

“Must have that Business Intelligence...!”

How to illustrate complex processes by interactive exercises and role playing.

Mirka Kans, Ia Williamsson

Abstract—In enterprises we find many complex processes consisting of several sub-processes and actors, each of them contributing to the end outcome. Teaching on complex processes is not easy if the aim is deep knowledge regarding the processes and how different activities and choices will affect the final outcomes. An example of a complex process is the Enterprise Recourse Planning (ERP) systems procurement. A lot of different business representatives are involved in the procurement project, each with their opinion on how the optimal solution looks like. These opinions are often conflicting and the demands too many to be included in the formal requirements specification. Sometimes the requirements are the same, but expressed in different terms.

Definition and selection of requirements is one of many potential pitfalls of Information Technology (IT) procurement which is dealt with during a half day exercise in ERP procurement in the course “Integrated Business Solutions”. Through role playing the students experience the transformation of theories into practice by identifying, arguing for or against and thereafter agree upon a limited list of requirements. Another complex activity is the evaluation of alternatives, where the students first need to find suitable candidate systems and thereafter assess how well these satisfy the formulated requirements. The vendor web pages and an online search function provided by a consultant are used. This gives a good basis for discussions regarding assessment of information sources and how decision making is affected by available information.

This article describes the purpose and implementation of the above mentioned exercise. The exercise serves as an exemplification of how to create active learning situations that provide hands-on experiences and puts the problem solving and analysis abilities in a real context. Different skills trained during the exercise are highlighted using the Conceive-Design-Implement-Operate (CDIO) syllabus. The article also identifies pitfalls to be avoided when creating this kind of learning situations.

Index Terms—Engineering education, application software

I. INTRODUCTION

To teach is to make simplifications of the reality based on own and others experiences. As a serious and hard working teacher, you strive for helping the students

understanding the complexity of the future profession. But frankly, this is not easy! It does not matter how well prepared your Power Point slides are, how well you have managed to split the complex phenomenon into digestible chunks, or that you found the very best course literature, learning is an activity made by the student and is dependent on the students’ abilities and strategies to learn. In general, traditional teaching methods promote surface learning [1], while a deep understanding of the content is what most teachers would aim for.

Both researchers and practitioners confirm that a learning environment that activates the students has positive effects on the learning outcome [2-4]. McDonald and Scott in [3] claim that learning by doing and an integrated skills training gives connection between conceptualization and reality, develops the ability to think in a holistic way and develops an intuition for engineering. These are exactly the abilities we strive to reach when teaching the third year students in ERP systems procurement by an active and hands-on approach. This is realized as the exercise described below.

II. EXERCISE DESCRIPTION

A. Purpose and setup

The purpose of the exercise is to depict the IT procurement process by active student participation. The aim is give the students understanding of the complexity of the process and ways to manage this complexity. The teaching is set up as a half day exercise including role playing and decision making activities based on information collected from real-life sources. The exercise is held quite late into the course, when the students received both theoretical and practical understanding of the ERP system concept.

The students are divided into smaller groups of 5-6 persons. One teacher participates in each group. The exercise starts as a round table discussion where pens and post-its are main material. The exercise continues in a computer room with internet access. There web sites and spread sheet applications are utilized.

The case company utilized for the exercise is fictitious but realistic. The students have previously used the same case company in other courses, thus they are quite familiar with the company description. The students have prepared by reading the case company description and the exercise instruction. The

M. Kans is with the School of Engineering, Linnaeus University, 351 95 Växjö, Sweden (+46 470 708488; e-mail: mirka.kans@lnu.se).

I. Williamsson is with the School of Engineering, Linnaeus University, 351 95 Växjö, Sweden (e-mail: ia.williamsson@lnu.se).

exercise begins with a short introduction, the general time frame is presented and the roles are handed out.

B. Presentation and planning

The students are given a specific role, e.g. IT manager, CIO or Production manager described with characteristics relevant for the procurement project. The roles are humorously described to tempt student commitment. Students present themselves to each other according to their roles, excluding the personnel characteristics such as “stubborn”, “focused” or “greedy”, and briefly plan the further work. Teachers participate in the role of consultant, thus are active in the role playing but not directing the activity.

C. Brainstorming

Each student identifies requirements of the future ERP system according to their roles and the presumptions of the case company. The requirements are written down on post-its. Thereafter each requirement is presented to the full group. The student group discusses and sorts the requirements. Duplicates are identified and common patterns in other requirements are highlighted. For example, “user friendly”, “easy user interface” and “big buttons” might be combined into one requirement.

D. Requirements selection and prioritizing

From the set of requirements, a manageable number are chosen. The goal is to agree on approximately 10 requirements. An important part of this work is arguing for the desired requirement, i.e. to find relevant and winning arguments for why the specific requirement should be considered. The group has to negotiate on the final set and find a suitable trade-off considering the overall objectives of procurement. The requirements are thereafter ranked according to importance (mandatory, important, desirable).

E. Selection of candidate systems

Supported by the final requirements list, 3-5 alternatives for ERP system candidates are selected. Here the student use an on-line search function provided by an ERP consultant. The requirements are used as search terms. If the terms in the search engine do not correlate with the requirements list synonyms have to be found. A requirement expressed as “financial module” will for instance require the students to specify functionality in more details, such as “budgeting”, “invoicing” and “accounts payable and receivable”. A note: the engine is based on information from the vendor and is programmed by the consultant, thus here we get subjective judgments that will affect the selection.

F. Systems evaluation

Once the candidate systems have been selected a thorough investigation and ranking of these is made. Yet another tool is introduced for this purpose: a multi criteria decision making (MCDM) matrix. In the matrix the requirements are inserted and the relative importance of each requirement is given in form of a weight between 0-100. The candidates are evaluated according to their ability to fulfill the requirements, in the

scale 0-5. The vendor web pages are utilized as main source of information for the evaluation. The total requirements coverage is thereafter calculated. The qualitative judgments are in this way transformed into quantitative measures.

G. Choice

The best alternative of the candidate systems is chosen based on the outcome of the MCDM quantitative measures. Most often the alternative with highest total score is elected. However, in some cases other characteristics need to be considered in addition to the result of the MCDM, such as mandatory requirements fulfillment; the candidate scoring highest in the MCDM might not fulfill the mandatory requirements, and therefore another alternative with lower score would be chosen which fulfills the mandatory requirements.

When the final choice is made, the groups will motivate and discuss the outcome in class. A discussion regarding the decision and decision making process is directed by the teacher to highlight factors affecting the final decision (such as information coverage, subjectivity in selection and in evaluating the alternatives, or the students’ previous understanding), and how these factors would lead to quite varying results even though all groups worked with the same case.



Fig. 1. Selection and prioritizing of requirements.

III. SKILLS TRAINED

Several important skills are trained during the exercise. In Table 1 the most important ones are listed using the terminology of the CDIO syllabus version 2 [5]. The CDIO syllabus consists of four main groups of skills; 1) Disciplinary Knowledge and Reasoning, 2) Personal and Professional Skills and Attributes, 3) Interpersonal Skills: Teamwork and Communication, and 4) Conceiving, Designing, Implementing and Operating Systems. The exercise trains skills from all four groups, but especially from groups two and three, because the personal, professional and interpersonal skills are a necessity for succeeding with the assignment. Without good team operation and dialogue the group will not be able to cooperate.

Similarly, without problem solving and analytical skills the group will get stuck in arguing without being able to make necessary trade-offs and decisions.

IV. REFLECTIONS AND RECOMMENDATIONS TO AVOID PITFALLS

To make this exercise useful as a learning situation and to get the most out of it, we would like to reflect on some abilities and preparations that we found necessary.

First of all, each individual student must enter the exercise with willingness to act and share their thoughts, and a wish to participate actively throughout the exercise. They should possess the ability to speak freely, not only when asked for. Moreover, the student group should be confident with each other and allowing, thus let all participants contribute based on their qualifications. The teacher must be participating, however in a non-controlling, sensitive and allowing manner. This means that the teacher should allow the students to make their own decisions even if they might not be the optimal, but have the ability to guide the group throughout the exercise and in the end discuss the outcome from the perspective of pros and cons in the strategy applied.

Preparations are extremely important for all participants. The teacher must plan the exercise thoroughly. Written instructions and the time plan should be shared and clearly described for the students well in advance. Students should be familiar with the case company and understand the roles given before the exercise starts. They should also have basic knowledge in the specific area, in this case ERP systems and IT procurement. In addition, all participants should know each other quite well. We placed the exercise towards the end of the course to be able to fulfill these requirements and give the students the best opportunity to use and consolidate the knowledge and abilities achieved during the course.

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TABLE I
SKILLS TRAINED ACCORDING TO THE CDIO SYLLABUS

| Skill group | Skill | Activity where skill is trained |
|---|--|--|
| Disciplinary Knowledge and Reasoning | - Advanced engineering fundamental knowledge, methods and tools | Overall exercise level |
| Personal and Professional Skills and Attributes | - Analysis With Uncertainty - Solution and Recommendation - Survey of Print and Electronic Literature - Thinking Holistically - Emergence and Interactions in Systems - Prioritization and Focus - Trade-offs, Judgment and Balance in Resolution - Initiative and the Willingness to Make Decisions in the Face of Uncertainty - Perseverance, Urgency and Will to Deliver, Resourcefulness and Flexibility - Creative Thinking - Critical Thinking - Time and Resource Management - Ethics, Integrity and Social Responsibility - Professional Behavior | Choice Choice Candidate systems selection, Systems evaluation Requirements selection and prioritizing Brainstorming Requirements selection and prioritizing Requirements selection and prioritizing Overall exercise level Overall exercise level Brainstorming, Candidate systems selection Requirements selection and prioritizing, Systems evaluation Presentation and planning Overall exercise level Presentation and planning |
| Inter-personal Skills | - Team Operation - Oral Presentation - Inquiry, Listening and Dialog - Negotiation, Compromise and Conflict Resolution - Advocacy | Overall exercise level Choice Presentation and planning Requirements selection and prioritizing Brainstorming |
| C-D-I-O Systems | - Understanding Needs and Setting Goals | Overall exercise level |