SPICE Level 3 - Experience with Using E-Learning to Coach the Use of Standard System Design Best Practices in Projects

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Abstract. Most improvement initiatives focus on assessments and derived improvement plans. However, the effort to really implement and sustain improvements is much bigger than the assessment effort. Also, it is crucial for SPI success that improvements are not just a collection of formal documentation requirements but show real benefit for the development and help to optimize the development.

Successful internal improvement programs focus on key solutions which can be used by all projects. This way e.g. design practices are exchanged, best practices established, and rolled out and coached to all projects. Thus if you have e.g. 30 customer assessments you do not improve 30 times with project specific budgets, you share and find a proper solution and roll it out to 30 projects. This thinking helps to focus the investments for improvements.

In this paper we describe how such a working group in SOQRATES (a set of shared task forces in German, Austrian and French industry) has set up a team to share best practices in design and how we elaborated this in a learning environment which has started to be rolled out organisation wide.

Keywords: Process Improvement, Learning Organizations, Integrated SPI Learning Strategies, Experiences.

1 Introduction and History

In 2003 the SOQRATES initiative has been kicked off supported by the Bavarian software initiative and ISQI. In SOQRATES cross company task forces have been set up to develop key knowledge for industry in the areas of system design, test, requirements management, agile development and functional safety [1], [2], 4], [5]. Since now 7 years the teams work together and deliver annual knowledge releases.

The team about "Systems Design" has been set up in 2003 and the team about "Functional Safety" started in 2006.

A. Riel et al. (Eds.): EuroSPI 2010, CCIS 99, pp. 213–221, 2010.

What makes the working groups special is the fact that we exchange best practices, base on experiences that really worked out and create concepts which are proven in use and also fit to the overall principle of Automotive SPICE and ISO 15504 [2],[4]. Thus instead of copy and pasting e.g. a standard guideline and book for re-usable design we rather made a research what worked in the leading firms, and then created our own library of best practices. Another difference to the generally known SPI papers and approaches is that we do not restrict ourselves to software development, but we extended the principles to systems and product development concepts.

Till 2008 best practices agreed were shared in a team working portal. In 2009 we developed a new strategy where the task forces create learning components in an e-learning portal so that people from the work place of the participating firms can attend learning sessions. This learning system know how has been provided by the EU project "ELM E-Learning Manager" [10]. This way the system design practices agreed among the members became available in online courses.

In 2010 the SOQRATES [8] partners shared a strategy with the "Integrated Designer Project" [10] which is supported by the EU and runs under the umbrella of the ECQA European Certification and Qualification Association. This allowed us to define the elaborated best practices as modules of a Europe wide qualification. To assure privacy of the working party members only principles were shared but the content which is knowledge of our working group has not been shared. This way the SOQRATES members had a chance for qualification and certification free of cost, unlimited access to the knowledge the group elaborated, and while we shared principles, the concrete success examples remain an ownership and in privacy for the group.

2 Learning Strategy

Processes describe objectives, roles, activities, results, etc. Knowledge bricks describe real useful and practice oriented work patterns which help to fulfill the technical and process goals at the same time. This synergy is a major driver that "theoretical" processes get acceptance by "practical" staff [2], [4].

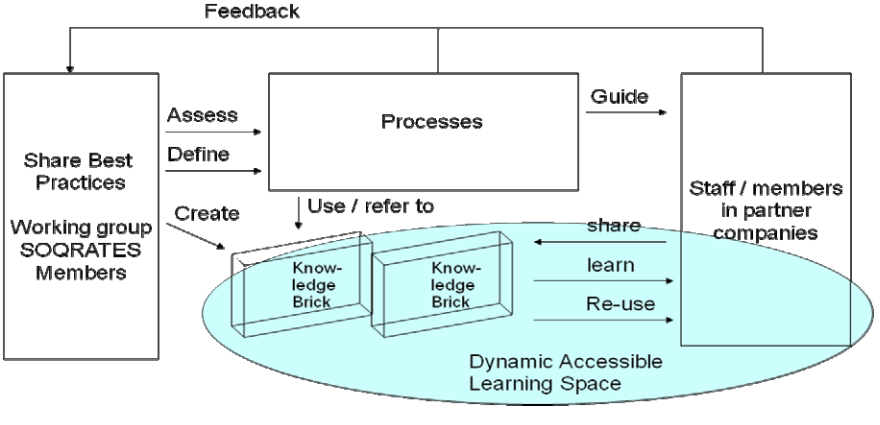


Fig. 1. Strategy - Sharing and Learning Best Practices

3 Implementation Example – System Design Best Practices Transfer

The working parties define goals per year and create a knowledge release per year. In the system design task force the following main topics had been elaborated until 2008.

- System design and Requirements Traceability
- Re-Usable Design
- Design Metrics
- Using SysML for systems design
- How to measure quality of a design

In 2009 the functional safety task force the following main topics had been elaborated until 2009.

- Additional requirements from IEC 61508
- Additional requirements from ISO 26262 [7]
- Integrating Automotive SPICE with IEC 61508 and ISO 26262 [7], [8]
- Creating an integrated assessment portal for SPICE and safety

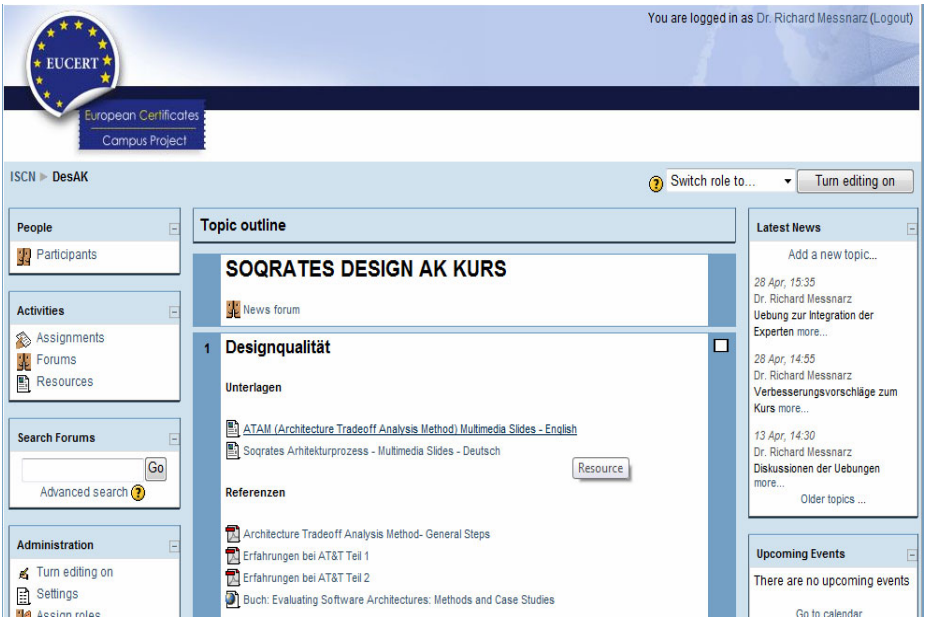


Fig. 2. Learning system for Best Practices

Since 2010 both working parties joined forces and elaborated on two main topics

- Integrating previous knowledge in learning portals and rolling the knowledge out with qualifications / certifications supported by ECQA.

- Elaborating on "How to measure complexity on products, systems, and software level". So far most measures which are published relate to software.

From April 2010 onwards the knowledge releases were available in this online knowledge system.

3.1 Learning Steps

In general each element was taught as follows [10]:

- Step 1
  - Presentations in Graz to those onsite
  - Those in Frankfurt, Erlangen and Nuremberg attended the online multimedia course element
- Step 2
  - Virtual discussion of the materials
  - Discussion of exercise and homework for 2 hours
- Step 3
  - Each company applies the principles on their own system and publishes an example
  - All meet on Skype and discuss the exercise results
  - Trainer concludes the lessons learned

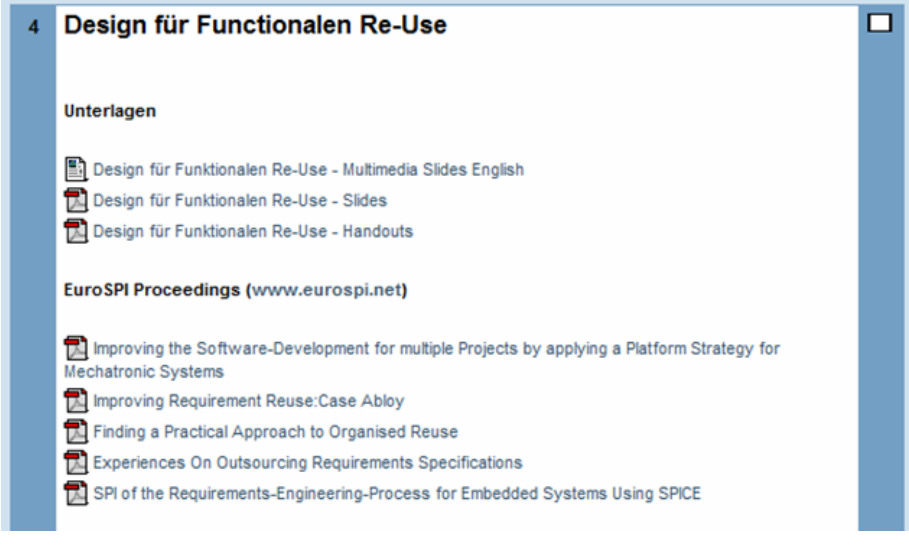


Fig. 3. Course – Functional Re-Use

The exercise included the example definition of reusable requirements and functional components for the automotive systems represented by the attendees.

Fig. 4. Exercises – Functional Re-Use

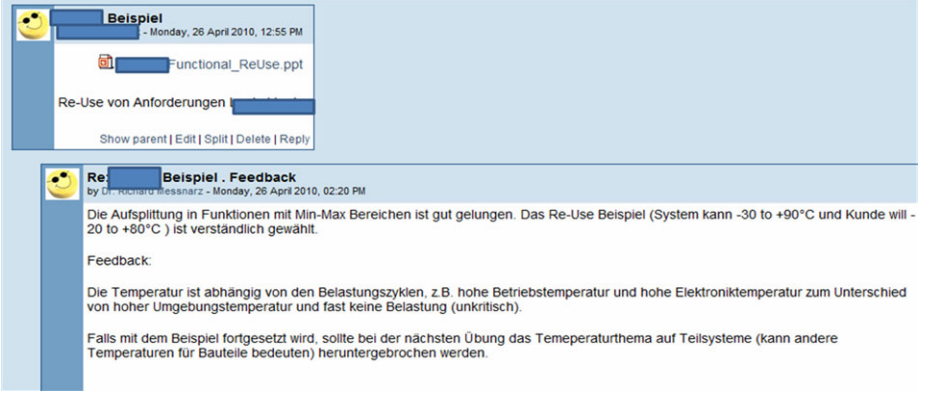


Fig. 5. Feedback – Functional Re-Use

3.2 Knowledge Roll Out

The following learning modules have been created in SOQRATES:

- Design Quality
- Design and Functional Re-Use
- Design and Requirements Coverage
- Functional safety Design

Within 2010 and latest till beginning of 2011 the following learning modules will be added:

- Design Using SysML (Elaboration of knowledge from previous years work)
- Measuring design complexity on product, systems, and software level.
- Combined Safety (IEC 61508 / ISO 26262) and SPICE Assessments plus Tool Training

Two online courses have been performed with leading SOQRATES members like staff from Continental Automotive, ZF Friedrichshafen AG, Magna and a set of middle sized electronic and service companies.

Within 2010 a trail in-house in a world wide active supplier take place. We plan to demonstrate the roll out of SOQRATES task forces knowledge into work places using this new ways of learning.

3.3 Certification for Design AK Skills

In SOQRATES we do not only share and now roll out best practices using new was of learning (where all can access from the work place) but we created the access to certification of staff based on a Europe wide level (recognised in 18 countries).

In the iDesigner project within the ECQA (European Certification and Qualification Association) we defined learning goals for the following elements in systems and product design:

- **Managing Complexity in Systems Design**
  - Design Quality
  - Design and Functional Re-Use
  - Design and Requirements Coverage
  - Functional safety Design
  - Design Integration
  - Design Innovation
- **Understanding Product Life-cycle Engineering**
- **Working in Distributed Engineering Teams**
- **Life-cycle Assessment in Integrated Design: Disassembly and Recycling**
- **Use of VR (Virtual Reality) Technology for Design Support**

The certificate for the iDesigner includes five main areas and elements per area. The SOQRATES modules refer to these elements and currently cover 4 of them.

The iDesigner training is a separate environment while the SOQRATES learning portals (for the elements we cover) contain same principles but more/additional practice and experiences.

This separation protects the interests of SOQRATES members.

However, basing on the same vision allows us to prepare own staff for the European certificate and offer training in-house online free.

The iDesigner project is largely driven by French engineering companies with contributions from a Europe wide manufacturer network including German members.

3.4 Advanced Certification for the Improvement Managers

In the ELM (E-Learning Manager) [10] project within the ECQA (European Certification and Qualification Association) we defined learning goals for improvement managers to use such learning systems to roll out best practices.

All SOQRATES members were offered free access in 2010 to this training and certificate. Here we learned the following topics:

In the management unit they improvement managers learn methods and practices to establish learning based best practice sharing and perform three major exercises where tools and examples are provided:

- **Exercise 1:** Select a recent problem the management wants to solve and where sharing of knowledge is needed. Argue an e-learning solution and analyse ROI scenarios.
- **Exercise 2:** Select your own organisation and try to define the learning process and position the e-learning methodology and technology as part of the strategy. Prepare this as a presentation to convince the manager to also include e-learning functions in the overall strategy of the company. Upload this in the discussion forum and discuss it with the trainer.
- **Exercise 3 (optional):** Perform an e-learning capability assessment (EMM Model) and conclude about an improvement plan.

In the technology unit the attendees learn how to implement the best practices in such a learning format.

- **Exercise 1:** Each participant was trained to create their own SCORM compliant package and upload this to the training environment.

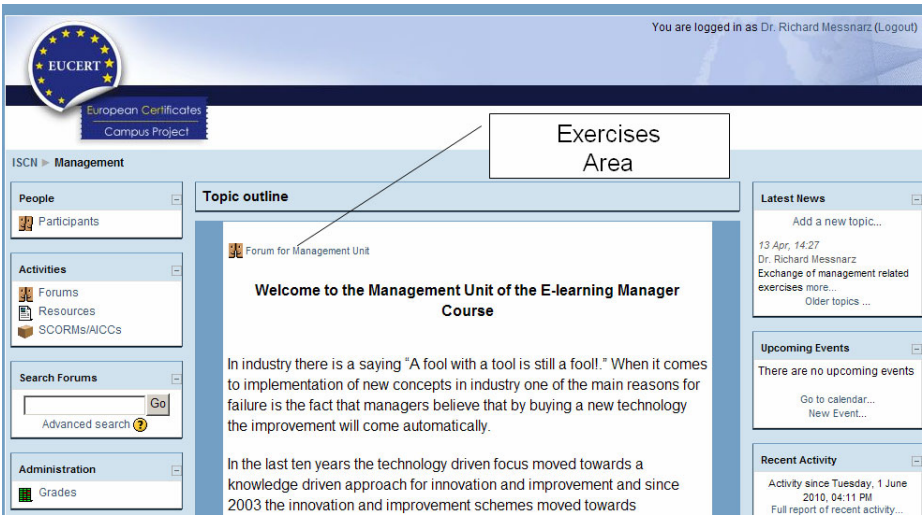
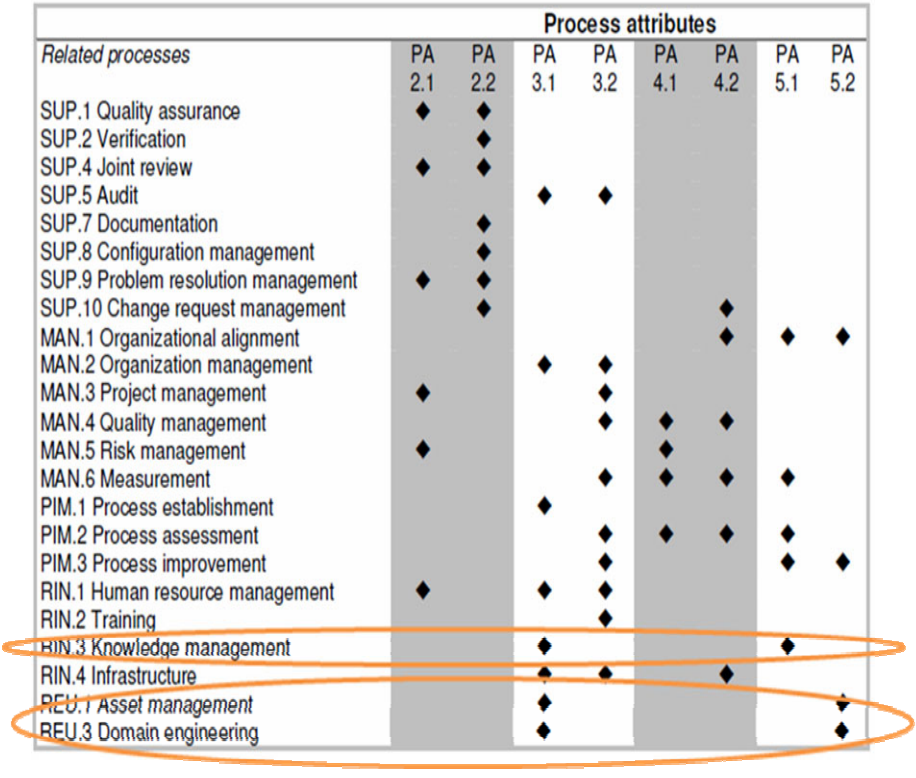


Fig. 6. Learning Manager Skills

3.5 Automotive SPICE Level 3 Strategy

In the SOQRATES [6], [8], [11] partnership the idea is (see Fig. 1 before) that a level 3 is not only a strategy for quality management. ISO 15504 [11] in the section related processes illustrates that level 3 is also related to Knowledge Management, Asset Management and Domain Engineering (see Fig. 7).

These processes are part of the ISO 15504-5 assessment model but have not been selected by Automotive SPICE. However, the SOQRATES group philosophy is that exactly these three processes assure that level 3 is a long term knowledge based approach which brings value to the form and is not just done to satisfy for a specific project a specific customer.



	Process attributes							
Related processes	PA 2.1	PA 2.2	PA 3.1	PA 3.2	PA 4.1	PA 4.2	PA 5.1	PA 5.2
SUP.1 Quality assurance	♦	♦						
SUP.2 Verification		♦						
SUP.4 Joint review	♦	♦						
SUP.5 Audit			♦	♦				
SUP.7 Documentation		♦						
SUP.8 Configuration management		♦						
SUP.9 Problem resolution management	♦	♦						
SUP.10 Change request management		♦				♦		
MAN.1 Organizational alignment						♦	♦	♦
MAN.2 Organization management			♦	♦				
MAN.3 Project management	♦			♦				
MAN.4 Quality management				♦	♦	♦		
MAN.5 Risk management	♦				♦			
MAN.6 Measurement				♦	♦	♦	♦	
PIM.1 Process establishment			♦					
PIM.2 Process assessment				♦	♦	♦	♦	
PIM.3 Process improvement				♦			♦	♦
RIN.1 Human resource management	♦		♦	♦				
RIN.2 Training				♦				
RIN.3 Knowledge management			♦				♦	
RIN.4 Infrastructure			♦	♦		♦		
REU.1 Asset management			♦					♦
REU.3 Domain engineering			♦					♦

Fig. 7. Related Processes

4 Experiences and Feedback

Concerning the Design AK modules the general the feedback was very positive and the teams actively collaborated. They also delivered a number of improvement comments.

- We should split between principle slides and case study. The case study slides can be exchanged per application area.
- All presentations should have same/similar multimedia style.
- The exercises and the discussion of exercise results is the highest value, so time for exercise discussions must be prolonged.

In future we plan that in all partner firms the best practices are available online in form of training and coached by practical exercises and examples. People do not travel, its just part of their work environment.

We realised that moving into this way of knowledge sharing requires an upgrade of skills of improvement managers. First they were sceptic but once they realise that

such a learning module with nowadays available systems can be established in a few days, they made the exercises and plan now to use it.

Level 3 is more than a defined set of processes. It's a platform of knowledge with shareable best practices that form a standard way of working. Practice shall be the basis of a standard implementation.

Learning nowadays has changed as well. Like we use Google to answer some general questions, we can use such best practice knowledge transport to answer technical and process related issues.

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If you want to join the working party please contact Dr Richard Messnarz as moderator of the task forces at rmess@iscn.com. Also please note that the participation requires a commitment to participate in 2 general meetings and additional 4 working meetings per year.

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