Towards Learning and Instruction in Web 3.0

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Editors

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Preface

This edited volume contains selected expanded papers from the CELDA (Cognition and Exploratory Learning in the Digital Age) 2010 Conference (www.celda-conf.org). It addresses the main issues concerned with problem solving, evolving learning processes, innovative pedagogies, and technology-based educational applications in the digital age. There have been advances in both cognitive psychology and computing that have affected the educational arena. The convergence of these two disciplines is increasing at a fast pace and affecting academia and professional practice in many ways. Paradigms (such as just-in-time learning, constructivism, student-centered learning and collaborative approaches) have emerged and are being supported by technological advancements such as simulations, virtual reality and multi-agent systems. These developments have created both opportunities and areas of serious concern. Hence, this volume aims to cover both technological as well as pedagogical issues related to these developments.

We organized the papers included in this volume around five themes: (a) Student-centered Learning, (b) Collaborative Learning, (c) Technology, Learning and Expertise, (d) toward Web 3.0 in Education, and (e) Exploratory Technologies. Each of the editors took lead responsibility for reviewing and editing the papers associated with one theme.

In Part I, student-centered learning, several issues are described and discussed. The authors address the issue of technology enhanced learning environments and propose an architecture to dynamically identify students' learning styles from their behaviour in a learning system, and updating their learning styles based on their behaviours. These learning styles' information is later accessed by an adaptivity module to provide students with customize feedback about their learning styles as well as about how to improve their learning processes (Graf, Kinshuk, Zhang, Maguire & Shtern, Chap. 1). Other way to enhance learners' efficiency is through the proposal on an annotation-based pedagogical process called SQAR (Survey, Question, Annotation and Review). SQAR aims to help the learners to enhance their learning activity and fosters learners' evolution (Mostefai, Azouaou & Balla, Chap. 2). Also an important issue in student-centered learning is the students' assessment. A survey is presented to analyse and infer from current and future online formative

assessments. The results provide insights on how to better plan online formative assessments having into account the expectancies of both students and tutors (Minder, Schmitz & Schär, Chap. 3). Lastly, informal learning and assessment has also been addressed by authors that investigated learners' performance and attitude toward a community-based project management learning system and the role of participatory media and Web 2.0 technologies in the whole process (Mohamed & Koehler, Chap. 4).

In Part II, chapters focus on collaborative learning issues. One way to achieve collaborative learning is through the use of games. A game has been devised specifically to accomplish this goal using mobile technologies (Sultana, Feisst & Christ, Chap. 5). Other authors propose a generic framework that complies with the rules of both higher education and life-long learning, and propose a virtual collaboration prototype (Porumb, Orz & Vlaicu, Chap. 6).

In Part III, chapters address technology, learning and expertise issues. Authors start by reporting the results of a survey conducted in an Australian University to explore the types of learning outcomes academics target in their curricula. This is assessed in lign with having in consideration how technologies are used to assess the referred outcomes (McNeill, Gosper & Hedberg, Chap. 7). The next chapter introduces mashups as a realistic method to develop new educational tools. The educational mashups can operate as a tool that combines data from an extensive variety of sources on the web, which can motivate students to share their learning experiences (Karavirta & Korhonen, Chap. 8). After that, three projects are presented to draw attention to several e-mentoring issues for example the nature of the mentoring process and the timing of the mentoring intervention. These projects demonstrate that a successful communication is critical to the improvement of the interaction between mentor and mentee (Lord & Coninx, Chap. 9). Finally, the authors recommend a new instructional design framework called IPTEACES (Involvement, Preparation, Transmission, Exemplification, Application, Connection, Evaluation and Simulation), which propose a suitable learning strategy for different learners in order to fit different learning profiles (Pena & Isaías, Chap. 10).

In Part IV, the chapters focus the issues of Web 3.0 in Education. Firstly, the authors compare two different representation methods that can encourage interaction behaviors between students within Virtual Learning Environments (VLEs). They believe that learning is a dynamic process of knowledge creation made by the learners' community with the help of the teacher (Pasqualino, Barchiesi & Battistoni, Chap. 11). Next, it is presented the results of a learning exercise in which students from two universities in the United States create a Website to promote a fictitious product online. In this exercise they must apply several different Search Engine Optimization (SEO) techniques to establish those which are the most useful (Frydenberg & Miko, Chap. 12). Other authors explore 3D Virtual Worlds (VWs) as an environment, which can introduce new educational benefits. By using 3D VWs, teachers can foment more interactive learning experiences to their students through the high representation fidelity that 3D Virtual Worlds can offer (Sampson & Kallonis, Chap. 13). In order to establish more adaptive e-learning environments, it is critical

to focus on the user as an individual with his own characteristics. To finish, it is described an exploratory study, which examine several cognitive processes of undergraduate students throughout mental rotation tasks (Mazman & Altun, Chap. 14).

In Part V, exploratory technologies are presented. Educational games are described as potential successful learning environments, due to the fact that they can stimulate the player by mixing casual and familiar content with educational content. It is described a solution on how motivation can be calculated and assessed during the game play (Ghergulescu & Muntean, Chap. 15). Other authors show that there is a common tendency of using merely acceptable-answer frequencies to evaluate if a student learning is both mathematically and psychologically unacceptable (Powell, Bernauer & Agnihotri, Chap. 16). Next, it is explored how an interactive cubic user-configurable modular robotic system, called Number Blocks, can facilitate the learning by 7–8 year old children regarding numbers and their pronunciation. This system merges physical interaction, learning and immediate response (Majgaard, Misfeldt & Nielsen, Chap. 17). Last, it is explored several reasonable ideas to produce devices for children through Computer-controlled Fabrication. The design and printing of physical objects has been growing and can be used for numerous educational purposes (Eisenberg, Ludwig & Elumeze, Chap. 18).

This is the third edited volume to result from a CELDA conference. We are convinced that this work covers the current state of research, methodology, assessment, and technology. When we have so many outstanding papers as were presented in Freiburg, Germany 2008, Rome, Italy 2009, and Timisoara, Romania, 2010 we will certainly seek to also have future edited volumes, as this benefits the entire professional community.

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Introduction
Is Web 3.0 Changing Learning and Instruction?

Dirk Ifenthaler

Abstract This chapter addresses the evolution of Web generations and their influence on learning and instruction. The development of current Web generations and their major distinguishing functions are addressed. Next, implications for learning and instruction will be discussed. This chapter concludes with remarks about future perspectives of Web generations and how they might influence learning and instruction.

Keywords Web generation, Web 2.0, Web 3.0, Semantic Web

Introduction

Almost 20 years ago, Rheingold (1993) described virtual communities as social aggregations of people which form webs of personal relationships by sharing interests and human feeling. Since then, the Web evolved from a primarily read-only information medium to a collaborative information vehicle (Lassila and Hendler 2007). The next evolution of the Web will include *intelligent technological behavior* which enables meaningful interaction between human users and the Web technology (Ifenthaler 2010). In this way, the Web could provide the basis for *free learning environments*, which have been regarded by educational theorists as the quintessential form of learning environment for decades.

This rapid development of information and communication technology has strongly influenced advances and implications for learning and instruction. A review of scientific databases (ERIC, PsychINFO) shows the development of publications focusing on Web generations and learning and instruction (see Fig. 1).

Interestingly, almost 4,000 publications focusing on Web 2.0 and learning and instruction were found. They increased from less than 20 publications (2005) to over 1,200 publications (2010). A query regarding Web 3.0 and learning found less than 200 publications in total with a slow increase so far. As technology is rapidly

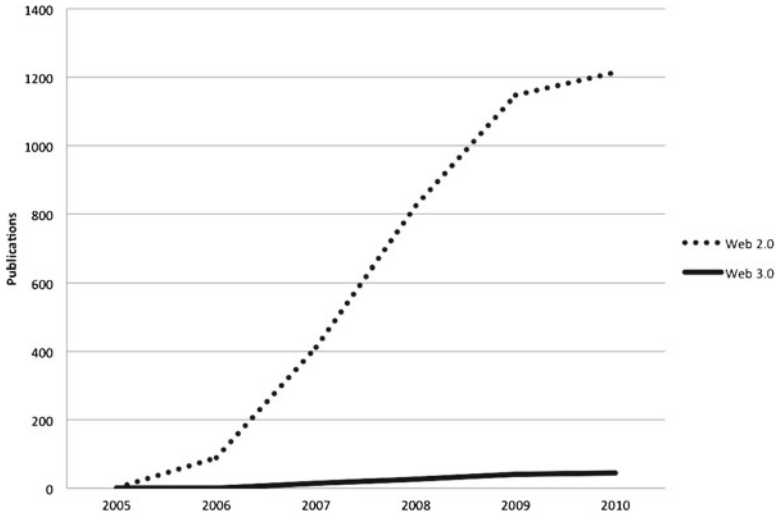

Fig. 1 Development of publications focusing on Web 2.0 and Web 3.0

advancing towards Web 3.0 applications, an increase of publications focusing on the new technological possibilities for learning and instruction is expected for the next 5 years.

In this introductory chapter, we address the evolution of Web generations. The reflection of Web generations (Web 1.0, Web 2.0, Web 3.0) provides a short overview of their technological functions and limitations. Next, implications for learning and instruction will be discussed. Clearly, it is difficult to predict new developments in the domain of learning and instruction, however, new developments of information and communication technology will continue to guide them in a sustained manner. We conclude with remarks about future perspectives of Web generations and how they might influence learning and instruction. Future CELDA conferences will provide the research community a perfect podium to discuss latest developments of learning and instruction in the digital age.

Web Generations

A common misconception regarding Web generations is that the newest Web generation will replace or suppress previous ones (Blumauer & Pellegrini 2009). In order to overcome this misconception, Fig. 2 illustrates the development of current Web generations and their major distinguishing functions.

Clearly, the core of the Web mainly consists of (X)HTML documents which contain static information (e.g., text, pictures, animations, etc.). The architecture of an individual website is usually represented in a tree structure including a hierarchical

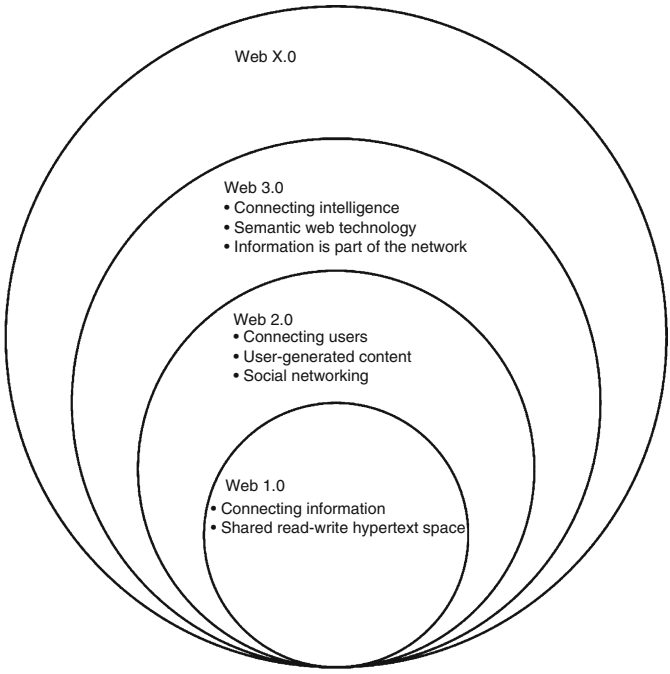

Fig. 2 Web generations and their key functions

array of (X)HTML documents. Further, specific information is connected through hyperlinks which refer to other documents all over the Web. Accordingly, the Web 1.0 generation connects information which is predominantly offered by a small group of experts who are able to develop these (X)HTML documents. The larger number of Web 1.0 users are passive, i.e. they browse and read single websites but are not able to add additional information to the Web.

One of the main strengths of Web 2.0 is the increased possibilities for *user generated content* (Ifenthaler 2010). Further defining characteristics of Web 2.0 are information sharing and a decentralization of its management and use. Accordingly, Web 2.0 represents a shift toward a *read and write* environment, inasmuch as the users themselves can participate actively in the creation and management of content. Web 2.0 already offers many so-called APIs (application programming interfaces) which allow users to use and exchange available data and services. Essential characteristics of Web 2.0 are (a) community, (b) tools, and (c) collaboration (Knappe & Kracklauer 2007). *Community* stands for the virtual union of users sharing common interests (e.g., XING, LinkedIn). This is where specific interest groups actively share their knowledge (e.g., Wikipedia). *Tools* are the technological foundations which enable users to interact with other users or groups of the Web. Vitally important is the high usability of the tools and low computer skills (e.g., no programming) needed for using them. *Collaboration* provides the basis for closed communities working on

specific projects using specialized applications and virtual workflow (e.g., Google Docs, WebLogic). Information of Web 2.0 is therefore self-organized, user generated, and primarily open source. Last, quantity is an additional characteristic. The more users actively participate in a Web community the more people get attracted. Accordingly, certain information gain in importance and quality (e.g., Wikipedia).

Web 3.0 has now been coined to describe the coming wave of innovation (Yu 2007). Accordingly, Web 3.0 will go a step further and will understand or rather learn what the user wants and suggests the information fitting to the users' needs. This requires that all information which is available in the Web is accessible by a certain standard and that the technology is able to *understand its meaning*. Thus, Web 3.0 is intelligent offering a data network consisting in a collection of structured data records published in the Web in repeatedly reusable formats (e.g., XML, RDF). Besides the service-oriented architecture, Web 3.0 will be the realization and extension of the concept of the Semantic Web (Lassila and Hendler 2007; Yu 2007). Web 3.0 operations will be designed to perform logical reasoning using a multitude of rules which express logical relationships between semantic meaning and information available in the Web.

What about Web X.0? There are of course many opinions as to the course further development of the Web will take – starting with concepts like *emergent technologies* or the *Semantic Web*, which will change the way we use the Web and constitute a step in the direction of artificial intelligence, and ranging all the way to the prediction that due to the increasing amount of connections to the Internet modular Web applications and improved computer graphics will play a key role in its further evolution. The next Web X.0 generation will be imminent.

Implications for Learning and Instruction

Although the advantages of current and future Web generations for learning and instruction are all beyond question, the pedagogically significant question as to how learning can be supported effectively is sometimes left out of the picture (Ifenthaler 2010).

When defining Web 3.0 as intelligent, one could assume that the future technology will take on the part of the instructor. Still, we assume that Web 3.0 learning environments do not make the instructor redundant. Although, it is expected that the role of the instructor is changing (Devedžic 2006; Morris 2011). The possibility of Web 3.0 will assist the instructor by creating reusable learning objects and providing immediate feedback to a learner at a specific stages of the learning process (Ifenthaler 2011).

Considering the inseparable interaction between the learner and the learning environment, three factors may be distinguished:

1. The learner's beliefs and expectations before the learning experience.
2. The learning experience itself and the inherent change of the learner's cognitive structure (both intended and incidental).
3. The learner's beliefs and expectations after the learning, both considering attitudes towards the learning experience and the content.

These factors may be supported by personal learning systems (PLS) which are regarded as intelligent learning environments in Web 3.0. In PLS, learners develop their individual learning by selecting various Web tools to meet their specific learning goals (Ifenthaler 2010). So far, PLS are expected to include four major characteristics: (a) portal, (b) integration, (c) neutrality, and (d) symbiosis. A PLS is an open portal to the Web which is connected with various tools and collects and structures information from sources of the Web. The content can be created by both learners and instructors using simple authoring tools. The required information is accessible in standardized formats which learners can subscribe to and synchronize with their mobile desktop applications. In this way, the learning environment is integrated into the user's daily working environment and connected to it. Individualized tasks are designed in such a way that the learners themselves can choose which application they wish to use to work on them. Also, PLS allow learners to collaborate with others on a specific topic under study (Oliver 2007). The PLS can make recommendations and provide meaningful support. Instead of creating new spaces, a PLS uses existing resources and information. The PLS works with existing free static content, social networks, reusable learning objects, databases, wikis, blogs, etc. All in all, PLS require increased personal responsibility, both from the learner and from the instructor. At the same time, however, they offer more freedom for individual learning.

Future Perspectives

A practical taxonomy for Web features might help instructors to develop meaningful learning environments for the digital age. Such a taxonomy may contain (1) the name of the Web feature, (2) a short description of the Web feature, (3) a classification of the Web feature with regard to the three design elements *information*, *instruction*, and *learning*, (4) the Web feature's association with instructional functions, and (5) exemplary recommendations for instructional use (Ifenthaler & Pirnay-Dummer 2011).

However, the development of such a taxonomy requires empirical research. This will enhance the understanding of the underlying psychological and educational principles of online learning. On the basis of these results, new instructional design principles for online learning could be introduced for classroom practice.

Closely linked to the demand of new approaches for designing and developing up-to-date learning environments in Web 3.0 is the necessity of enhancing the design and delivery of assessment systems (Spector 2010). Recently, promising methodologies have been developed which provide a strong basis for applications in research and instruction for the Web 3.0 generation (Isaias and Ifenthaler 2011). However, only a few assessment methodologies are available which have the potential to meet the requirements of future Web 3.0 learning environments so far. Future systems need to accomplish specific requirements, such as (1) adaptability to different subject domains, (2) flexibility for experimental and instructional settings, (3) management of huge amounts of data, (4) instant or rapid analysis of specific data,

(5) immediate feedback for learners and educators, and (6) generation of automated reports of results (Isaias and Ifenthaler 2011).

The CELDA conferences have been and definitely will be a perfect podium to discuss these highly important developments for learning and instruction in the digital age.

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