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What if undergraduate students designed their own web learning environment? Exploring students' web 2.0 mentality through participatory design

G. Palaigeorgiou,* G. Triantafyllakos† & A. Tsinakos‡

*Department of Computer and Communication Engineering, University of Thessaly, 37 Glavani – 28th October Street, 382 21, Volos, Greece
†Computer Science Department, Aristotle University of Thessaloniki, POB 888, Thessaloniki, Greece
‡Department of Industrial Informatics, Technological Educational Institute of Kavala, Agios Loukas, 65404, Kavala, Greece

Abstract Following the increasing calls for a more skeptical analysis of web 2.0 and the empowerment of learners' voices in formulating upcoming technologies, this paper elaborates on the participatory design of a web learning environment. A total of 117 undergraduate students from two Greek Informatics Departments participated in 25 participatory design sessions, employing two needs' elicitation techniques, with the aim of envisioning a learning platform that meets their learning particularities and needs, incorporates and exploits their new technological habits, and can be harmoniously situated in their daily routine. Overall, 773 needs were elicited, proving that students had refined views about the elements that can render the next wave of e-learning applications successful. They convincingly demonstrated their web 2.0 mentality but sought for a smooth transition to the new environment, promoting an evolution rather than a revolution. The resulting set of needs demarcates a zone of expectancies where the enhancement of the learning content and the contextualization of knowledge remain top priorities with revamped opportunities, while networking, participation and collaboration complement and improve their characteristics. Our study is an example of exploiting participatory design for exposing students' thoughts and requirements from a critical design perspective.

Keywords e-learning 2.0, learning management systems, participatory culture, participatory design, student empowerment, web 2.0.

Introduction

Educational commentators have pledged encomiastic remarks for the Web 2.0 'fairy tale' and the profound effects of the new online lifestyle of young people to their learning ecology – in this paper, the 'Web 2.0' term is viewed from a practice perspective (Dohn 2009), denoting more certain forms of user activities or practices in web-mediated environments rather than describing the supporting technologies. In the web 2.0 era, learners are regarded as cooperative and altruistic actors (Vassileva 2008), who refuse to take on the role of a passive consumer and are transformed into active contributors, authors with a disposition to innovate, share, and form communities of interest, communities of practice, and networks (Boyd 2007). Students, who supposedly inhabit the social web with ease, are placed at the centre of online activities, initiate and influence

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Correspondence: George Palaigeorgiou, Department of Computer & Communication Engineering, University of Thessaly, 37 Glavani – 28th October Str, 382 21, Volos, Greece. Email: gpalegeo@gmail.com

curriculum, connect to the world as a whole, and self-direct and self-regulate their learning (McLoughlin & Lee 2008). All too often, new manifestos promoting the virtues of the emerging networks make their appearance, while new visions of revolutionary pedagogies and learning theories have already been proposed, e.g. connectivism, pedagogy 2.0 (McLoughlin & Lee 2008), etc.

However, these promises coexist with limited signs of threats to the prevailing learning practices and authorities. Great enthusiasm has been replaced by voices advocating a need for critical reflection on social software and Web 2.0 practices (Selwyn 2007). Essentially, the e-learning 2.0 concept is founded on assumptions derived from observations of students' behaviour in personal cyberspaces rather than being based on empirical research validating the envisioned transformations (Hemmi *et al*. 2009). Only recently has formal research on Web 2.0 in higher education started to get published, and there is still no evidence that the promised revolution has been unleashed. Research reports even contradict the expectations, as for example in the case of blogs or pod-casts which have failed in engaging undergraduate students in several cases (e.g. Cole 2009; Kerawalla *et al*. 2009). The findings vary and require a re-examination of both the questions posed and the answers explored (Ravenscroft 2009).

Often, researchers disregard the fact that, even though technological resources provide opportunities for innovative interactions, they are not the definite regulator of pedagogical change (McLoughlin & Lee 2008). The introduction of web 2.0 practices and technologies requires a significant shift in students' mindset and it is imperative to consider that change is not an instantaneous incident but a complex and subjective learning/unlearning process for all concerned (Scott 2003). Research shows that students of all ages are heavily influenced by prior learning practices and methods of delivery and are inclined to decipher new technologies through conventional views of learning (CLEX 2009; Crook 2001). Respectively, 'old world' educators may confront a 'culture shock or skills crisis' (McLoughlin & Lee 2008) when forced to introduce novel approaches of which they may lack experience and confidence. Hence, pragmatic e-learning 2.0 should be concerned not solely with affordances but also with the intersections between stakeholders' expectations, motivations, skills and experiences (Cole 2009).

In this transition stage (CLEX 2009), 'learner voice' has regained special focus (Seale 2009). Researchers claim that it is essential for the educational systems to conform to the learners, rather than the other way round and consider an open dialogue between learners and educators about educational reform to be an essential requirement for developing new mediation tools and practices either in the school (Clark *et al*. 2009) or the university context (Conole & Creanor 2007; Selwyn 2007; Seale 2009). Students are the 'insiders' in educational contexts, have a firsthand account of the various effects of learning interventions (Lohnes & Kinzer 2007) and also have high expectations of how learning should take place and which technologies and learning environments best meet their needs (Conole & Creanor 2007). However, the opportunities to contribute as equal partners in the educational reform are not commonplace. Given the dominance of constructivist and participatory approaches to learning, keeping students out of the design of new educational environments creates a paradox: while we seek students' active involvement, we suppress their freedom to make decisions about their own learning (Siozos *et al*. 2009).

Undergraduate students' input, until recently, has been constrained to the evaluation of prototypes or the assessment of their attitudes (Lohnes & Kinzer 2007; Seale 2009), and there is a scarcity of studies that focus on exposing their thoughts and desires from a critical design perspective (Creanor *et al*. 2006; Seale 2009). Students' empowerment should be accompanied by an exploration of new methods for extracting their needs, desires, and expectations (Lohnes & Kinzer 2007). Interestingly, the participatory culture of Web 2.0 has not been associated with the participatory design rationale that advocates the involvement of learners in the design process of new tools. In this paper, we will delve into undergraduate students' needs for web-learning environments through participatory design. A significantly shorter, preliminary analysis of the results of the specific study, before its completion, has been presented in Palaigeorgiou *et al*. (2009). In this paper, we elaborate more on the research questions and the methodological framework employed, describe in detail the set of students' proposals based on an extended sample of participants and focus on an interpretative view of the results in regards to the Web 2.0 discussion agenda.

Participatory design

Participatory design is an approach to the design and development of technological and organizational systems that promotes the active involvement of potential or current users in the decision-making processes. Sanoff (2007) states that 'participatory design is an attitude about a force for change in the creation and management of environments for people'. All participatory design approaches share a commitment to the belief that users can and should be involved in the design process of technology that affects their work or their life (Bødker *et al*. 1991). The favourable participatory design outcomes are usually attributed to the exploitation of users' tacit knowledge and the activation of their collective intelligence (Sanoff 2007).

Studies with students of all ages as co-designers of educational tools are drawing the interest of an increasing number of researchers. Several participatory design methods have a strong ethnographic tradition and include contextual interviews and participant observations in order to gain insights into how the participants use technologies in their everyday lives (for example e.g. Creanor *et al*. 2006 with interpretative phenomenological analysis). Seale (2009) asserts that the strong narrative and in-depth insights of these methods could be of high relevance 'to research that is focusing on hearing the ' "student voice" in relation to e-learning experiences'. However, there are also participatory techniques which focus on system design with students as participants such as scenario-based design, future workshops, and design games. For instance, in cooperative inquiry (Druin 2002), children were involved in cooperative prototyping and brainstorming activities, or in bonded design (Large *et al*. 2006) intergenerational teams of users created low-tech prototypes of products through needs assessment, brainstorming, prototyping, and consensus building.

While the literature is rich in case studies of children participating in the design of technology products, it is nevertheless limited when it comes to the critical design perspective of undergraduate students. Triantafyllakos *et al*. (2008) have proposed the We!Design participatory methodology for incorporating undergraduate students in the development of educational applications claiming that '[undergraduate students], as a result of their extensive experience with common educational tasks (1) are able to easily recall, state and elaborate on their prior problems and needs; (2) have unconsciously or deliberately thought of and formed solutions and proposals concerning those processes; (3) are willing to collaborate with their colleagues . . . ; and (4) may produce numerous diverse ideas for the construction of prototypes in a short amount of time'. Undergraduate students' willingness to participate in a process of re-conceptualizing existing tools and educational practices has been indicated in several case studies (Triantafyllakos *et al*. 2008, 2009; Siozos *et al*. 2009). The missing element is usually researchers and learning designers' determination to take students' visions seriously.

Aims

Today, learning-management systems (LMS) constitute one of the most prevalent electronic platforms for providing learning content to undergraduate students. LMS have extended the educational paradigm by expanding the classroom boundaries, capturing and maintaining course content, supporting the sharing of various resources, enabling students' communication, collaboration and assessment, and giving instructors more flexibility for developing and delivering pedagogical activities (Coates *et al*. 2005). The overwhelming majority of higher-education institutions have installed one or more LMS-type products since they are considered as well-structured 'single-entry-points' for organizing constructivist learning experiences which are on par with students' technological expectations (Coates *et al*. 2005; Lonn & Teasley 2009)

Nevertheless, LMS have invoked little disruption to teaching practices (Blin & Munro 2008) and students use them mostly as document and communication management tools (Lonn & Teasley 2009). LMS have been criticized for replicating the anachronistic instructor-centred classroom or lecture-hall model that regards students as mere information consumers or end-users in the 'walled garden' of the institution's systems (McLoughlin & Lee 2008). LMS do not conform to modern society metaphors, signs and practices (Hemmi *et al*. 2009), and the Web 2.0 philosophy. They prohibit students' choice and independence in shaping their own learning paths, they do not exploit networking potentials, and fail to support diverse learning styles (Craig 2007), eventually leading to students' de-motivation and monotony. Even though educational institutions

demand from their users to access their LMS, their attempts are usually unsuccessful due to the 'what's in it for me' factor (Chatti & Jarke 2007).

In this study, our objective was to help undergraduate students of a Greek Technological Institution to focus on their learning needs and experiences, and project them in their modern techno-centric practices in order to conceive/invent a web learning environment that address their own highest learning and technological expectations and needs. We intended to investigate the breadth and the nature of the desired educational services, to identify students' needs related to web 2.0 'learning ways' and to contribute to the corresponding debate. Typically, participatory design products usually ensure students' satisfaction, a characteristic of great importance when it comes to online learning environments (Palmer & Holt 2009). However, the design products are also inextricable from the participants' characteristics and particularities, along with their educational environment. Therefore, students' suggestions will reveal experiences and inspirations influenced mainly by the Greek academic environment and their study subject which, however, have been formed in the context of the universal internet experience.

Methodology

We followed the participatory design framework of the We!Design methodology (Triantafyllakos *et al*. 2008), which designates that educational requirements can be extracted by conducting several iterations of concise and highly structured collaborative design sessions with different students. The iterations ensure the representativeness of the undergraduate students' needs, while their short duration renders them attractive to many students without significantly disturbing their primary educational obligations. Such methods allow early design explorations more easily and in cost-effective ways (Kensing & Blomberg 1998).

We conducted 25 design sessions with the participation of 117 undergraduate students (52 male and 65 female) studying in two different Informatics departments of a Greek Technological Educational Institution. Students were on the third or fourth year of study (with a mean age of 22.8 years old) and fulfilled the methodology's requirements for extensive computer experience, since they were engaged in social media, were familiar with Web 2.0 technologies, and had extensive educational experience in tertiary courses and corresponding LMS. Hence, they were expected to have refined predispositions towards the weaknesses of the institutional e-learning services and the opportunities for change. Students' registration in the design sessions was voluntary – they were granted extra credits for their participation – and it was conducted through the use of a web-based registration system; hence, group synthesis was not controlled.

Each design session lasted for approximately 2 h and 30 min and was comprised of four to six students and two experienced coordinators who had conducted more than 50 similar design sessions in the past. The coordinators guided the students throughout the design process and provided support when needed. The design sessions consisted of three phases: the introductory phase (~30 min), the needs elicitation phase (~100 min) and the evaluation phase (~20 min). Two different participatory approaches were employed for the elicitation of students' needs which enabled us to control the final set of needs for technique bias. Although the two methods incorporated several common activities, they meant to provoke fundamentally different experience and engagement. The first one asked for a structured exploration of the design space, while the second one evolved as a design game.

In both cases, our intention was to support students in exploring the design space through three discrete perspectives; one pragmatic, one situated, and one innovative. The pragmatic perspective aimed at a paradigm-preserving, nearly conservative, exploration of the design space through the use of appropriate cues that could help students recall prior experiences. The situated perspective encouraged students to situate their needs in real use contexts exploiting cues that referred to different time and space settings. The innovative perspective initiated both a paradigm stretching and a paradigm breaking exploration of the design space through the use of various creative activities. The techniques were inspired from studies referring to idea generation theory (Halskov & Dalsgaard 2007; Perttula & Sipilä 2007). By employing imagery or textual elements, such as verbs, nouns, etc., participants were encouraged to be creative, and to avoid the tendency to generate ideas with minimum cognitive effort that could lead to the reproduction of slightly modified instances of existing ideas or objects (Ward 1994). The design game aimed at establishing a more playful environment where

students' interactions are unaffected by social influences on idea generation, such as production blocking, free riding, cognitive inertia, etc. The fact that the design games use explicit and well known rules and game mechanisms, can make the participants feel more at ease with the unfamiliar role of the designer they are asked to play (Johansson 2006).

Introductory phase

At the beginning of both types of design sessions, a detailed description of the design problem was presented, namely, the envisioning of a web learning environment that meets students' particularities, that incorporates, exploits and extends their web 2.0 practices and that can be harmoniously situated in the daily routine of a contemporary, active student. The Web 2.0 term was exemplified, firstly, by referencing to the opportunities and consequences of user practices in well-known web 2.0 services (e.g. YouTube©, Flickr©, Facebook©), and secondly, by posing questions about students' underlying attitudes with regards to participation, collective knowledge production, and social networking.

Students were then asked to play the role of a scriptwriter and develop their own fictional characters – 'design alter egos' (Triantafyllakos *et al*. 2009) by selecting a photograph from a rich set of photographs and by shaping her physiological, sociological, and psychological traits (personality traits, professional ambitions, computer experience, etc.) in a predesigned form. Then, the design alter ego then became their communication agent throughout the design process, an 'object to think with' and an 'object to think for' (Triantafyllakos *et al*. 2009). Design alter egos were introduced in order to liberate the students from the fear of straightforwardly exposing themselves, to support and enhance their introspection and creativity (Triantafyllakos *et al*. 2009), and to overcome the notion of the 'implied' student (Ulriksen 2009) that is formed from their prior educational experiences.

Needs' elicitation technique I

Five activities for extracting students' requirements were conducted: (a) Students were provided with a set of textual stimuli, in the form of nouns, verbs, and questions regarding the diverse contexts where their design alter egos could spend time during the course of a day (e.g. 'in the morning, in the afternoon . . . with my roommate, with my family', etc.), together with exemplary imagery (e.g. photographs of a lecture room, a computer lab, a student's room, etc.). They were then asked to create and elaborate on short ideal scenarios of using the web learning platform under design in the specified contexts. (b) In the next activity, students focused on their fictional character's personality traits and behaviours, and searched for needs directly linked back to their psychological characteristics. (c) Next, students were asked to imagine their design alter ego in an advanced technology context and identify new media affordances. Stimuli in the form of questions were provided (e.g. 'What kind of opportunities do Web 2.0 technologies offer for your design alter ego?'). (d) Afterwards, a set of printouts depicting existing course websites were given to them. Students critically evaluated those solutions and incorporated their characteristics (or not) into the needs pool. (f) During the last activity, students were shown a 5-min video comprised of segments from well-known science fiction movies. Afterwards, they were asked to envision the ways in which the educational system might change and how the new status quo could affect the requirements for the corresponding learning environment. Students were provided with a set of 23 printed hand-sized cards which presented all the activities and the corresponding stimuli and acted as a guide throughout the session.

Needs' elicitation technique II

The second approach was structured as a board game. The main elements of the game were a round board and a set of pawns and dice, one for each participating student. The board was divided in 20 slices, each one accompanied by a description card which provided cues for creating scenarios. Students were given points whenever they managed to fulfil what was asked of them. Seven categories of slices were offered: (1) *The learning category*, which provided students with different sets of verbs and nouns extracted from learning theory books (e.g. learn, explain, assessment) in order to help them combine the essence of learning with the design task at hand. (2) *The time category*, which presented prompts of different periods of time in design alter ego's daily routine. (3) *The context category*, which provided images of three distinct contexts where

their design alter ego might live: university, students' rooms, recreational spaces. (4) *The technology category*, which asked students to envision the ways in which upcoming technological innovations could affect their design alter ego's needs, problems and requirements. Cues, as in previous categories, included verbs referring to the future and questions regarding the use of novel technology products in the classroom (e.g. Tablet PCs, interactive whiteboards). (5) *The divergent category* consisted of two creativity techniques which asked students to imagine that the course website was either replaced by a human agent or transferred to another medium such as theatre, radio, etc. and then try to think of ways for addressing their design alter ego's needs. (6) *The existing solutions category*, in which printouts of existing learning management systems were presented to students. (7) *The extras category*, which allowed students to use cards from whichever category they wanted.

In both techniques, students, after being presented with the given tasks, thought alone at first and presented and discussed their scenarios afterwards. Every need presented was reiterated and written down by one of the coordinators while at the same moment students co-formulated its wording.

Inquiry

The first technique was applied in 12 sessions (54 students), while the second one was applied in thirteen sessions (63 students). In the evaluation phase of each session, students assessed the extracted needs in terms of their perceived significance for the learning process and their innovativeness in a 5-point scale. They also completed a questionnaire for assessing the design process, the coordinators' influence, and for specifying their computer experience. Additionally, a semi-formal discussion was conducted with questions regarding students' attitudes and evaluations of the product and the process. The design sessions were captured by a video camera and the discussions were transcribed. Inductive content analysis was conducted on students' proposals in order to organize them in a number of categories. Identical analysis was also conducted on the transcripts that derived from the video recordings, in order to extract students' perspectives on issues relative to the web 2.0 debate. In the second case, the identified categorical scheme was connected with existing theory in order to function as a base for making inferences. The credibility of the analysis was established in both cases through peer debriefing.

Results

Students and the process

The participants could be considered as a representative sample of computer-literate students since they used computers for an average of 4–5 h per day and for an average of 6.29 years [M = 6.29, standard deviation (SD) = 2.29]. Their most frequent computer tasks included listening to music (M = 6.29, SD = 1.15 – in a 7-point scale of frequency), emailing (M = 5.56, SD = 1.39), seeking for entertainment material (YouTube, etc.) (M = 5.56, SD = 1.34), and social networking (M = 5.40, SD = 2.02).

Students were excited with their participation and evaluated very positively both the process and the products of the design sessions. They characterized the resulting needs of their session as 'innovative', 'interesting', and 'complete' and the design process as 'fun', 'creative', 'unexpectedly enjoyable', and 'efficient'. The majority of students projected upon the design alter egos an idealized version of themselves and claimed that the characters liberated them from the fear of straightforwardly exposing themselves while they also functioned as a source of inspiration. Students underlined the friendly, collaborative, and creative atmosphere that prevailed throughout the sessions and stated that the coordinators did not interfere or affect their design suggestions (M = 4.51, SD = 0.64 – answered in a 5-point scale of agreement) and that their behaviour was not influenced by the camera (M = 4.57, SD = 0.85). The latter was also apparent from the informal atmosphere of the sessions in the video recordings and the students' statements in the semi-formal discussions. Significant statistical differences between the perceived satisfaction and effectiveness of the two techniques, which produced similar needs, were not detected; although in the second technique, students recorded significantly more needs per session. Most needs discussed later were extracted by both techniques.

A frequent question regarding participatory design is whether participants' proposals are superficial. Three facts argue for the opposite, in our case. First, the inherent structure of the We!Design methodology tries to overcome such problems by seeking ideas from

multiple individuals and sessions ensuring a minimum level of convergence and representativeness on the final set of needs. Secondly, students were excited with the participation, there was creative cooperation for the design of 'their' product, and, hence, irresponsibility was far from evident. Thirdly, even though students reviewed only those needs produced in the session they participated in, they claimed that they would rely more on educational tools designed with similar participatory approaches (M = 4.13, SD = 0.87), and as a participant commented: 'It was about time for our thoughts and ideas to be heard'. Students' assessment of the identified scenarios was high (M = 4.22, SD = 0.66) and they suggested that their ideas could eventually lead to the design of an original and particularly satisfying learning platform (M = 4.38, SD = 0.73).

Needs elicited

Students produced 773 distinct needs in 25 design sessions (duplicates in each session were removed). These needs were organized based on their content, and similar needs were rephrased and grouped in 12 discrete categories commonly identified and agreed from the authors, as presented in Table 1. Three of the categories (usability, entertainment, and secretariat services) incorporated requests which were not of high relevance to the learning process and will not be analysed.

1 *The contents and presentation* category gathered the majority of students' needs, providing validation of the high value students attribute to online learning resources. More specifically, students asked for live broadcasts of lectures together with the delivery of the corresponding recorded versions, in the form of pod-casts or vodcasts. In two sessions, documentary was indicated as an intriguing format for presenting learning material in a more appealing and concise way. Students attributed great value on summaries (textual, pod-casts, or vodcasts) while they asked for resources that could help them contextualize the course contents in real working environments (e.g. video-presentations from the workplace, video interviews with domain experts, etc.). They sought for simulation software in order to experiment with the learning tasks and seemed puzzled about their absence in existing learning platforms. Rewarding collaborative game-like simulations and question banks with collaborative answering mode and analytic feedback were considered significant. Students requested extensive historic/background information for the subject domain, its evolution, and its projections in the future, along with information about the most important figures that determined its development. A similar proposal concerned the presentation of videos in the form of 'as today', as an additional motivation for visiting the website on a daily basis. They underlined the significance of providing study material beyond the scope of the course requirements, and, asked for extensive bibliography and linkography. Interestingly, they asked for self-initiated psychometric and learning style questionnaires and required video tutorials presenting optimal studying strategies in relation to their distinctive characteristics. Finally, they proposed the creation of an encyclopaedia, in the form of a wiki which could be a valuable reference and a useful peer-to-peer learning tool.
2 Students proposed typical services of *synchronous and asynchronous communication* with their peers and their professors (forums, chat, video-conferencing). They evaluated highly the idea of submitting public questions to the instructors, so as to enforce immediate answers. In essence, they wanted to exploit the transparency of the medium in order to render it as a regulative medium that could make both teachers and learners commit to their obligations. Summative video-answers to students' questions were also proposed and the value of an online appointments booking system was underlined, since they still value face-to-face interaction with their instructors.
3 Students suggested typical *news services* including information feeds in the form of emails, short message service (SMS), and really simple syndication (RSS). However, they pursued a wider variety of relevant information such as political news (laws, policies, etc.), industry, and research news (discoveries, new software, press, etc.), and related activities taking place in the academic environment or their city of residence (seminars, conferences, etc.). They exhibited a genuine interest regarding the respective labour market of the subject domain and proposed the incorporation of employment ads relevant to the course domain, as a means to gaining a deeper understanding of the labour market orientations.

Table 1. Students' requirements for their ideal web learning platform.

Needs	#	S	I
Content delivery	245		46%
Learning material (pdfs, slides, notes, etc.)	22	4.6 (1.3)	2.6 (1.3)
Lectures live video-streaming	19	4.4 (0.8)	4.6 (0.8)
Resources for relative software	9	4.4 (0.8)	3.5 (1.0)
Extensive self-study material	13	4.2 (1.0)	2.9 (1.3)
Simulations	10	4.2 (0.9)	4.0 (1.0)
Multimedia versions of learning material	9	4.1 (1.0)	4.0 (1.0)
Documentaries	2	4.0 (1.0)	4.2 (0.8)
Professional case studies in videos	13	4.0 (0.9)	3.9 (1.1)
Video/voice summaries	9	4.0 (0.9)	4.3 (0.8)
Lectures video-recordings	21	3.9 (1.0)	4.5 (0.8)
Textual summaries	9	3.9 (0.9)	3.0 (1.2)
Wiki encyclopaedia–dictionary	14	3.9 (1.0)	3.4 (1.2)
Formative assessment	17	3.7 (0.9)	3.5 (0.9)
Bibliography–linkography	20	3.7 (0.9)	2.9 (1.2)
Adaptability options	14	3.7 (1.1)	4.0 (0.8)
Learning games	17	3.7 (1.1)	4.2 (0.8)
Extracurricular content for further studying	15	3.6 (1.0)	3.3 (1.2)
Lectures pod-casts	4	3.3 (1.1)	4.4 (0.7)
Domain historical information	8	3.2 (0.9)	3.9 (0.9)
Communication	83		40%
Public questioning boards with instructor	10	4.5 (0.8)	3.7 (1.2)
Chat, email with instructors/online booking	26	4.2 (0.9)	3.9 (1.2)
Forums (+ summative video answers of instructors)	17	4.1 (1.0)	3.0 (1.3)
Synchronous with colleagues (chat)	22	3.7 (0.9)	3.6 (1.2)
Blog-style comments on all resources	8	3.4 (1.1)	3.5 (1.0)
News	81		26%
Legislation, political and research roadmaps	2	4.3 (0.7)	4.3 (1.0)
Lectures, announcements, projects, grades	21	4.3 (1.3)	2.4 (1.3)
Labour market	5	4.0 (0.8)	4.1 (0.7)
News feeds: email, RSS, SMS	20	4.0 (1.1)	4.2 (1.2)
Events, exhibitions, seminars	15	3.9 (1.0)	3.5 (1.2)
Research-industry news	18	3.6 (1.0)	3.5 (1.0)
Projects	71		32%
Projects library	17	4.4 (0.7)	3.0 (1.3)
Projects submission-feedback	13	4.3 (0.8)	3.5 (1.2)
Supportive material for projects	14	4.3 (1.0)	3.2 (1.2)
Best projects library and video presentations	7	4.0 (1.1)	3.8 (1.1)
Project workspaces	10	3.8 (0.8)	4.0 (1.0)
Team formation tools	7	3.5 (1.4)	4.1 (0.8)
Peer to peer projects' assessment	3	3.4 (0.8)	3.8 (0.7)
Course description	56		21%
Contents description	3	4.7 (0.5)	2.2 (0.8)
Educational opportunities (postgraduate studies)	7	4.3 (1.1)	3.6 (1.1)
Frequent students' mistakes – FAQs	3	3.9 (1.1)	3.7 (1.2)
Expected skills video demonstration	5	3.9 (1.3)	3.5 (1.2)
Success rate analysis	2	3.8 (1.6)	3.4 (1.5)
Calendar (lectures, activities, etc.)	14	3.8 (1.3)	3.0 (1.3)
Estimated study load analysis	2	3.7 (1.5)	3.8 (1.3)
Aims, introductory trailer	15	3.6 (1.1)	2.8 (1.4)
Prerequisites-relative courses	4	3.5 (1.5)	2.2 (1.5)
Artistic connections (films, narratives, etc.)	2	3.1 (0.8)	4.1 (1.2)

Table 1. *Continued*

Needs	#	S	I
Networking	53		51%
With instructors	7	4.1 (1.3)	3.0 (1.3)
With students of similar courses	5	3.9 (0.9)	4.3 (0.7)
With other courses (instructors, projects, etc.)	23	3.7 (1.0)	3.7 (1.1)
With ex-students	3	3.6 (1.1)	3.9 (0.8)
With professionals	4	3.4 (1.1)	3.8 (1.0)
With fellow students	9	3.2 (1.4)	3.5 (1.3)
Exploiting existing social networking sites	2	3.1 (1.5)	4.0 (0.9)
Participation	47		47%
Present and share projects	9	3.8 (1.0)	3.2 (1.4)
Produce and share notes, links, papers	12	3.8 (1.1)	3.4 (1.1)
Extracurricular projects, e-mentoring, voting	20	3.7 (1.0)	4.2 (0.9)
Produce course assessment in video format	4	3.7 (1.0)	4.1 (0.9)
Produce fun material from lectures	2	2.3 (1.0)	4.0 (1.4)
Course exams	36		36%
Prior exams library	16	4.6 (0.7)	2.7 (0.7)
On line rating, feedback and discussion	14	4.2 (0.9)	4.0 (1.1)
Preparative e-assessment tools	6	4.1 (0.9)	4.6 (0.7)
Course assessment	18		50%
Instructor's assessment	5	4.2 (0.9)	4.1 (1.1)
Course's organization and content assessment	13	3.7 (1.1)	3.7 (1.2)
Usability	61		46%
Utilities for students with special needs	2	4.9 (0.4)	4.6 (0.7)
Desktop application for local copies of the website	2	4.4 (0.5)	4.5 (0.7)
Easy, simple and appealing interface	8	4.1 (0.8)	3.3 (1.1)
Minimal personalization	9	3.9 (1.1)	3.2 (1.3)
Resources update services	5	3.9 (0.9)	3.1 (1.2)
Advanced search utilities	8	3.7 (1.3)	2.5 (1.4)
Personal folder	7	3.5 (1.0)	4.1 (0.9)
Mobile access	4	3.5 (1.1)	4.7 (0.6)
Interface agents	7	3.1 (1.1)	4.7 (0.5)
Mash-up interface for incorporating widgets	2	3.0 (1.4)	4.0 (0.8)
Customizable interface	7	2.5 (1.1)	3.5 (1.1)
Entertainment	13		15%
Music streaming	6	2.6 (1.3)	3.7 (1.3)
Games	7	2.2 (1.2)	3.6 (1.2)
Secretarial integration	9		22%
Secretarial services integration	9	4.1 (1.0)	3.0 (1.5)
Total	773		

Needs, needs categories ordered by significance in each category.
#, number of needs ≈ design sessions in which the need was discussed; S, average perceived significance (standard deviation); I, average perceived innovativeness (standard deviation)/percentage of perceived innovative needs per category; RSS, really simple syndication; SMS, short message service; FAQ, frequently asked questions.

4 Students put emphasis in the creation of a *projects pool* in which they could easily discern and study the best ones with video presentations. They said that they would like to be able to contribute to this project pool and connect their work to their personal portfolio. Many needs concerned group work which, according to students, should be better supported by providing integrated project workspaces for structured collaboration. They also wanted to have the choice to control their groups' synthesis and illustrated a tool which could enable them to select teammates from an available 'bid market'.

5 The students anticipated *clear and explicit expectations from the courses* and asked for a thorough syllabus. They discussed the idea of incorporating a video introduction to the course subject similar to that of a movie trailer. They insisted on the need for a better contextualization of the domain description into their world and asked for the incorporation of relevant educational prospects (postgraduate studies, opportunities for diploma theses, etc.), artistic work that could stimulate the pursuit of the philosophical roots and pragmatic consequences of the course's subject matter (films, literature, etc.), as well as a detailed portrayal of the skills they would acquire (e.g. through the use of videos showing professional practice in industry). Students also seemed to be interested in informal views and empirical hints from their professors and asked for an estimated study load analysis – a subjective judgment of the anticipated load students will have to deal with during the semester – and a frequent learning mistakes list which could help them avoid common pitfalls.

6 The scent of web 2.0 was particularly detectable in the *networking needs category*. Students were interested in learning more about their instructors and, essentially, wanted to overcome the prescribed walls of formality inherent in their relationship. Many of them had already requested to become 'friends' with those professors who had active accounts in social networking sites. Students also asserted repeatedly that the learning platform should be part of a network of similar courses in different universities, a network with explicit possibilities for sharing resources and one which could overcome the existing organizational and computational infrastructures. They expected a variety of video presentations, notes and case studies coming from different instructors, search services that index all these resources, and attributed great significance to innovative communication/cooperation opportunities with other departments' students and professors. They also asked for extensive networking opportunities with practitioners so as to communicate with them during project development, to understand their daily routine and to make themselves available in the case of job offers or any kind of internship openings. Students also asked for networking opportunities with ex-students who had successfully attended the course or graduated from the department in order to discuss and share their views on the value of the course contents. They evaluated as less important the networking with their fellow students.

7 Another set of innovative needs was identified in the *participatory category*. Students stated that they were willing to create and share learning resources (such as class notes, bookmarks, and links to relative papers) as well as fun material from lectures or team projects. Additionally, they wanted to participate in the formulation of the learning process by selecting and voting on their preferred way of teaching, selecting topics of interest that would be elaborated by the instructor during dedicated lectures, organizing electronic mentoring sessions with the instructor or ex-colleagues, initiating extracurricular student projects relevant to the domain, and finally, by voting on student-initiated requests, such as the change of the exam dates. They also said that they were willing to video-record informal assessments of the course which could be useful for prospective students before selecting the course. More intriguing ideas included short video-recorded dramatized summaries of each lecture by groups of students and periodic online 'press conferences' with the instructor for answering their questions.

8 The *exams category* included needs such as an old-exams repository with exemplary answers and online access to grades together with the teacher's feedback. Students wanted to examine the validity of the assessment process by anonymously reviewing their colleagues' answers and marks, and by being able to start an e-argumentation in case of dispute.

9 Finally, students wanted to be able to *evaluate both the instructor and the course's contents.* They suggested that informal evaluations should be conducted during the semester and should have a direct effect on the course's progression. The forms of the proposed evaluation included questionnaires, a regular column of complaints, an anonymous blog devoted to assessment, and the realization of an online anonymous session for discussing problems and suggesting improvements.

While we did not delve into the details of students' proposals, it is apparent that they extracted a great breath of needs which are not met in their totality by any current system. Students evaluated 40% of their proposals as innovative and, hence, they provided a balanced

set of needs including both typical and innovative ideas for them. Most innovative ideas came up from a relatively small group of participants (19 from 117) that explored many ideas beyond conventional practices. However, these students were not necessarily the 'digital pioneers' (as called in Clark *et al*. 2009). There was no significant statistical correlation between the number or the innovativeness of the proposed needs and the students' computer experience. Students with less computer experience but who were more self-conscious about their learning, did have elaborate views on how technology can be exploited. It would be safe to say that the rest of the participants extracted needs at least as very demanding consumers, if not contributors, revealing that the spectrum between the two poles is wide. Nevertheless, it should be expected that the students' study subject, computer science, favoured the development of technologically innovative ideas.

Interpretative analysis of students' needs

Students did not seem eager to challenge the dominant paradigm of LMS, an observation which is in agreement to research results concerning Web 2.0 tools that appear to extend rather than challenge current pedagogies (Hemmi *et al*. 2009). However, when looking at the most innovative needs proposed, it is obvious that students already expect to incorporate several of the Web 2.0 practices. Their proposals are in a close relation to the participatory culture (Jenkins 2006; McLoughlin & Lee 2008) where there are greater opportunities to initiate and influence the curriculum (e.g. they wanted to propose lecture subjects, to organize mentoring sessions, and negotiate procedures), to produce and share content as authors (e.g. they were willing to initiate extracurricular projects, to produce dramatized summaries and video-assessments for the course, to share notes and links), to interact with a wide network of stakeholders and resources (e.g. they asked for multiple networking opportunities with instructors, fellow students, ex-students, fellow students of similar departments, professionals), and to control and personalize the learning experience and the user interface (e.g. they wanted explicit adaptability options, mash-ups, etc.). As expected, the two of the three categories with the most innovative needs (as a percentage of the total needs per category) were the categories 'networking' and 'participation.'

In general, students asked for a learning platform that could enable them to discern the idiosyncratic characteristics of the learning field, open up to its opportunities, and, essentially, allow them to enter inside the domain's world instead of merely learn about it (Dall'Alba & Barnacle 2007; Ulriksen 2009). For this reason, they sought for an acquaintance with the course's knowledge domain (e.g. industrial, research news), its historical evolution (e.g. historical videos), the academic and professional opportunities it provides (e.g. labour market news), its leading figures (e.g. biographies), and the environment in which it flourishes (e.g. legislation, research agendas). Students were in opposition to the isolating experience of traditional education (McLoughlin & Lee 2008), asking persistently for the contextualization of the domain's knowledge and its grounding in real cases studies and circumstances (e.g. expert interviews, conferencing with corporations) (Dall'Alba & Barnacle 2007) and in their world (e.g. films, literature, postgraduate studies). They sought for a shift from text-based content to new forms of delivery (Jenkins 2006) and suggested the cinematic and documentary languages as two prospective candidates for improving content presentation and understanding. They also insisted on multiple forms of contents delivery (e.g. e-books, notes, simulations, games) with the video format being a common denominator in almost all needs categories.

Students exploited the possibilities provided by networking in order to dissolve the boundaries between universities, between universities and industry, and between students with similar learning interests. They envisioned networks with weak ties and asked more for object-centric (overlapping interests and affinities) rather than ego-centric (personal ties such as 'friends', 'acquaintances', or 'colleagues') networks (Ryberg & Larsen 2008). They promoted interaction with their colleagues only when it concerned further elaboration on the course material (Moore 2008) and not for the expansion of their social life.

They attributed to the instructor the role of an authoritative source of information (Hemmi *et al*. 2009) and wanted to take advantage of his/her expertise as an intermediate adaptation mechanism for accessing resources tailored to their level of knowledge. They tried to move instructors towards being facilitators that serve their needs and also learn by them (CLEX 2009) and mentors with whom they can socialize. Although

students considered instructors as an essential parameter of successful learning, they questioned:

- the instructors' ability to address the complex set of the needs on their own. They seemed to have several objections to the one-to-many teaching model and they explicitly wondered about the need to limit the number of instructors and students interacting in the digital world. They envisioned digital 'constellations' that provide plentiful networking opportunities, exploit technological advancements and offer better learning opportunities, without negating the institutional organization.
- the instructors' authenticity in regards to the professional environment. Students asked for the establishment of direct communication channels with professionals, video case-studies from the industry, and news from the labour market. They wanted to be able to critically evaluate their activities in the work environment (McLoughlin & Lee 2008) and underlined their current detachment from the professional reality which is antithetical to a world of specialized qualifications.

Not all of the typical web 2.0 expectations were confirmed. The majority of students did try to design a system around advanced digital literacy skills or personal learning environments. They did not seem to emphasize self-direction; instead, they focused on improving existing practices of self-studying enriched learning contents. Students were not willing to take full responsibility for the learning contents, nor did they concentrate on learning experiences that are short and random. They rather placed greater emphasis on content consumption and once more validated that they attribute more importance to the course's content than to the interaction (Moore 2008).

Moreover, despite any contrary suggestions (e.g. Barnes & Tynan 2007), students did not make strong analogies between their daily computer-related routine and the learning platform, and they did not synthesize needs, hobbies, and practices from the two areas. No-one asked for the incorporation of academic services into their personal networking spaces, and no one proposed the creation of online clubs, interest groups, etc. in the learning environment. Instead, they wanted to keep their learning and personal cyberspaces apart, and preferred the coexistence rather than the convergence of these two worlds (Creanor *et al*. 2006; Conole & Creanor 2007; Selwyn 2007; CLEX 2009).

Discussion

Are researchers' projections on par with the students' expectations? The Greek undergraduate students convincingly demonstrated their e-learning 2.0 'mentality' (Crook 2008), their cultural disposition towards openness, participation, and interaction through the fact they were in position to extract these innovative (from their perspective) needs and the significance that they attributed to them. However, students sought for a smooth transition to the new environment, and they promoted an evolution rather than a revolution. Their primary focus concerned the advancement of the form and the content of the learning material, the recognition of its dynamic character, the contextualization of knowledge, its grounding to research and industry communities of practice, the intra-university cooperation, networking opportunities with all related stakeholders, and the establishment of a more facilitative role for the instructors: an old set of needs expressed in terms of the new media. The resulting set of needs demarcates a zone of expectancies and offers a grid of feasible intermediate modifications that can retrospectively motivate and drive students to even more demanding and revolutionary calls. It is an intermixture of needs, problems, and wishes or, in essence, experiences, inspirations, and visions. Can such sets of needs become the genes of the new web X.0 systems? Participatory design offers tremendous unexplored opportunities for better managing educational change and for promoting locality and diversity, involvement, and collaboration (Siozos *et al*. 2009).

The students' proposals have also practical implications for learning systems designers. Beyond the apparent value of the requested functionality (as presented in Table 1), the pool of proposals can also be revisited and reorganized in order to envisage more conceptions of students' expectations. For instance, students attributed to the web course a more transitory character that transcends the time constraints of a semester, supports knowledge exchange among students, professors, and professionals through informal means and, essentially, requires constant intra-university cooperation. Also, students suggested an impressive variety of metrics for the evaluation of the course's attractiveness such as previous students' video assessments, demonstrations

of targeted skills, trailers, relative labour market news, opportunities for networking with professionals, etc. Similar ideas could be investigated in more detail since they challenge the structural elements of existing systems and provide new directions and perspectives for the design of learning systems.

Certainly, students' proposals should not be considered as a complete and well-processed set of requirements. The practical fulfilment of students' needs is far from easy and requires thorough refinement on behalf of the designers on the one hand and the establishment of new social and institutional norms and processes on the other. Students expressed their vision for their own learning paths without considering the other stakeholders' needs, abilities, and constraints. Moreover, it is sensible to envisage dissimilar sets of needs for different educational environments, subject matters, and levels of computer experience. The proposals exposed inspirations influenced mainly by the Greek academic environment and were produced from computer literate students. Hence, the representativeness of the participants in regards to the global undergraduate population should cause a concern when generalizing the results. Interestingly, three observations possibly widen the applicability of the proposals. Firstly, the students' Internet experience which filtered their views on opportunities and challenges is relatively homogenized across universities and countries and, consequently, functions as a shared platform for design thinking. Secondly, our study indicated that computer experience is not the most determinative factor in conceiving technologically innovative educational set-ups. Therefore, students of other disciplines could have also provided insightful approaches or be satisfied by the current sample's needs. Thirdly, if the educational community strives to develop a global community of learners, then the intersections between their expectations should be identified and met. In this study, we revealed Greek undergraduate students' vision. We aimed at the application of similar participatory design techniques in different universities and/or countries and the conjoint analysis of the extracted ideas in order to validate the previous claims.

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