Adaptivity in web and mobile learning services

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So far recent special issues of this journal had concentrated on the more direct parameters to control and optimise conditions for learning and training. Gradually, we see that both corporate training and regular learning institutes tend to fall back on generic facilities for communication and www resources. An extreme example of this trend is the absorption of mobile devices in sharing expertise and involving colleagues in tasks that the single employee was never trained for before. As you can imagine, it is not possible to improve effectiveness by tuning the variables as we normally do in instructional design.

This special issue explores topics related with the new opportunities, paradigms, and technologies for *adaptivity in web and mobile learning services*. Hopefully, the papers that form this special issue have addressed some of the above mentioned open questions. The papers are organised based on three dimensions of adaptivity in web and mobile learning services identified.

The use of computers and the internet has enabled the design and development of educational services which are based on new technology-enhanced learning paradigms and facilitate the access to available digital resources. With the recent developments in mobile technologies and the development of web service standards, further possibilities are emerging to provide next generation learning services via mobile devices and the web.

As a result, a new business model arises. It moves from '*systems' business logic* to '*services' business logic* and pretends to provide total solutions for access and interaction. This has created various challenges and opportunities in terms of *adaptivity in access*, *customisation*, and *personalisation*. New architectures and techniques should be developed in order to take full advantage of the potential of this new infrastructure.

There are several open questions concerning different dimensions of adaptivity in web and mobile learning services (Hong et al., 2001; Keegan, 2002). The first dimension is the *learning content* and/or *learning activities*. The open issues in this dimension concern the design of learning resources in order to be used in adaptive web and mobile services (Roibás and Sánchez, 2002; Kristof, 2002). The second dimension considers *the design of architectures* and development of systems supporting the delivery of adaptive learning services through web or mobile devices as well as *evaluation frameworks* for such systems (A'herran, 2001; Waycott, 2001; Rogers, 2002). The third dimension focuses on *user interactions and the dynamic creation of learning communities* (Suthers, 2001; Bouras et al., 2002).

In the first paper entitled 'Don't lose the learning from learning objects!- a request for care in the adaptive content community', the authors identify the significant growth in the number of initiatives that use mobile devices to support teaching and learning, and an increasing amount of interest in this from many sectors. As with other emerging research and development areas of educational technology, a key issue of concern is how to 'scale up' learning systems to provide services in a wider context. They argue that although there is potential for m-learning platforms to use e-learning resources by optimising them for the network and delivery platforms, this should not be done at the risk of losing the learning objects' underline pedagogy. They focus on how to design and deliver effective m-learning in a scalable manner, to a multiplicity of technologies, by means of adaptive content architectures. They consider how adapting the delivery of learning objects to a heterogeneous assembly of devices may impact upon the pedagogical efficacy of the learning objects comparing the diversity of existing technologies in the area of m-learning.

In the second paper entitled 'MAS-SHAAD: a multiagent system proposal for an adaptive hypermedia system', the authors identify the heterogeneity problem (in terms of different types of access devices, bandwidth of the network, preferences/characteristics of the user, etc.). They discuss different alternatives that have been already developed in order to allow universal access to different types of content focusing on adaptive educational hypermedia systems (AEHS). They propose a design framework for AEHS based on the use of multi-agent systems (MAS) utilising the GAIA methodology.

In the third paper entitled 'Personalisation services for learning management systems in mobile settings', the authors present a multi-agent recommendation system that suggests educational resources to students into a mobile learning platform for higher education. Their work focuses on three dimensions of m-learning. The first dimension concerns the design of effective models for mobile learning. The second regards the evaluation of learning processes in mobile learning environments, and the third focuses on the technological aspects of integrating multi-agent recommendation systems into mobile learning management systems. They present the integration of InLinx, a multi-agent web-based hybrid recommender system that provides on-line bookmarking services, in an m-learning architecture.

In the fourth paper entitled 'Validating proficiency mining strategy in adaptive leaning environment', the authors identify performance evaluation in the learning process as a key component of adaptive learning environments. They propose a data mining methodology for performance evaluation and demonstrate the use of this methodology in the case of a learning system aiming to improve programming skills. They propose the addition of proficiency mining in the learning process to explore the proficiency level, strength of knowledge, cognition, and skill. The proposed process involves the use of selected parameters to characterise abstract learning behaviour. This learning behaviour comprises interactions among learners, learning material, and learning environment. The authors claim that by tracking and summarising these interactions, a higher density of evaluations can be obtained rather than by tests and homework only. They use quantified parameters to approach actual learning behaviour and construct an adaptive learning environment to support the discussion in the experiment. They present evaluation results which demonstrate that proficiency mining shows sufficient evidence to represent programming performance and personalise computer-assisted learning.

In the fifth paper entitled 'Privacy and personalisation in a smart space for learning', the authors identify the problem of privacy and data protection for personalised learning services offered over the internet. Adaptive learning systems typically involve learner profiles with sensitive information and activities that might breach learner's privacy, such as tracking, profiling or collaborative filtering. The authors discuss privacy aspects of personalisation and adaptation in smart spaces for learning. A smart space for learning is a system for mediation of learning services, which is being developed in the EU IST ELENA project. They present threats and requirements in smart spaces for learning, model learner profile data that are necessary for privacy protection, and describe privacy-enhancing technology based solutions.

In the sixth paper entitled 'Layered evaluation of adaptive learning systems', the authors discuss issues related with the evaluation of adaptive learning systems. They propose an alternative to the traditional 'black-box' approach of evaluating adaptive learning systems. They argue that the commonly recognised models of adaptive systems can be used as a basis for a layered evaluation that offers certain benefits to the developers of adaptive learning systems. They propose a layered evaluation framework, where the success of adaptation is addressed at two distinct layers, namely the user modelling, and the adaptation decision making. They outline how layered evaluation can improve the current evaluation practice of adaptive learning systems and present evaluation results of InterBook – an adaptive educational hypermedia system – and KOD – an adaptive learning environment providing personalised learning content – following the proposed evaluation methodology.

In the next paper entitled 'Growing interest-oriented learning communities for mobile-learners', the authors identify the need for effective clustering of m-learners based on the dynamic learning behaviours. They present a framework for providing personalised recommendations based on the use of a system that groups similar learners according to their interests and dynamic interactions. They use a multi-agent mechanism to manage and organise learners and learner groups, and present experimental results demonstrating that the proposed approach can be used for effective learners' classification.

In the final paper entitled 'Knowledge awareness for a computer-assisted language learning using handhelds', the authors describe how computer supported collaborative learning (CSCL) can be implemented in a ubiquitous computing environment. The ubiquitous computing evolution has recently been accelerated by improved wireless telecommunications capabilities, open networks, mobile devices, continuous increase in computing power, improved battery technology, and the emergence of flexible software architectures. The authors present a system called CLUE, in which learners provide and share individual experience and interaction corpus and discuss about them. They focus on the design, implementation, and evaluation of knowledge awareness maps, claiming that the use of those maps can facilitate in finding peer helpers, and induce collaboration. These maps visualise relationships between the shared knowledge and the current and past interactions of learners. They demonstrate the use of PDAs (personal digital assistants) for language learning as an application domain of their research.

We would like to take this opportunity to thank the reviewers for their great efforts and all the authors who submitted their papers to the special issue. We particularly thank the authors of accepted papers for their high-quality work and for having worked on a tight schedule to come up with their revised versions in a timely manner.

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If you feel inclined to build further on the ideas launched in this special issue, and think about proposing a new paper from your perspective as well, please contact the Inderscience editors of this journal.

References

A'herran, A. (2001) 'Integrating a course delivery platform with information, student management and administrative systems', *Proc. of the 13th World Conference on Educational Multimedia, Hypermedia & Telecommunications (EDMedia2001)*, Tampere, Finland, June 25–30.

Bouras, C., Psaltoulis D., Psaroudis C. and Tsiatsos T. (2002) 'An educational community using collaborative virtual environments', *Proc. of the 1st International Conference on Web-based Learning*, Hong Kong, China, pp.180–191.

Hong, H., Albi, N., Kinshuk, He, X., Patel, A. and Jesshope, C. (2001) 'Adaptivity in web-based educational system', *Proc. of the 10th International World Wide Web Conference,* Hong Kong, China, pp.100, 101.

Keegan, D. (2002) *The Future of Learning: From Elearning to Mlearning*, available at http://learning.ericsson.net/mlearning2/old_sites/book.html.

Kristof, N. (2002) 'Toward a philosophy of m-learning', *Proc. of the IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE2002)*, Växjö, Sweden.

Rogers, T. (2002) 'Mobile technologies for informal learning – a theoretical review of the literature', *Proc. of the European Workshop on Mobile and Contextual Learning*, Birmingham, UK.

Roibás, A.C. and Sánchez, I.A. (2002) 'Design scenarios for m-learning', *Proc. of the European Workshop on Mobile and Contextual Learning*, Birmingham, UK, pp.53–56.

Suthers, D. (2001) 'Collaborative representations: supporting face-to-face and online knowledge building discourse', *Proc. of the 34th Hawaii International Conference on the System Sciences (HICSS-34)*, Maui, Hawaii.

Waycott, J. (2001) 'An investigation into the use of mobile computing devices as tools for supporting learning and workplace activities', *Proc. of the 5th Human Centred Technology Postgraduate Workshop (HCT-2001)*, Brighton, UK.