Understanding IT-Management and IT-Consulting
Teaching as Product-Service System:
Application of an Engineering Model

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Abstract: In this research-in-progress paper we conceptualize the teaching of IT-Management and IT-Consulting as a hybrid package of products (resources) and services (teaching). This understanding offers a new perspective on teaching approaches and creates new opportunities for all stakeholders. Following a well-established procedure model for product-service systems (PSS) engineering, we derive the customer requirements to the hybrid package. Than a product model is developed. Based on these findings, an Education Integration Platform Solution (EIPS) is prototypically designed. Finally, a conclusion and outlook are given.

1 Introduction – The Challenge of Teaching ITMC

The current business and information technology (IT) environment can be characterized by dynamically evolving concepts and technologies as well as unprecedented volatility [OB11]. This fact poses challenges on the future working force, which can only be faced by permanent training of skills and knowledge [La10]. A combination of several cross-disciplinary qualifications is necessary for managing the complexity of the environment [Wi02]. However, not only the professionals have to cope with new technology and structures, also educational systems face challenges, like for example technological and organizational change, globalization and international commerce as well as environmental challenges [OB11]. It has been shown for example that sustainability concerns have an impact on teaching approaches [SBZ11]. Furthermore, what people learn, how they learn, and where they learn will radically change in future [Wa07].

IT management and IT consulting (ITMC) are two important fields, which both are very personal-intensive [CM09]. IT management covers different areas like managing IT resources (and personnel) as a competitive advantage or the development and operation of information systems [Lu04, CM09]. In this field, a variety of IT professionals, like programmers, analysts, IS managers and others, are employed. In the following, we focus on analysts and IS managers. IT consultants focus on building, managing and
operating information systems [VSB12]. They work as intermediaries between IT and business function [BD95].

Teaching ITMC involves several substitutable products and services [BSB11]. One cannot solely focus on the actual act of teaching (service) [MT03]. The learning resources, in terms of presentations, working sheets, exercises and other documentation [TR05] are the physical part of the teaching product-service system (PSS). The special thing about understanding teaching ITMC as a PSS is the fact that the physical resources play a more important role than in other teaching cases. Participants often cannot attend every presence lecture due to frequent travelling in their jobs (this is especially true for IT consultants) and therefore a good documentation is required. Mobile and individual e-learning opportunities can support their learning. Furthermore, the ITMC field is wide and the content, which has to be taught, is complex and difficult to understand. Therefore, personal teaching and coaching components are highly relevant. Hence, the provision of this hybrid PSS has to be made transparent and measureable to all involved stakeholders. That is the reason why our central research question can be formulated as follows: How can PSS engineering methods be used to develop an integrated solution that allows and effective and efficient teaching of ITMC?

2 Towards an Integrated Solution

2.1 Method

As we develop a holistic product-service system that incorporates the necessary aspects of teaching ITMC as well as satisfying the requirements of all stakeholders, we focus especially on the integrated design of products and services [TWL08]. Therefore, we use a method for PSS engineering, developed by [WSB04] that has been successfully applied in research [BFS11].

Following [BFS11], the procedure consists of three phases: (1) definition, (2) synthesis, and (3) analysis. First, the requirements of the PSS are derived and based on the to-be properties have to be defined. By separating the inquiry of the requirements from the definition of properties of the product-service system, the transformation of them into the properties of the PSS can be made transparent [TWL08]. In the second phase, new or changed characteristics and components of the hybrid service bundle with its inner relationships and dependencies are derived. Finally, the as-is properties of the service bundle are evaluated by comparison with the to-be properties. Here one has to clarify which requirements already have been fulfilled and which still have to be covered.

2.2 Requirements

In order to determine the requirements to the PSS, we conducted qualitative expert interviews with six practitioners from international consulting companies and representatives of five universities during a workshop in February 2010 [BSB11]. As the findings of these interviews provide only a rough overview on the requirements, a deeper analysis is
necessary. Therefore, we conducted a literature review [WW02]. Search terms like teaching, training, information technology, IT management, IT consulting, Learning Management System or education system were used to search for relevant papers in leading journals (top 20 journals according to AIS) and conferences (ICIS, ECIS, WI, AMCIS, HICCS) within the last 20 years. These findings have been integrated into those from the expert interviews. The result is depicted in Table 1.

<table>
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<th>Social and person-centric requirements</th>
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<td>- Diffusion and transfer of knowledge between the stakeholders</td>
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<td>- Giving opportunities for developing interpersonal skills</td>
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<td>- Acquisition of needed technical skills and competencies</td>
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<th>Economic requirements</th>
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<td>- Providing certificates after completion of program (value for money)</td>
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<td>- Monetary or time savings and/or noticeable quality improvements</td>
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<td>- Ensuring efficiency of the methods by measuring economic and ecological values</td>
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<th>Ecological requirements</th>
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<td>- Minimizing the ecological impact of the program through state-of-the-art learning methods (e-learning, blended learning, simulation)</td>
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<td>- Creating awareness among the stakeholders for ecological issues</td>
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<th>Execution-related requirements</th>
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<td>- Integrated platform for all phases from enrollment over execution till evaluation and evolution (4E of Teaching)</td>
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<td>- Rapid adoption of teaching new technologies and concepts</td>
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<td>- Ensuring mobile as well as offline e-learning access</td>
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<td>- Safeguarding and motivation for long-term impact and top management awareness and acknowledgement</td>
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Table 1: Customer Requirements on the Teaching PSS.

3 Conceptualization and Implementation

3.1 Definition of To-Be Properties and Synthesis of Properties

The to-be properties now can be defined based on the requirements. The collected data of the previous step (cf. Table 1) is grouped into functional aspects and subsequently transferred to the level of properties of the product model of the PSS. In Figure 1 an excerpt of the developed model is shown. The characteristics and properties as well as their relations are depicted.

Within the synthesis phase, the to-be properties of the PSS are realized by the definition of system characteristics. Existing logical relations and interdependencies between product and service components within the PSS are illustrated by the inner relationships between characteristics (cf. Figure 1). Based on the customer requirements new characteristics of the PSS are added in order to analyze their impact on the previously determined requirements in the form of relations. As a result teaching ITMC is especially related to content, cooperation and mutual exchange together with the enabling technological platform. Hence, we focus on these aspects in a way that the characteristics of the software component of the PSS are constituted and their relations to the level of properties are determined (cf. Figure 1).
3.2 Analysis of As-Is Properties

By analyzing the as-is properties one can monitor the fulfillment of the design goals from various perspectives. For doing so, we use a descriptive and argumentative evaluation [Fr06]. We developed the PSS using expert interviews and a systematic literature review. The resulting product model fulfills the requirements, which have been gained by the definition and synthesis phase (cf. section 3.1). During the analysis we recognized that a data warehouse (DWH) needs to be integrated into the IT architecture [BK10] in order to cope with requirements like quality of data, the degree of integration as well as the generation of reports (cf. Figure 1). This DWH is incorporated into an Education Integration Platform Solution (EIPS) and additionally offers central services like a role concept and an authorization mechanism. Unlike existing Learning Management Systems, which have been mainly developed by looking at technical possibilities [ZZZ04], our system uses a holistic approach in looking at the user requirements on the complete ITMC teaching process as a whole.

A high-level data model of the prototype is depicted in Figure 2 as Entity-Relationship Diagram. Of course, the stakeholders and their affiliation, e.g. university or company name, are represented. Stakeholders in EIPS can be participants, researchers and practitioners while feedback can be given to from any stakeholder to any other one. Researchers and practitioners work together in a partnership and therefore act as a tutor within a training unit. This training unit has several participants and consists of a hierarchy of training units which together form the module list. The necessary modules for teaching ITMC have been outlined by [BSB11]. Each training unit has its at least one associated content, but each content should only be covered by one training unit in order to avoid redundancies. The content is linked to a set of skills. Skills are ability to apply the learned content and competencies are defined as the proven ability to apply content...
These two concepts are modeled separately in EIPS in order to document the learning progress. For each skill there are several teaching methods [HMT05] represented in the system. New teaching methods like simulation [LPP11] and practical case study exercises [TR05] are also supported by EIPS. Additionally, specific resources can be stored and assigned to one or more of the methods.

Figure 2: Data Model of the EIPS.

4 Conclusion and Outlook

We conceptualized teaching ITMC as a hybrid package of products (resources) and services (teaching) in this paper. Synthesis-analysis cycles of a systematic procedure model have been run through in order to derive and implement our integration concept. As our research is currently in progress, only the Education Integration Platform Solution (EIPS) has been briefly presented.

The proposed approach offers some limitations and therefore raises further questions: First, we have not been able to evaluate the PSS entirely. This is the task of future research. Also a detailed comparison with other Learning Management Systems is required and needs to be done in a real world environment. Second, our approach cannot cover all requirements on an integrated approach. The success of teaching strongly depends on the persons who teach and those who are willing to learn (social aspects like mutual acceptance and understanding, motivation etc.). Future research might cover these issues in investigating mechanisms for facilitating them. The task of future research is to find out, how the proposed approach can be implemented and offered in an efficient way. However, we are convinced that the utilization of the PSS engineering method in the context of teaching is a novel approach which results in an effective solution.

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6 References


