Developing Media Competence in Vocational Education – Architecture Design for Context-sensitive and Individual Learning

Christina Di Valentin, Andreas Emrich, Dirk Werth and Peter Loos

Abstract—**This paper presents an approach for integrating media education into the vocational education and qualification chain. Therefore, an architecture proposal for a technological learning concept called "Social Navigator for Media Competence" is made, which provides users recommendations about appropriate media contents and measures of media competence within specific learning contexts of vocational (re)training. The focus is on trainees and students as well as on groups that are involved in vocational qualification processes, such as teachers, trainers, supervisors and pedagogic personnel. Hence, the competencies of trainees in dealing with digital media, in particular social media, are fostered. With context-sensitive and individually tailored recommendations of media contents and measures of media competences (e.g. training programs, tools, concepts / methods of education or teaching scenarios), the Social Navigator makes an important contribution to strengthening the learning capacities of each individual as well as involved training companies within vocational education.**

Index Terms—**Digital and social media, ontology evolution, proactive information delivery, web 2.0.**

I. INTRODUCTION

Digital media shape the living world in many ways. In particular social media applications, such as Twitter or Facebook have had a large influence in the way people communicate [1], [2]. Aspects like simplicity, affordability and flexibility of information and communication technology go along with an increase of its popularity in the application field of education (vocational as well as ongoing professional development) [3]. Social media is being used by more and more students, in particular in apprentice jobs and at universities, with the goal to contact other students to obtain the required information about specific tasks and exercises in educational processes [4]. However social media requires from each individual in the private sector as well as in the working world skills for being able to effectively use social media technologies in educational processes [5]. Hence, an efficient use of digital and social media represents an important factor for strengthening the education and learning capacity of each individual as well as an efficient organization of working processes. Studies of the European Commission (EC) have demonstrated that aspects like the development of teacher's qualifications, suitable learning environments as well as transparency and mutual recognition of competencies and qualification amongst learners and teachers represent current trends in vocational education and training (VET) [6].

The project KOMMIT presented in this paper aims at integrating aspects about media education into the chain of VET, especially in the field of jobs in information and communication technologies, such as IT administrators or qualified IT specialists. The goal of KOMMIT is the development of an IT-based tool ("Social Navigator for Media Competence", in brief Social Navigator) that supports each involved group of people in learning and teaching processes through advisory concepts and support frameworks. Hence, in particular supervisors and pedagogical personnel obtain assistance in using digital media and realizing didactically meaningful scenarios within educational processes. The primary goal of the project is to strengthen the cooperation between companies and vocational schools through the strategic use of social media for an efficient communication and collaboration of all personnel groups that are involved in VET. This paper shows a first architecture proposal about the technological concept to be implemented in KOMMIT.

The research design follows a design-oriented approach [7]. Based on a systematic literature review and expert interviews with several representatives in the vocational education sector (teachers, trainers, supervisors, pedagogic personnel and trainees), shortcomings about current learning concepts in VET are derived as requirements. These requirements serve as basis for the conceptual architecture and implementation of the Social Navigator.

The outline of the paper is as follows: First an overview of current technologies in the field of context sensitive learning is given in Chapter 2. Based on the State-of-the-Art, Chapter 3 presents a possible application scenario and an architecture proposal to consider each individual's preferences and the status of each participant within the educational qualification process. The paper closes with a summary and an outlook on future research in the field of context-sensitive learning.

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II. STATE OF THE ART IN CONTEXT-SENSITIVE TECHNOLOGIES

A. Context-sensitive recommendations of multimedia content

A basic functionality of the Social Navigator is the provision of context-sensitive recommendations about media contents and media competencies. These recommendations enable a problem related use of media applications in the context of VET [8], [9]. Training companies and institutions are characterized by a large number of information such as multimedia contents, semantic information, context information and curricula. For teachers and trainees, this goes along with the problem of searching and finding the right information. Existing portals (e.g. LibraryThing, YouTube, imeem) are able to provide contents to users, however recommendations offered by these portals are based on past usage behavior. Instead of reactive supply of information, the project presented in this paper is focused on proactive delivery of information by taking into account the current learning and working context (with minimal efforts for involved groups). The project builds upon existing ontologies like FOAF (Friend of a Friend), SIOC (Semantically Interlinked Online Communities) or MetaCafè. The conceptual framework consists of an upper level ontology that abstracts from the specifics of an integrated ontology by providing an easy and efficient infrastructure for semantic requests.

B. Ontology Evolution

Ontologies are often used for the representation of conceptual models, their constituent elements and their semantic relationships [10]. Ontology evolution comprises a consistent and continuous adaptation of ontologies over time [11], [12]. When carrying out modifications on ontologies, it is important to be aware about retaining their consistence [13], [14]. Hence, modifications on ontologies must be continuously traced and logged to be able to carry out a mapping between new versions and an evidence of used instances [13–15]. In the past years, several trends about ontology evolution have evolved: change management of distributed ontologies focuses on methods and tools that are needed to dynamically avoid changes within existing ontologies [12], [16], [17]. For the specification of the ontology, OWL (Web Ontology Language) is used. The Change Requirement Discovery supports exposing the reasons for changes within ontologies and on deriving requirements on these changes [11], [18]. KAON (Karlsruher Ontologie) is a middleware that supports a continuous distribution of ontologies during the entire lifecycle [19]. Belief Change comprises the automated adaptation of an ontology to new knowledge without the need of human intervention [20].

The architecture proposal presented in this paper builds upon the principles of ontology evolution to combine aspects from different information sources such as learning portals, social networks and multimedia data. Hence an interdependent knowledge network emerges [21]. Based on this infrastructure, several complex and multidimensional analysis are planned to be realized to link usage behavior to, for example, learning success. Hence, previously modeled best practices (e.g. referring to media competence) can be constantly monitored and incrementally improved.

III. ARCHITECTURE PROPOSAL OF THE SOCIAL NAVIGATOR

A. Application Scenario

A trainer plans to deploy his/her trainees in the Marketing department. Therefore, he/she wants to teach his/her trainees about how to use a YouTube channel to create videos and to moderate the corresponding blog of the channel in the context of public relations. One question that appraises in this context is: how can the trainer convey to his/her trainees the competence to create such a channel with a corresponding blog? Aspects like the creation of professional blog posts, a correct answering of comments and the professional communication via media, like, for example, YouTube, requires specific competencies that have to be taught to the trainees.

The Social Navigator can be used to search for similar projects or questions that have already been discussed by other trainers and/or teachers concerning a similar problem. By this means, the trainer is recommended projects in other training companies in which similar aspects have already been considered. Hence, the trainer gets insight and recommendations about training methods that have already been applied by other training companies. The trainer also finds teaching scenarios that are provided by the Social Navigator platform itself. These teaching scenarios can be individually integrated in the in-house training curriculum. His or her colleague (teacher) from vocational school who is responsible for the trainees in the company gets informed about this specific marketing project carried out with the trainees. Thus, the teacher uses the scenarios provided by the Social Navigator platform for the curriculum in the vocational school and additionally finds exercises that are needed to systematically teach the needed competencies at the trainees. Afterwards, these exercises can be given back to the community via the platform.

B. Consideration of the Learning Context

One important aspect about the Social Navigator represents the search and recommendation component. Thereby, the context of the involved groups represents the starting point for media recommendations. Figure 1 shows the interactions between a user and a concrete task within a specific teaching or learning process.
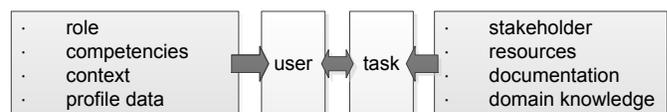

Fig. 1 Coherence between user and task

Within the Social Navigator, users are described by their role within the teaching or learning process (e.g. student, teacher, trainer, personnel development officers, pedagogic personnel or supervisors). Further aspects are the competencies that are assigned to each individual in the teaching and learning process. These competencies can be provided proactively by the user, but they can be also evaluated through collaborative filtering within the Social Navigator. Thereby profile-relevant data can be gained by readouts and semantic categorizations

(e.g. evaluation of posts in Twitter). This additional information can be used to enrich the user profiles of all members within the Social Navigator. The consideration of the user's current context enables to provide information which is adapted at current requirements. In doing so, e.g. teachers can receive recommendations about teaching contents that match to the current situation within the training company as well as to the trainee's current state of knowledge. In addition, profile data gets continuously enriched by machine learning and additional information. Thus, users of the Social Navigator can be related to particular tasks. These tasks can be described by specific stakeholders, resources, documents or certain domain knowledge.

C. Architecture Proposal of the Social Navigator concept

The Social Navigator is going to be developed as web-based platform on the Web and represents a stand-alone solution which is interfaced to several social networks and to the Internet (e.g. via "Member Buttons" or via interfaces to social education apps from social networks, etc.). Furthermore, it is planned to implement specific parts of the Social Navigator in form of an app into social communities to ensure that the Social Navigator can be found and used by a large number of users. The Figure 2 depicts an architecture proposal of the system architecture.
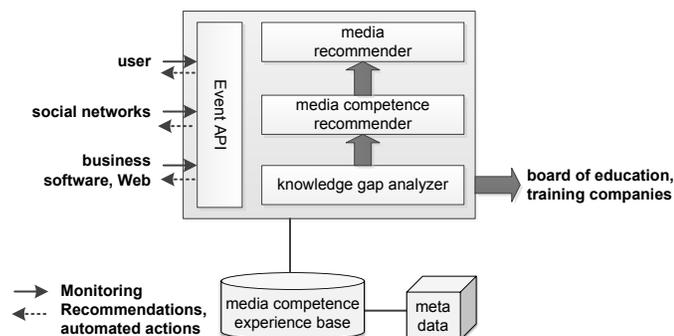

Fig. 2 System architecture of the Social Navigator

To access context-based and profile-based data, the Social Navigator is interfaced to several social networks (e.g. Facebook, Xing or Twitter). An event API ensures a continuous actualization of media contents within social networks and web portals (e.g. web portals of training companies and vocational training schools) as well as a continuous evaluation of relevant events (e.g. a trainee adds in his or her profile additional competencies and/or learning progresses; in a forum exist new entries concerning specific programming languages or developer platforms). This consideration of current lifecycle information enables supervisors, personnel development officers, pedagogic personal and trainees to receive information about suitable media contents that match to their demographic, social and knowledge-based situation. At the same time, trends and current topics in VET can be identified. Hence, the comparison of several contexts of different users can be ensured. By this means, collaborative media competencies of several users can be incorporated in teaching and learning processes, which plays in particular in a dual vocational system an important role. The gained knowledge can be, for example, used by vocational teachers to efficiently divide learning and working groups. This information can be provided by the Social Navigator either proactively or based on the user's search requests. Hence, trainees can be provided additional media contents in form of videos, presentations, forum discussions or interfaces to social networks, which represent an amendment of currently discussed course topics of the vocational training.

In addition to recommendations of media applications, the Social Navigator also supports the gain in competence of the involved groups by providing process recommendations and guidance of actions in form of best practices. Thus, media and contents can be provided that fit to the individual learning processes of trainees by considering current curricula at the same time (guidance of action within specific predefined curricula). The basic idea in this scenario is: curricula in most cases are predefined by the federal government and the federal states. However, every trainee has an individual approach to deal with specific topics and tasks. The Social Navigator individually supports students and trainees to work on specific tasks and learning contents the way they prefer to by providing recommendations, such as support in searching for media types or the derivation of best practices for the usage of multimedia contents in different types of documents. Thereby, recommendations will be generated about how social media can be applied for carrying out specific tasks.

D. Process of Recommendation

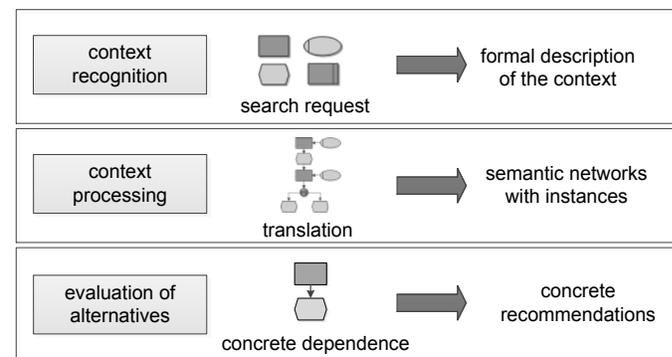Figure 3 shows the generation of recommendations.

Fig. 3 Recommendation process of media content and media competencies

In a first step, the system captures the current context of the user. This is carried out by a formal description of current context data (e.g. Mr. Smith, a skilled accounting clerk, is working with a new table of accounts according to the accounting regulations IFRS. Mrs. Reid from the same company is an expert in IFRS). Every time a user interacts with an object within the system, several analyses are caused to identify the impacts these changes have on the learning process or the so far generated recommendations. For this reason, each event within the system is logged. This goes along with the interface within the platform of the Social Navigator.

In a next step, the current process of the learning and/or teaching person is recognized. Thereby, interdependencies within this process step are traced and current context data is processed. Based on a query translation, complete semantic

sub-networks including their entities can be indicated at instance level. These semantic sub-networks depict the complete knowledge space of the current context. Finally, on instance level the system is able to evaluate alternatives by providing recommendations about different media types as well as persons and processes that match to the user's current context. These processes can be e.g. reference processes in form of best practices (either identified through global mining or indicated by teaching staff) or individual and collaborative best practices.

To be able to boost media competences, the identification of knowledge gaps plays a significant role. The Social Navigator must be able to recognize unsuccessful attempts of media use within document types as well as finding the most effective media type for each individual within the learning or teaching process. This is carried out by analyzing historic logs. Based on these historical logs, recommendations for searches, post-processing and the use of media and media types can be derived.

IV. Conclusion

This paper has presented an architecture proposal of a technological concept (Social Navigator) which provides individualized support to several personnel groups involved in teaching and learning processes within VET by providing context-sensitive recommendations. The Social Navigator will be implemented as an integrative component of several social networks. Thus, possibilities offered by these technologies can be used to promote and communicate competencies.

However, the presented approach is also characterized by several limitations. Section III has shown, that for an efficient use of the Social Navigator, concrete application scenarios have to be defined. One further aspect to be considered is that the Social Navigator has to be continuously used by the involved user groups to ensure a continuous expansion of the knowledge base.

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