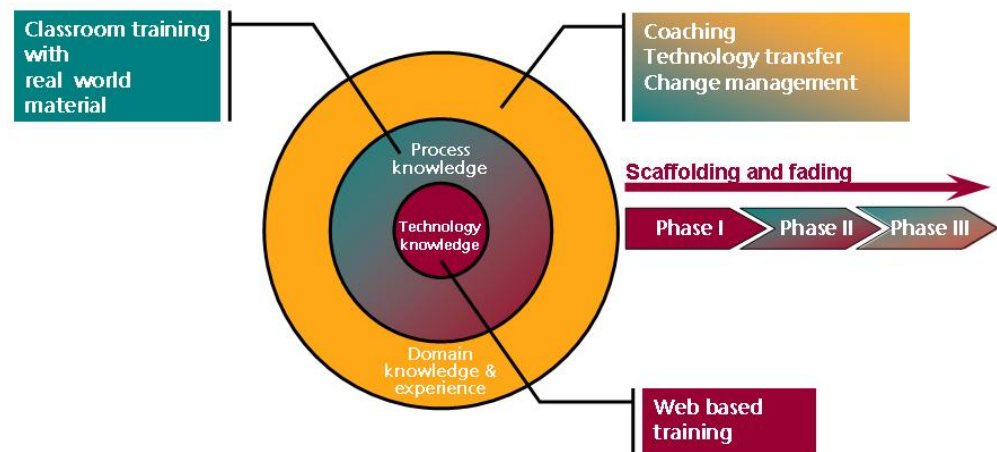
Figure 4:   Knowledge Layer Model

One possible set-up of such a type of training is shown in Figure 5. It needs to be stressed that the first and the last step are independent of any organized qualification program. The web-based form of training and the programs offered by a Community of Practice are uncomplicated, informal, and free learning programs that consciously keep the threshold inhibiting people from learning more about requirements engineering low. For learners who want to get involved deeper and who want to learn more, Fraunhofer IESE offers needs-oriented seminars on special requirements engineering topics.

Figure 5:   Extended Training Approach

5 Conclusion

In addition to systematic qualification regarding requirements engineering methods and techniques, sensitization for the issue and motivation for practical implementation are among the central tasks of successful knowledge and technology transfer. Approaches based merely on the disadvantages of insufficient requirements engineering are obviously too short-sighted and accomplish little in practice. The (economic) benefit must be clearly proven and communicated, and possibilities for uncomplicated learning and implementation of the methods must be shown.

The application of the techniques learned in the respective company of the learner usually entails (re-)structuring of the old processes and the technological environment. Supported by coaches acting as a knowledge resource and as advisors, this "change" is implemented with a lasting effect both on the knowledge level and on the technology transfer level Embedded in such a long-lasting learning environment, the web-based training course "Fundamentals of Requirements engineering" can act as the starting point for the structured and planned transformation of the requirements engineering processes in a company.

Freely accessible, compact introductions to the world of requirements engineering such as RE-Wissen.de and the web-based training course „Fundamentals of Requirements engineering" reduce the complexity of the issue and offer the option of dealing with the processes and their implementation in one's own company in a stepwise manner. Formal and informal training programs or Communities of Practice have good chances for success if they do not exclusively follow a content logic that satisfies the experts, but rather place enough emphasis on motivational aspects and take into account the real situation in the respective application contexts.

References

[1]   El Emam, Kh.and Madhavji, N.H.. A Field Study of Requirements Engineering Practices in Information Systems Development, in: Proceedings of the Second IEEE International Symposium on Requirements Engineering, York, England, 1995: IEEE Computer Society, pp. 68-80.

[2]   Gabb, A.: Requirements Denial - Examining the Excuses. Proceedings of the The International Test and Evaluation Society (ITEA), October 1999, pp.?

[3]   Hall,T. Beecham, S. and Rainer, A.: Requirements problems in twelve software companies. An empirical analysis, in: IEE Proceedings-Software, Vol.149, No.5, October 2002, pp.153-160.

[4]   Juristo, N., Moreno A.M., Silva, A.: Is the European Industry moving towards solving requirements engineering problems? In: IEEE Software, November/December 2002.

[5]   Kamsties, E. Hörmann, K. and Schlich, M.: Requirements Engineering in Small and Medium Enterprises, in:Requirements Engineering, Vol. 3, No. 2, pp. 84-90.

[6]   Morris, P., Masera, M. and Wilikens, M: Requirements Engineering and Industrial Uptake, in: Proceedings of the Third IEEE International Conference on Requirements Engineering, Colorado Springs, 1999, Colorado: IEEE Computer Society, pp. 130-137.

[7]   Uolevi, N., Sajaniemi, J., Kälviäinen, H.: A state-of-the-pracitice survey of requirements engineering in small and medium sized enterprises. Telecom Business Research Center Lappeenranta, Research Report 1, Lappeenranta University of Technology, Lappeenranta 2000 http://www.lut.fi/TBRC/

Document Information

Title: Can eLearning contribute
              to the practical usage of
              requirements engineering
              in SMEs?

Date: October 6, 2006
Report: IESE-139.06/E
Status: Final
Distribution: Public