SHARING EXPERIENCE

INNOVATIVE DEVELOPMENTS

1ˢᵗ **Moodle** Research **Conference**

Editors
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Heraklion, Crete-Greece
SEPTEMBER, 14 - 15, 2012

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1st **Moodle** Research**Conference**
Heraklion, Crete-Greece **SEPTEMBER, 14 - 15, 2012**

PREFACE

The rapid development of computer networks and hypermedia systems, both in software and hardware, has increased the potential of their utilisation in formal and informal educational settings. Cornerstones of their wide utilisation are the learning management systems (LMSs) or virtual learning environments (VLEs). They offer affordances that allow them to support open, flexible and learner-centred patterns of study, facilitate active learning and provide ways for learners to communicate and work collaboratively.

The prospect of the use of the LMS in authentic educational environments is very good. Real proof is Moodle which is by far the most popular open source LMS and perhaps the most popular LMS in existence, with over 6 million online or blended learning courses in 200 countries that 58 million students attend with the support of more than 1 million teachers.

Nevertheless, validating evidence of their learning effectiveness from the use of Moodle (or any LMS) in actual educational settings is scarce. Data from case studies as well as best practices both in term of course design or utilization of existing or recently developed features/plugins need to be shared and evaluated.
It was for this purpose that we set up the Moodle Research Conference - to provide opportunities for sharing, discussing and providing constructive criticism of research and development outcomes and methods.
Starting this year on the 14th & 15th of September 2012 on the beautiful and historic island of Crete in Greece, we hope that the Moodle Research Conference will become a unique annual event for academics, researchers, experts and practitioners who use and develop Moodle, to connect with each other and help improve the design and use of Moodle in the future.
After a systematic review process 24 papers and 7 short papers will be presented covering topics such as:

- Research studies and case studies on teaching with Moodle
- Mobile Learning with Moodle
- Innovative Moodle plug-ins
- Learning Analytics in Moodle
- Collaborative Learning with Moodle
- Moodle communities of practice
- Interoperability with Moodle
- Accessibility in Moodle
- Adaptivity in Moodle

We would like to thank all the members of the program committee for their invaluable contributions during the review process. And of course, special thanks to the members of the organizing committee i.e. people from Moodle HQ, especially Mr. Michael de Raadt, ITisART Ltd, especially Mr. Petros Georgiakakis, Mr. Michalis Boloudakis and Mr. Yannis Arapoglou, as well as the CoSyLlab research group at the Department of Digital Systems, University of Piraeus.
We welcome all delegates and their guests to the 1st Moodle Research Conference. We hope that you will enjoy your stay in Crete and find the conference program interesting and relevant!

Symeon Retalis & Martin Dougiamas

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A Community approach to staff development in eLearning

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Abstract

This narrative seeks to identify practices that have enabled staff in eLearning roles to support their peers to increase the use of eLearning within a New Zealand tertiary education context. Specifically, it examines those factors that have contributed to the development of institutional capability in eLearning over a two-year funded period.

Unitec New Zealand has recently implemented a transformative eLearning Development Strategy with the aim of developing the capability and capacity of Unitec academic staff in integrating learning technologies. The eLearning Strategy has seen the funding of a number of temporary roles to support and foster increased staff capability and capacity in eLearning. These roles have had the responsibility of engaging in an institute wide Community of Practice, and encouraging a local community of practice within Faculty departments.

In completing this narrative we ask ourselves what factors can contribute to the development of a sustainable learning culture at Unitec with specific regard to eLearning. The authors identify how a community approach has enabled greater confidence and capability across not only an eLearning community but the wider Unitec Academic staff. In this narrative, we will explore and reflect upon the enablers and barriers experienced in the eLearning roles, the insights, and the implications arising from this model and its efficacy in meeting institutional goals.

The merits of a funded time release as a prerequisite for change of teaching practice are examined, so as to inform recommendations for future initiatives that foster growth in eLearning integration without dedicated funding.

Options are envisioned for the future direction of eLearning capacity development, informed by community participants, literature and the authors' own reflections. These discussions anticipate which measures are sustainable solutions for the future, and consider other measures which could be employed to improve the status quo and ensure a continuing culture of learning and development amongst Unitec teaching staff.

Keywords

eLearning, capacity building, staff development, Community of Practice, tertiary, New Zealand

Background

Unitec is New Zealand's largest Institute of Technology providing vocational and applied professional education from Certificate to Doctoral level. Four campuses in Auckland offer mostly face-to-face courses but with an increasing demand for more flexible delivery of courses.

The institution purchased a Blackboard license in 1998 that was for the majority of courses used as a repository for core documents, and a means for announcement broadcasting. As a result of an LMS (learning management system) evaluation a Moodle pilot was undertaken in three departments in 2009. It was identified that funding saved on proprietary licenses could be better employed for the development of staff capacity in eLearning. The funding of academic staff development by peers was a preferred solution to the contracting of external expertise, as it enabled Unitec to develop internal capability and retain expertise after the implementation phase of the eLearning Strategy and the transition from Blackboard to Moodle.

In 2010, Unitec began implementation of a transformative initiative described as the Living Curriculum. The Living Curriculum has been defined by a number of key principles including complex conversations, curiosity, focus on practice, social constructivism, blended learning experiences, research-informed, interdisciplinary, literacies for lifelong learning and embedded assessment. Underlying this, an additional 'eLearning Development Strategy' was launched with the aim of developing the capability and capacity of Unitec academic staff in integrating learning technologies in creative and meaningful ways to enhance the learning experience offered to Unitec students. Previously, there had been no strong, sustained institutional commitment to eLearning, and a lack of clarity in strategic direction in this area. (Left, Neal, & Marshall, 2008)

The eLearning Strategy identified ten strategic objectives. These including the up-skilling of all academic staff in eLearning capability, embedding academic literacies in learning environments, and building institutional capability that enables continuing learning development and leadership. It was recognised that in order to fully integrate eLearning into the Living Curricula, institutional capability had to be developed and support structures provided to facilitate development activities. As a vehicle for realising these objectives, the Community of Practice (CoP) model was selected as a potentially empowering approach to building social capital.

Communities of Practice

Wenger (2006) defines communities of practice as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly". For a community to be defined as a Community of Practice however, Wenger, White & Smith (2009) tells us three critical elements must be present and facilitated. A shared domain of interest unites the members of a community of practice and creates the identity of the Community . Members have some aptitude in the domain and the community values its shared social capital. The element of community describes the nature of the interactions that define a Community of Practice. Communities of Practice provide an environment for helping, sharing, reflecting, and discussing with peers who have common interests. Finally, practice acknowledges the participants of the community as practitioners. Within the community, given time and ongoing interaction, members begin to develop a shared repertoire of practice.

Research identifies a number of essential enablers for the Community of Practice (CoP) model, which could be loosely categorised under the headings of resource (time, finance, committed investment of resources, enabling technologies, engaged sponsorship), community roles (identified champions, energised core, internal leadership, effective facilitation, support and stewardship, voluntary membership and member-driven agenda) and community culture (high expectations, passion, practice focussed, trust, established outcomes and ground rules, value for time, personal touch, fun, celebrating success) (Wenger & Trayner 2010, McDonald 2010). Conversely, threats to the success of a CoP can include lack of time, leader neglect, red tape and ideology, information technology and logistics, command and control, management intervention, inflexibility, de-energising tasks, and a focus on documents and events (Wenger, 2010).

The Community of Practice model was selected with the aim to facilitate staff capacity building partly because a Community of Practice presents the opportunity for the practitioner to adopt the role of both expert and learner within the Community, depending on the recognised skill sets and knowledge of the domain held by the participants. This is of particular significance given the nature of the Living Curricula, and in questioning the traditional role and identity of academic staff as experts rather than life-long learners and collaborative constructors within the domain. "Part of the rationale was the desire to have teachers experience the shift from the acquisition metaphor of learning to the participation metaphor in line with the pedagogic underpinnings discussed previously in relation to their own learning (Sfard, 1998)" Keesing-Styles & Ayres (2011). This approach is also more fitting with 'Ako', the Māori concept of teaching and learning as a reciprocal, connected and interrelated process "where the educator is also learning from the student and where educators' practices are informed by the latest research and are both deliberate and reflective. Ako recognises that the learner and whānau [family community] cannot be separated". (Ka Hikitia, 2008, p.20)

Additionally, the Community of Practice model is one which is said to offer a "demanding and productive perspective" (Wenger, 2009) from which to view the relationship between community and technology. In understanding how technologies can influence, challenge, foster and be adapted by communities, participants are afforded the opportunity also to experience and reflect on the implications of eLearning as framed within the Living Curriculum.

The tension between a management directed strategy and the organic nature of the Community of Practice model was recognised at the outset of the Strategy implementation, however the potential development

opportunities afforded by participation in a CoP, were deemed to have complementary synergies with the key principles of both the Living Curriculum and eLearning Strategies. To counter the tension "every effort was made to allow complete autonomy for each CoP to form its own structure and explicit objectives" (Keesing-Styles & Ayres, 2011).

Funded Roles to support eLearning Strategy rollout

Unitec leadership recognised that the implementation of the eLearning Strategy, Living Curricula and transition from Blackboard to Moodle, would present staff with some confronting change. In acknowledging that change can be a difficult process for academic staff, and that "change brings a certain amount of anxiety and can be very threatening" - (Guskey, 2002, p. 386), it was acknowledged that staff would need time and support to enable an optimal response to the new demands being posed. The success of the eLearning Strategy therefore was dependent on strong support within departments and central support teams, to ensure staff had adequate scaffolding for the change process. Staff would need time "to engage with each other, the technology stewards, and with new technologies" (Keesing-Styles & Ayres, 2011). "Teacher's capacity for change is frequently compromised by issues of workload, and a significant ongoing challenge was enabling processes whereby workloads could be managed effectively to allow the time and space for conversation and reflection." (Keesing-Styles & Ayres, 2011 p. 50).

Higgins & Prebble highlight the importance of appropriately resourced central support services in implementing strategic initiatives, identifying that "...they are often the conduit between the institutional strategic direction statements and the actual practices used in faculties, schools and by individual academics. Staff development units supportive of, competent in and knowledgeable about e-learning are more likely to achieve the institutional e-learning goals than those that do not have those characteristics" (2011, p. 39). Unitec leadership recognised the key value of providing well-resourced support services in enabling the pedagogical shift and technical skills acquisition required to successfully implement the eLearning Strategy, as "support allows those engaged in the difficult process of implementation to tolerate the anxiety of occasional failures" (Guskey, 2002, p. 388). It is known that lack of support and training impacts negatively on teacher competence, and consequently, teacher confidence and motivation in integrating the use of ICTs. Conversely, teachers who can confidently use technologies in their practice are likely to understand the benefits and pedagogical potential of ICT integration. (Bingimlas, 2009). Provision of support under the eLearning Strategy involved both centralised and faculty-based resourcing.

The eLearning Strategy was driven through Te Puna Ako, the learning and teaching development centre, using the Community of Practice approach. The Centre provided dedicated expert support for staff in eLearning (including technical support in partnership with IT services), general academic support, and support in the integration of literacies. The Te Puna Ako Learning Centre provided academic support to students.
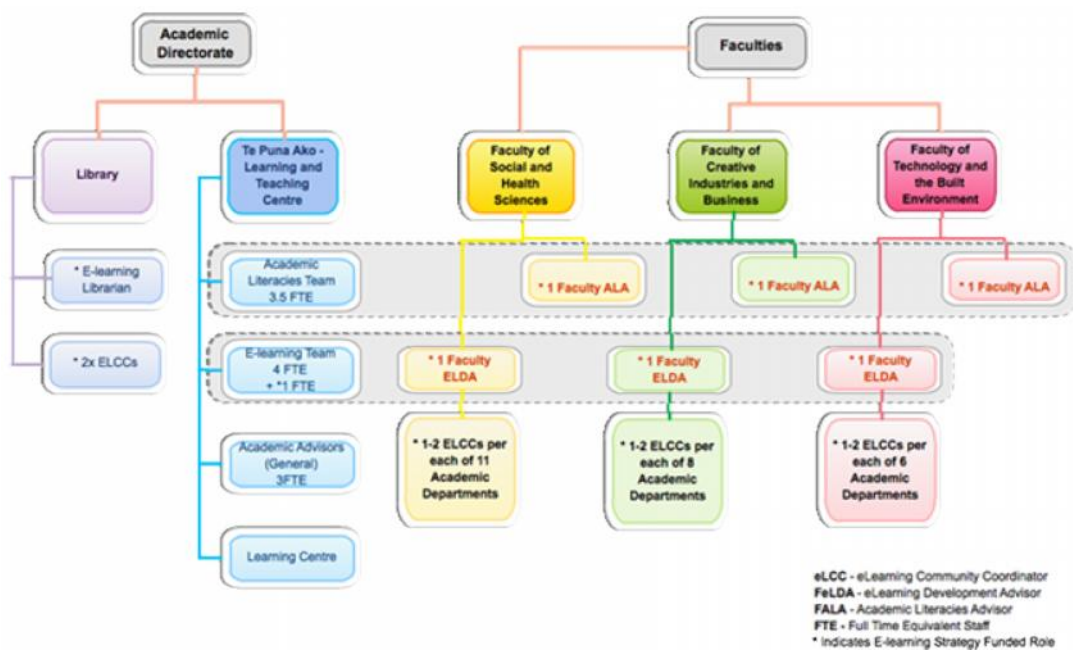

Figure 1: eLearning Staff development support roles for the eLearning Strategy Implementation

The eLearning Strategy has seen the funding of a number of additional, temporary roles to support and foster increased staff capability and capacity in eLearning and associated academic and information literacies. A supplementary central eLearning team member was employed in Te Puna Ako for the duration of the eLearning Strategy rollout. Additionally, one full time eLearning Librarian role, three full time Faculty eLearning Development Advisors (FeLDAs) and three Faculty Academic Literacy Advisors (FALAs) were recruited to complement the department-based eLearning Community Coordinators (eLCCs) and to work closely with Te Puna Ako.

These additional roles were initially deployed for 18 months to support and foster increased staff capability and capacity in eLearning and associated academic and information literacies. Investment to enable key staff to assist in development of their peers was seen as preferable to the temporary contracting of external expertise to shift content from Blackboard to Moodle. The department-based eLearning Community Coordinator (eLCC) roles were a part-time appointment filled by existing Unitec teaching staff, who were each given (up to 0.2) time release. The eLCCs provided staff development opportunities within their department. It is worth noting that the members of the eLearning community were not voluntary as is recommended in a Community of Practice model, but appointed by the department to represent them. This method of role appointment likely impacted commitment to the role and achievement of associated outcomes.

> "The CoP model has been a key vehicle for facilitating collaboration within and across departments, as has the funding of specific 'technology stewards' (eLCCs) within the departments. These eLCCs are vital shaping voices in helping keep the focus and purpose of eLearning developments on core pedagogic issues." Keesing-Styles and Ayres (2011)

The FeLDA's and FALA's significantly assisted in liaising with and supporting the various departments in Unitec, and supporting the Communities of Practice which had been and were being established. The initiatives driven by the Library impacted on institution-wide adoption of eLearning, assisting in embedding information literacy through technology, building capacity, and providing access to resources and equipment. A focus on building capability in the institution saw the formation of an Information Literacy Community of Practice that provided participants with a wide range of online and face-to-face activities, the development of a Moodle-based professional development course for Library staff, and significant collaboration between the Library and academic departments.

Community of Practice Implementation

In 2010 official implementation of the CoP approach was launched with a five-day workshop facilitated by Etienne Wenger & Beverly Trayner. The focus was on developing communities of practice in each department at Unitec. This was attended by key stakeholders including the eLearning Community Coordinator (eLCCs) appointed across Unitec, Academic Development management and the eLearning team. The Wenger and Trayner workshop set the stage for the eLearning community in establishing an identity, defining roles and initiating the eLearning Strategy at Unitec.

> "The first organised event most of the eLCCs attended was the week-long Community of Practice workshop with Etienne Wenger and Bev Trayner. I cannot emphasise enough how important and meaningful this event was for me. Wenger and Trayner provided the eLCC group with an important introduction into community of practice theory and practice, and eLCCs spent the week conversing, bonding and learning. We entered as individuals and exited as a community. As far as I'm concerned, the organisation of that workshop was a stroke of genius." (eLCC quoted in Benseman, 2011, p. 8)

The eLCCs had regular informal and formal events together, coffee catch ups and workshops, regular mini symposiums where they shared what they were doing, shared knowledge, and talked together about the challenges they were facing. These opportunities were utilised more by the active eLCCs and those who had time available. Some of the eLCCs then also ran a similar CoP within their department, but tailored to their departmental needs.

To facilitate the CoP a Ning site was established for posting event information, hosting discussions on best practice, and sharing learning. Through the process of developing as a community, the members decided that they would prefer a Moodle course to be used for this, providing the dual purpose of fit for purpose tool and helping them learn more about the new learning management system being adopted and how it may be used with their students. Additionally, the social constructionist approach underpinning the Moodle LMS

complemented the transformative practices proposed in the Living Curricula and eLearning Strategies more completely than other options.

The eLearning team modelled the role of "technology stewards" (Wenger, White & Smith, 2009) for the communities, encouraging interdepartmental interactions and sharing of best practice, which led to the FeLDAs and eLCCs becoming technology stewards for their departmental communities. This coaching from the eLearning team assisted eLCCs to support their CoP's as they were established and shaped to meet each department's needs. The use of Moodle Docs, Moodle tracker, and forums supplemented the internal support. Participants of the eLearning CoP also contributed in wider Moodle community activities.

Identified Issues

A mid-point survey and end point interviews of eLCCs were conducted in the eLearning Strategy implementation period. Several themes emerged from this data, which are useful in informing an evaluation of the efficacy of the approach taken, and in reflecting on those factors which had impacted on the eLCCs ability to foster staff development. Evidence is also drawn from the Strategy evaluation and evaluation moderation documentation.

Time and Workload

Time and workload were highlighted as the most significant barriers to participation in the eLCC community, and in fostering community and staff development within the Departments. Feedback indicates that for those staff in the eLCC role, the conflict between the responsibilities and priorities of their academic roles (teaching and research), detracted from their ability to invest energy in supporting the CoP process, and offering professional development activities. "I find I am busy and don't put enough time in making events as my main priority is meeting my students needs." (eLCC). Similarly, "Many staff are keen to learn more and get involved - but the opportunity to do so is limited by staff and eLCC's time, free meeting "slots" and similar resourcing issues". (eLCC)

Diametrically, the affordance of allocated time to participate in Community activities was reported to be a crucial enabler. "Having an official role and time release within my department allowed me to greatly expand the eLearning support I had previously been unofficially providing to staff in my department. It enabled me to have individual discussions with each of my colleagues and provide them customised support to achieve their eLearning goals." (eLCC)

Digital Literacy

Digital literacy levels of staff impacted on the uptake of eLearning technologies by staff, and their ability to recognise the pedagogical affordances of these technologies. There were many staff requesting Moodle basic tools workshops who were simply not ready to discuss Living Curriculum characteristics or the eLearning Strategy as they did not feel confident using online technologies. One of the eLearning team member's research outputs give us this useful insight "The radical pedagogical changes noted in these projects were not because of the technology itself, but rather how it was used, thus pedagogy played an intricate role in the process." (Narayan, 2011). The Natural Sciences department found the collaborative design and use of a Moodle course template alleviated some of the barriers related to literacy issues for their staff.

Resistance to Community of Practice Approach

A significant issue raised was that the community of practice model was being imposed. In some cases resentment was expressed by staff that they were being forced to apply the CoP label to their existing practices.

> "It was decided we would get better buy in if we dropped the title of CoP and just carried on engaging our colleagues with new initiatives as we had done in the past. This continues to work well - a group of like minded people working towards creating a better environment for our students, ourselves and Unitec as a whole." (eLCC)

This conflict may have impacted on the adoption rates of both the community approach, and the implementation of the eLearning Strategy. "Mainly because of the resistance it made it difficult to engage everyone. Also getting them to take it seriously and not just consider it a "fluffy ideology" imposed on them." (eLCC).

It is important to note that this 'compulsory' approach to CoP participation is contrary to the principles of a Community of Practice as identified by Wenger (2006), and was recognised by Unitec Leadership as a key risk, which required some allowance for mitigation.

> "The tension of having an institutional strategy to develop organic CoPs was acknowledged as potentially conflicting, although every effort was made to allow complete autonomy for each CoP to form its own structure and explicit objectives." (Keesing-Styles & Ayres, 2011)

The impending organisational deadlines around the LMS transition and departmental accountability to these targets also appeared to impact negatively on the staff development process. "I can't get 10 minutes to talk about our plans in staff meetings....everyone is panicking about templates and course shells. I want to talk about my plan and planning strategy, not templates and shells" (eLCC).

Support

Midpoint and endpoint feedback accorded with the Unitec leadership's acknowledgement that support systems would be crucial to the implementation of the eLearning Strategy. From the eLCC perspective particularly, the value of local (within Departments) and central support services, and conversely, the detrimental impact of a lack of support were perceived as crucial determiners in enabling both community and staff development to flourish.

Central Support

The integral role Te Puna Ako played in staff development was frequently recognised, both for the provision of practical training and advice, and for the interpersonal support and connections. The support activities offered by Te Puna Ako were highly valued, with one on one training and mentoring rated by eLCCs as the most useful support received. "I've found the TPA [Te Puna Ako] support to be great throughout, whether through formal training or informal assistance and advice" (eLCC). Additionally, support from the central Te Puna Ako eLearning team was appreciated when eLCCs anticipated resistance within their departmental community. "A member from TPA attended the day long workshop and supported our efforts. This was great as we met significant resistance to the initiative" (eLCC).

The value of face-to-face communication with Te Puna Ako was also highlighted. "TPA staff are our hub to go to. It is excellent to be able to drop in anytime and have face to face contact" (eLCC). eLCCs ranked the Te Puna Ako mini symposiums in particular as being 'highly useful' in supporting the eLCC role. "I learnt a lot, met so many people, very friendly and approachable lot at TPA, exchange of experiences, friendly atmosphere, love the homemade cakes" (eLCC). Activities facilitated through the central support teams provided important opportunities for sharing knowledge and keeping momentum. Celebration of success with peers in the wider community was valued.

> "the eLearning communities' mini symposiums were great as you got to see how web 2.0 tools could be utilised in teaching in a way that I could understand and hear staff talking about successes they were having, so I could then see scope for being innovative and creative in teaching, and TPA provided a great space for that to happen with an inclusive open flow through feeling about it". (eLCC)

Many of the eLCCs requested more opportunities to share best practice in the existing format of TPA sponsored mini symposiums, though equally there was a desire for tools based workshops, highlighting the need to consider digital literacy levels for these key staff. "I have found that when I need to do a specific thing in eLearning that specific consultation is very helpful." (eLCC)

The importance of Just-In-Time, needs appropriate training was a common theme, and the availability of responsive training was identified by eLCCs as being very important in preparing eLCCs to be responsive to their departmental communities.

> "I will be attending a course facilitated by TPA… and the reason I signed up is because the course tools are based around the same tools I have recently introduced to my group. I am hoping [to gain] a better insight as to how to best manage these tools and most importantly how to keep them relevant and stimulating during the year." (eLCC)

> "As my main role is as a Support person. I will try to make more events, though often I find that not all the information I find is relevant as of right now. But I do find when I do get a specific need I can contact the eLCCs and someone is always keen to help."

In supporting their own departmental communities, the eLCC's reported that workshops were the most commonly utilised vehicle for professional development, though one on one support and formal meetings were also commonly employed.

> "We now have Moodle up and running and we have recently introduced other tools that we launch from Moodle. Staff response has been good and what I have noticed is that they buy-in to these tools when they are ready. So it is an ongoing project but in general 70% of staff are using Moodle but at different levels."

With the knowledge that there was central support behind them, the vast majority (95%) of eLCCs were confident in running staff development events for their department.

Local Support

It was concerning that one quarter of the eLCCs felt they received 'little or no support' from within their department, and only 40 per cent of respondents felt they were well supported by their department. The majority met with their Head of Department monthly or less than monthly, and were more likely to met with Te Puna Ako staff. One eLCC wrote that "without active support and championing within a Department's management and leadership structure it is difficult to get traction."

Strong local support greatly enhances the chances of successful staff development. In the Department of Languages there was strong leadership support, evident in the provision of additional, department funded e-learning leadership roles to support the work of the eLCCs. This department had very active eLCCs who took were proactive in enhancing their own capability and sharing their learning and experiences, in the Department CoP and National Moodle Moot for example. There was recognition of successes within the department and ongoing dissemination of the learned expertise across the department. Many staff development activities were initiated in this department, including in-depth forum conversations, 'social' eLearning events and a variety of workshops. The development of a skillset checklist enabled them to identify not only the skills they deemed necessary for teaching languages but to work to address any gaps. The additional development of a course evaluation tool helped the teachers identify further development opportunities within their programmes. This department integrated a number of additional web 2.0 technologies and worked with the eLearning team to identify discipline specific Moodle modules and plugins that supported their students to meet learning outcomes.

Role Ambiguity

A lack of clarity of the eLearning roles may have impacted on their efficacy and on the way in which the roles were received and perceived by other staff. This ambiguity appears to have resulted in part from the tension between the organic and dynamic nature of roles within a CoP, and the management and peer expectations of a paid role in achieving specific outcomes in a given timeframe.

Roles within a Community of Practice are by necessity fluid, allowing for participants to in turn offer their unique perspectives, experiences and expertise. Peripheral participants in this model may remain peripheral, or, in developing their identities within the community, assume active core roles. Scope exists within the CoP model to appreciate the unique contributions made by different practitioners within the domain. The expected outputs required of the eLCCs, FeLDAs and central eLearning staff under the Strategy however, may have been at odds with their roles as CoP participants and stewards.

For some staff, the eLearning Strategy was seen as revolving around the shift from Blackboard to Moodle. During the initial eLCC workshop eLCCs defined their role, asserting that the role was not to provide technical support. However, within their departments, several eLCCs stated that they struggled to divorce themselves from the responsibilities and the peer perception of a technical-help role. The FeLDAs and eLearning team members found similar issues in terms of staff role perception. It could be surmised that the eLCCs had an advantage in this regard in that they were already recognised among their peers as being subject matter experts and teachers within their discipline.

Although issues around role ambiguity and perception were often problematic, the undefined nature of the FeLDA and eLCC roles created space for tailored response to the specific and immediate needs of each Department and Faculty. Individuals with eLearning roles approached their local communities in accord with

the demands of those communities. Sometimes the drivers were somewhat perfunctory or motivated by urgency (for example 'shifting a course' between LMSs) rather than inspired by pedagogical shifts and a focus on staff development. However, traction was made in all Departments and Faculties towards achieving elements of the eLearning Strategy, even if to the detriment of the Community of Practice model.

Accounting and Finance setup a department Community of Practice Moodle page to communicate events and share what they were learning. They designed their own theme that then led on to use of the theme for the courses they offered to students too. The pictures they chose for their theme are of their building and the surrounding area where there are Pukeko (native birds) and pohutukawa trees (native trees). This theme development created more buy-in to the eLearning Strategy and helped build a unique sense of identity. They used "Poll Everywhere" displayed in a course block to focus their community on trying new things. The approach this eLCC took to support his department CoP developed not only his peers eLearning skills, but helped build their confidence and increased their sense of support as learners.

Reflections on Community

The actualisation of a true Community of Practice may not have been realised in the eLearning implementation period. However, a community approach to adapting to the LMS migration and eLearning Strategy was certainly a defining characteristic of the process, and a catalyst for 'shift' in pedagogy, and staff development initiatives. "Sharing practice is more useful than sharing/ discussing academic position" (eLCC). While feedback on the efficacy of the Community of Practice model was mixed, there is evidence that the approach taken by Unitec had very positive outcomes in empowering staff initiatives, and providing the basis for a collaborative approach to staff development.

> "My involvement in the Unitec eLearning Community of Practice was hugely beneficial to me, impacting my role both within my own department and across the institution as a whole.... Being part of a wider community exposed me to a range of other Unitec staff with an interest in eLearning. I was able to share my ideas with others from different disciplines and to adopt ideas used elsewhere to good effect. I have certainly learned a lot from the experience and continue to benefit from a number of ongoing professional relationships formed through this community." (eLCC)

While some staff with eLearning roles reported that the central CoP was more effective than their local departmental CoPs, others reported that they found their immediate community networks, or interactions with sub-clusters of the central CoP, to be more beneficial than the broad communities of practice. An eLCC said "the community within my department was much more useful for me than the Unitec wide community, as I know the people". The eLCCs located in one Faculty felt they were geographically remote from the central support infrastructure so they informally developed into a small community of practice, sharing their different skills, workloads and learning experiences.

Over the Strategy period, there was a visible shift in focus from Moodle tools to discussions around pedagogy. This was evidenced in eLCCs presentations at community workshops and mini symposiums for example. The scope of interest broadened to the integration of other tools with the Moodle platform as staff, delved into eportfolios, use of twitter for collaboration and introducing RSS feeds to encourage currency within the discipline in Moodle learning spaces for example. The exploration of iPads as a teaching and learning tool grew as did educational gaming and digital storytelling. There were more Web 2.0 technologies integrated with Moodle and more complex use of core Moodle tools and investigations into their application to learning. This experimentation improved the support the eLCCs could offer staff across all levels of digital literacy.

Some of those in eLearning roles have exponentially increased in capability and confidence as a result of the funded time release. The growing confidence and capabilities staff have in integrating eLearning has resulted in eLCCs presenting at institute internal events, national and international conferences, as well as online conferences. Unitec organised and hosted the International Conference on eLearning Futures in 2011 as well as co-hosting with Moodle Partner HRDNZ the first Moodlemoot in Auckland in the same year.

The Community approach as a vehicle for staff development, and a means of facing institutional change enabled participants to own part of the vision of the eLearning Strategy, and development of eLearning use in the institution, as well as providing a forum for challenging some of the Strategy's goals. Recognition needs to be awarded to the departments who have - with the support of their eLCCs and FeLDAs - developed successful communities where sharing of best practice and continuing focus on staff development was becoming a norm.

"The most effective e-learning programmes tend to occur where a whole programme team makes a commitment to develop and deliver their courses to a shared set of guidelines on service and standards'. (Ministry of Education, 2007c, p. 22)" cited in Keesing-Styles & Ayres (2011, p. 49).

Where to from here?

The change from Blackboard to Moodle 1.9 is now complete. The more active members of the Community of Practice are influencing the current Moodle 2.2 upgrade project scheduled for July 2012, with their input leading to customisation, enabling of features, repositories and portfolio selections, and improvements in our processes.

The Faculty eLearning Development Advisor positions have been extended to maintain momentum in embedding eLearning into teaching practice. A number of Departments have self-funded time release for key staff to continue developing their peers. Additional departmental positions have been created out of a deeper understanding of the value in supporting staff to embrace eLearning.

An eLCC initiated an institution-wide mobile technologies Community of Practice which Unitec launched in 2012, supporting exploration into the potential integration of iPads and similar devices in learning and teaching. The key facilitators of this community are not allocated any funding or time release for their contributions, and participation in the community is entirely voluntary. Participants are actively involved in the community activities because of a shared interest in investigating the potential of new technologies in learning and teaching.

Since the conclusion of the initial eLearning Strategy implementation phase, tailored communities of practice have been emerging in response to staff interests and skills, knowledge and experiences acquired over the past two years. These communities are evidence of an institutional shift in approaches to staff development, and have empowered teaching staff to initiate their own fora for exploring interest topics. It appears that true Communities of Practice are now developing in the wake of the eLearning Strategy, and that the emergence of these communities has been facilitated by the opportunities afforded by funded time release for staff development and community participation.

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Building a Moodle front-end for Greek language learning

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Abstract

Learning Management System (LMS) environments can be powerful tools in education, especially when they are combined with core learning principles, and principles of interactivity and adaptivity. In the case of Greek language learning, e-learning environments need substantial improvements in order to provide effective solutions to the end user. This paper aims to describe an e-learning environment that is being developed for the learning of the Greek language.

This environment is an interdisciplinary effort and is designed to provide an effective solution to the end user. By following the latest research directions, the working teams have been developing high quality digital content (animations, multimedia content, HTML pages enriched with graphics, etc.) that is being categorized with respect to the users' expectations, characteristics, and knowledge. The environment uses the Moodle LMS in order to exploit the features of courses, quizzes, user tracking, and tools of collaboration and communication. Moreover, new Moodle features are created, or extended in order to fulfill the Greek language learners' educational needs. For the same purpose, the Moodle embedded representation of content as lists of resources is being encapsulated through a graphically enriched navigation system. The material is thus presented to the user in a flow that is educationally documented.

Keywords

Adaptive e-learning systems, Moodle LMS, Greek language learning, efficient e-learning

1. Introduction

Nowadays Learning Management Systems (LMS) are a powerful tool in the educational process, as they support web-based context courses and quizzes, along with tools for communication and collaboration. One of the most widely used LMS systems is Moodle (Modular Object Oriented Developmental Learning Environment LMS) (Despotovic-Zrakic, Markovic, Bogdanovic, Barac, Krco, 2012). Concerning the use of LMSs in education, and language learning in particular, the literature highlights the need for developing effective e-learning environments by using pedagogical and design principles (Liu, Moore, Graham, Lee, 2002). An effective e-learning environment can be built when we have a clear comprehension of the features provided by current technologies, a set of well-defined and documented goals (Zhao, 1996), as well as a combination of core learning principles with Course Management System (CMS) tools (Carmean, Haefner, 2002) which basically are a more general type

of LMSs. These ideas are taken a little bit further by Despotovic-Zrakic et al. (2012) who suggest that adaptive e-learning environments which take into account a group's characteristics, expectations, knowledge, and preferences will constitute a new generation of the e-learning system.

With respect to the needs and principles described above, our team has started the development of an e- learning environment that will be used for the Greek language learning. This paper describes this system in detail and is organized as follows: Section 2 provides a quick overview of the environments for Greek language learning, and analyses their features in terms of the needs that are highlighted through current literature. A description of the proposed e-learning environment, already under construction, follows next. It is also explained how this environment fulfills general e-learning environments' requirements. Section 3 outlines the system's architecture, and Section 4 describes the development process that is being followed. Section 5 presents and discusses some system screenshots. Finally, Section 6 summarizes the environment's key points and outlines our intentions for future work.

2. Related work

A quick Web search on "web based language learning" results in a list of several platforms and websites that support different languages. Thus, it was necessary to focus the search on "web based Greek language learning" as it brings the results closer to the system we are building. A quick overview of the first five systems that resulted by searching on Google Search TM follows.

Learn Greek: This website provides a collection of resources that contribute to the study of Greek Language, in three different knowledge levels, as well as extra material for grammar and vocabulary. Despite the variety of content, the website provides the material as a list of resources, through a simple user interface. Moreover the material does not exploit modern ICT technologies by providing either interactivity or feedback to the user.

BBC – Languages – Greek: All you need to start learning Greek: BBC Languages provides a pleasant user interface, even though the material organization is a bit unstructured and confusing. The main aim of this site is to provide travelers with the basic knowledge of a language, by using a wide variety of multimedia resources, including audio recordings of dialogues, and videos. The environment is static for all users as there is no option of registering.

Learn Greek Online!: Learn Greek Online is constructed by using the Moodle TM Learning Management System (LMS). Its content constitutes of real audio files, online student notes, and a collection of collaborative learning tools, Greek online dictionary, and a Greek spell checker. "Learn Greek Online" benefits from the Moodle organization of resources as well as the existing - simple user interface and navigation methods. Therefore, it could be characterized as a large collection of resources enriched with interactive online features such as forums, online notes, and quizzes. This environment benefits from the use of the Moodle LMS, for user registration and tracking. However the solution does not provide a user friendly navigation system through the material. As a result the user has to encounter large lists of resources and spend a lot of time, in order to discover the resource that will cover his needs.

Learn Greek Online – Modern Greek language lessons: "I Learn Greek.com" is a commercial platform for learning the Greek Language. This constraint made it more difficult to explore the material in detail, but a "preview" feature offered a way of having a quick overview. This solution also provides a collection of resources, such as interactive games. Although the solution offers a registration method, it is mostly used for charging a registration fee and not for user tracking or personalization.

Filoglossia, ILSP: This solution is essentially a web edition of a subtotal of the filoglossia+ CD- ROMS. The content of the CD- ROMs is transferred to the web as static resources or simple interactive exercises that do not however keep track of the user or adapt to the user. The environment is presented with a very simple, static interface. There is no user registration in this solution either.

As one continues searching, one realizes that user friendly, adaptive and accessible environments are rare. This impression is also confirmed by research conducted for the European Commission and reported in "International Web- based Language learning on the Internet". This research provides an overview of international, commercial and noncommercial language learning course providers, and it concludes that most are usually just a collection of language study material with no associated grammar and vocabulary exercises. However, in the research literature, it is often argued that an educational environment has to contain two features: interactivity and adaptivity (Brusilovsky, Schwarz, Weber, 1996; Stern, Woolf, Kurose, 1997; Stern, Woolf, 1998).

Furthermore, research by Kukulska-Hulme and Shield (2004) focuses on the need to maintain the principles of pedagogical usability, intercultural usability and website evaluation while building a language learning environment. The writers also emphasize the importance of the end-user experience in terms of end user feedback, suitably linked resources with learning support tools, and user feedback. The web-based environments described above maintain a small subtotal of these requirements; therefore, there is a need for implementing an e- learning environment for Greek language learning that fulfills the requirements described above.

Adaptivity is a complex concept that could be analyzed in much detail. For the purposes of this paper the Brusilovsky (1998) definition is used. Brusilovsky (1998) defines Adaptive Hypermedia Systems as:

> All hypertext and hypermedia systems which reflect some features of the use in the user model and apply this model to adapt various aspects of the system to the user. In other words, the system should have a user model, and it should be able to adapt the hypermedia using this model (i.e. the same system can look different to the users with different models) (p. 2.).

Guided by the principles of adaptivity and interaction we have started designing and implementing a large-scale Web Based Learning Environment for the Greek Language that is targeted to be used by teachers and students worldwide. Online learning management systems (LMSs) are a useful tool when building large scale environments, as they can reduce the costs and time needed (Naidu,2003). So it was decided that using an LMS as the core of our system, would benefit the project. There are many LMSs available: Blackboard TM, FirstClass TM, Moodle TM, Lotus Learning Space TM (Naidu, 2003). Out of the LMSs mentioned above, Moodle was selected to be the core of our system. Moodle is a free, Open Source LMS with a huge worldwide community that develops and supports it. The fact that Moodle is Open Source makes it possible to contribute with our own additions to its code, and preserve the hope that in the future, there will be an Open Source "sub-community" that will support the learning of the Greek Language. Last but not least, Moodle will save a lot of cost and time for our project as it provides a satisfactory percentage of the needed functionality. Additionally to the Moodle structure and functionality, our environment encapsulates the representation of the resources collection lists in a front – end, which is a user friendly navigation system. This design guides the user to navigate through the resources by using a predefined sequence of text and exercises, for each learning target that the user wants to achieve.

In terms of adaptivity to the user's level and abilities, the resources have been categorized in two levels of language knowledge in conformance to the EU defined levels of language knowledge (Council of Europe, 2001). More particularly, the Council of Europe (2001) defines the levels of Level A: Basic User (A1, A2), Level B: Independent User (B1, B2), and Proficient User (C1, C2). As our system's target users are students in the school age, the context covers the knowledge levels of Basic and Independent Users. Each level of knowledge consists of text sections and exercises. The text sections are an enriched context that contains a lot of interactive features, such as flash animations, real audio files, grammar explanations, dictionaries, video, photo galleries, and help. Exercises are mainly implemented by Moodle question types and plug-ins, although we have extended these with others tailored to the specific needs of the Greek language learners. The adaptive part of exercises is that the user can navigate to easier or more difficult exercises of the same knowledge level. In addition, it benefits from the Moodle LMS embedded user tracking in order to provide feedback to the user, and hold statistics for each student's quiz attempts. The system's context also takes into account the users' age. Assuming that the language knowledge advances accordingly to age, the context of the first language knowledge level contains more interactive material that focuses on the teaching of simple key phrases. In contrast, the remaining knowledge levels have increasing difficulty, and their context concerns teaching more complex phenomena.

3. System Architecture

This section analyzes the system architecture in more detail, by describing the ways that Moodle is combined with the components we develop, in order to make a complete solution. More specifically, Moodle core components and plug-ins are used as a back-end system, which is encapsulated by a front- end system. The front-end system is partially using existing Moodle components, and the rest is developed by our team. At this point it should be mentioned that this approach raises many technical issues, that mostly stem from the need to adapt the front-end components (interactive games, graphics, animation, etc.), to the Moodle back-end structure requirements.
Figure 1 shows the front-end components, while Figure 2 shows the back-end's architecture:
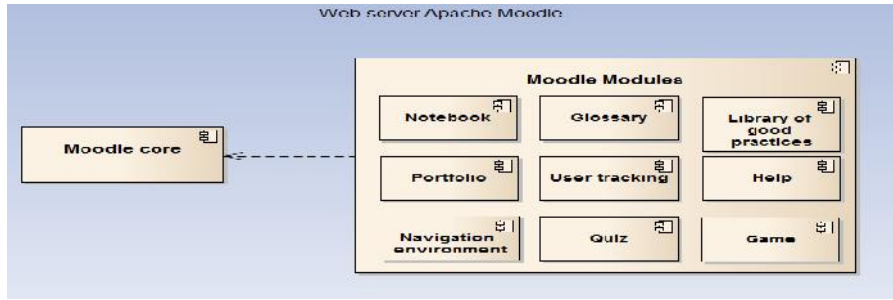
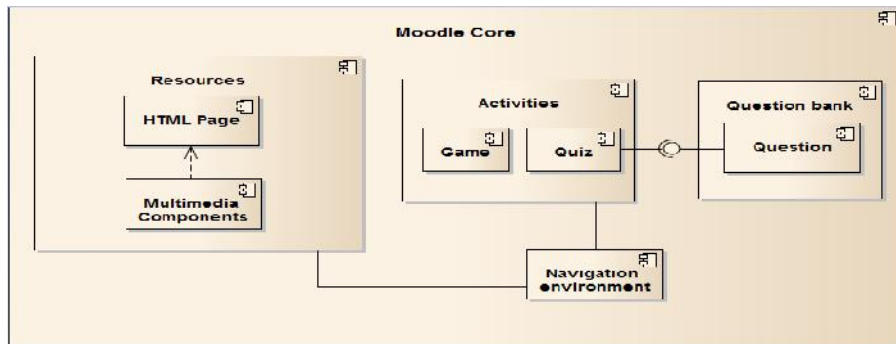**Figure 1: Architecture of the additional front-end components**

Figure 2: Moodle Architecture in detail

More particularly, the components that are used can be analyzed as follow:

- Navigation environment: There is no plug-in available in Moodle; our team develops it entirely.
- Notebook: There is no plug-in available in Moodle; our team develops it entirely and adapts it to the project's needs.
- Glossary: There is plug-in available in Moodle; our team adapts them to the project's needs.
- Library of good practices: There is no plug-in available in Moodle; our team develops it entirely and adapts it to the project's needs.
- Portfolio: There is a plug-in available in Moodle. Our team adapts it to the project's needs.
- User tracking: There is plug-in available in Moodle. Our team adapts it to the project's needs.
- Help: There is no plug-in available in Moodle; our team develops it entirely and adapts it to the project's needs.
- Resources: web material is being developed and placed to the environment by our team in collaboration with the graphics team, the team of content development, and the team of pedagogical design. Resources are pages, text files, sound files, video files, animation files, etc. Also learning objects might be used in future editions.
- Activities: web material that is being developed and placed to the environment by our team in collaboration with the graphics team, the team of content development, and the team of pedagogical design. Activities are interactive material, which consists of games, quizzes, etc. We should highlight here, that quizzes are questionnaires that are used to group Moodle question bank's elements.
- Question bank – Questions: Some question types are available in Moodle, while others were found in plug-ins. Question types functionality has been adapted by our team according to the project's needs.

Figure 3 shows the flow chart that a student will follow when using the e-learning environment.
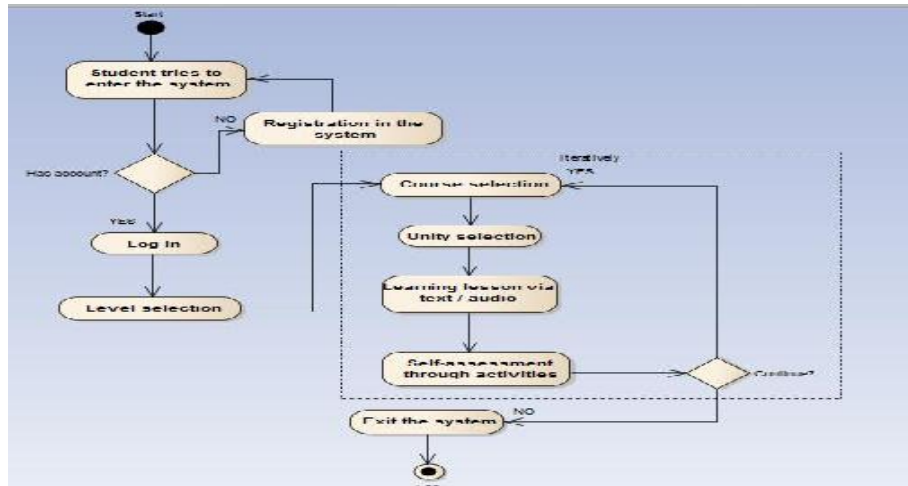
Figure 3: E-learning system Use Case Model

4. Development Process

Modern software projects require an interdisciplinary cooperation of teams with different expertise and skills that may or may not be related to Information Technologies (Jaccheri, Sindre, 2007). This project follows that approach. There are several teams involved in the project: teams for content generation (different teams for different teaching modules, such as language, history and civilization, and different knowledge levels), the team of pedagogical design, the graphics team, and the team of technological design. Each team has a supervisor, who is also responsible for the coordination between teams, under the guidance of the project coordinator. Because of the interdisciplinary nature of the project (linguists, pedagogues, historians and computer scientists are working together), and the fact that each team has a different domain of discourse and expertise, communication is not an easy task. It requires full understanding of each team's roles, and total devotion and interactive effort. Moreover, we have had to agree on a project management plan, in order to be effective and successful.

The project has a timeline that is divided into "lifecycles" that correspond to the content unities. Each lifecycle has six phases:

1. *Preparing the content:* In this phase the content teams generate the content. Then the content teams cooperate with the pedagogical design team in order to make the first user interface mockups, and define the user requirements. Then the team of pedagogical design discusses the requirements with the graphics team and they both decide the final mockups.
2. *Preparing graphics and sound files:* The graphics team generates the graphic and sound files, which are sent to the technological design team as fully functional HTML templates, and .ogg files.
3. *Preparing the environment, and importing the content, resources, graphics and sound files:* When the technological team has received enough material, they start integrating it into the environment. The technological team also alters the Moodle core or adds features in order to cover the specified user requirements in terms of functionality.
4. *Content team and pedagogical design team make alterations:* Content and pedagogical design teams review the system carefully. They contact the graphics team, and the technological design team to discuss the proposed changes. This action essentially is the repetition of phases 1-3. However, the system version is almost final, and phases 1-3 are quicker than the first time.
5. *Technological design and graphics teams update the system according to alterations:* The graphics team makes the relevant alterations and submits the new files to the technological design team. The technological design team integrates the updates to the system. During the project development, phase 4 may be repeated some times until all the teams are satisfied with the result. However, this procedure stops when specific deadlines are met.
6. *Feedback from teachers:* When the first beta edition is ready, it is released to selected "testing" schools from all around the world. Teachers from these schools have already had some training sessions and they have seen demos during the development phases. So they have specific expectations of the project. The teachers

will give their opinion through questionnaires that will then be analyzed in order to decide for the final changes that will be integrated in the first beta release.

7. *Release beta edition & final edition of the project:* When the final alterations are finished, the first beta edition will be released. However the schools will continue giving feedback and the teams will continue working in order to make the final edition of the project, and release it one year after the release of the first beta edition.

Figure 4 shows an activity diagram of the development process described above.
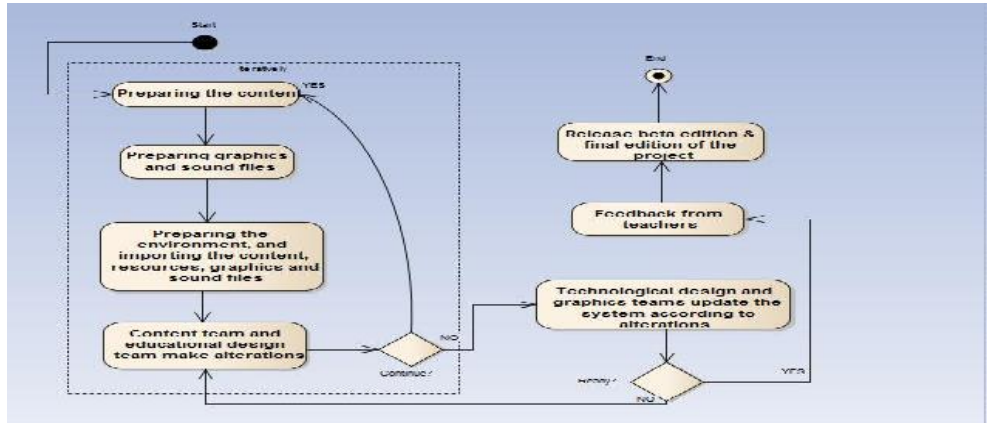
Figure 4: Activity diagram of the development process

5. Environment overview

The implementation of the environment described above has already started in a form of beta edition. This section provides some screenshots of the system. Figure 5 shows the first screen through which the user chooses a knowledge level to practice on.

Figure 5: Navigation System – Choosing the knowledge level

Figure 6 shows the screen that follows the knowledge level selection. In this screen the user chooses the course he would like to be trained with.

Figure 6: Navigation System – Choosing the course

Figure 7 presents a text enriched with hypermedia elements (blue words are links to pop-up windows as the one depicted at the right of the screen), audio (audio player at the right bottom of the page), and photo galleries (the user may switch the pictures by using the play button at the right bottom of the gallery).
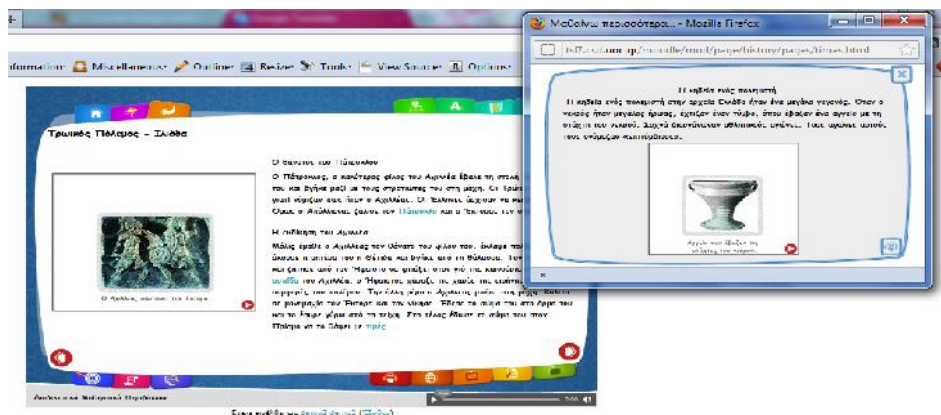
Figure 7: Learning via hypermedia and multimedia enriched text

Figure 8 presents an interactive drag and drop exercise for A1 knowledge level. At the end of the exercise the user gets feedback. The menu at the right part of the screen gives the user the possibility to navigate through exercises that are either easier, at the same level or more difficult. The difficulty of the exercise is depicted by the stars at the right top of the page (1/3 levels of difficulty, so only one star is pink).

Figure 8: Drag and Drop exercise for A1 knowledge level

6. Conclusions and future work

In this paper we have described an e-learning environment which concerns the learning of Greek as a second foreign language. As LMSs are capable of saving cost and time for e-learning projects, our system also uses Moodle LMS for its base. However, the Moodle code is being extended and tailored according to the Greek language learners' needs. In order to fulfill the learner's needs in an optimized way one has to respect core learning principles, as well as the current research guidelines that suggest adaptive and interactive environments.

Consequently, this project is an interdisciplinary effort for developing an educationally documented environment. The content is the product of specialized content teams' efforts, while the environment is being designed by the educational design and graphics teams, and built by the technological design team. The final e-learning environment is comprised of courses, quizzes, user tracking, user feedback, animations, and multimedia elements that are being categorized accordingly to the user's language knowledge level. Although the total or a subset of the above elements is met in existing Greek language learning environments, the hallmark difference of our system is the user friendly navigation environment that encapsulates the LMS's list of resources and guides the user according to specific goals and needs, as well as the content's adaptivity to the user's language knowledge level.

The environment described above is still under construction which means that our team intends to continue enriching the platform with extra content, and new features, or adapting the existing features to the project's needs. These plans also include the integration of an interactive teacher – student environment, and the creation of learning-communities within which the participant schools will be able to communicate, exchange ideas, and participate in collaborative projects. When a beta release of the e-learning environment is ready, it will be evaluated by teachers and students from schools that will be using the environment. The ultimate goal is to optimize the e-learning environment, and enable the system to support the creation of worldwide learning communities for the Greek language.

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Acknowledgements

CADMOS: A learning design tool for Moodle courses

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Abstract

This paper presents CADMOS, a graphical learning design tool that allows a practitioner to easily create lesson plans. One of the main innovative features of CADMOS is that a lesson plan can be exported so that it can be deployed and enacted in a Moodle platform.

Keywords

CADMOS, learning design tool, Moodle

Motivation

The learning design process, normally, involves a number of steps such as: the specification of the learning activities need to be performed by human actors (e.g. learners, tutors) in order to achieve the learning objectives, the orchestration of the learning activities, i.e. the sequence of the specified learning activities as well as the identification of the learning resources and services that need to be used in order to support the learning activities (Koper, 2005). The output of this process is called learning design or lesson plan or learning script. Since this process is iterative, learning designers, mostly teachers, need to easily modify, update or enhance their designs in order that to achieve the required level of learning effectiveness (Tattersall et al., 2005).

Learning designs are usually documented either in a narrative format (usually called lesson plans) or using specifications and graphical notations. According to Conole (2008) the learning design approach should "act as a means of eliciting designs from academics in a format that can be tested and reviewed by others involved in the design process, i.e. a common vocabulary and understanding of learning activities". Narrative forms cannot easily meet this requirement since designers do not use a standard/common template and such designs are often quite extensive in order to fully describe the learning flow. On the other hand, graphical learning design tools allow designers to create their designs by "dragging and dropping" activities, putting them in a sequence and linking them to learning resources and tools can help (Neumann and Oberhuemer, 2009). The ASLD website (http://www.ld-grid.org/resources/tools) contains a list of quite popular learning design editing tools such as WebCollage, CompendiumLD, OpenGLM, CADMOS, LAMS. Also several reviews of such tools have recently been made (e.g. Katsamani & Retalis, 2011).

Perhaps the most popular learning design tool is LAMS (Dalziel, 2007). It is not only provides a simple and intuitive user interface that allows the designer to drag and drop learning activities and services into a workspace and organise them into a learning workflow but also to execute the created learning design in a proprietary learning environment or in a LAMS enabled learning management system such as .LRN or Sakai. All the other tools allow the designer to export the learning design in IMS LD specification which can be executed in a simulated learning environment via an IMS LD player.

Nevertheless, most teachers use Moodle or Blackboard which are the well-known learning management systems (LMS). Till now, there is no learning design tool that allows a teacher to create a learning design which can be deployed into these LMSs. The goal of this paper is to present CADMOS graphical learning design tool. CADMOS is the only graphical learning design tool which allows a teacher to design an online course which can be transfered to Moodle for enactment. This paper will show an example of how CADMOS can aid in bridging the gap between the design and deployment in Moodle of a learning design.

CADMOS by example

Overview

CADMOS is a user friendly IMS LD level A & B compliant graphical learning design tool addressed to novice learning designers, i.e. practitioners/teachers with basic computer skills and knowledge of learning standards (Katsamani & Retalis, 2011). CADMOS enables a practitioner to design a learning script in layers (see Figure 1): first by specifying the learners and teachers activities and the associated learning resources and services required thus creating a learning activity conceptual model, and then by orchestrating the activities per human actor and adding rules and constraints using the metaphor of swim lanes which are all depicted in the learning activity flow model. Thus, not only can a practitioner determine in which order the students should perform the activities but also to specify conditions, preconditions or rules that will be associated to these activities, i.e. a student must study the theory before doing a self-assessment or the student must score at least 70% before proceeding to another activity.

The output of the learning design process using CADMOS can have three forms: i) a learning design codified in its own format in order to be re-used and modified at some point later on; ii) a learning design package that conforms to the IMS LD level A & B specification; and iii) a package for Moodle which could be uploaded onto a Moodle server and used for "restoring" it as a Moodle course.
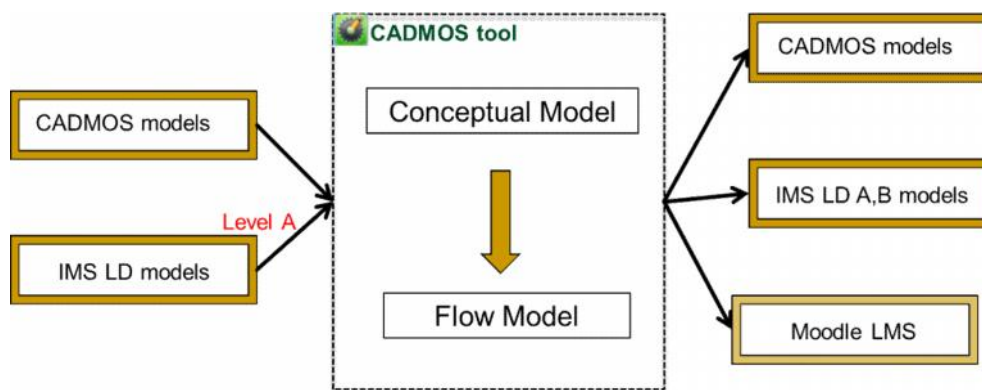

Figure 1: CADMOS learning design process

CADMOS also allows a designer to reuse existing learning designs that conform to IMS LD level A specification. It is the only graphical learning design tool that offers this feature.

Furthermore, the most innovative feature is that CADMOS tries to bridge the gap between the design of a learning script and its deployment into Moodle. It enables a learning designer to export the learning script as a Moodle package thus allowing its enactment in the Moodle learning platform. Thus, it can become a user friendly learning design tool for Moodle courses.

Creating a learning script for Moodle with CADMOS

Figure 2, 3 and 4 show screenshots of CADMOS learning activity conceptual model, learning activity flow model and the Moodle version of a learning script that promotes high school students' acquisition of collaborative inquiry learning skills in understanding the importance of the waterlands from environmental point of view.
At first students study the theory of environmental importance of the waterlands and afterwards they watch an interview in the form of a video about the proper ways of waterlands' exploitation from tourist point of view given by an officer responsible for tourism development at the Municipality Avdiron, Prefecture Xanthis in Greece. Then each student must do a self-assessment exercise i.e. answer multiple choice questions. Then the teacher divides the students in pair-groups and asks them at first to visit a number of sites about the Porto Lagos Waterland for studying related material and then to collaboratively create a Google doc about the significance of this waterland as well as possible ways of its exploitation. Finally, the teacher grades the assignments submitted by the groups, gives feedback and closed the lesson with a summary about the importance of the waterlands from environmental point of view.

We created 1 composite learning activity and 6 simple learning activities in this scenario:

Composite Activity 1

> **Learning Activity 1**   Each student studies theory about the waterlands from the view of an environmental expert (type theory)
>
> **Learning Activity 2**   Each student watches a video interview given by an officer responsible for tourism development at the Municipality Avdiron, Prefecture Xanthis in Greece (type theory)

Learning Activity 3   Each student performs a self-assessment quiz (type assessment)

Learning Activity 4   The teacher shares a worksheet with the creation of pair groups and the outline of the exercise (type informative)

Learning Activity 5   Each pair group accesses specific sites on the internet about the waterland of Porto Lagos (type theory)

Learning Activity 6   Each pair group creates the "googledoc" exercise (type assessment)

Learning Activity 7   The teacher grades the exercises and sends feedback to the groups (type feedback)

Learning Activity 8   The teacher summarizes (type theory)

Figure 2 shows the conceptual model of the learning scenario "Waterlands-The Waterland of Porto Lagos". For each simple activity we define metadata (title, description, learning goal, prerequisite, type, role), which are not shown in the figures. Specifying the types of the activities, gives the opportunity to the designer to get an overall idea of the nature of the learning design (e.g. more emphasis is given on theory or students have to do a lot of assessment and no collaboration, and so on) by clicking on the "Statistics" button of the tool.
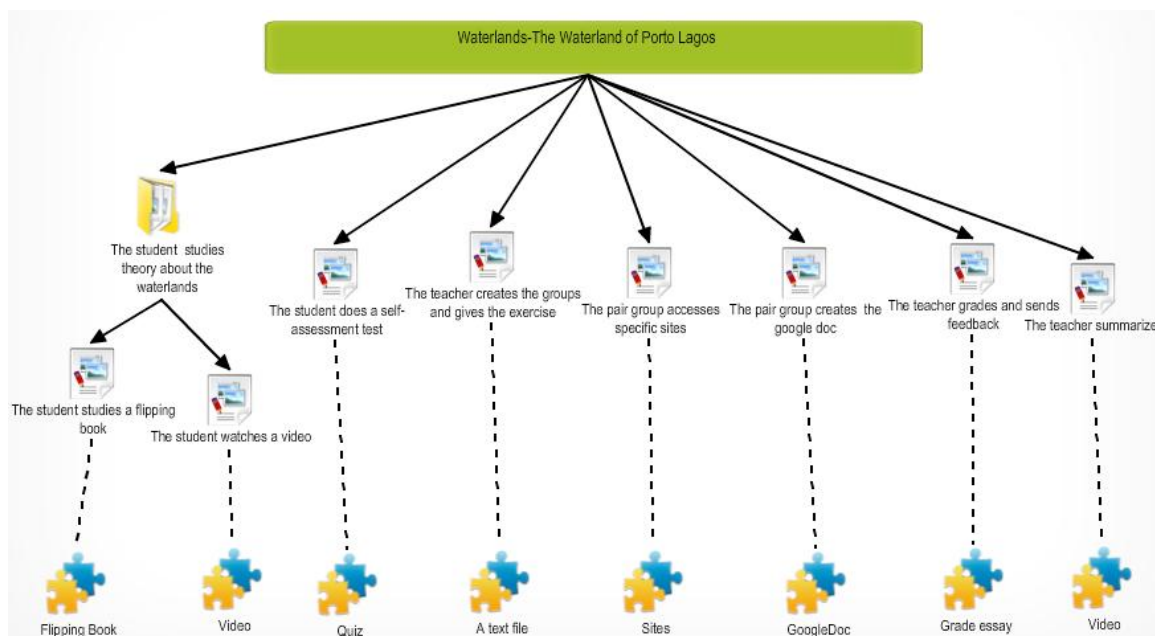
Figure 2: Conceptual Model of the "Waterlands-The Waterland of Porto Lagos"

As we can see in Figure 2, every simple activity is linked to a resource. For every resource we also define metadata (title, author, description, type, copyright, resource file), which are not shown in the figures.
In the suggested scenario we define the following type of resources, as shown in Table 1 below.

Table 1: Activity's resource types in CADMOS

Activity	Type of Resource
1	hypertext
2	video
3	quiz
4	hypertext
5	hypertext
6	hypertext
7	hypertext
8	video

Figure 3 shows the flow model of the scenario. In this model we see three different swim lanes, one for each role i.e. student, teacher, group. The activities are set in the vertical axis, according to their chronological order. The model is divided into three different phases: Phase 1: Study Phase, Phase 2: Practice Phase, Phase 3: Closure Phase. In the student's swim lane the first two activities are grouped inside a rectangular in order to show that they belong in a composite activity, as it was specified at the conceptual model. Also the self-assessment has a time-limit rule that specifies that this activity should end after 1 hour and 20 minutes.
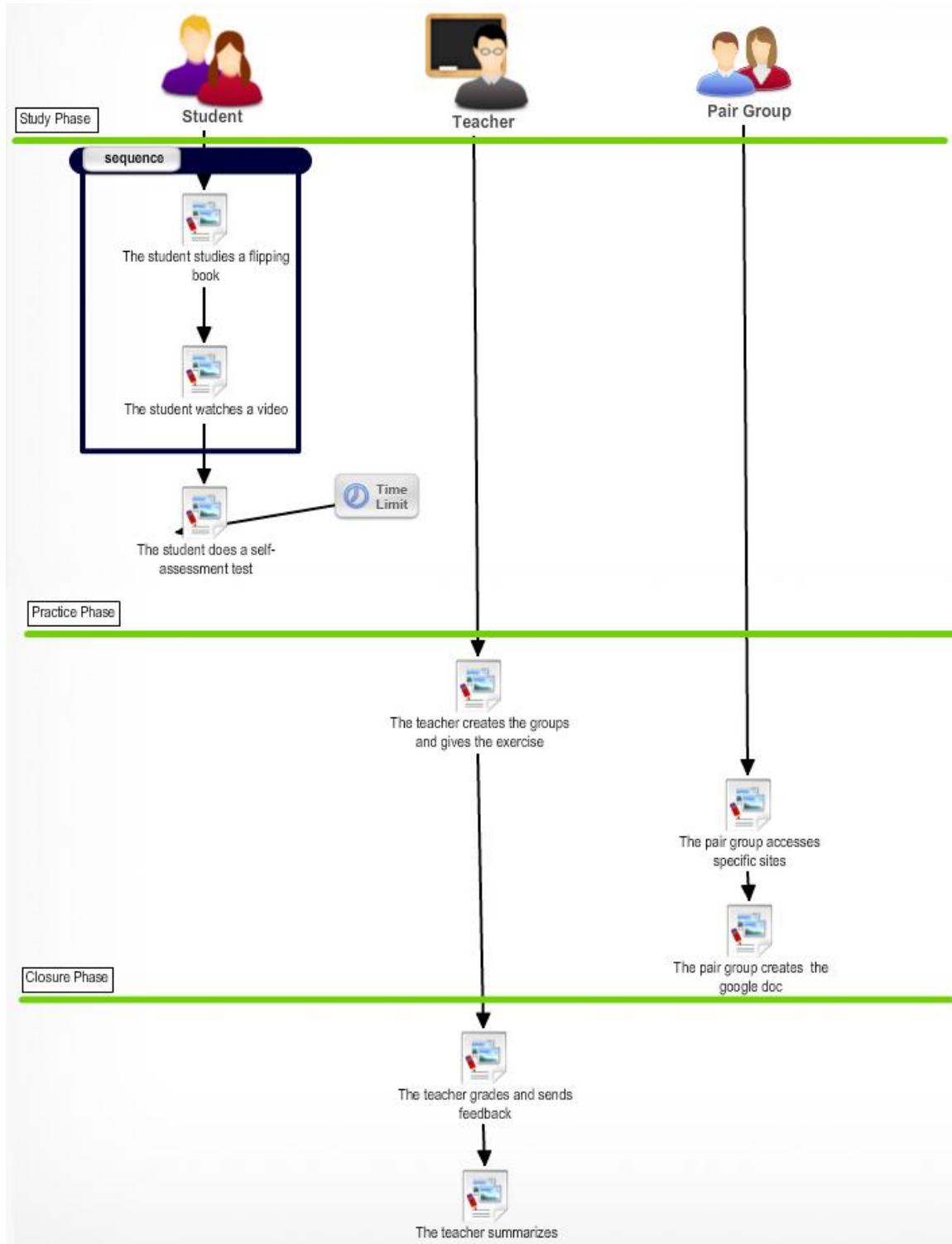
Figure 3: Flow Model of the "Waterlands-The Waterland of Porto Lagos"

Figure 4 shows the Moodle preview function of CADMOS tool. With this function CADMOS converts the learning script into a Moodle course ready to be deployed by converting CADMOS tasks/activities to Moodle resources/activities, phases to Moodle topics etc. according to a mapping schema that is explained in Figure 5. The mapping schema between the CADMOS resources and the Moodle course resources/activities is shown in Figure 6.
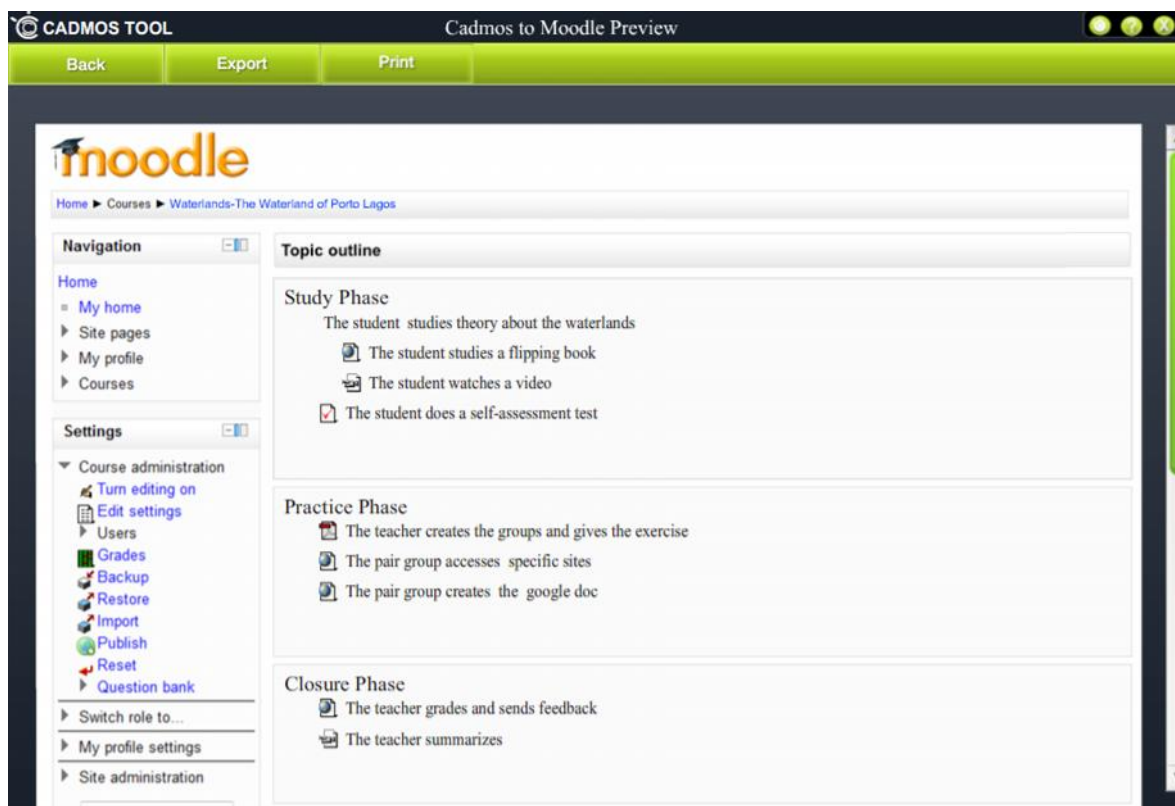
Figure 4: Preview of the collaborative inquiry learning script, as it will be deployed in Moodle.

The learning script is now ready to be exported as a Moodle course and be deployed in a Moodle platform for enactment. The exported file is Moodle course backup file (.mbz) and can be imported in Moodle through the course restoration process. The deployed Moodle course will allow teachers to evaluate their learning scripts during the educational process and make adjustments if needed directly in Moodle or in CADMOS.

Table 2: Activity's resource types from CADMOS to Moodle

Activity	Type of Resource	Moodle Resource
1	hypertext	url resource
2	video	file resource
3	quiz	Moodle quiz
4	hypertext	file resource
5	hypertext	url resource
6	hypertext	url resource
7	hypertext	url resource
8	video	file resource
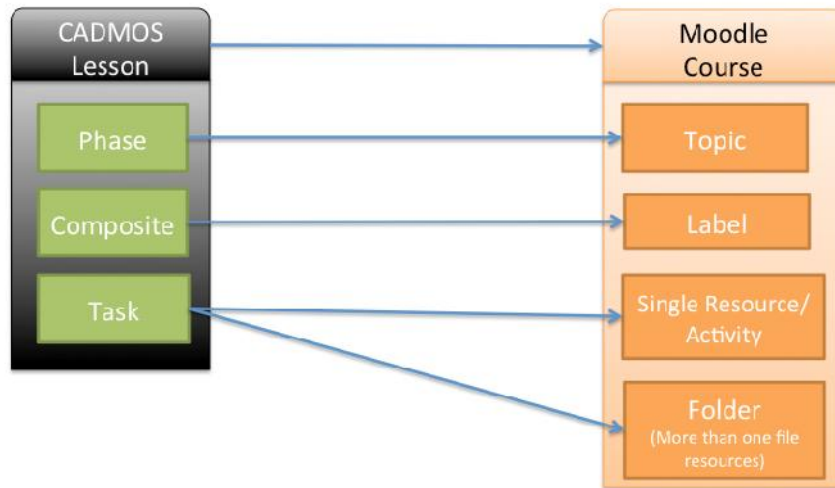
Figure 5: CADMOS to Moodle Structural Model
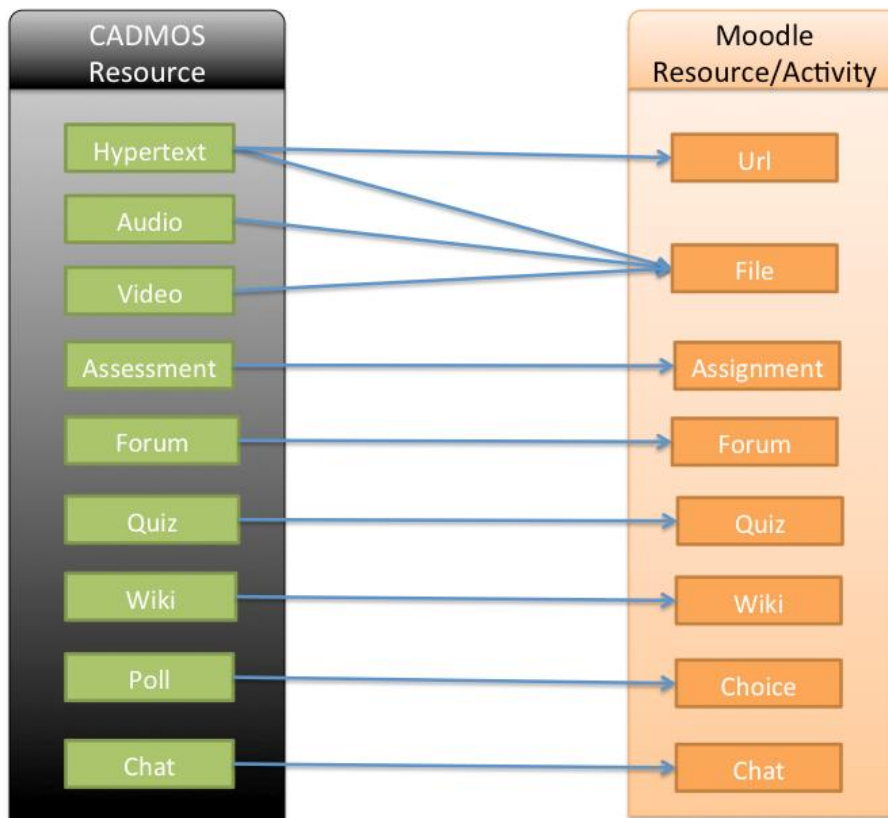
Figure 6: CADMOS to Moodle Resources/Activities Mapping

CADMOS Evaluation

17 out of 30 students, who attended an Msc course on e-learning technologies, which is being organized from the Faculty of Primary Education of the University of Athens in collaboration with the Department of Mathematics of the Technical Institute of Piraeus, voluntarily participated in a usability evaluation case study of the CADMOS tool (v.1.9). Fifteen (15) of these participants were teachers (9 of them were primary school teachers and 6 of them were high school teachers). Nine of them didn't have experience in learning design,

while the rest of them had used one learning design tool at least. All students had used CourseLab, Moodle and QuickLesson.

The evaluation study was organized in two phases:

Phase 1: During this phase the philosophy of the CADMOS design method as well as the functionality of the tool was explained in a laboratory. Students had a hands-on experience since they were called to create lesson plan using CADMOS which was given in a narrative format. The lesson plan was about a topic of environmental education in high school and it is suggested by the Greek Pedagogical Institute. This phase lasted almost three hours and the research group made observations about the students' usage of the tool and wrote down the students' questions and first reaction.

Phase 2: During this phase the students were given the CADMOS tool v.1.9 and another prescribed lesson plan in a narrative format taken from the curriculum of history of the last grade of primary school (also a suggestion by the Greek Pedagogical Institute). This lesson plan concerned the historic facts about Alexander the Great which was familiar to all participants. Participants were asked to design this lesson plan using the CADMOS and deploy it as a Moodle course. The duration of this phase was one week. During this week participants could pose questions or make comments about the software via a web forum.

After the completion of these phases, participants were called to answer an on-line questionnaire of 31 questions. 24 close type questions of this questionnaire were related to i) the user friendliness of the CADMOS enabled design approach and ii) the usability criteria of the CADMOS tool. Six questions were open type that allowed participants to express themselves about the CADMOS tool and the CADMOS supported design method.

In general the comments were positive. 94,11% of the participants declared that they can easily understand the philosophy of the tool and the two different models. 94,12% of them argued that the use of CADMOS is very simple to use while 52,94% said that they likes the tool a lot. 64,71% mentioned that were satisfied from the guidance that the tool offers them. 76,47% of the participants claimed that the graphical representation of a learning design in CADMOS is more illustrative, easy to create and to understand than the usual narrative form. Some of the questions were about the Moodle course deployment feature. The majority of the participants (58,82%) claimed that with CADMOS they could design easily a course for Moodle. 64,70% of the participants stated that they could easily understand how to design a Moodle on-line course using CADMOS, while 64,71% of them said that they agreed with the way the Moodle elements had been mapped to CADMOS conceptual elements. Very important remark was that 58,82% of the participants claimed that the way that the course was represented in Moodle was in full accordance with the two models of CADMOS design. In general, from the observation of the research team and the analysis of the submitted lesson plan, participants were satisfied by the CADMOS and hugely appreciate the fact that there is a tool that can help them design and deploy a Moodle course.

Conclusions and Future plans

This paper presents the CADMOS tool which is a stable, user friendly learning design tool (as the various case studies show) that allows an educational practitioner to create a learning script which can be deployed to Moodle. There are several issues need to be further explored when using CADMOS as a learning design tool. For example, although in its current implementation CADMOS offers a specific taxonomy for describing the learning and support activities. CADMOS taxonomy is definitely smaller than other taxonomies such as the DialogPlus (Bailey et al., 2006). Still, validation by teachers and experienced designers is needed in order to make sure that all activities can be appropriately characterized keeping CADMOS taxonomy rather small. The same issue is related to the metadata (especially the "type" element) of the learning resources. As we can see in the above example the provided options cannot sufficiently characterize learning services such as file sharing or online document creation.

Moreover, using CADMOS as a learning design tool for Moodle courses is quite challenging. First, CADMOS needs to offer flexibility to a designer on how to create a learning script in terms of the way to orchestrate the activities, the rules need to be added, the types of activities that students should perform, etc. As an effect, a learning design in CADMOS might have adaptation rules that Moodle cannot support such as the option to change the order of execution of the learning tasks in a composite activity from sequence to free selection. There are also other rules that Moodle can support but the current version of CADMOS does not allow a designer to include them in the export package of a learning script that will be deployed in Moodle. Although a

designer can add rules using CADMOS, the way to codify them and "package" them into a learning scipt in order to be deployed in Moodle needs further investigation. For example, a learning script might include a self-assessment activity where the next activity to be performed by a learner depends on the assessment score -a learner might need to repeat an activity if the score is below average or skip an activity if the score is high. Although both CADMS and Moodle can support this rule, more experiments are needed to be made on how CADMOS should "package" them in order to be fully compliant with Moodle's restoration mechanisms.

Moreover, CADMOS should make sure that the mappings between its learning design elements and the Moodle's elements are correct and comprehensible from both semantic and functionality point of view. Such case is the "phases" element. In its current implementation, CADMOS suggests that each phase is mapped to a "topic" element in Moodle. However, Moodle offers another way of structuring an online course which is the weekly structure. Mapping a "phase" to a "week" is feasible but also a bit tricky since CADMOS allows a designer to assign time limits to each learning task. So, "weekly structure" by default imposes a time limit to each learning activity, which might not be what a designer had originally in his/her mind.

As an effect, further experimentation with learning designers and design experts are needed in order to reach to create usable learning design tool that meets their needs. The immediate plan is to release the current version of the CADMOS tool to the Moodle community and ask users to give feedback.

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Acknowledgements

Case Studies: Using Moodle for Collaborative Learning with University and Senior Secondary Students

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Abstract

The recently developed Australian Curriculum recognises the global changes that impact on the learning programs for all education institutions. We are now a globalised society, where the challenge of an economic crisis in one part of the world has widespread implications. Civil wars and famines lead to humanitarian crises and refugee migration that have an international impact. The Centre for Integrated Human Studies at the University of Western Australia recognises that the 21st Century provides humankind with significant global challenges on a number of fronts – social, economic and ecological. Providing students with the knowledge and skills to connect with members of the global community will ensure our future citizens are well equipped to contribute to meeting these tests. Learning management systems such as Moodle are seen as key strategies to enable education which prepares students for a challenging future.

Since 2009, The Centre for Integrated Human Studies has developed post-graduate programs using Moodle as their learning management system. During this period a unique senior secondary program in regional Western Australia that incorporates the use of high definition IP video conferencing also has been developed with Moodle. This combination of Moodle and regular video conferencing enables a high degree of class engagement and collaboration from students across up to five schools. The post- graduate program currently has 40 off-campus national and international enrolments and the secondary program about 80 students over seven courses. In reporting on these two case studies, this paper will describe how these programs have developed and the school-based research undertaken. The next phase of the development will be using Moodle to support collaboration between the university and secondary schools.

Keywords

Introduction

Collaboration, engagement with a globalized society and independent learning skills are high priorities for both Integrated Humans Studies and the new K-10 Australian Curriculum. Indeed the Australian Curriculum and Assessment and Reporting Authority (ACARA, 2011) describes the goals of the Australian Curriculum are to develop in individuals:

- their capacity to learn and play an active role in their own learning;
- the essential skills in literacy and numeracy - recognizing that creative and productive use of technology, especially ICT, is a foundation for success in all learning areas;
- creativity, innovation and resourcefulness - solving problems in ways that draw upon a range of learning areas and disciplines;
- a capacity to plan activities independently, to collaborate, to work in teams and to communicate ideas;
- the confidence and capability to pursue university or post-secondary vocational qualifications leading to rewarding and productive employment;
- the ability to relate to and communicate across cultures;

- a capacity to work for the common good, in particular sustaining and improving natural and social environments;
- a capacity for responsible global and local citizenship.

In order to achieve these goals schools must enable students to manage their own learning and collaborate globally. Learning management systems such as Moodle provide an ideal platform to facilitate these learning strategies.

Developing collaborative capacity in students is also a focus of an Organisation for Economic Cooperation and Development (OECD) initiated project Assessment and Teaching of 21st Century Skills (University of Melbourne, 2011). This project aims to develop support for school systems participating in the international PISA tasks from 2014 that will include the use of ICT for collaborative problem solving.

The advocacy for the incorporation of futures education in the curriculum is a development of interest to users of Moodle. The 21st century is presenting challenges for society of unprecedented importance (Martin, 2007). The inclusion of futures thinking in the curriculum provides students with a capacity to appreciate these challenges and contribute to society's response (Hicks, 2012), (Slaughter, 2004), (Gidley & Hampson, 2005). Hicks (Hicks, 2012) includes engaging in active and responsible citizenship - locally, nationally and globally as a key theme of futures education. A recent description of school-based research by Bateman (Bateman, 2012) as well as reflections by Hicks (Hicks, 2012) and Gidley (Gidley, 2012) indicates that futures thinking has been the focus of research and curriculum interest for some time. Clearly a learning management system, such as Moodle provides a very useful platform to enable the engagement of students globally and support them in developing a futures perspective. These are important goals for both secondary and tertiary education systems.

The case studies that follow outline how these goals are addressed in two Western Australian settings - a metropolitan university and cluster regional secondary schools. The final section of the paper describes research related to university/school collaboration and plans to use Moodle in a project between a university and secondary school schools.

Case Study One: Moodle in Integrated Human Studies at the University of Western Australia

Integrated Human Studies (IHS) is a new field of tertiary education that brings together the sciences, social sciences, humanities and applied disciplines to explore the nature and future of humankind. It asks what it means to be human in the 21st century: its objective is to promote human wellbeing in a sustainable world through education and action. At the University of Western Australia we have designed first year undergraduate units in IHS to provide students with a broad understanding of humans and human futures and to provide context for their chosen careers. At a postgraduate level we have developed Certificate, Diploma and Masters level programs to provide graduates with the knowledge and skills needed to address complex problems in a rapidly changing world.

Our challenge in developing IHS units and programs was two-fold: first we had to create new content and concepts or curricula material that would transcend normal discipline-based studies and focus on complex real life problems at a local, regional and global level. Secondly we needed a pedagogy that would promote creativity, critical thinking, problem solving and above all collaboration and the ability for students to express and share alternate points of view. We wanted to attract students from a broad range of disciplines and careers and as far as possible from a broad range of cultures and nationalities to enhance interaction and global understanding. Above all, we wanted students to have a learning experience that would not just inform but would engage them in a shared concern for human and world futures. Thus we opted for a social constructivist pedagogy (Moodle, 2012) where students are active and collaborative learners and selected Moodle as the learning management system that best exemplified this approach.

We are now in the third year of delivering the postgraduate programs: they can be studied on-campus at UWA or fully online through partnership with Open Universities Australia. Importantly, the on-campus and fully online students study and collaborate together; the main distinction is that on-campus students can meet face to face, although even this distinction is lessened with the use of live on-line tutorials that all students are invited to join and the use of Skype and other communication systems for small group interaction. Unit enrolments have been growing steadily, currently there are around 40 students enrolled from disciplines and professions

such as teaching, law, medicine, engineering, town-planning, public service, music, dance, agriculture and anthropology.

In both the development and delivery of the programs, we have used some of the principles of action research. Interdisciplinary studies with the breadth of IHS require continued updating and indeed change at the level of evolution. The world is changing more and more rapidly; our ability as unit coordinators to keep abreast of new ideas, technological advances and world affairs, let alone incorporate these into the courses, is a real challenge. Thus we have adapted action research to include students in course maintenance and curriculum development. Through forum activity, messages to coordinators and specific assignments, students are encouraged to suggest new material, skills and delivery methods to enhance teaching in current units and contribute to future curriculum and course design. We use Moodle assignment and grading systems to reward students who choose to be active in this area.

Another major feature of our units is allocation of 20% of the final grade to collaborative activities. This is largely through interaction on forums but and an important element is how much they have helped each other with advice on projects, essays and assignments. Again Moodle grading systems provide a good base for assessing collaborative activity.

Research was undertaken by the Centre into the views of post-graduate students about the effectiveness of Moodle as a learning management system (LMS) in achieving aims of the IHS courses. The IHS programs aims to develop a range of attributes and capacities, many of which are consistent with the Australian Curriculum outlined above. The survey was conducted after the completion of semester one courses in 2012. Twenty students participated in the online questionnaire out of the 29 students enrolled. Of the 10 students (out of 20 responding) who have used other LMS, all regarded Moodle as a superior or effective as other LMS experienced. At least 75% of respondents agreed (or strongly agreed) that Moodle enabled the IHS course objectives of communication and collaboration with other students to be developed. For the course aims of delivering effective online learning, the development of independent learning skills and the communication with the course coordinator, 90% of respondents found Moodle effective. Moodle was not considered effective by 25% of respondents in enabling leadership skills to be demonstrated.

Respondents in the study also were asked to identify the elements of Moodle that were most effective in supporting their learning in IHS. Those identified were the forum for weekly posts (by 95%), email messaging for contact with course coordinator (by 80%), uploading work to be submitted (by 80%) and the use of the grade book for feedback on marks (by 80%). The side blocks were considered the least effective element of Moodle, with only 40% agreeing they were effective. Whilst the messaging was seen effective in contacting with the course coordinator, there was a view that the messaging capacity to provide notifications and communication with other students was less effective.

Case Study Two - Moodle in a Regional Cluster of Secondary Schools in Western Australia

An overview of the secondary school cluster and their collaboration

A number of secondary schools in Western Australia encounter challenges in providing a senior curriculum that is sufficiently broad and meets the expectations of local communities. This challenge is particularly evident in regional areas and especially in regard to specialised senior courses in English literature and in mathematics where enrolments at individual schools may be less than six students. Provision for academically able students is also a challenge for these schools, as gifted and talented students from regional areas may not take up places in designated metropolitan schools or in centrally provided on-line programs. See figure 1.

An example of a regional group of schools working collaboratively with Moodle to meet the challenge of curriculum provision is a cluster of public secondary schools in the south of Western Australia. This collaborative is now in its third year of delivery of courses with Moodle as the learning management system together with two hours of high definition video conferencing per group each week (see Figure 1 below). Professional support for staff in regional schools has also developed using multi-modal provision with Moodle and video conferencing. The use of Moodle has also extended to some mathematics and English teachers of wholly on-site classes who are able to see the benefits of access to course work for students who are participating in Vocational Education and Training (VET) programs and miss some in-school classes.

Figure 1: Year 9 mathematics enrichment students from two schools collaborating on a problem solving task using Moodle and video conferencing in southern Western Australia. Teacher: Mrs Jane Forte, Albany Senior High School. 28 June 2012.

The role of Moodle in enabling a secondary school collaborative

Moodle provides the key mechanism by which the secondary cluster of schools collaborates. It provides the learning management system (LMS) that is pivotal to the programs across the schools. Whilst the medium for synchronous interaction between the teacher and students has moved from web-conferencing to HD video conferencing since 2010, Moodle has continued to be favoured by teachers as the preferred asynchronous means of delivery. Moodle will be hosted and supported by Education Services Australia (ESA) for the cluster until the end of 2012.

Front-end Moodle training has been provided each year to staff and the cluster coordinator together and ESA provided on-going advice to individuals. It is quite apparent to the authors, that Moodle has features that enable early adoption by novice ICT users. In addition, as confidence grows Moodle provides opportunities for staff to innovate over time. This has been demonstrated by observing that Moodle is used initially as a repository of course information for students and then progresses through to a more collaborative platform where students share their learning through the forums. Novice users also have shown a capacity to adapt with confidence, a course template developed by a colleague with core course information and then used with their own class.
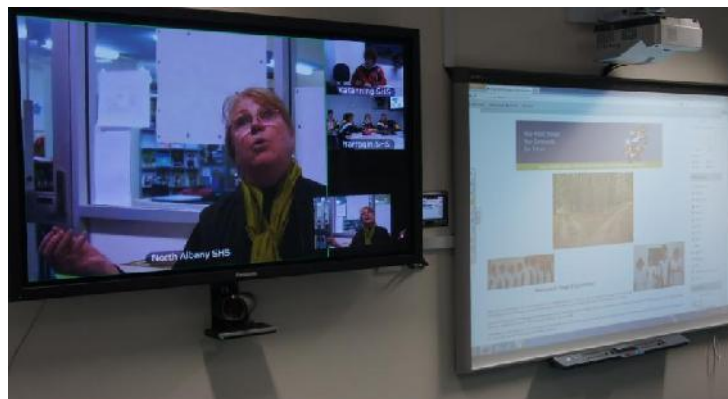
Figure 2: Senior students from three schools collaborating using Moodle and video conferencing in southern Western Australia. Teacher: Mrs Barbara McNeill, North Albany Senior High School. 28 June 2012.

Research in Western Australian Secondary Schools on Moodle and other ICT use

During 2011 a study (Paynter & Bruce, 2011) was undertaken with 115 teachers from twelve secondary schools in metropolitan and regional areas of Western Australia responding. Questions in the survey related to the general capabilities of ICT capacity, critical and creative thinking and problem solving. In addition a general appraisal of teachers' interest in broader global issues, their sense of self-efficacy and their suggestions for curriculum support was included in the study.

Respondents were asked to describe their personal use of various ICT applications for teaching, preparation or private purposes. Moodle (or other learning management systems) were used by over a third (37%) of respondents, with about 14% of the respondents indicating use of more than 5 hours per week.

Respondents also described the extent of their students' use of ICT in their classes. Almost half of the respondents (46%) indicated that their students were using Moodle or another LMS, with almost a quarter (22%) indicating more than 2 hours use per week. Not surprisingly a positive correlation between staff personal use and student use in class was found.

The introduction to this paper described the importance of a learning management system such as Moodle to support schools in meeting the goals of the new Australian Curriculum. This curriculum identifies ICT capacity as a priority and has five integrated elements. We believe students collaborating with local and international colleagues using Moodle will develop the communicating with ICT and applying social and ethical protocols and practices attributes in this curriculum. Given the priority identified in the new Australian Curriculum and other international initiatives for ICT capabilities and collaboration we consider that priority needs to be given to on-going professional support for teaching staff in their use of Moodle.

The role of Moodle as a LMS in developing the key themes of collaboration and global engagement in futures education was referred to in the introduction. Given the pre-eminent influence of teachers on educational outcomes for students (Hattie, 2009) recent research was conducted by the authors (Paynter & Bruce, 2011) to explore the views of teachers in Western Australia about futures education and their degree of self-efficacy. Self-efficacy of teachers for this element was assessed by asking respondents to express their view about ten commonly cited reasons as to why people don't like to think about the future. The results of this study indicates a presence of teacher efficacy where possible futures are seen to be within the capacity of the individual to influence (Paynter & Bruce, 2011).

Consequently this study provides assurance that many teachers have a sense of confidence in their own capacity to influence possible futures. Teachers' belief in their personal efficacy to motivate and promote learning affect the types of learning environments they create and the level of academic achievement of their students (Bandura, 1993). Consequently it is our view that when this proactive view is present, teachers will engage students effectively in key futures education themes – including the use of information and communication technology (ICT) and Moodle. This study also provided insights about the nature of the on-going professional support for Moodle and other ICT to ensure the aims of secondary education are achieved.

University and Secondary Collaboration Using Moodle

Close collaboration between secondary schools and universities has always been seen as an ideal but one difficult to establish in practical terms. Often collaboration has been limited to curriculum design to ensure good preparation of students for tertiary studies or collaboration of teachers and academics to develop disciplinary texts or other specific materials. Slater (2010) reviewed a number of case studies of broader and more innovative collaborative projects at both an institutional level involving university faculties and schools and a more individual level involving interested staff from each institution. Slater considered that an understanding of the cultural elements of each organisation is crucial to introducing and sustaining collaborative activity and that the nature and effectiveness of interaction within the collaborative group is pivotal to success. Given that schools and universities have similar educational objectives and pedagogies and share much subject matter it is somewhat surprising that there are not more examples of effective collaboration between the two. One reason may be that until recently the technical support needed for effective collaboration was lacking. We cite here an initiative one of us was involved in, namely setting up 27 years ago a school-university collaborative group in Human Biology. This was hosted by the Australasian Society for Human Biology (Australasian Society for Human Biology, 2012) which had and still has the following aims:

1   to promote and support human biology research in the region of Australasia.
2   to promote and support the teaching of human biology in Australasia.
3   to promote the professional needs of human biologists including established research workers, research students, educators at tertiary institutes and secondary schools, technicians and support staff.
4   To cooperate and form affiliations with other organizations having similar objectives.
5   To promote the study of human biology in schools and tertiary institutes and to publicize the role of human biologists to the general public.

The model we generated did indeed promote strong collaborative activity not just between staff from both educational sectors but between students. However, difficulty of communication, effective forum discussions, dissemination of teaching materials and workshops gradually reduced the effectiveness of this initiative. All this of course has now changed with advances in ICT in general and in our experience Moodle in particular. From this background and experience we at the Centre for Integrated Human Studies are seeking collaboration with secondary schools in Western Australia. Economics students have already engaged with university staff to explore futures scenarios. During the next stage of this collaboration it is expected that Moodle will play a crucial role in providing a learning management system for shared projects and communication between both staff and students at universities and secondary schools. Through this collaboration the aims of the Integrated Human Studies course as well as the futures orientation of the secondary curriculum will be addressed. In addition it is hoped that the benefits recognised from collaborative problem solving can be realised. Given that the university students will be located both within Australia and internationally, our experience shows that Moodle, with a capacity to securely manage access, will be an ideal learning management system for this collaboration. The framework by which the project will occur is being developed in collaboration with participating school staff: progress will be reported on our website: Education for World Futures (Education for World Futures, 2012).

Conclusion

We have seen in the case studies outlined a university course and a cluster of secondary schools responding to the changing education needs of students in the 21st century. The value of a futures perspective in the curriculum has been outlined and insight provided into current education practice in Western Australia.

Common amongst all these elements is the importance of collaboration – both for students and for their learning institutions. Moodle has been shown to be a highly suitable learning management system to enable this collaboration and provides opportunities for further development. This future development will include university and school collaboration and will be based on the work of Slater (2010) and others who have reported on school and university collaborative strategies.

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Case Study of Integrating Moodle into University Teaching in an Islamic Environment

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Abstract

In the academic year 2011/2012, Alfaisal University started admitting female students, becoming the only educational institution in Riyadh city in the Kingdom of Saudi Arabia to teach both male and female undergraduates in the same (split-level) classrooms, with men sitting on the ground floor and women in the balcony. This trial integration carried with it some cultural and religious restrictions designed to limit the amount of interaction between the sexes, and this impacted the structure of our learning management system. Male and female students were allowed to communicate and collaborate directly with one another while the instructor was in the room, but on Moodle communication between them was prohibited as were all collaborative activities, since the interaction could not be adequately monitored. However, both male and female students needed access to the same course content and were allowed to collaborate with members of their own sex. Male and female faculty members, on the other hand, were allowed to communicate and needed to do so, as many of them teach identical courses. In this case study, we will focus on our experience of using Moodle with shared content and gender restrictions and how this arrangement affected the quality of instruction received by the students.

Keywords

Moodle, learning management system, Collaborative learning, E-learning, Constructivism, Islam.

Introduction

According to the "Webometrics Ranking of World Universities", Alfaisal University, located in the capital city of Riyadh, is ranked first among private universities in Saudi Arabia, and 21st in the kingdom overall. The university's primary goal is to deliver a world class education in medicine, engineering, and business, and it is unique in the Kingdom in that the faculty consists primarily of western instructors.

In 2008, the university decided to use Moodle as its learning management system, and since then male students have accessed most of their class resources and activities using this platform. Faculty members were trained to design courses and upload material in Moodle with the support of the Moodle administrator. In the academic year 2011/2012, Alfaisal University started admitting female students, piloting a Ministry of Higher Education program that saw males and females being taught in the same classroom, albeit with girls in the balcony with protective screen to allow them to see lectures without being seen and boys on the ground floor (Figure 1).

The significance of this pilot program cannot be overstated. Since the establishment of the monarchy in 1932, segregation of the sexes has been strictly enforced, and even this seemingly slight relaxation of the accepted practice was literally unprecedented.

As part of the rationale for this initiative it is possible that the variation could be attributed to the different instructors' techniques in each course if we were only to consider the minor increase in grade averages in biology, for example, but instructional techniques wouldn't account for such a large disparity in the English classes, a subject in which student interaction is crucial for skill development.

Figure 1: male and female student classroom

The success or failure of this program would have far-reaching repercussions on the Kingdom's male/female dynamic, so it was imperative that any interaction take place strictly within the narrow confines dictated by the Ministry of Higher Education. To that end, each classroom was equipped with a SMART Board and e-podium (Figure 2) on the ground floor for the use of male students and the instructor, and identical information was displayed for female students by using an additional projector and screen set at their eye level (Figure 3), in addition the balcony has microphones hanging from the ceiling (Figure 4) and speakers fixed to the walls (Figure 3), this allows the instructor and other students to hear female student in the classroom.

Figure 2: Classrooms e-podium

However, this setup precluded females from interacting with the SMART Board, relegating them to a strictly observational role. To compensate for this, some instructors allowed verbal interaction and collaboration between male and female students during their classes, such as allowing female students to answer questions asked by their male peers, or allowing both sexes to engage in discussion about issues related to the lecture, as the instructors felt that this interaction enhanced the students' education. But all of this collaboration was still strictly supervised by the faculty, so as to permit the continuation of the pilot program.
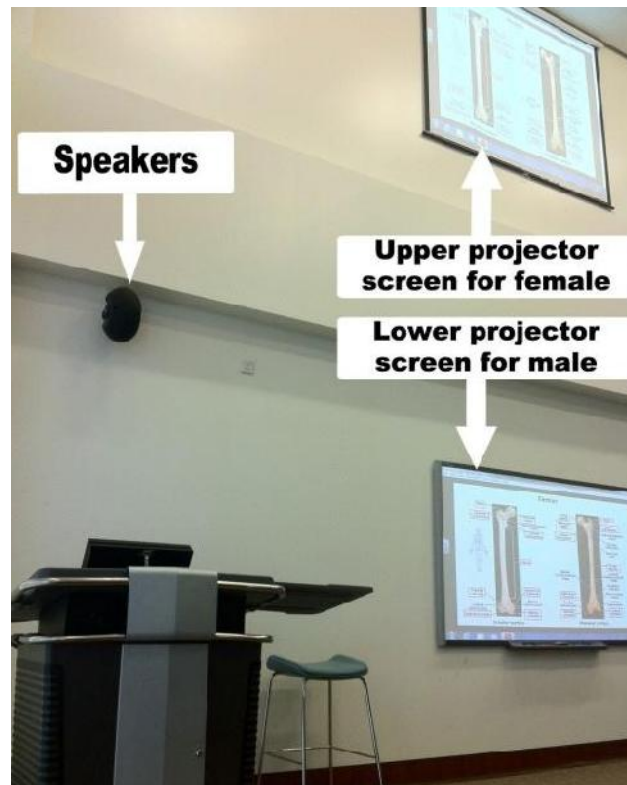
Figure 3: projectors screens and speakers

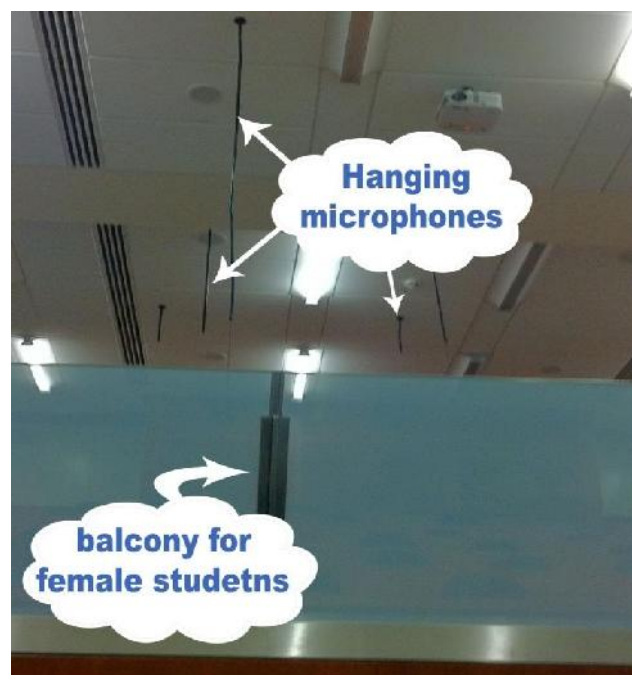**Figure 4: microphones hanging from ceiling**

Moodle Implementation

Along with the decision to admit female students came a lot of new considerations, especially regarding the structure of Moodle. Students of both gender had to be able to access the same courses without being able to communicate with each other at all, and female students had to be taught without any face-to-face instruction

from male instructors. Also, whatever solution was finally settled on, students of different genders must not be allowed to communicate face-to-face or even directly in forums, chats, wikis, or email. Due to the regulations of the Ministry of Higher Education in Saudi Arabia, any collaboration has to be controlled by the teachers, including collaboration using written activities. In forums, for example, all posts should be monitored before being posted, so as to avoid any personal information exchanges between the sexes occurring. There were also additional considerations, such as ensuring that faculty could easily post the same material for both genders. As we found early on, even the perception of increased difficulty on the part of the faculty resulted in a drop in instructor Moodle usage, which had to be avoided at all costs, since the female students were counting on Moodle to be the primary teaching instrument. After a couple of meetings with the administration team, and after evaluating the requests from the faculty, we came up with two different options for configuring Moodle.

Option 1: Make two separate Moodle installations for male and female students under separate domains

Advantages:
- Faster solution.
- Guaranteed limitation of the communication between male and female students.
- Less customization (roles, permissions, groups).

Disadvantages:
- Two separate Moodle installations.
- Each teacher would be required to log in to two different Moodle sites, an irritating duplication of effort.
- Asking teachers to create the same resources and activities for two separate courses would be another annoying duplication.
- Duplication would also be necessary for site maintenance, add-ons and backups.
- Grading would be made more difficult, as the teacher would need to export grades from both Moodle domains to the university grading system "Blackbaud".
- Creating the students accounts and enrolling them in courses would take twice as long.

Option 2: Define two new roles with different permissions for male and female students under the same Moodle installation

Advantages:
- One Moodle installation.
- Teachers would be able to share courses easily.
- All resources and activities would be created by teachers only once.
- Less effort and time would be spent on site maintenance, add-ons and backups.
- Importing grades to the university registrar's Blackbaud system would be faster.
- Creating the students accounts and enrolling them in courses would be faster.

Disadvantages:
- More customization would be required (roles, permissions, groups).

Selected option and required modifications

After comparing the advantages and disadvantages, we selected the second option. Next, we had to separate the student role into male student and female student (Figure 5) and then define and modify the permissions for each role (Table 1) to match the required restrictions. All of the permissions were checked and were changed to "prevent" or "prohibit" for those allowing any communication between genders. These permissions modifications affected some activities like blogs, forums and wikis, as well as some blocks like the Online Users block.

Table 1: Permissions modified

Permission	effect
Send messages to any user	Students will not be able to communicate using messages
View participants	Students can't see other participants in courses
See all user blogs	Students can't see other gender blogs
See all user posts	Students can't see other gender posts in forums
Enable/disable email address	Students can't enable/disable there email address
Access a chat room	Students can't access a chat room
View list of online users	Students can't see other online users

Figure 5: Define male and female student roles

Impact on the Quality of Learning

Looking at students who studied the same material and took the same tests during Term 3, we can see that average class grades were higher in courses in which the instructors encouraged collaboration between students such as in answering questions asked by other students or engaging in lecture-related discussions (Table 2). The results of this small sampling are representative of those obtained in more comprehensive research. To date, some 500 studies of learning have found that students working in a collaborative environment experience a higher degree of learning accompanied by increased levels of satisfaction with the learning process and the learning outcomes (Johnson and Johnson 1989) than those in non-collaborative environments.

Table 2: The Impact of collaboration on the student's grades

Course	Classes with collaboration	Classes without collaboration
Math (overall average)	87.35%	68.1%
Biology (overall average)	83.75%	82.53%
English (overall average)	81.95%	65.95%

End of year Survey

At the end of academic year 2011/2012, we decided to circulate a survey to the faculty and students (both genders) asking for feedback about Moodle and their opinion of the setup. The survey were created and sent out using Google forms.

Survey Summary

The results of the survey were quite interesting. Despite undergoing training, most of the faculty did not use Moodle heavily when it was first introduced. It was only after a great deal of effort was spent demonstrating how it would positively impact their teaching, that many grudgingly decided to give it a try. The results of the survey, then, came as a pleasant surprise in that a higher-than-expected percentage of faculty members (73%) agreed that Moodle improved the students' learning (Figure 6).

Q5.2 Rate questions on a scale of 1 to 5.
Teaching my students using Moodle improved their learning.

Strongly disagree	1	5%
Disagree	0	0%
Neutral	3	16%
Agree	10	53%
Strongly agree	5	26%

Figure 6: Teaching students using Moodle improved their learning

Just as the male teachers had begun to get comfortable using Moodle, however, they were thrown another obstacle. With the admission of female students, male instructors were now being asked to limit how they used the collaborative features that they had just mastered. To compensate, many of them relied more heavily on verbal interaction than was initially envisioned by the Ministry of Higher Education. This resulted in 58% of the faculty responding that they do allow their students to verbally interact and collaborate in classes when the instructor is in the room (Figure 7).

Q5.1 Rate questions on a scale of 1 to 5.
My students (male & female) verbally interact and collaborate in classes when I am in the room.

Strongly disagree	1	5%
Disagree	3	16%
Neutral	4	21%
Agree	3	16%
Strongly agree	8	42%

Figure 7: Allowing students to verbally interact and collaborate in classrooms

Interaction of any kind with the opposite gender was new for Saudi students, and after they experienced collaboration in the classroom, we wanted to know their opinion about the prospect of collaboration in Moodle, as well. As we can see, 57% of the students think that allowing males and females to collaborate in Moodle using blogs, forums, and wikis would enhance learning (Figure 8).

Q4. Rate questions on a scale of 1 to 5.
Allowing male & female students to collaborate in Moodle using blogs, forums, and wikis would enhance learning.

Strongly disagree	11	14%
Disagree	2	3%
Neutral	21	27%
Agree	19	24%
Strongly agree	26	33%

Figure 8: Collaboration using Moodle improved learning

Conclusion

As we have seen here at Alfaisal University, integrating and using collaborative technology leads to educational benefits regardless of nationality or religion. Therefore, given the Kingdom's cultural situation, what we need to do is find and maintain an acceptable level of collaboration until such time as the practice becomes part of the architecture of the educational environment. Once a critical mass of people sees the benefits of collaboration between genders in the classroom, a tipping point will be reached and true educational change can take place. Alfaisal University will keep developing their Moodle learning management system and using it to improve classroom education, and as a result of the success of the program and the positive feedback from students and faculty, Saudi Arabia's Ministry of Higher Education has agreed to extend the program of mixed-gender education for the coming year.

Due to the small sample size, the statistics in this paper don't really prove anything yet, but at least they illustrate the desire of students and faculty alike to push the boundaries of what is considered traditional in order to realize greater educational benefits.

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Categorization of learning design courses in virtual environments

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Abstract

This paper proposes a categorization of learning design developed within the framework of virtual educational environments. It is aimed at the identification of categories and the construction of learning design patterns for courses listed in the Moodle platform of the Universidad de la República de Uruguay.

Keywords

Learning design in virtual educational environments, elaboration of course categories, statistical analysis in Moodle.

Introduction

The demands of the university in its quest for improving the quality of teaching and of the educational system as a whole make it necessary to introduce alternatives that promote more flexible learning systems and better communication with students. Presently, Virtual Learning Environments (EVA in Spanish) are integrated into the basic infrastructure of educational institutions and, together with the effective use of teaching and learning technologies, have become a key factor in matters of higher learning.

The integration of technologies in learning systems is a complex process. Thoughtful planning, steady implementation, and continued support is needed to develop the potential and secure an effective implementation.

This paper describes the initial actions of the Project: "Learning Quality in the Use of TIC for Higher Education" (8). It aims to identify categories of learning design of courses listed in the EVA (1) of the Universidad de la República de Uruguay (UR), developed using Moodle, with the objective of building patterns based on evidence derived from a contextualized analysis for various fields of knowledge.

The paper is organized as follows: Section one covers elements pertaining to the learning design of virtual environments. Section two is a proposal for the construction of learning design categories, specific for the Moodle environment. Section three describes the results of the application of the categorization to the analysis of learning design of courses in Moodle (in the case of the EVA/UR). Finally, in the conclusions, some research advances linked to case analysis and future work are included.

Learning Design of Virtual Environments

Virtual design is defined as the application of a given pedagogical model for a learning objective, target group, context or knowledge domain. A good design specifies teaching and learning processes, together with the conditions under which these are possible, including the activities carried out by professors and students withcertain results in mind within a specific framework. This framework is made out of learning items and services used during the performance of activities [5].

Also, as stated by Salinas [13], the core of the pedagogical system is the context, the specific situation, the scene where learning takes place, and it is here where the teaching methodologies are developed. This shows the importance of constructing educational design models that take into account the specific characteristics of each context. Contextual variables may be areas of knowledge, students' characteristics, teaching and learning goals, institutional, cultural and geographic variables, etc.

This educational design activity carried out by the educator can be performed within previously established environments such as the virtual environments [4]. The educator is the one who chooses the teaching devices to be used, the content and resources as well as interactions that are meaningful for participants in this setting. In the last ten years, educators have had access to a series of studies about teaching modalities in virtual learning environments that have resulted in various taxonomies. Salinas [13] offers a good summary of all of these studies.

There has also been a standardization of international specifications for e-learning, such as IMS Learning Design, a proposal of modeling standards for learning environments; and LAMS (Learning Activity Management System), a set of standards and tools for the design, management, and access of on-line activities of collaborative learning [6].

Brouns et al. [3] presents three types of development of learning design, the first two are widely used, and the third one represents a new tendency in learning design: 1. Theory based designs; 2. Best practice based designs; 3. Pattern based designs. Here the designer takes patterns of courses that can be used for the development of new courses, where these patterns become a generalization of a series of best practices of educational design.

Construction of educational design categories for courses

There are references for the construction of educational design categories based on the didactic use of resources and technological tools. Salinas [13], starting with prior proposals [9, 12], develops a taxonomy based on the use given by professors to the virtual environment. He identifies five categories linked to degrees of utilization, seen as increasing levels of utilization of activities and collaborative work, with this becoming the more relevant indicator:

Type 1: use of platforms for distribution of materials, management of class content, either through the use of calendar, boards, forums, etc.

Type 2: use of platforms for distribution of materials, as well as a means to present mandatory individual activities.

Type 3: use of platforms for distribution of materials, as well as a means to present mandatory individual and group activities.

Type 4: use of platforms for distribution of materials, as well as a means to present mandatory individual and group activities in a collaborative model.

Type 5: use of platforms for distribution of materials, either individual, collective collaboratively, without assigning any type of material.

Berggren et al. [2] make a comparison with the terminology used in the IMS LD and the Moodle terminology, shown in Table 1, taken from the study mentioned before. This compares learning design components and tools and resources available in Moodle, allowing the application of IMS LD specifications to the design of patterns based on categorizations of the use of Moodle:

Table 1. Differences in terminology for IMS Learning Design and Moodle LMS (Berggren et al., 2005)

Terminology in IMS LD	Terminology in Moodle
Run of a Unit of Learning	Course
Unit of Learning	Course export/import file (without runtime data)
Activity-structure of type selection	Topics in a course
Learning activity with one single environment with one tool (depends on the activity)	Activity Module, Activity
Conference of type 'announcement'	Forum Announcement
Conference of type 'asynchronous'	Forum
Conference of type 'synchronous'	Chat
Learning Object of type 'tool'	Wiki
Learning Object of type 'test'	Assessment
Learning Object of type 'tool'	Glossary
Learning Object of type 'tool'	Journal
Learning Object of type 'test'	Quiz

For this study, we devised a categorization of degrees of utilization of the EVA for the definition of elements of learning design. It combines typologies described in Salinas [13] and terminology used in Moodle. It was built based on increasing and cumulative degrees for the classification of virtual resources. Using this category, we classified the resources based on type and amount of activities, tools and resources used:

1. Courses defined as repository are those that have resources that can be materials in various formats such as text, images, videos, as well as labels, directories, web pages. They have a forum for updates that comes built in when you develop a new course in Moodle. This category includes all courses with at least 4 resources.
2. Courses that are defined as self-evaluations are those that are repository and are centered in the use of self-administered tools (i.e.: questionnaires, HotPotatoes, or consults). Courses with less than 2 activities fall in this category.
3. Participative courses are those that are repositories, with self-administered evaluation and have discussion forums and/or have tasks. In this category a greater level of interaction is required on behalf of the student. This category consists of courses that have at least 4 of these activities.
4. Collaborative courses are those that are repositories, with self-administered evaluation and have discussion forums and/or have tasks, have activities such as wiki or glossaries, and are used with webconference and/or chat resources. This category consists of courses that have at least 4 of these activities.

Courses were labeled according to a binary and incremental code. Therefore, a course classified as Repository is labeled 0001 and has a considerable amount of resources, but not forums, nor self-evaluation tools, or collaboration. A Participative course is labeled 0111 due to its considerable number of resources, forums, self-evaluation activities and tasks, but excluding collaboration activities and/or synchronous communication tools. As it is a cumulative classification, each category has a greater degree of demand than the previous one.

Applying categories to the analysis of learning design courses in Moodle

To evaluate the learning design components of the Virtual Learning Environment (EVA in Spanish) of the Universidad de la República (UR, Uruguay), we improved the module Statistics in Moodle [1] to gather data on different types of resources and activities proposed in the courses, and their frequency of use. In contrast to the original module, Statistics in Moodle, the modified module shows detailed information generating data from all courses of one category (including all subcategories). This was translated into Spanish and is available for free download [1].

The classification process using the modified statistics module allowed us to gather data for a categorization of courses according to degree of use based on types of available elements in the learning design of the courses (categorization is shown in Section 2). Available courses were classified using this criteria in the main server of the EVA at UR1. Work was performed on a total of 492 courses in all areas of knowledge. These courses represent 25,945 student registrations.

Following is a distribution of courses according to classification already mentioned in Annex 2. Figure 2 shows results for four initial categories (that we shall classify as "pure", 0001, 0011, 0111 and 1111). Also, combinations of categories showing significant values, we shall classify as: Social Forum, Participative Forum, Collaborative Repository, Participative Collaborative.
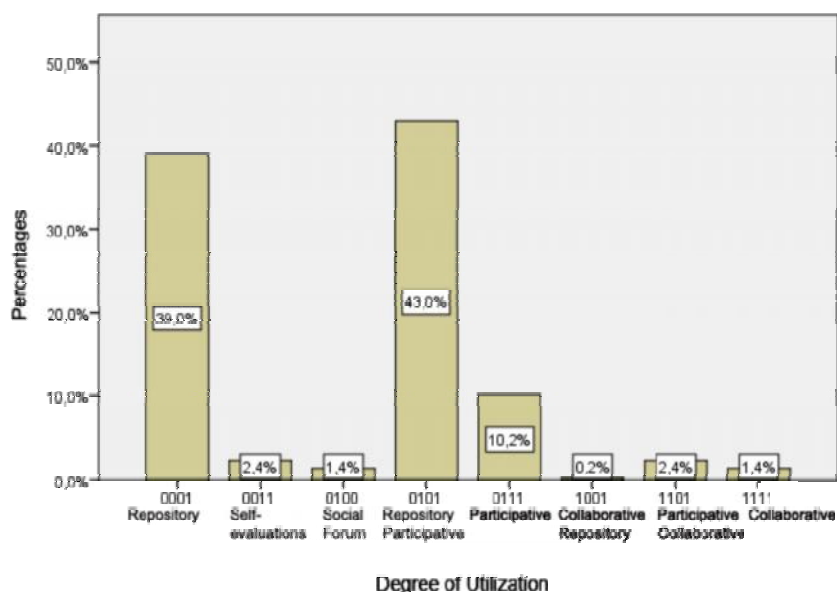
Figure 1. Course classification according to type and quantity of activities, tools and resources used

Results shows a strong concentration in the initial stages of the categorization inclusion models. Within the "pure" categories of the classification model, the model of repository of materials courses (39%) is strongly evidenced.

However, the great discovery of the categorization is the one identified as participative repositories. An almost absolute majority of courses (43%) are classified in this new category, characterized by a deficit of self-evaluation tools. As soon as these courses begin to include these evaluation tools, they will change to "pure" participative courses that now represent slightly more than 10% of total.

Results show proof of a reduced percentage of collaborative type courses, especially if we consider all courses that include some type of collaborative activity. Here we see a future intervention action from several perspectives (training educators, sharing experiences, institutional level evaluation, etc).

Figure 3 shows the way that degrees of utilization are distributed according to areas of knowledge where each course belongs to, allowing us to move towards a categorization of learning design according to each specific domain area.
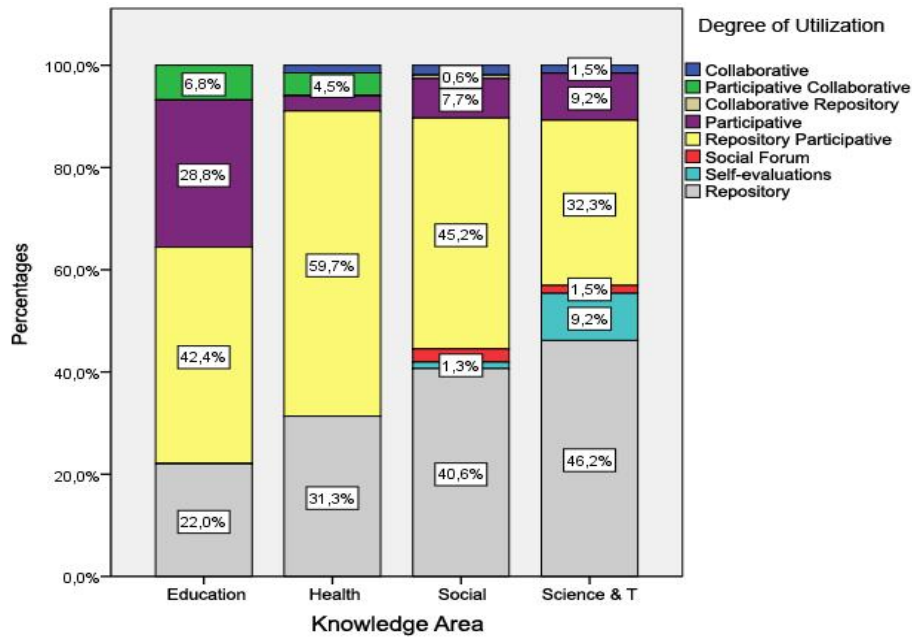
Figure 2. Resource utilization profiles, according to knowledge areas. (Percentages for each area of knowledge)

Generally, resource utilization profiles are relatively similar among the various areas of knowledge. A frequent use of Discussion Forums is found in the four areas. The area that uses more extensively the EVA as an interactive space is Education (almost 70% of courses). The case of Health Sciences also deserves to be mentioned due to the relevance of the participative repository model in 60% of the courses. The weakness in the development of courses in these areas is in the inclusion of Evaluation and Self-Evaluation tools.

The Scientific Technologic area stands out for the use of the EVA as a repository (46%), as well as for being the area that uses more tools for self-evaluation (9%).

Figure 4 shows the distribution of courses according to the level of utilization of the EVA and the amount of students registered in the course. As we can see, the profiles of tool utilization of the EVA are less dependent on the amount of registered students than what could be expected.

From the data shown in the figure it could be said that the utilization of available tools in the EVA is more dependent on the teaching content than on the amount of students per course.

To summarize, it is clearly shown that courses that make more use of participative tools are those with students ranging from 25 to 60, an those that make more use of self-evaluation tools are the courses with more students, 60 and above2.
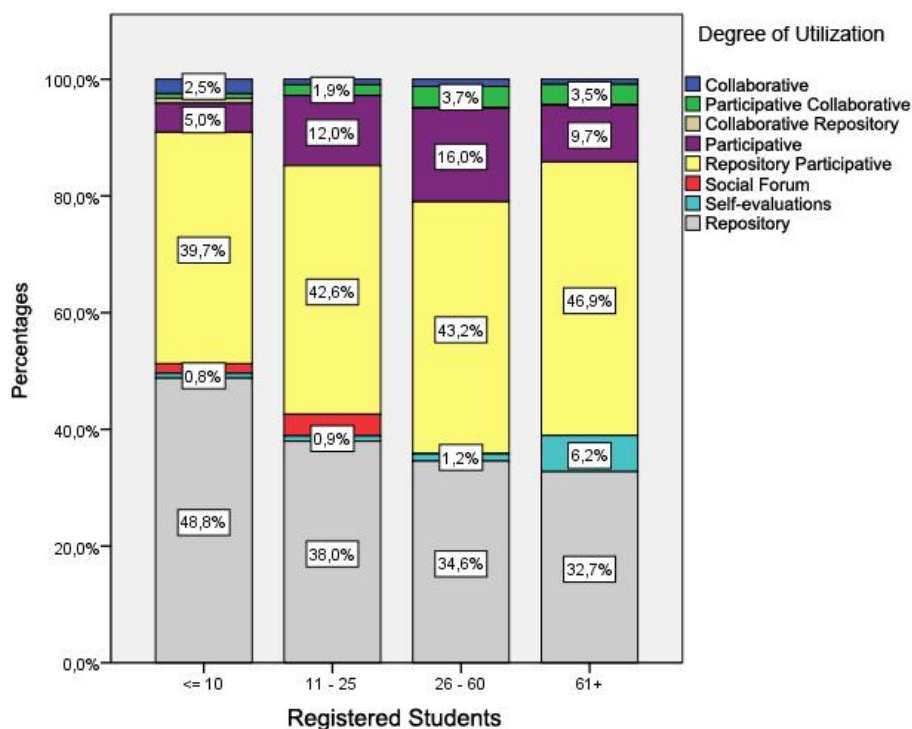
Figure 3. Classification according to degree of utilization of the EVA and number of registered students.

The results previously shown indicate the value of the categorization developed and of its utility for the evaluation, monitoring and planning of strategies for the improvement and further use of the EVA tools.

This methodology, supplemented by qualitative type studies based on the analysis of case studies, will allow us to move towards the development of a contextualized model, multidimensional and dynamic, previously defined from the comparison among: 1. categories found in the practices of learning designs in virtual learning environments (contextual and specific categorization); 2. Categorizations found in literature, developed by educational experts, defined for all cases as "good practices of learning design" (prescriptive type typology).

From this model it would be possible to establish automatic relations between the established model and specific learning design practices developed for a particular course, based on the elaboration of patterns as was mentioned on Section 1.

Conclusions and Future Work

In the present stage, we are developing an analysis of study cases that include grade courses residing in the EVA, based on the classification shown in Section 3. It is a descriptive type study that allows us to identify various elements included in each learning design, while also trying to identify patterns that result in the construction of design categories for some specific domain areas and a localized context. This categorization will also be compared with others already in existence in the literature, moving towards the modeling of learning design patterns specific to the institutional context, developed using standard metadata. In the future it is possible to incorporate the analysis of intrinsic characteristics of the design elements created as learning goals, as well as relations among components and the specific context (teaching styles by discipline, pedagogic models, among others) and/or adaptation to characteristics of student profiles.

Three years from the opening of the EVA courses at the University, we consider that this type of study is useful to obtain information about the actual uses of virtual spaces. Also, to evaluate alternatives for future interventions that allow the support of educators in the development of skills [7] needed to use the EVA as a comprehensive component of the learning experience, thus adding to the quality of education.

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Concept Tagging in Moodle

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Abstract

The Moodle learning management system (LMS) is becoming increasingly widespread due to its adoption by education providers at all levels. The system however does not provide educators with the ability to create connections between online course material and domain concepts easily and visibly. We chose concept tagging as the method for allowing teachers to provide these links in a new concept tags plug-in for Moodle. Our concept tagging plug-in allows the creation, management and application of concept tags to course content. Students and teachers will mutually benefit from the use of such a mechanism, as it would aid information location in and retrieval from course content. An initial evaluation of the plug-in showed that teachers find the concept tagging of course modules to be a desirable and usable functionality that Moodle lacks. The work in this paper describes the first prototype of the plug-in, the aim of which is provide the first step in contributing to the addition of basic student modelling functionality to Moodle as part of a wider project. By continually keeping track of a student's progress on each concept tag, Moodle will be able to suggest appropriate course modules for further study based on this progress.

Keywords

Concept tagging, Moodle plug-in, metadata

Introduction

Moodle does not currently associate a course's resources and activities with its domain concepts, as it has no knowledge of what domain concepts any particular resource or activity covers. For example, Moodle can identify a 'quiz' but lacks a mechanism, at present, to link it to a concept in the domain covered by a course. We believe that a feature allowing the 'tagging' of resources and activities in online courses with 'concept tags' would address this absence of domain knowledge.

In fact, despite the overall success of tagging due to its flexibility, extensibility and simplicity (Smith G. , 2008), tagging remains absent in E- learning (Bateman S, 2007). Furthermore, an easy-to-use system promotes its adoption and usage as well as motivating users to tag because it helps them manage and retrieve their information (Smith G. , 2008). This is the concept tags plug-in's aim. Using this plug-in, teachers have the ability to create, manage and apply concepts to course modules. Consequently, the system becomes more 'intelligent' and is able to communicate to students, via the plug-in, a list of which course modules cover which concepts. The concept tags plug-in essentially adds a missing metadata layer to a course's contents, aiding students in the location and retrieval of information from course content by providing a more structured environment for students when exploring course materials.

The concept tags plug-in is a part of a larger project aimed at adding basic student modelling functionality to Moodle to enable it to provide adaptive assistance to students. By continually keeping track of a student's progress on each concept tag, Moodle will be able to suggest appropriate course modules for further study. In addition, students will be able to view their progress on each domain concept and make decisions about which resource or activity to view next.

Background Information

Moodle roles and capabilities

Moodle defines 'roles' for users of its system, which offer varying degrees of control over course contents and participants depending on 'permissions' given for 'capabilities' in a 'context' (Roles and capabilities: Moodle.org). A 'context' is an 'area' of Moodle, such as a course, which in turn can contain more contexts, such as plug-ins like the forum module. We are interested in the 'teacher' and 'student' roles for this plug-in.Teachers belong to a specific course (Features: Moodle.org) and add and manage course modules within it. Students participate in a course and make use of its resources and activities.

Tagging

A tagging system enables the application of a 'tag' to a 'resource' within the system. Users are the individuals who create and apply tags and, in our case, add resources, such as a PowerPoint presentation. The tags themselves are metadata, or "structured information", describing, explaining or otherwise facilitating the retrieval, use or management of an information source (NISO Press). We deal with 'concept tags', where each tag is the name of a concept in a course's domain. The teacher decides on the tags' granularity. Concept tags are essentially 'descriptive' metadata, which, when applied to course modules, will better describe course content to aid discovery and identification (NISO Press).

Related Work

Tagging in Moodle

At the time of development, Moodle's tagging system allowed users to tag blog entries while creating the new entry. The author of the entry can add new tags and delete or modify existing tags after publication. Each tag appears as clickable links at the bottom of published blog entries, which displays a page listing related tags and recent blog entries and users tagged with the tag. This occurs as a user's 'interests', as described in their profile, makes use of the same tagging infrastructure. Moodle 2.0 extended tagging to courses (Moodle.org Tracker, 2010) and questions (Moodle.org Tracker, 2010).

There is a Moodle Social Bookmarking activity that allows students to share links to online content (Piguillem, 2008). The links can be tagged and organised similarly to the service offered by 'delicious'1, allowing inquiry-based activities known as WebQuests to be created for Moodle courses for example. Although we could have made use of this through using the internal Moodle link to a resource or activity, our idea is to eventually allow tagging at a finer-grained level (for example a specific slide in a slideshow).

General Tagging Work

FreeTag is a free of charge, open source plug-in that allows users to add tagging to existing applications that use PHP and MySQL (Smith D. H., 2012). After downloading FreeTag, the application developer simply runs the provided script to add a new table to an existing database schema that has unique, integer keys for the 'users' table and the 'objects-to-be- tagged' table (Luk, 2005). The application programming interface (API) then becomes available for use with the system. In theory, the concept tags plug-in can use the FreeTag API but we did not at this stage as we did not come across this code until we were carrying out our evaluation study.

The Semantic Hacker API is available for free, unlicensed use if fewer than 20 000 queries occur per day, at a rate of less than five per second (Forum: Sematic Hacker). It includes a 'Concept Tags' feature, which generates tags from text-based content (API Overview: Semantic Hacker, 2012). Using the online demo, we generated concept tags (see Figure 1) for the sample resource used in our evaluation1. The article introduces data trees in an Artificial Intelligence (AI) setting, so all the generated tags are relevant. A teacher for an introductory course to AI may decide that 'ai' is too coarse-grained because it would apply to the majority of course modules,

Figure 1: Concept tags for an article about data trees1, generated using the Semantic Hacker API demo. Each tag's 'weight', indicated by its size, shows its importance in relation to the topics contained in the content (API Overview: Semantic Hacker, 2012)

Figure 2: Concept tags for the same article about data trees2, generated using AlchemyAPI demo

diminishing its value as descriptor of the modules' contents. In another course however, it may be important to point out that this article is one of a subset of course modules about AI.

Moodle caters for many types of course modules, not all of which are text-based, so the Semantic Hacker API could provide a method of initially populating a course's list of concept tags solely from its text -based resources. Another potential way of creating an initial list of concept tags for a course using its existing "Internet-accessible URLs and posted HTML files or text content" is the AlchemyAPI (AlchemyAPI, 2012). AlchemyAPI generated a different set of relevant concept tags (see Figure 2). We can explore the option of pre-populating the tags list in the future, including using one or both of these APIs, but this project explores giving teachers the ability to tag course modules and leaves the creation of concept tags to the teacher.

Design and Implementation

Extend Moodle's tagging system to tag course modules

Although the ideal solution in terms of direct input to Moodle, we did not want to set about extending and modifying the Moodle core code due to our inexperience with Moodle development and time restrictions. In addition, the project aims to explore concept tagging in Moodle, so creating an independent block allows us to focus on exposing potential users to the idea of concept tagging and analysing their feedback, rather than attempting to add functionality to multiple, existing sections of the Moodle code straight away.

At the time of development, the 'mdl_tags' table did not store any data about the course to which each tag belongs. We initially thought that as tags are thus not local to a course so that clicking on a tag would list all course modules tagged with it, regardless of the user's enrolment in the course. Hence, the modules displayed may not be viewable or irrelevant to the course. It later became apparent that it is possible to create course-specific views. There was no ability to maintain a course-specific list of concept tags we required however.

Develop a new and independent concept tags block

Implementation of the concept tags plug-in as a block means that there are some limitations in usability as the tagging of course modules is separate from their addition to a course. Due to time constraints and the exploratory nature of the project, this solution best allows us to focus on concept tagging in Moodle. Re-implementation and improvements can now occur more quickly and effectively due to the experience gained.

The Glossary module is an activity module allowing participants to create and maintain a list of definitions, like a dictionary (Features: Moodle.org). Using this module as a beginning point for a concept tags module means that any occurrence of a tag in the course could provide an automatic link back to its page in the 'glossary' (Features: Moodle.org). This page can display a list of course modules tagged with that concept tag. The tags would also be searchable. Using the infrastructure of the glossary module, we can consider student contributions to the creation and application of concept tags as it includes a feature allowing entries made by students to be approved by teachers prior to becoming visible to others. We still need to provide a tagging and managing tags interface, which we decided to focus on first.

Figure 3: The concept tags block as seen by teachers (left) and students (right) - students will only be able to request a list of course modules alongside applied concept tags to eliminate the need for moderation and censorship should students add and manage concept tags themselves

The concept tags plug-in will therefore be a block that allows teachers to create new concept tags, rename/delete/apply concept tags to course modules and view modules alongside their tags. Once the plug-in is at a stable and reliable stage, we would like to consider its inclusion in and/or integration with the Moodle core.

Solution Design

The plug-in is a Moodle block (see Figure 3), essentially serving as a starting point from which to access and use the actual tagging and management features. An administrator would need to install the block in the Moodle system prior to teachers being able to add it to their course. There is no configuration necessary for this block to function however, so teachers are able to start using it as soon as they add it to their online course. The only knowledge required to use the plug-in is a basic idea of how tagging works.

All data related to the concept tags block is stored in the 'mdl_concept_tags' database table, automatically created during the installation of the concept tags block and added to the existing Moodle database. The 'id' attribute is an integer primary key used to differentiate between different records, which all Moodle database tables require. The foreign key 'courseid' references the 'id' attribute of the 'mdl_course' table, which lists all courses in a Moodle installation. Similarly, 'moduleid' references the 'id' attribute of the 'mdl_course_modules', which contains all resources and activities in a course. Lastly, the 'tag' attribute is the 'normalised' concept tag: the user-specified tag stripped of extra whitespace and in lowercase characters. No user data is stored when a user creates or applies a tag, as there is no value obtained from knowing who created or applied a tag because only teachers are able to do so. We have made this decision because we assume that teachers will be uploading the course materials and as domain experts would know which concepts are covered by each resource or activity. In addition, there is a separation between tags for each course because we would like to keep the system's monitoring of progress on a domain concept in the context of a course.

Managing concept tags

Teachers can manage a course's concept tags by creating new tags and viewing a list of existing tags allowing the deletion and renaming of concepts as necessary (see Figure 4). They can also choose to populate or extend the list by importing terms previously exported from a Moodle course glossary as an Extensible Markup Language (XML) file. The placement of the importing link is in the same place as the export glossary entries link for familiarity and easier access. In addition, the plug-in's glossary entry importing function is an adaptation of the Glossary module's equivalent functionality in order to provide greater reliability when dealing with glossary export files.

Tagging resources and activities

In the tagging view, the page displays a list of all course modules in a list box. Teachers cannot tag certain modules like labels due to their use for the organisation of groups of course modules on a page. The selection of an item from the list, followed by the clicking of "select" displays a list of all concept tags in the current course alongside a list of concept tags applied to the selected course module (see Figure 5). These list boxes are initially empty.

Creation and applying multiple tags to the selected course module involves typing a comma-separated list of concepts into the "create new tag(s)" text field and clicking the "+" button. Alternatively, selecting a tag from the "all course concept tags" list box and clicking the ">>" button applies it to the selected course module. Removing a tag similarly involves selecting it from the "applied concept tags" list and clicking the "<<" button.
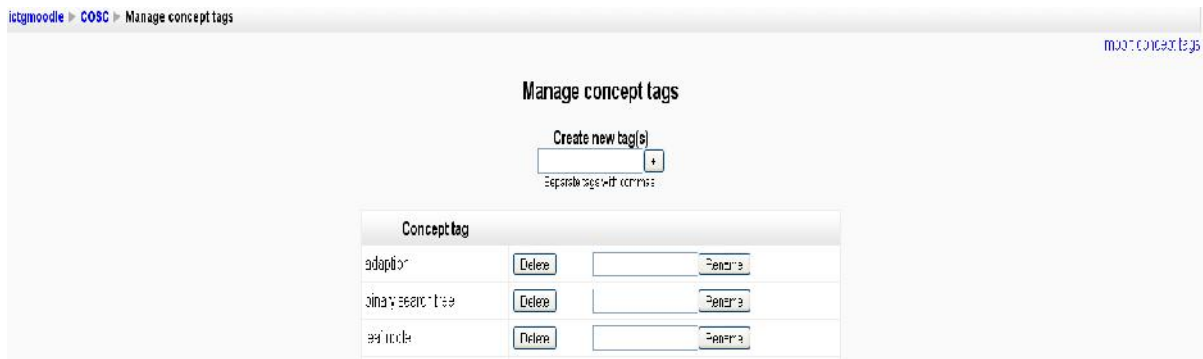
Figure 4: Managing course concept tags – teachers can add, delete or modify concept tags as well as import glossary entries as a starting point for a course's list of concept tags that they can then modify

Viewing resources and activities

When viewing a course's resources and activities, the modules will be clearly visible as hyperlinks with their tags, in alphabetical order, and type next to them (see Figure 6). Clicking on any of the module instances will take the viewer to the resource or activity of interest. This view is available to both teachers and students. The concept tags themselves are not searchable or navigable from within the plug-in, which may limit its benefits until this is done.

Evaluation

An evaluation study was carried out with five University of Canterbury and Lincoln University lecturers (one female). Participants were from different backgrounds: namely Education, Computer Science and Accounting. The purpose of the study was to receive feedback on the concept tags plug-in from teachers, its primary users, regarding its adoption and usage by them as well as highlighting strengths and weaknesses of the system.

Prior to each evaluation session, the participant read a short, online article, varying depending on his or her area of expertise. In addition, lecturers provided an electronic copy of a resource from one of his or her Moodle courses and, if possible, an XML file containing entries exported from a Moodle glossary. A course was set up
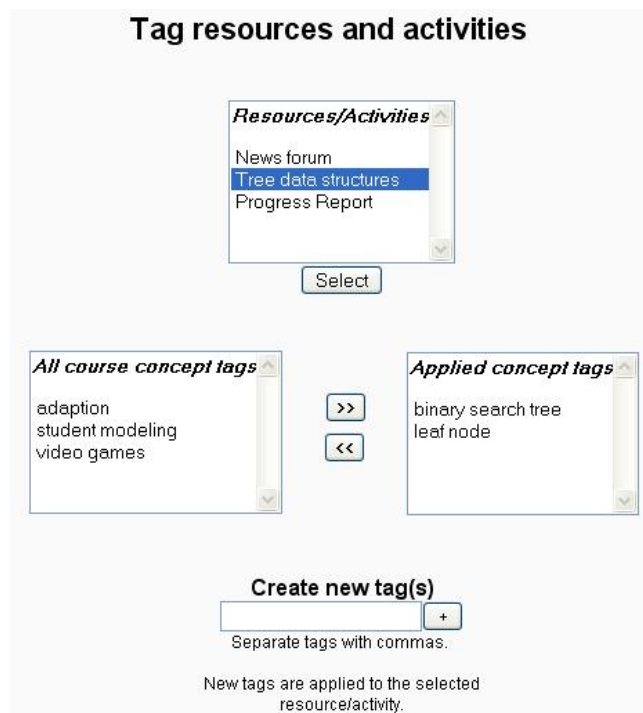

Figure 5: The tagging of course resources and activities occurs via this interface

Figure 6: The viewing of course resources and activities occurs via this interface - clicking on a course module's name takes the user to the resource or activity

for each participant on a local installation of the Moodle system so that data for each lecturer would remain separate. All courses had the same layout, the only difference being the previously uploaded resource.

Participants read an information sheet describing the project and evaluation session, signed a consent form and filled in the first part of the questionnaire prior to beginning. While working through the tasks, participants described their actions and thoughts 'out-loud'. The rest of the questionnaire was then filled out. Tasks included creating new tags for an existing resource, uploading and tagging a resource and importing tags from a Moodle glossary. All features of the plug-in were used at least once. We took the screen recording and a video of each session.

Overall, the questionnaire consists of eighteen questions, including both open-ended and close-ended questions. Some questions require the participant to decide on a position on a 5-point Likert scale and comment on their choice. The success of the plug-in depends on the responses to two particular statements in the questionnaire: "I would use the concept tags plug-in in my Moodle course(s)" and "I would recommend the concept tags plug-in to my colleagues." A response higher than '3' for both statements would indicate that this plug-in is successful as the participant is willing to use it and encourage their colleagues to use it as well.

Major Findings

There were varying levels of familiarity with Moodle among participants in the study, ranging from lecturers who had recently set up an online course to one who had developed seven courses. In addition, only one participant was already familiar with 'tagging' prior to using the plug-in and thought that it was "useful for showing key topics."

In response 'having the ability to tag resources and activities would be useful', one participant strongly agreed, as "tagging seems to get an excellent balance between effort and benefit." Two other participants chose '4', one because the "the idea of concept tagging can assist my students to enhance their ability to be able to master key concepts in the ... curriculum", the other interested "to try this new means for [their] students." The rest were neutral, citing "no experience of tagging" and lack of "understand[ing of] their utility." Three out of the five participants felt neutral to the statement 'I would use tahis feature for all my courses'. One teacher indicated that the plug-in's adoption "would ultimately depend on the amount of time and work it would take to set up." Similarly, the participant who strongly agreed admitted that it would "depend... on experience with trial courses." The remaining participant chose '4' as they were "not sure how effective it will be, but [thought that it] seems like a good idea."

One lecturer was neutral and one strongly agreed that it was enjoyable to use the plug-in as "it was easy to implement and relatively straight forward." The rest chose '4', stating that using the plug-in was an "interesting exercise" and the concept tagging functionality "uncommon" and "difficult to rate... without knowing more about concept tagging – what it does, its utility and what a student would see and get out of it." Four participants also found it easy to use and picked '4'. As intended, the plug-in is "very straight forward to ... use once [it is] understood what tagging involve[s]" and it "will get easier with repeated use." Participants spent an average of 8.36 minutes (s.d. 2.88 minutes) using the concept tags plug-in during evaluation sessions, which indicates that a basic familiarity can be obtained in a short time. Moreover, two lecturers strongly disagreed with the statement 'I found the concept tags plug-in frustrating to use' as it was "not at all difficult [to use] once a purpose was established." The others chose '2', one commenting on the "usual minor Moodle frustrations [like] finding blocks/buttons."

Participants liked that the plug-in is "reliable", "simple", and "easy to use." Although one participant found concept tagging to be "an interesting idea", they decided that they "would need more use/familiarity of it to be convinced." In contrast, one participant "likes the ability to be able to link ... core concepts to each resource in order to display such information to [their] student and then they [the student] can develop their level of understanding at their own pace." Dislikes about the plug-in include the "lack of detail", in the form of onscreen instructions and help documentation, and being "unsure about the benefits for students [and] their dislikes." Further improvements need to be made to the tagging interface, for example, the use of the word 'applied' in "Applied concept tags" was found to be confusing as it suggested that this was a category of tags of which another would be "theoretical concept tags." A participant also made the recommendation of a "larger scroll window for [the lists] of tags." In addition, it "would [be easier if the resource or activity were] visible [while tagging]." This lecturer overcame this obstacle by opening the resource in a new tab in the same web browser they were using. Evidently, while improvements need to be made to the interface, teachers only require an understanding of the idea behind and purpose of tagging in order to begin using this plug-in.

Two participants strongly agree that students will benefit from being able to view concept tags and click on them to find all the associated resources and activities. One is neutral and the remaining two chose '4', one because "this creates a very succinct chronological order of learning material for [the students'] understanding", the other that although they agree, it "depends on [the] interface and [the] effort out into tagging by [the] teacher." Although the plug-in calls for extra effort from teachers, where a Moodle course glossary already exists, it can be used to create a list of concept tags that may be altered as required. A participant who tried the 'import concept tags' feature expressed approval at the ease with which a glossary can be used as a starting point for a concept tags list. It was also recognised that tagging "is an excellent means for students to be able to gain assistance when the teaching staff may not be available", which may result in less direct enquiries being made to the teacher about which course modules to use to learn more about which concepts. This needs further investigation however.

Two out of five participants answered '4' to the statement 'I would use the concept tags plug-in in my Moodle course(s)'. One strongly agreed while the other two were 'neutral', a lecturer indicating that they might but that they "would need to know more about the utility of tagging first." After using the concept tags plug-in, no lecturer decided that they would like to use the plug-in in their Moodle course(s) less than they initially indicated. Three out of five participants chose '4' on the Likert scale in response to 'I would recommend the concept tags plug-in to my colleagues' and another strongly agreed; with one indicating that the plug-in provides an "easy way to make material more useful." The other participant was neutral. Since it is clear that three or more participants chose either a '4' or '5' for both statements, the evaluation study shows that the concept tags is a successful idea and should be further developed for future installation in 'real' Moodle systems.

Once participants were informed that the concept tags plug-in is a part of a larger project aimed at ultimately providing adaptive assistance to students, all opinions about the plug-in became positive. The idea that Moodle will keep track of a student's progress on each concept tag and suggest appropriate resources/activities for further study was described as providing "very valuable feedback for [the] teacher [and] worth the extra effort." Given this background information, one lecturer "can see now better the idea behind tagging" and another thought this was "an excellent idea [as the concept tags plug-in and student model together] would become an invaluable tool."

Conclusions and Future Work

Moodle is missing a mechanism that allows teachers to add metadata to their online course resources and activities. The concept tags plug-in allows the 'tagging' of resources and activities with 'concept tags' created, managed and applied to them. An evaluation study showed that concept tagging is a desirable and usable functionality that Moodle lacks. Most notably, the plug-in was described as useful as it would assist "students to enhance their ability to be able to master key concepts... [, e]specially when [the] discipline requires the mastery of its own terminology." This is the concept plug-in's goal: to add a layer of metadata to course content to provide a more structured environment to aid users in the navigation and retrieval of information from course modules. Ultimately, this will allow students to locate and focus on specific content to better understand concepts. The concept tags plug-in is a part of a larger project aimed at adding basic student modelling functionality to Moodle so that it can provide adaptive assistance to students. Moodle will continually keep track of a student's progress on each concept tag and suggest appropriate course modules for further study. Most notably, the concept tags plug-in lacks a "pivot browsing" feature, whereby a tag, resource or user is a vantage point for viewing particular slices of data in the tagging system in order to explore the tag space (Smith

G. , 2008). To maximise the value of concept tagging, the concept tags should be clearly visible as hyperlinks on course module pages. Clicking any concept tag can open a webpage with all the resources tagged with it, allowing the student to focus on that concept for example. In addition, concept tags are currently specific to a course, which means that teachers are not aware of what tags have been used in other courses. This is not a major issue however because it is possible to generate lists of concept tags as a starting point for teachers while maintaining course privacy.

Improvements to the existing plug-in include more onscreen help and instructions. In addition, changes need to be made to some of the terms used in the interface to improve usability and remove some of the confusion. The interface has therefore been redesigned to be simpler and so should be more intuitive to use. Greater value would be obtained if teachers were able to tag specific sections of course modules, making tagging finer-grained. For example, a teacher may decide to tag an overall PowerPoint presentation as well as specific slides in order to better direct students to relevant information. We would like also to look at re-implementing the concept tags plug-in with the FreeTag API for improved reliability and even extending Moodle's tagging infrastructure following the seeking of feedback from the Moodle development community.

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Do Moodle analytics have a role to play in learning design, feedback and assessment?

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Abstract

The project's main aim is to investigate feedback for teaching and learning using analytics via Moodle. Moodle analytics allows institutions to accumulate information which can be used for analyzing students' behaviour within a virtual learning environment (Romero, Ventura, & García, 2008). This information can include records of computer operations in the form of logged data of students' activities. However, students' activities and their e-learning interactions may vary across an institution because of the different ways course spaces are designed between schools/departments. Through Moodle analytics, it would be possible to evaluate students' online behaviour and possibly to explore what this behaviour can tell us about how students learn online and to identify various departmental pedagogical disciplinary practices (Martín-Blas & Serrano-Fernández, 2009). The project focuses on the study of students' activities and its relationship with the design of course spaces in the areas of feedback and assessment and will build on the work of San Diego and McAndrew (2008). Through this project, we will explore the potential of Moodle analytics to provide feedback to tutors about learner activities in relation to the design, structure and content of a module, and also to provide feedback to students on how they use these resources. In order to achieve this, records of learning activities through Moodle analytics need to be translated into a display that teachers can interpret easily and that students can appreciate. Studies around learning activities with Moodle will be conducted across six departments on selected modules with large student numbers.

Keywords

Learning analytics, learning design, pedagogical practices, feedback and assessment

Background

The design of learning activities with Moodle can vary, as can its users, who may interact and engage with learning in various ways. Furthermore, in implementing learning technologies, such as Moodle, the proper use of a tool is not obvious from the design nor is the use entirely conventional, needing to be taught to the learner by the teacher or their peers (van der Veer, 2010). However, learning technologies can be designed to inform learners, in some ways, how they can use the technologies properly through analysing how they use it and also considering the culture of the learner (Daniels, 2010). Learners' use of technology can be captured through analytics. Analytics has emerged as a key driver for business transformation (Kiron et al., 2011) which has been appropriated into the educational space as academic analytics or learning analytics (Long & Siemens, 2011). As the field matures, different types of analytics operate in various educational contexts. Learning analytics, in particular, is now a rapidly growing area of research for technology enhanced learning (TEL) that distinguishes itself through a focus on providing value to the teaching and learning process (Ferguson, 2012). Many kinds of learning analytics are being explored around social Learning Analytics (Ferguson & Buckingham Shum, 2012); feedback and engagement (Trowler and Trowler, 2010); feedback and assessment (Deakin Crick, 2007; Prineas and Cini, 2011). So, it is important to explore how learning analytics can be exploited to provide an alternative assessment system through formative feedback and engagement and its relationship to the learners' context and learning design. This project will explore the potential of Moodle analytics to provide feedback to both the learners and the tutors about learner activities in relation to the design, structure and content of a module, and also to provide feedback to students on how they use these resources.

Sharing of analytics and feedback

The project is at its initial stage so we are taking the opportunity to do some exploratory work that would encourage discussions about our ideas regarding analytics through a workshop and a poster. The poster part will be an interactive format. The poster is designed with 'blank 'sections. The idea is that in the spirit of open academic dialogue, we will benefit from sharing thoughts and ideas with the conference delegates. Delegates who come and listen to our poster presentation will be asked to share their thoughts and help populate the blank sections. The blank sections will consist of headings representing key information we would like to gather (for example: draw us an analytic, feedback useful to teachers, feedback useful to learners, and so on). We will provide some paper and drawing pens. Every now and then, we will analyse the contributions and the 'results' will be presented by reorganising the poster and displaying the results as analytics. By doing this, we hope that the poster will constantly capture dialogue with colleagues and will also attract delegates during breakouts. We will also use social media to gather more contributions through Twitter (hash tag #KEATSAnalytic, KEATS: King's e-learning and teaching service being an acronym of the College's Moodle environment). The workshop part of the presentation will start with a short presentation about the project. Then, the participants of the workshop will be asked to share their views about the question 'Do Moodle analytics have a role to play in learning design, feedback and assessment?' through the results gathered from the delegates' contributions in the poster.

Possible presentation and project outcomes

The outcomes of this presentation will be made available via the project website as a wiki where delegates of the conference can continue to contribute. Ultimately, we would like to be able to provide some insights to the question posed in the title: Do Moodle analytics have a role to play in learning design, feedback and assessment. If there is enough empirical evidence, to speculate what they learn, we will aim to do so. In either case, the investigation above will greatly help in giving a direction to and shaping the outcomes of the project and provide some useful insights to the academic community.

The outcomes above will greatly help in giving a direction to and shaping the outcomes of the project. Our original project planned outcomes are:

Feedback Display's requirements analysis from the data gathered from KCL students and tutor participants. An implemented Feedback Display selected on users' requirements.

Recommendations for further analytics that will be made available via the project website. Some design guidelines on designing course spaces from evaluating the analysis of the results.

Project methods

We believe that conducting the above data gathering and workshop will immensely help the success of the project in conducting that five phases and activities outlined below.

1   **Identification of Feedback Display**. As informed by the contributions from the conference (existing analytics) and using the data from (2) below, examples of Feedback Displays will be designed and will be made available to the students and teachers of the participating course spaces. Their opinions will be collected and a selected few will be interviewed.
2   **Student tracking and collection of logs**. The techniques proposed by San Diego and McAndrew will be employed in capturing learning interactions. These will include automatic recording and tracking of computer actions captured via Moodle (i.e. content visits, participation in activities, discussion forums and other activities that are not directly assessed as part of the student's educational progress).
3   **Implementation of Feedback Display**. The Feedback Display will be modified and refined after analysing students' and teachers' opinion from (1). The resulting Feedback Display will be implemented in order to investigate whether students will appreciate the functionality of the Feedback Display within KEATS.
4   **Evaluation of the usefulness of feedback to teachers and students**. The evaluation of the usefulness will be determined from the data gathered from analytics gained from implementation (3). A survey will be designed from this qualitative information. Then the survey will be given to all the students participating students in all the course spaces.

5   **Specifications of learning design guidelines from the project outcomes**. This phase is exploratory as it is highly likely that the project will come up with some 'learning design' specifications for course spaces development. 'Learning design', in this context, refers to an application of a pedagogical model around the different components of teaching and learning activities (e.g. objectives, methods, context, knowledge) on the levels describing the learning process (e.g. programme, course, module, unit) (San Diego et al., 2008)

Examples of existing feedback analytics and possible feedback display outcome

The following examples are some of the analytics and a learning analytic approach around engagement that we are considering in developing our Feedback Display. We will use this to stimulate discussion during the workshop and the poster presentation.

Engagement as a metric that supersedes previous linear metaphors encompassing the quantitative data of site visits, the qualitative data of surveys and performance, as well as the fuzzy data in between that represents social media. Haven and Vittel (2008) elaborate this as a developmental process through the four key stages of discovery, evaluation, use, and affinity.
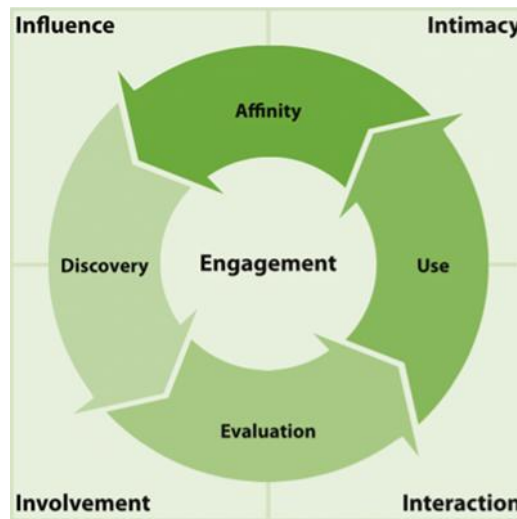

Figure 1: Engagement Model (Haven, 2007)

Involvement describes the presence of a learner within the institution and includes data such as physical or virtual visits. While this is not a key indicator in itself, these activities are critical to make connections with the other components and metrics.
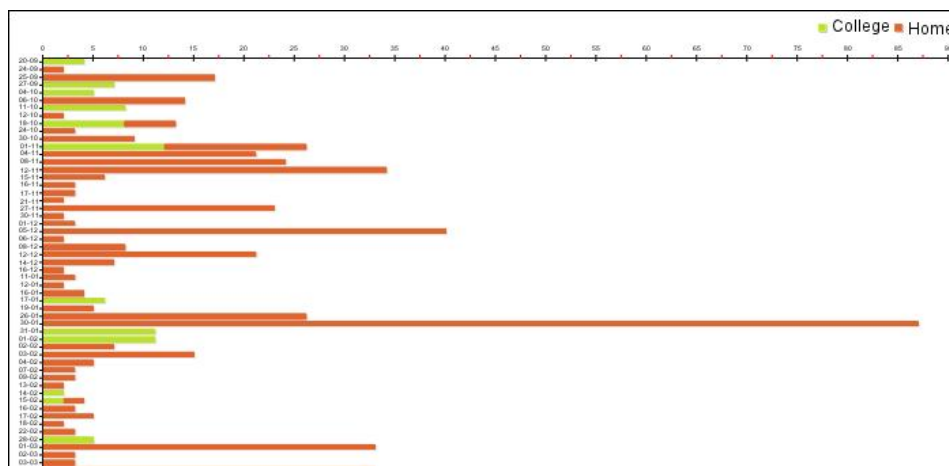
Figure 2: User logs over time

Interaction provides a depth of understanding that involvement does not where development is more dependent on meaningful experience of activity than the particulars of performance. Using a learning design framework, such as Conole's (2007) task type taxonomy offers the opportunity to explore patterns of use where a higher level of interaction should allow the learner to experience a wider range of digital literacies.
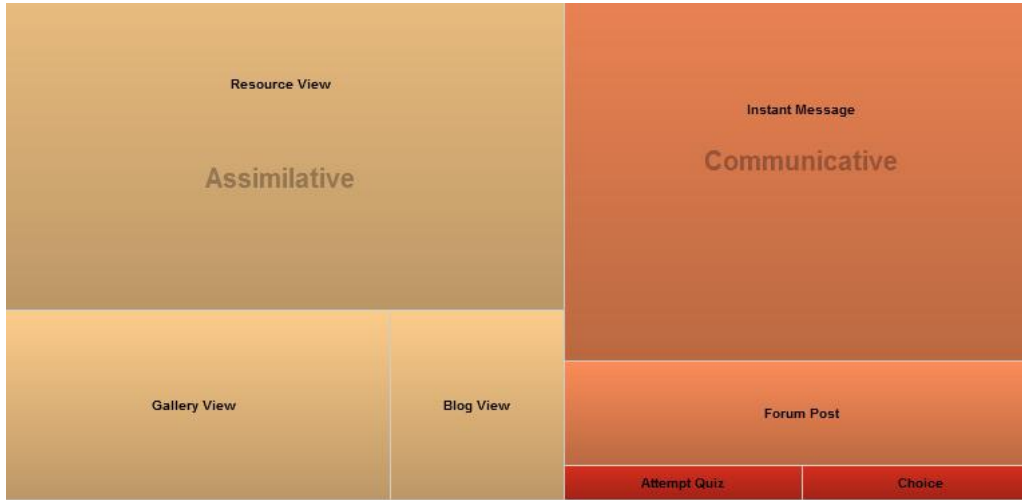
Figure 3: Activity types for a user based on task type taxonomy (Conole, 2007)
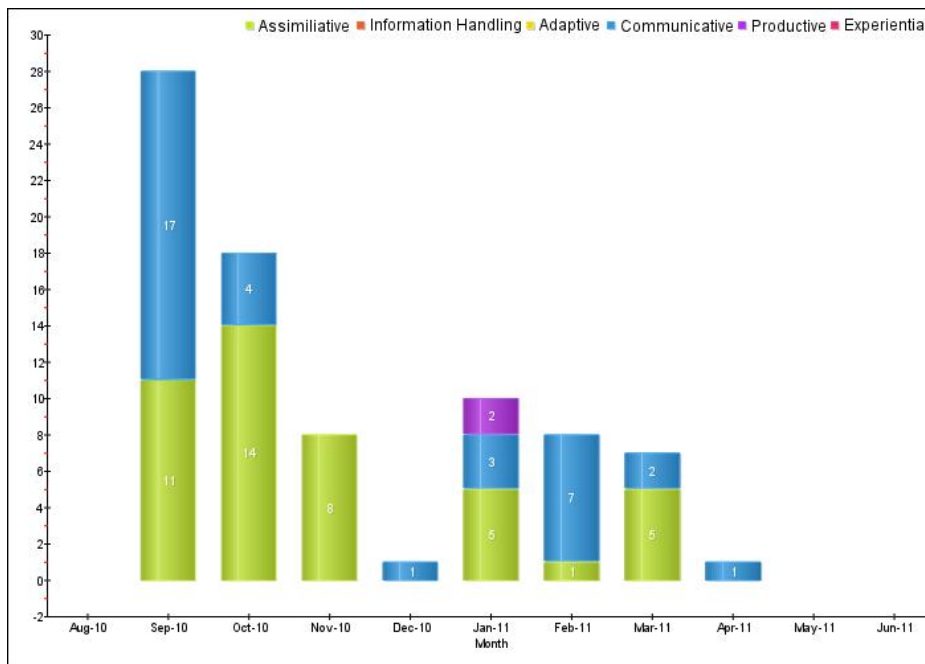
Figure 4: Task types over time

Another example emerges from Lave and Wenger's (1991) community of practice approach which suggests learners must learn to talk, rather than learn from talk. Legitimate peripheral participation may be indentified through learners who are actively engaged in passive tasks but perhaps not contributing as much as others. Understanding whether this represents peripheral participation or disengagement is a key aspect of interaction analysis.
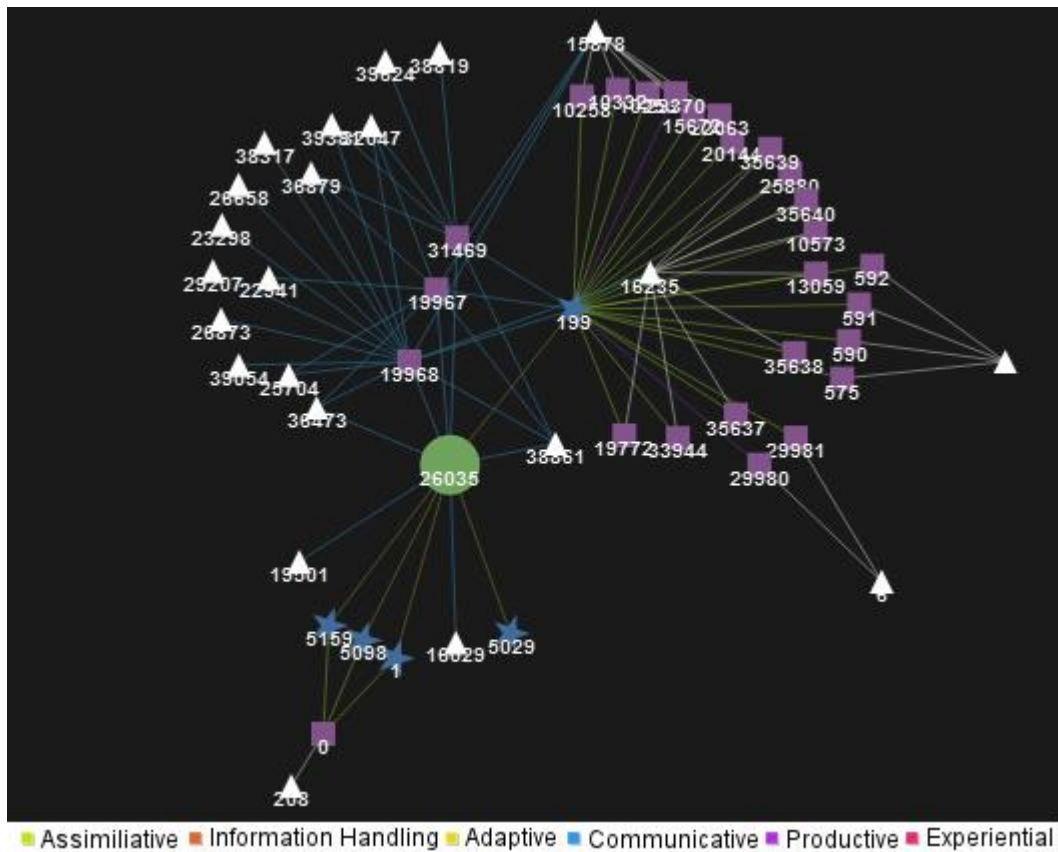
Figure 5: Connectivity map for a user

Intimacy goes beyond interaction to help understand sentiment and or affection. The most common way to collect this type of data is through interviews or surveys. Some examples with high validity include Dweck's (1999) self-theory surveys to identify preferences towards learning or performance goals, the Motivated Strategies for Learning Questionnaire (MSLQ) as a way of understanding metacognitive learning strategies adopted (Pintrich & de Groot, 1990), and the Effective Lifelong Learning Inventory (ELLI) and the understanding of Learning Power (Deakin Crick, 2007).
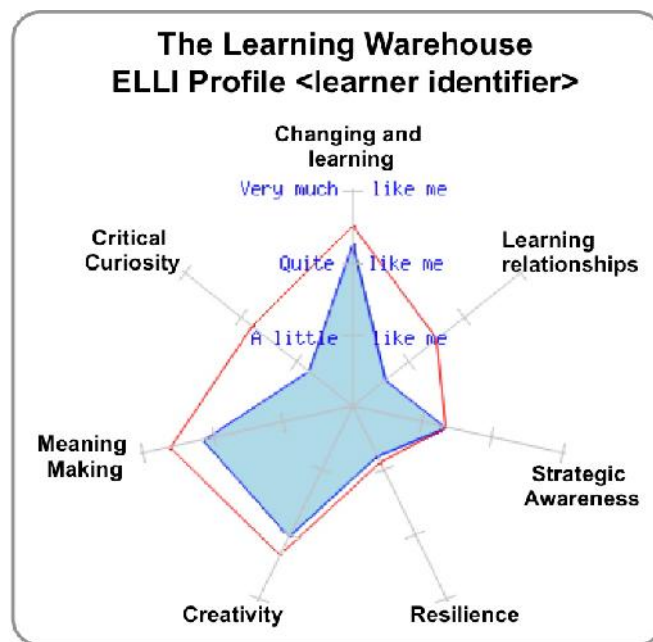
Figure 6: ELLI Profile (Buckingham Shum & Deakin Crick, 2012)

Influence extends beyond sentiment to determine the likelihood of the individual recommending a "brand" to others. Within the context of learning one may look to determine contributions to local culture through action as determined in the 4th quadrant of Harré's (1983) participation pathway. Digital literacies concerned with distributed cognition, collective intelligence, networking, negotiation and visualisation should feature prominently in analysis of this component.
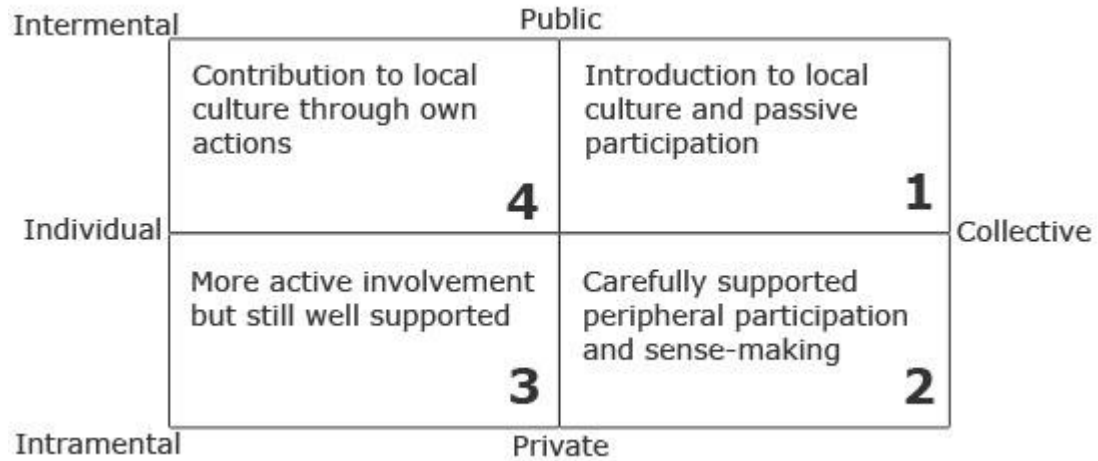
Figure 7: Harre's participation pathway

Where patterns of use can be established it may be possible to replicate and enhance these models. In particular a coding across this site and other sites may empirically identify and establish patterns. Identifying possible factors would provide a necessary step in being to influence identified patterns. This type of visualisation tends to form a course or site dashboard .

Figure 8: Grouping patterns by Moodle course
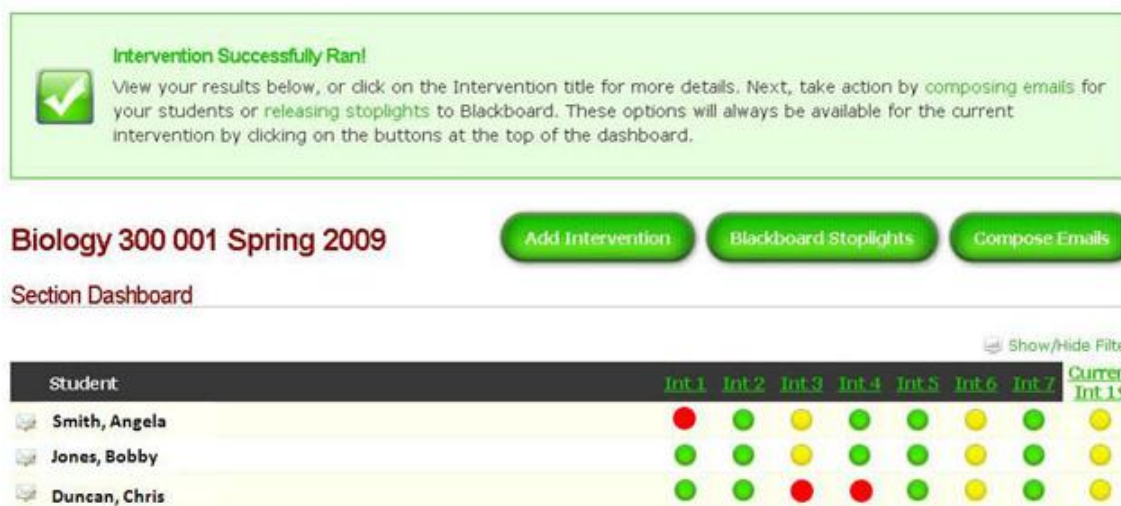
Figure 9: Signals course dashboard (Arnold, 2010)

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Acknowledgements

ELIS – Managing Enterprise Level Learning Programs with Moodle

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Abstract

Moodle as a learning management system does a superior job managing individual courses, their content and the users within them. Enterprise users frequently have needs beyond the course, especially with managing its users in organizational structures into learning programs.

This paper looks at ELIS, an application add-on for Moodle that provides a way to manage Moodle users and courses into targeted learning programs and report on progress in those programs. It will describe the use cases that led to ELIS, the work done to define and build it, the feedback mechanisms to help define the feature roadmap and the process used to build and manage it.

Keywords

Moodle, Enterprise, Reporting, Compliance, Certification

Background

Many of our clients wanted to use Moodle, but found Moodle lacked the tools they wanted to manage large groups of users over the history of their education, and to easily archive and access the educational progress of those users. These clients needed to be able to group courses together to achieve specific larger learning goals. These curricula or learning programs could also have dependencies. Tracking the progress and achievement among these courses is crucial. In corporates and public sectors, this need is frequently part of compliance training and skills certification. Additionally, managing the users in these programs needed to be done in an organizational structure that closely matched the enterprise's structure. And different managerial roles needed to be assigned within these structures.

What became ELIS, originally started out as a project to provide an on-line university with the ability to manage its courses in curricula, and manage its users in the system in clusters. Reporting was also needed to provide transcript-like reports and curriculum progress reports.

Moodle has many third-party plug-ins available. Reviewing all of the known add-ons available, revealed none that could provide curriculum-like management within Moodle. There were commercial student management systems and CRM's that could provide similar functionality. The possibility of developing integration layers between Moodle and those systems was explored, but the costs of the commercial systems and the efforts to maintain any developed integration layers proved prohibitive. Also, there were other LMS systems that had this functionality native or available to be added, but these again were high-priced commercial systems and would not meet the base cost criteria. And since one of the key goals was to keep the solution in the Open-source world, closed, commercial systems were ruled out. As such, a project to develop the functionality as a series of Moodle add-ons was created.

It also became apparent that many of our corporate clients had a need for similar functionality in order to meet their various compliance and certification needs within their organizations or for the organizations they were responsible to monitor (in the case of governing boards). A project was setup to expand the curriculum and cluster system built for the on-line university into ELIS – Enterprise Learning Intelligence System.

The continuous evolution and development of ELIS was and is managed through continuous "in-production" research using key "anchor" clients, who represent the broadest coverage of Moodle with ELIS use cases.

ELIS General Concepts and Structures

Addressing the basic requirements defined above, we organized the basic structure of ELIS into six essential structures:

- Course Description (previously, "Course")
- Class Instance (previously, "Class")
- Program (previously, "Curriculum")
- Track
- Learning Objective (previously, "Completion Element")
- User Set (previously, "Cluster")

In earlier versions of ELIS, the "previous" terms noted above in brackets were used. This document uses the newer terms as much as possible, although the older terms may appear in some places, particularly imagery.

The following diagram shows the relationships of course descriptions, class instances, programs and tracks:
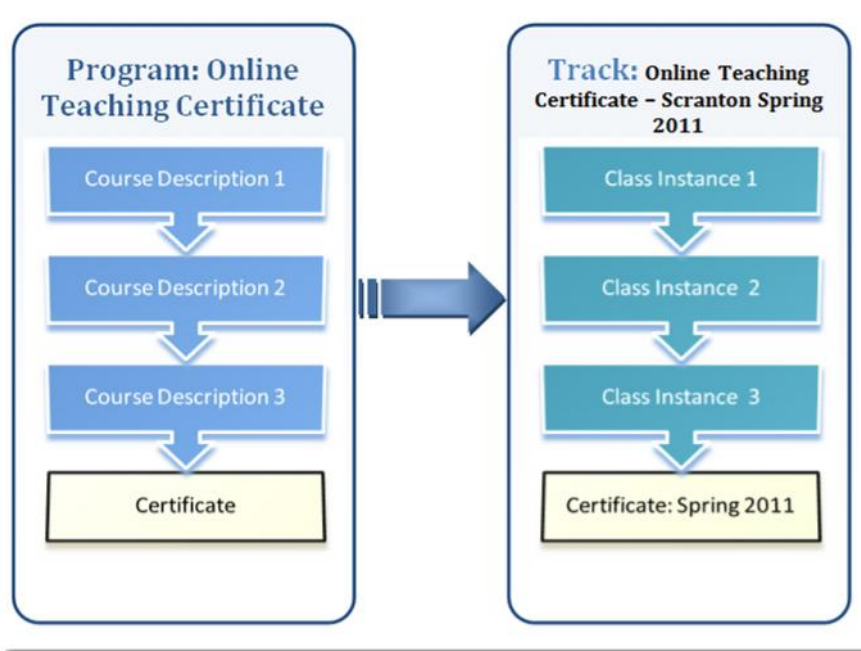
Figure 1: Learning Program Relationships

Course Descriptions

Course descriptions define the meta-data, credits, duration, and learning objectives for a course of study. This is a software implementation of the course descriptions that are frequently published in course catalogues or listings of required compliance, skill, or competency courses. Users are not enrolled in course descriptions. They are enrolled in class instances, which are created from course descriptions.

Standard Moodle forms were developed to facilitate the entry of all course description information such as name, code, description, number of credits and required grade. Course descriptions can be linked to a Moodle template course for automatic creation of Moodle courses when class instances are created from the course description.

Figure 2: Course Description Data

Class Instances

Class instances are instances of course descriptions. Students are enrolled, and results are recorded and stored in these. Class instances can be associated or connected with Moodle courses, or can be a record keeping and reporting tool for face-to-face courses which have no online component. A class instance can also have elements from a Moodle course and have elements recorded manually from face-to-face meetings or other external events, providing support for blended learning.

Standard forms were created to facilitate the manual creation of class instances from their course templates. The additional information, such as start and end date and maximum number of students can be entered at the same form. Once created, extra data is then available to be added and edited on the class instance. This includes connecting the class instance to an existing Moodle course, by selecting it from a drop-down. This connection, facilitates the automatic data exchange from ELIS to Moodle and vice-versa.

Figure 3: Class Instance Data

Enrolments can also be managed. An enrolment record consists of a user and their progress information – completion time, completion status, grade, credits and the status of any learning objectives. While a class

instance is connected to a Moodle course, users can be automatically enrolled into the Moodle course from ELIS, or in a Moodle-centric setup, users can be enrolled in the ELIS class from the Moodle course. Any connected grade information, such as Moodle grade elements with a matching id code to an ELIS learning objective, are automatically synchronized. The key to ELIS is that this class instance information can be kept independently of the future existence of the connected Moodle course.

Figure 4: Class Enrolment and Learning Objective Data

Programs

A program in ELIS is a series or group of course descriptions. They are a set of linked courses used to track specific learning goals. For instance, a student might have to complete a series of courses to get a certificate, to demonstrate their competency for a job, or to maintain their certification on a critical skill. Programs are used to define these series, independently of date or a particular set of users.

Forms were created to allow for creation of programs. At its basic level, a program has a name, id code, description and the required credits for completion. It also contains one or more course descriptions, each defining whether it is required for completion, the position to display in and frequency information. Programs allow for reports to track progress of the users assigned to them.

Figure 5: Program Data

Tracks

A track is a given instance of a program - a set of class instances that are given a particular schedule, with a particular set of users. Tracks are used to manage enrollments, start and end times, reports, etc. Wherever it is required that a group of users take a particular program of study, a track is quick way to create classes and manage enrollments for that program.

One of the strong functions of tracks are their use in automation. When a track is created from a program, the program has all of the course descriptions defined. Each of those course descriptions can have Moodle course templates assigned to them. When the track is created, a "create all classes" option is available. When this is used, all of the ELIS classes can be created for that track automatically. Additionally, any Moodle courses can be created from course descriptions with defined Moodle course templates, and connected to the ELIS classes. Further, any users assigned to the program, or to the track, can then be automatically enrolled in the ELIS classes and the Moodle classes.

Figure 6: Track Data

Learning Objectives

Learning objectives operate at the ELIS course description level as a method for assessing learner competencies, the key concepts or ideas that learners should take away from a course. They exist outside and above the Moodle course content level, at the ELIS course description level. Learning objectives can define required activity in a course needed for a student to be considered complete. How those objectives are met can be defined in the class instances themselves. For example, at the Moodle level one instructor might decide that a particular learning objective for the course would be met by a quiz, while another might decide it is met by a series of assignments. Learning objectives become part of all class instances, and can be manually managed with a class instance enrolment record. This facilitates recording of non-Moodle classes as well.

Learning objectives can be defined for each course description using a Moodle form. If a course description has a defined Moodle course template, then the learning objective can be easily linked to a Moodle grade item using the browse feature to look at that Moodle course's grade items.

Figure 7: Learning Objective Data

The learning objective data is permanently stored with a user's enrolment record in ELIS, even if the associated Moodle course is removed later.

User Sets

User sets are flexible site level groupings of users. They can be used to set up hierarchies of users, such as the organizational structure of an enterprise organization. These hierarchies can be role and permission based, allowing specific users to be assigned reporting, managing and other administrative duties over selected sets of users by defining roles at appropriate context levels. User sets also facilitate the management of groups of users through programs, providing easy methods to enrol groups into appropriate courses and programs.
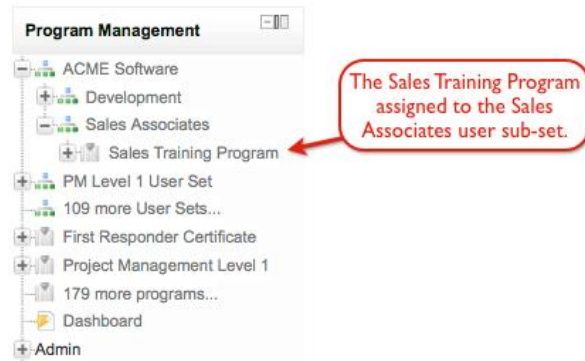
Figure 8: User Set Hierarchy

User sets can be used to automate movement of users through the learning program by assigning to programs, tracks and classes. Users can be automatically assigned to user sets using profile data settings. And, user sets can be automatically associated with Moodle groups and groupings in Moodle courses. The data for user sets can be managed using Moodle forms.

Figure 9: User Set Data

ELIS Evolution

Moodle is key to ELIS. We chose to develop ELIS using Moodle's API's and structures for several reasons:

- We were already "experts" in the platform, so no learning curve.
- Moodle is the central component to delivering the learning of the system.
- As Moodle evolves, functionality that ELIS provides is occasionally adopted into Moodle, allowing ELIS to migrate that function away.
- Releasing ELIS as open-source, provided the community as potential enhancers.

There were and are problems to deal with by using Moodle's API's:
- Changes "under the hood" to Moodle, that don't affect users, can greatly affect development (2.2 capabilities model).
- ELIS development lagging behind Moodle releases.
- Management of multiple releases.

ELIS Generation One

The early releases of ELIS focused on learning programs and reports. Structurally, ELIS code was built in a separate directory below the Moodle home directory, and managed with a block plug-in. Minimal core changes were done in order to keep the code management process as simplified as possible.

The initial release had all of the previously defined structures with basic functionality built around them. The first releases of ELIS, required much of the data to be entered manually. The focus was on getting a working learning program set up, and then allowing the reporting to do what was necessary. Users were manually entered into user sets, classes were entered into tracks, connections were made to Moodle courses and learning objectives were connected – all from the UI.

For this generation, ELIS was integrated with an external business intelligence and reporting engine, Jasper. Jasper had an open-source, Java based application that provided interfaces to other applications. A number of "canned" reports were created to distribute with ELIS, that would report on the most commonly asked for data.

ELIS Generation Two

After several months of piloting the first releases of ELIS, the "anchor" clients were interviewed to learn their experiences, and determine what needed to change. The three biggest issues were the complexity of setting up the system, the amount of manual labour to integrate with large amounts of enterprise data and the difficulty configuring the reports to their specific needs.

To address setup complexity issues, we added training programs, user manuals, integration applications and more automation. The integration and automation additions also helped to solve the manual labour issues with large amounts of data. For reporting issues, a new reporting engine was built and released.

Automation

One of the largest improvements to ELIS was adding more management tools around user sets. Typically, in a large organization, users were managed into learning paths in defined groups. User sets made sense to do the same. And, in these organizations, there was usually data that defined what user sets users should be in.

ELIS already had the ability to move users into programs and classes by assigning them to user sets, and then assigning those user sets to tracks and classes. We created automatic ways to add users to user sets through the manipulation of user profile data. Essentially a user set could be configured to add all users who had certain profile data fields set to specific data. When a user's profile data became that value, they were automatically assigned to the user set. If that user set was already assigned to tracks or classes, then the user would be enrolled in those classes. This allowed user sets and learning programs to be managed using profile data settings.

Once this function existed, it then became easier to create new methods of managing profile data, so that the process could become more automatic. Using integration points, enterprise data could be imported into ELIS/Moodle through a variety of conduits (web services, text upload). If this data contained profile data, changing the data allowed for automated movement through the system.

Other automation that was added was the auto-creation of ELIS and Moodle classes through the track elements. By linking course descriptions to specific Moodle course "templates", when class instances are created from those course descriptions, ELIS can use Moodle's backup and restore functions to create new Moodle courses and ELIS classes and link them together. When tracks are created from programs, this can automatically create whole new series of classes and enrolments using this method.

Reporting

Although Jasper provided a flexible business intelligence engine, allowing users to create and manage their own reports, it had a very steep learning curve. It also wasn't easy to theme, making it difficult to create a unique looking report for each client. It became apparent that most clients simply wanted ready-made reports that looked like their sites.

While not abandoning the Jasper integration, we set it aside to build a flexible PHP-based report engine that would allow us to build reports easily to clients' requests. This required programming, but most of our clients didn't want to build their own reports – they simply wanted them to be available easily.

ELIS Generation Three

The latest incarnations of ELIS, along with being built on the Moodle 2 technology, contain even more automation and more integration options.

We have built a results engine into ELIS, that allows for learning paths to be defined adaptively, based on progress through other classes and learning objectives. The results engine lets you define a goal based on an ELIS learning objective or class grade. When the goal is achieved, actions can be defined to enrol the user in a specified track, enrol the user in a specified class and/or set a specific profile data field to a specific value. This means that learning programs can be set up to drive users into other programs or tracks based on their results in a course or activity. And data can be set to use in reports or other possibilities.

The next generation of ELIS integration point has been developed to allow import and export from more external systems in a pluggable way. This system allows for user, progress, enrolment and other data to be easily exchanged with ELIS and Moodle. The system is pluggable, meaning that conduits can be defined and developed for multiple external systems using multiple data methods.

ELIS Development, Management and Distribution Process

One of the biggest problems managing the development of ELIS, is maintaining it to the current versions of Moodle. While Moodle strives to be supportive of the external developers as well as its users, out of necessity its users come first. This means that occasionally, a release changes something fundamental under the hood that impacts the way ELIS was written, even though it does not visibly affect the user experience (except maybe to improve performance. We also have to be careful of any core changes to Moodle made to support some of the features of ELIS. And there is simply integrating in the latest maintenance releases of Moodle.

To do this, we have adopted similar processes to Moodle HQ. We maintain our own git-based repositories that draw from the main Moodle repositories as well as our own. We also export just the ELIS portions of the code to a community repository located on Github. The repository setup has allowed us to create a release and distribution process that automates (as much as possible) the integration of all of the code bases.

We have spent a great deal of time creating unit tests in all of the ELIS code. We have also created a large library of user tests, based on use cases, for all of the ELIS functionality. These tests allow us to more easily discover problems when integrating in new Moodle releases. These tests have allowed us to cut down our testing time from months a couple of years ago to less than a week now. We are also in the process of automating our user tests using Selenium-based automated testing.

Lastly, we have based our entire development process on Agile/Scrum processes. Like Moodle, we use JIRA and its agile tools to manage our development releases into sprints. This process has allowed us to maintain schedule by breaking features down into smaller, easier projects. This process has reduced the stress on the presonnel, allowing them to see frequent successes rather than constant delays and failures.

ELIS Future

Our goal is to add more learning program automation, and more adaptive learning features. We are designing more dashboard style interfaces, ideally that fit into the My Moodle interface, that will help users and administrators manage their way through their programs. And, we want the dashboard to have more on demand reporting.

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GLUE! - GLUE!-PS: An approach to deploy non-trivial collaborative learning situations that require the integration of external tools in VLEs

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Abstract

The deployment of non-trivial collaborative learning situations in VLEs is a burdensome and error-prone process for teachers, especially as the number of participants, groups, tools and activities grows. Besides, this deployment frequently suffers from the limited set of VLE built-in tools teachers can select to support learning activities. GLUE! and GLUE!-PS are two alternative routes for the deployment of collaborative learning situations that respectively tackle the integration of multiple external tools in multiple VLEs, and the deployment of abstract learning designs generated within multiple authoring tools in multiple VLEs. This paper discusses how the GLUE! - GLUE!-PS partnership represents a deployment route that overcomes both the two aforementioned limitations, when deploying in VLEs non-trivial collaborative learning situations that require the integration of external tools. An authentic, though somewhat complex collaborative situation deployed in Moodle illustrates the benefits of the GLUE! - GLUE!-PS approach. Higher education teachers that deployed this situation in Moodle as part of a professional development workshop highlighted that this approach allows an efficient deployment, and emphasized the benefit of reusing learning designs in other courses and VLEs.

Keywords

Deployment, collaboration, integration, learning design, GLUE!, GLUE!-PS, Moodle, VLEs.

Introduction

Virtual Learning Environments (VLEs), also referred to as Learning Management Systems (LMSs), have been mainstream for a while now, especially for distance and blended learning, both in academia and industry (Dillenbourg et al., 2002). Moodle is currently the most popular VLE with more than 65,000 registered sites worldwide as of this writing[1]; other widely adopted VLEs are Sakai or Blackboard.

Teachers play a central role in VLEs, providing learners with adequate resources aimed at meeting the learning objectives and developing intended knowledge and skills (Matsubara et al., 1997). To do so, teachers typically define a structure of activities supported by certain resources (e.g. a website, a static PDF file) and VLE built-in tools (e.g. a quiz about the content of the PDF file). Some of these built-in tools particularly foster the communication and groupwork among learners (e.g. chats, forums). Besides, most VLEs also enable the definition of groups of learners to collaboratively accomplish the learning activities, thus making them suitable for the deployment and enactment of computer-supported collaborative learning (CSCL, see Stahl et al., 2006) situations.

Nevertheless, there are two limitations that significantly hinder the deployment of CSCL situations in VLEs. The first one is the **limited set of built-in tools** included in VLEs to support learning activities (Bower et al., 2011); as an example, Moodle 2.2 only includes 14 tools in its default distribution. Some research efforts are striving to increase the number of tools teachers can choose from by integrating third-party external tools in VLEs using different approaches (Wilson et al., 2008; De-la-Fuente-Valentín et al., 2011). For example, there exist *ad hoc* plugins integrating external tools in Moodle[2]. However, developing these plugins demands a significant effort that can barely be reused for other VLEs or tools. Another example is Apache Wookie (Wilson

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1 http://moodle.org/stats. Last visited: May 2012.
2 http://moodle.org/plugins. Last visited: May 2012.

et al., 2008), which promotes the generic integration of W3C widgets (World Wide Web Consortium, 2011) in VLEs. Nevertheless, only those tools that meet the W3C widgets specification can be integrated through this approach, thus precluding many existing and popular tools from being integrated. IMS LTI (IMS GLC 2011) is a generic integration specification that has been adopted by several major VLEs like Moodle, although not many tool providers currently comply with it[3], mainly due to the high development effort required to make tools meet this specification. A subset of IMS LTI, called Basic LTI, which promotes the loosely-coupled integration of tools with a lower development effort, has gained a certain degree of adoption among VLE providers. However, Basic LTI only defines how external tools should be accessed by students using VLEs, but not how these tools should be managed by teachers in the deployment of collaborative activities. That management normally entails the creation and configuration of different external tool instances (e.g. one shared document) for each group of learners, which is a particularly cumbersome task when deploying activities that involve multiple groups.

The GLUE! (Group Learning Uniform Environment) architecture (Alario-Hoyos et al., submitted; Alario-Hoyos et al., 2010) enables the lightweight integration of external tools in VLEs, supporting both individual and collaborative activities. GLUE! imposes few and widespread restrictions on VLE and tool providers, and facilitates the management (and access) of external tools within the VLE interface. Besides, GLUE! is designed to be extended by third-party developers, who may integrate new tools and VLEs. The current implementation of GLUE! has already been used in authentic educational scenarios to integrate different external tools like Google Presentations or W3C widgets in VLEs and other platforms, such as Moodle or LAMS[4].

The second limitation is the **heavy burden that deploying non-trivial collaborative learning designs in VLEs implies for teachers**, especially those complex designs with a high number of groups, activities and tools. In CSCL, it is common to structure the activities intended for learners at multiple social levels with changing group sizes and composition. The discipline of Learning Design (LD, see Koper et al., 2005) has studied for years how to formalize the structuring of groups and activities in a reusable and pedagogically explicit way, producing authoring tools like CompendiumLD[5] or Collage (see Hernández-Leo et al., 2006) and specifications like IMS-LD (see IMS GLC, 2003) for describing learning designs. The compliance with authoring tools and specifications would allow teachers to express and share their learning designs, and to deploy them semi-automatically in VLEs. However, despite some efforts to make VLEs compliant with IMS-LD (Berggren et al., 2005), currently there is no easy way to deploy teachers' learning designs (collaborative or not) in major VLEs like Moodle, apart from manually creating and configuring all the groups, activities and tools involved, which is a time-consuming and error-prone process. LAMS is an exception to this, providing an integrated environment to design, deploy and enact CSCL situations (Dalziel, 2007), although these designs cannot generally be deployed in other VLEs.

GLUE!-PS (GLUE!-Pedagogical Scripting, see Prieto et al., 2011) is a service architecture that aims at bridging this deployment gap between LD authoring tools (and specifications) and VLEs. By using an underlying common data model with the most common LD and VLE concepts (Prieto et al., 2011), GLUE!-PS allows to translate, for instance, a complex collaborative learning design expressed in IMS-LD, to Moodle concepts like topics, activities, groups and groupings[6]. These translated designs can then be deployed automatically in the VLE, e.g. as part of a Moodle course. When used together with the aforementioned GLUE! architecture, these designs cannot only include built-in tools, but also external tools, all configured and ready to be enacted in the classroom. This automation of the deployment process from multiple authoring tools to multiple VLEs aims at facilitating the adoption of this approach, since it is not tied to particular tools, and may favour an efficient (and time-saving) deployment of non-trivial CSCL situations.

This paper shows how non-trivial CSCL situations that require the integration of external tools can leverage the advantages of the GLUE! - GLUE!-PS partnership. An authentic CSCL situation that is intended to be deployed in Moodle serves as an illustrative example. University-level teachers from multiple disciplines deployed this situation using GLUE! and GLUE!-PS in a professional development workshop, with encouraging results.

The next section discusses the deployment of CSCL situations, first using only GLUE!, then using GLUE!-PS alone, and finally using the GLUE! - GLUE!-PS partnership (the main novel contribution of this paper). Then, first evidences of the usefulness of this combined approach are presented, including the illustrative collaborative

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3 http://imsglobal.org/cc/statuschart.cfm. Last visited: May 2012.
4 http://lamsinternational.com. Last visited: May 2012.
5 http://compendiumld.open.ac.uk. Last visited: May 2012.
6 http://docs.moodle.org/22/en/Groupings. Last visited: May 2012.

learning situation and evidences collected from teachers that actually deployed this situation. The paper concludes with remarks of the relevance of this approach and future research directions along this line of work.

Deployment of CSCL situations using GLUE! and GLUE!-PS

GLUE! and GLUE!-PS are two alternative routes that allow the deployment of CSCL situations in VLEs, with different design goals. While GLUE! aims at increasing the set of tools teachers may select when deploying these situations, GLUE!-PS aims at facilitating the management of structures of groups, activities, resources and tools to be deployed in VLE courses or lessons. Thus, GLUE! and GLUE!-PS can be combined to facilitate the deployment in VLEs of non-trivial CSCL situations that require the integration of external tools.

Deployment using GLUE!

Figure 1 (circle labeled 'A') shows the GLUE! architecture and the elements involved in the GLUE!-mediated deployment of CSCL situations that require the integration of external tools in VLEs. GLUE! is a three-tier, loosely-coupled architecture composed by an intermediate layer (*GLUElet Manager*), and two sets of adapters (Gamma et al., 1995) for VLEs and tools (*GLUE! VLE adapters* and *tool adapters*). These adapters wrap existing VLEs and tools and make them interoperable with the integration contracts defined by the GLUElet Manager (Alario-Hoyos et al., submitted). These contracts aim at overcoming the limitations of previous tool integration approaches (Alario-Hoyos et al., 2010) by imposing few and widespread restrictions to VLEs and tools, and reducing the development effort, due to the definition of popular loosely-coupled technologies (e.g. these contract interfaces follow a RESTful approach, see Richardson, 2007). Besides, this architecture fosters the many-to-many integration of VLEs and tools, insofar as the development of a new VLE adapter automatically enables the integration of the available external tools in the corresponding VLE, and vice versa.
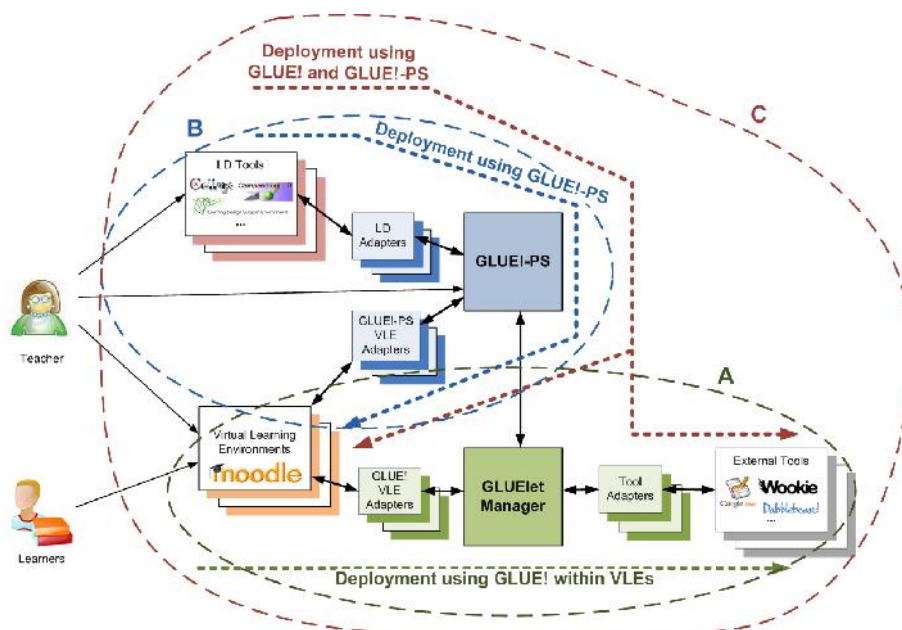
Figure 1: Deployment in VLEs using: A) GLUE!; B) GLUE!-PS; C) GLUE! and GLUE!-PS.

The elements of GLUE! are designed to provide the functionality to manage the life cycle of external tools (Gómez-Sánchez et al., 2009), which includes the *creation*, *configuration*, *retrieval*, *deletion* and *update* of external tool instances. This life cycle can be combined with the native features of VLEs, so that teachers can request the creation and management of instances in a way that every VLE group automatically receives its own shared instance in each activity. The support of these operations enables teachers to seamlessly design and deploy CSCL situations that require the integration of external tools within the VLE graphical interface.

The GLUElet Manager, three GLUE! VLE adapters and nine tool adapters have been already implemented as of this writing (see http://gsic.uva.es/glue for further details). Thus, in its current state, GLUE! enables the deployment of CSCL situations that require the integration of external tools such as Doodle, Google Spreadsheets or Kaltura in VLEs and learning platforms like Moodle, LAMS or MediaWiki.

Deployment using GLUE!-PS

Figure 1 (circle labeled 'B') depicts the GLUE!-PS-mediated route to deploy non-trivial CSCL situations in VLEs. GLUE!-PS (Prieto et al., 2011) is the main element of another three-tier service-oriented architecture that enables the automatic deployment of learning designs generated with multiple authoring tools and LD languages in multiple VLEs. This three-tier architecture is formed by *GLUE!-PS* as a central component, and two sets of adapters: *LD adapters* (which translate from authoring tools or LD languages to a common data model used as a sort of *lingua franca*) and *GLUE!-PS VLE adapters* (which deploy the translated learning designs into VLEs). Thus, the same learning design may be deployed, thanks to GLUE!-PS, in different courses and lessons in the same VLE, and even in different VLEs, what makes GLUE!-PS an advisable alternative for those teachers interested in sharing abstract learning designs, no matter the VLE they normally use.

Through the GLUE!-PS graphical interface, learning designs coming from authoring tools and LD languages may be particularized, modified or extended to include concrete information about groups, activities and resources. In this regard, GLUE!-PS can overcome some limitations of authoring tools and LD languages. For instance, the designs generated with authoring tools that do not consider the concept of groups (e.g. the Pedagogical Pattern Collector[7]) can be extended using GLUE!-PS in order to include a certain group structure. Before deploying a learning design in a particular VLE, GLUE!-PS can import (through the corresponding GLUE!-PS VLE adapter) the list of participants registered in a certain course or lesson, as well as the list of built-in tools provided by such VLE, allowing teachers to populate the groups and select the specific tools supporting each learning activity.

As of this writing, the GLUE!-PS prototype includes two LD adapters (one of them for the most widely used LD specification, IMS-LD) and two GLUE!-PS VLE adapters. This limited implementation already enables at least 4 different deployment routes, from WebCollage[8] (or other IMS-LD Level A compliant authoring tool) and the Pedagogical Pattern Collector, into Moodle and MediaWiki.

Deployment using GLUE! and GLUE!-PS

Figure 1 (circle labeled 'C') shows a third possibility: the approach that combines both GLUE! and GLUE!-PS to deploy non-trivial CSCL situations that also require the integration of external tools. Here, when teachers set the tools intended to support the learning activities within the GLUE!-PS interface, they may select any VLE built-in tool, but also any external tool integrated through the GLUE! architecture. The deployment of learning designs in VLEs is then done in a similar way as if using GLUE!-PS alone, although in this case VLE users that enact the learning activities can access both the built-in and the external tools selected by the teacher.

The interoperability between GLUE! and GLUE!-PS is achieved because the latter meets the contract defined by the GLUElet Manager for VLE adapters, being GLUE!-PS also able to request the creation, configuration and management of external tool instances. Thus, the GLUE! - GLUE!-PS partnership allows the deployment *in multiple VLEs* of learning designs created *with multiple authoring tools* and *LD languages*, and that include *multiple external tools*.

Validation of the deployment of a CSCL situation in Moodle using GLUE! and GLUE!-PS

A non-trivial CSCL situation, intended to be deployed in Moodle, illustrates the two limitations mentioned throughout this paper (i.e. the need for integrating external tools, and the cumbersome deployment process for teachers). Real higher education teachers have designed, particularized and deployed this situation in Moodle as part of a professional development workshop.

An authentic CSCL situation

The teacher of Research Methodology, a master-level degree course on research about Information and Communication Technologies (ICTs) at the University of Valladolid (Spain), wants to conduct a CSCL situation to get students to improve their skills to search for reliable information in a critical manner, produce well-structured written reports and work in teams. In order to achieve these learning objectives, the students participating in this course must discuss with their partners the typical structure of a research paper on ICT, and also agree on the ten main references on this research field.

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7 http://tinyurl.com/ppcollector3. Last visited: May 2012.
8 http://gsic.uva.es/webcollage. Last visited: May 2012.

This situation has a blended learning format, with three face-to-face hours (in two different sessions) and another four hours of on-line work (equally distributed before and after the first face-to-face session). During the situation, students should enact four collaborative activities (two face-to-face and two on-line). These activities are arranged following a collaborative learning flow pattern (CLFP, see Hernández-Leo et al., 2006), called *Pyramid*. The Pyramid pattern fosters reaching a consensus solution to one complex, open-ended problem (i.e. to agree on the typical structure of a research paper and the top ten references), with students working in groups of increasing size. In this CSCL situation the four activities are organized in a three-level Pyramid, as depicted in Figure 2. This figure also represents the resources and tools supporting the activities (i.e. a paper provided by the teacher, a collaborative text editor and a collaborative drawing tool), and the group structure exemplified for a 12-student class. Interestingly, in three of these activities some of the outcomes from previous activities need to be reused (e.g. in the last level, drawings from the second activity are used as material for the debate).
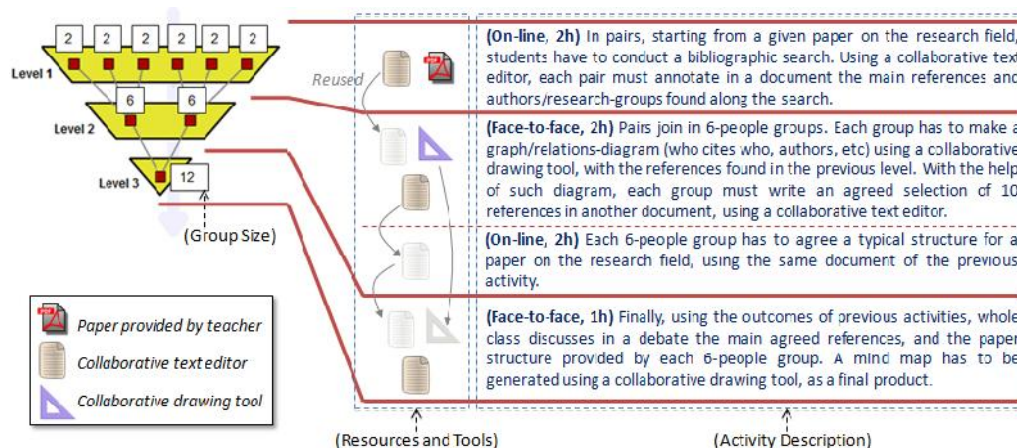

Figure 2: Structure of the collaborative learning situation.

This CSCL situation is to be deployed in a VLE to facilitate the structuring of activities and the sharing of resources and tools in a blended learning context. In this case, Moodle is chosen, since this is the University of Valladolid's institutional platform, and students are already registered in the corresponding course. Moodle provides some built-in tools that may be of help to support collaborative activities (i.e. the paper provided by the teacher can be added as a Moodle resource). However, Moodle does not include drawing tools, and the built-in collaborative text editors (Moodle's wiki and online text) offer a very limited functionality. Also, the teacher might prefer a popular tool, rather than Moodle built-in tools to reduce the cognitive barrier (for students and for himself). Thus, the deployment of this situation in Moodle suffers from the *restricted set of built-in tools*, and so, some way of integrating external tools is needed. The teacher might accomplish this integration manually (i.e. creating instances of each external tool using its own interface, copying and pasting the instance locations to Moodle activities, and assigning these activities to the corresponding groups/groupings), but that is a very time-consuming and error-prone process, especially when a large number of groups and tools are involved.

For illustrative purposes 12 students are included in the Pyramid (see Figure 2), with six pairs forming the first level, two 6-people groups in the second level and one whole-class group in the third. Nevertheless, there is no restriction on the actual number of students that may enact this CSCL situation. This kind of group arrangement requires a non-trivial structure of Moodle groups (for the first level) and Moodle groupings (for the second and third levels). Moodle enables the creation of a particular shared instance of its built-in tools for each group in one single Moodle activity. However, a different Moodle activity must be created to obtain equivalent results in the case of groupings. Therefore, the deployment of this situation in Moodle also suffers from the *heavy burden demanded to the teacher*. Remarkably, this burden increases as the number of participants does. Therefore, it would be desirable to have some way of facilitating this deployment.

Deployment using GLUE! and GLUE!-PS in Moodle

The GLUE! - GLUE!-PS partnership can be employed to deploy this CSCL situation in Moodle, overcoming the two limitations detected above. The teacher can choose either integrated external tools through GLUE! or Moodle built-in tools (as usual). Both built-in and external tools can be selected within the VLE interface or within the GLUE!-PS interface. Once the design is deployed, teachers might also add new tools through the

VLE interface. Among all the available external tools, the collaborative text editor *Google Documents*, and the collaborative drawing tool *Dabbleboard* fit the teacher's needs for this situation.

Besides, the use of GLUE! offers several interesting features for the deployment of this situation. GLUE! enables the individual configuration of each external tool instance. Thus, teachers may, for example, upload templates to Google Documents when selecting this tool, in order to e.g. establish the format in which the references should be noted. GLUE! also allows the update of users sharing instances in a way that teachers may modify the group members once the designed is deployed to adapt it, for instance, to some students' absences.

Thanks to GLUE!-PS, this non-trivial CSCL situation can be formalized using an authoring tool, being afterwards particularized and deployed in Moodle. For example, WebCollage is an authoring tool that supports the definition of learning designs using best practices in the form of CLFPs (such as the *Pyramid* considered here). This authoring tool enables the definition of the group structure, the set of activities, and the learning objectives. Once the activities, groups and objectives are defined in WebCollage, they can be particularized for the concrete Moodle users enrolled in the course in which the design is to be deployed.

GLUE!-PS can retrieve the users of this Moodle course, as well as the list of Moodle built-in tools and the external tools integrated through GLUE!. Using the GLUE!-PS interface or even the WebCollage interface (since GLUE!-PS acts as a service offering this data for other tools to take) the teacher can populate the groups, as defined in Figure 2, adding also Google Documents and Dabbleboard to the learning activities. Significantly, GLUE!-PS also supports the reuse of previously used external tool instances in subsequent activities, allowing e.g. the documents and drawings generated in 6-people groups to be employed in the last debate activity.

Once the groups are populated, and the (built-in and external) tools are selected, the learning design can be deployed in Moodle. In its current prototype (available for Moodle 1.9), the deployment is done by generating a Moodle course backup with all the information, mapping the GLUE!-PS data model concepts to Moodle data model concepts (e.g., GLUE!-PS *activities* are mapped to Moodle *topics*); this backup is imported and deployed within a Moodle course using the Moodle restauration process for a course. The fact that GLUE!-PS allows for the manipulation and particularization of abstract learning designs facilitates these designs to be easily reused in different academic years and courses. Even more, teachers may share these designs with other practitioners, to be easily deployed and enacted in their own Moodle courses, and even in other VLEs.

Validation through a teacher professional development workshop

In order to provide a first validation of this approach, especially regarding teachers' perceptions on the usefulness of the GLUE! - GLUE!-PS partnership, this CSCL situation was put in practice in a professional development workshop with higher education teachers at the University of Valladolid. Although the complete evaluation of this workshop is still in progress, a preliminary analysis of the available data is presented here. This workshop is developed as part of a workshop series organized at the University of Valladolid during 2011-2012. Interestingly, a study was realized in two other workshops to analyze the information lost from design to enactment when using different tools (Muñoz-Cristóbal et al., 2012). In this study, results showed evidences that even though some information was lost, teachers would use the deployed courses.

This particular workshop aimed at improving teachers' skills in designing and enacting collaborative activities using new technologies, and followed a blended format with 12 hours of face-to-face and on-line work. 24 teachers with multidisciplinary backgrounds (mathematics, medicine and education, among others) participated in this workshop, in which they had to design and deploy this CSCL situation in Moodle, using GLUE!, GLUE!-PS and WebCollage. Teachers were provided with a description of this CSCL situation and a worksheet to guide them throughout the whole process. GLUE! was (transparently) used due to the need of integrating external tools (Dabbleboard and Google Documents). It is noteworthy that none of the participants had used GLUE!, GLUE!-PS or WebCollage before, although most of them had previous experience with Moodle.

The face-to-face sessions were audio- and video-recorded, and observed by at least two researchers. The face-to-face sessions also included a debate among the participants in order to discuss the usefulness and practical uses of the workshop and the technological support (which was also audio-recorded). Moreover, an optional on-line questionnaire with quantitative and qualitative questions was answered by most of the teachers.

Main findings from teachers participating in this workshop are arranged in Table 1, indicating the data sources wherein there are evidences to support them. The first relevant finding is that all the participants were able to successfully design and deploy this CSCL situation into Moodle (*F1*), only requiring specific help in particular actions of the WebCollage and GLUE!-PS graphical interfaces. Concerning the integration of tools, 81% (17/21)

of the teachers completely or quite agreed that the tools they added to support the learning activities (i.e. Google Documents and Dabbleboard) allowed to put in operation their design ideas (*F2*). In addition, 86% (18/21) of them were in complete or quite agreement that having all the tools and resources learners need to use in a centralized platform would facilitate the enactment of the learning activities (*F3*).

Table 1: Main findings and data sources from teachers participating in the workshop.

Tag	Finding	Data sources
F1	Teachers with different backgrounds can design and deploy this CSCL situation into Moodle using GLUE!, GLUE!-PS and WebCollage.	Questionnaire, Observations
F2	The external tools integrated through GLUE! allow to put into operation the design ideas in this CSCL situation.	Questionnaire
F3	The centralization in a VLE of all the tools and resources needed in this CSCL situation facilitates the enactment of the learning activities.	Questionnaire
F4	Designing and deploying this CSCL situation with GLUE!, GLUE!-PS and WebCollage is efficient in time.	Questionnaire, Debate recording
F5	The learning design in this CSCL situation can be reused in different Moodle courses.	Debate recording
F6	The learning design in this CSCL situation can be deployed in various learning environments.	Debate recording

The process of designing with an authoring tool like WebCollage, particularizing and extending these designs with GLUE!-PS (and GLUE!), and subsequently deploying them in Moodle was considered efficient by the teachers (*F4*), as it can be inferred from the 81% (17/21) of them in complete or quite agreement with this statement. Teachers' comments in the debate also remarked this fact, e.g. *"I will use this in my practices because the tools* [the authoring tool, GLUE!-PS and GLUE!] *save time"*. Some teachers also noted the potential of reusing learning designs thanks to GLUE!-PS (*F5*), e.g. *"GLUE!-PS offers flexibility to reuse learning designs"*; *"the design can be easily tailored"*. Finally, after the deployment in Moodle, teachers were told to deploy the same learning design in MediaWiki, something that sparked their interest and also received positive feedback (*F6*), e.g.: *"It is an advantage to deploy it not only in Moodle, but also in* [Media]*wiki"*.

All in all, findings *F2* and *F3* highlight the need of an integration approach like GLUE! to centralize all the tools students must use in a single environment, and the suitability of the external tools integrated through GLUE! to support this type of CSCL situations. Findings *F5* and *F6* underline the importance for teachers of reusing learning designs in different courses, and the potential to deploy these designs in different VLEs, something that is facilitated through the use of GLUE!-PS. Significantly, *F4* makes a point on the importance of time-effectiveness for teachers, emphasizing the efficiency of using the GLUE! - GLUE!-PS partnership for the deployment of this non-trivial CSCL situation. Finally, *F1* suggests that the technological support was not an impediment for the teachers to accomplish the deployment of this CSCL situation in Moodle.

Conclusions and future work

The GLUE! - GLUE!-PS partnership facilitates the deployment of non-trivial CSCL situations that require the integration of external tools, such as the one presented here. This partnership is designed to *reduce the heavy preparation and configuration burden* on teachers, especially regarding the creation and management of complex group and activity structures that are a hallmark of many CSCL situations. The preliminary experimental evidences hint that teachers perceive the potential usefulness of this partnership.

Apart from the workload reduction, there are other collateral benefits of this partnership that should be highlighted. First, it allows teachers to *widen the array of tools* they can choose from to enact their learning activities, enabling them to select external tools that they (or their students) might already be familiar with (e.g. Google Documents). Second, and more important, this partnership enables an *easier sharing and reuse of learning designs*, even among practitioners that use different VLEs (i.e. it is not restricted to Moodle users). Again, our first experiences with teachers from multiple disciplines hint that teachers appreciate the value of these advantages. Besides, the open, extensible nature of GLUE! and GLUE!-PS enables third parties to extend or change the way each tool or VLE is supported (e.g. to take advantage of latest developments in a tool/VLE).

Yet, however useful this kind of technological support might be, this approach is still under research. More thorough experimental validation is needed in the immediate future. The support for new external tools, LD authoring tools and VLEs (by developing new adapters of different kinds) is currently ongoing. Even more, the

extension of this approach to include augmented-reality and geolocated collaborative activities (e.g. using mobile devices), is another promising research path being explored in our immediate future work.

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Acknowledgements

Improving the design of courses thanks to graphical and external dedicated languages: a Moodle experimentation

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Abstract

Designing learning scenarios and exploiting them for setting up a learning situation on Moodle is still a complex task. Visual Instructional Design Languages and their dedicated graphical editors have been identified as important conceptual tools for achieving more creative design solutions within a design process. However, binding and operationalizing such learning models is not tackled for now. In this article we propose the specification and development of visual languages and editors 1/ dedicated to Learning Management Systems like Moodle, and 2/ taking into account specific instructional expressiveness from communities of practices. This original approach requires the identification and formalization of the LMSs implicit and internal instructional design language. It also requires the development and addition to the LMS of a dedicated API in order to expose this proprietary format for communicating inside and outside LMSs. Then, we propose to use this LMS semantics as a base for the specification of external instructional languages. We follow a theoretical, methodological and technological research framework based on the Domain-Specific Modelling domain. Such software engineering domain provides some relevant tooling and techniques for assisting and guiding the elaboration of domain-specific languages. All our experimentations and development prototypes have been focused on the Moodle platform. These first propositions and results are presented. Also, a dedicated funded research project has just started in order to deeper address the highlighted issues and objectives.

Keywords

Instructional design, operationalization, Domain-Specific Modelling, Visual Instructional Design Language

Introduction

Nowadays, Learning Management Systems (LMS) such as Moodle are in widespread use and are not restricted to intensive and distant formations. Most of academic organizations provide teachers with some similar platforms. Teachers can then use them for improving or completing their face-to-face courses by some additional activities from simple resources access to scheduled communication or online assessments. During the last decade, many languages and tools have been designed in order to provide support to the instructional design actors: Educational Modelling Languages (EML) (Koper and Manderveld 2004) for the specification of learning scenarios ensuring interoperability and reusing purposes, dedicated authoring-tools and execution engines / 'players', various techniques and frameworks for operationalizing learning scenarios or other educational models, Visual Instructional Design Languages (VIDL) (Botturi and Stubbs 2007) providing diagrammatic notations facilitating communication and thinking for practitioners, etc.

Despite all this potential support, the operationalization of learning scenarios on existent LMS like Moodle has not reached a mature level for providing practitioners with some appropriated solutions. Most of teacher-designers directly use and handle platforms for setting up courses from the pedagogical situations they mentally designed or, at best, which they documented following specific paper-centric guidelines. They have to understand the LMS underlying "way of thinking and designing". They have to appropriate the various form-based inter-faces and screens in order to identify and separate pedagogical features from technical / low-levels parameters.

We aim at helping practitioners to improve their capacity of abstraction and understanding of the LMS they have at their disposal in order to more focus on the instructional design aspects of the distant or mixed learning situations they have to set up. We then assume that every LMS embeds an implicit instructional design language. Our original objective is to provide practitioners with dedicated instructional tools based on this LMS language. Concretely, we aim at specifying and developing specific Visual Instructional Design Languages, and dedicated external authoring-tools, related both to a target-LMS and to their practices and needs. Such external

approach has to meet the VIDLs' added values (visual notation improving instructional design reflexion), the EMLs ones (formalization and binding), and those from LMSs (compliant-semantics and communication). We propose the following steps for a given LMS: (1) identification and formalisation of its language, (2) its exploitation for the development of a communication bridge between the LMS and its external environment, and (3) specification of VIDLs and graphical editors based on top of this language. As a methodological and practical framework we propose to apply theories and practices from the Model-Driven Engineering (MDE) and Domain-Specific Modelling (DSM) domains.

The paper is structured as follows. Section 2 discusses the current internal/external instructional approaches about designing, binding and operationalizing when using an LMS. Section 3 is dedicated to the presentation of our LMS-centred approach for providing dedicated instructional design tools. Because Moodle is the main LMS addressed by our research works, this article will draw and discuss applications and results of our propositions in relation to it in Section 4. Before concluding, we present and discuss within Section 5 the funded GraphiT project that has just started. Indeed, this research project aims at prolonging our current results by shifting the problematic to the specification of VIDLs both LMS-centred and practices/needs-oriented (i.e. further from the LMSs semantics as concretely addressed for now).

Background: instructional design and LMSs

Several approaches aim at facilitating the design of courses by focusing on the specification of learning scenarios (a formal description of a learning situation). Nevertheless they require some infrastructures and facilities for interacting with LMSs and for taking in charge the automatic creation and configuration of the corresponding courses.

The instructional design requires a 'domain language' or Educational Modelling Language (EML). Current EMLs propositions (mainly standards or de facto standards such as IMS-LD (De Vries et al. 2006), SCORM 2004 (Gonzalez-Barbone & Anido-Rifon 2010) (Mekpiroona et al. 2008), IMS-SS, etc.) allow the design of learning activities and unit of learning and propose a 'binding' technique (machine-readable scenario). Thus, they focus on "abilities" (interoperability, reusability, etc.). Differently, Visual Instructional Design Languages (VIDLs) are other specific instructional languages (e.g. MISA, CPM, E2ML, PoEML, etc.) (Botturi and Stubbs 2007) offering some visual notations from simple drawing with a few symbols to complex diagrams. These VIDLs focus on higher-level languages, i.e. with syntaxes and semantics closer to some instructional theories or to some specific communities of instructional designers' practices. VIDLs aim at supporting imagination, creative thinking, communication, etc. Because VIDLs are rather visual domain-specific languages focusing on human-interpretations, they do not systematically provide some binding techniques. Learning models are generally saved as proprietary files mixing learning scenarios data with graphical information. Some VIDLs or authoring-tools provide instructional designers with a standard binding by the means of a dedicated export service (e.g. MISA and CPM provide a model exportation towards IMS-LD). Nevertheless, resulting models are generally less expressive than the original scenarios because of the semantic gap between the source/target languages.

The COLLAGE approach (Hernández-Leo and al., 2006) proposes some collaborative design patterns to practitioners in order to specify scenarios. These patterns are specified and developed on top of the IMS-LD standard: their semantics and the LD-translation has been taken into account from the start. Thus, the operationalization of COLLAGE models then shifts to the problem of operationalizing IMS-LD models.

With the exception of all-in-one infrastructures (authoring-tool and execution environment specific to some TEL approaches / paradigms), none of the current design languages proposes a direct binding and operationalization to some existing LMSs. Some research works have dealt with partial transformations from practitioners-centred scenarios towards LMS-centred models (e.g. from PPC to Moodle (Abdallah et al. 2008), from IMS-LD to Moodle (Burgos et al. 2007). Target-models are based on the LMS semantics by the means of a subjective Moodle metamodel specified by researchers. Such transformations attempts showed a semantic gap leading to some information losses or lacks from the source models. However, they have also highlighted the relevance of applying techniques and tools from the Model-Driven Engineering domain (MDE). They also demonstrated that LMS semantics is difficult to identify and very subjective.

Next issue of these works concerns the operationalizing of LMS-compliant models. Some attempts have been tried by means of a Web service-oriented approach (from LD to LMSs including Moodle in (Caron et al. 2005) and (Ortiz et al. 2007) but it requires the development of a dedicated service-oriented API within the LMS. Such

technical approaches require the development of specific LMSs' add-ons more complex than developing additional modules to LMSs allowing such extensions.

The LAMS solution was at first a specific TEL environment with an internal graphical editor (Dalziel 2003) whose user-friendliness has been considered as one of the most appropriate and is used as a reference for the specification of recent graphical VIDLs or graphical authoring-tool dedicated to EMLs (e.g. the IMS-LD compliant GLM graphical editor (Neumann and Oberheumer 2009)). LAMS integration to existent LMSs has been studied (Lengyel et al. 2007) and has led to some concrete results like the one for Moodle: the LAMS graphical editor has been integrated with the same notations and semantics but produced scenarios or courses are related to a specific LAMS runtime engine also added to the LMS. This approach does not rely on the LMS internal semantics. Moodle designers have to choose the LAMS format for a new course and cannot use the LAMS editor for a basic Moodle course.

Similarly, the importation of SCORM content (1.3 being the most integrated format within existent LMSs while SCORM 2004 is rarer) requires choosing a specific SCORM format for a new course (in relation to a Scorm dedicated runtime-engine). A study has been realized about the integration of IMS-LD in Moodle (Berggren et al. 2005) (Burgos et al. 2007) but it concluded that such compliance would imply Moodle to evolve by extending its semantics and integrating additional and dedicated runtime-engines.

For now, because external learning design approaches fail to support the operationalization of their models, most of LMSs' practitioners within academic contexts are still designing their learning situations by directly setting-up the various parameters from the forms-oriented screens of the LMSs they have at their disposal. Existent LMSs are widely built upon a client-server architecture. Their underlying technological features, programming languages, frameworks, etc. limit and constraint the development of user-friendly internal editors.

An LMS-centred external designing approach

Current proposals rely on a same underlying idea about evolving existent LMS by large add-ons (editors or runtime engines) in order to integrate external learning design standards or improving the internal design. Their common position is to evolve the internal learning design logic with some new semantics in order to bridge the gap between them. We do not aim to add new semantics to the domain-specific model embedded into the LMS.

We assume that LMSs are widely spread into academic institutions and that it is relevant to focus on helping teachers-designers in using them instead of proposing yet another design solution that do not deal with binding or automatic deployment facilities. Our approach then follows two objectives: to facilitate the design of learning scenarios in accordance with the LMS abilities (hiding low level and technical details required by the form-oriented LMS screens), and to propose a solution exploiting these scenarios as productive models for pre-configuring the corresponding courses within the target-LMS. We then consider our instructional design proposition as LMS-centred. In order to overcome the limits and constraints inherent to the technological and technical choices related to the development of LMSs, we propose to focus on an LMS external solution although it requires then a communication bridge.

Formalization of the LMS Instructional Design Language and communication bridge

Our approach is based on the idea that every LMS is not pedagogically neutral but embeds an implicit instructional design language relying on specific paradigms and educative theories followed by the LMS providers. We propose to identify and formalize them in order to exploit them as new specific formats for import/export exchanges between LMSs and external instructional design tools (similarly to the more specific formats sometimes provided like the self-Moodle-format for importing quizzes). In our mind, such self-labels can be considered as equivalent to the standard ones (SCORM, IMS-LD) because of their focus on instructional design but they have to exclude the managing of resources in order to be deployed as a self-contained XML file. Our proposal also requires an LMS modification: a specific import/export add-on has to be developed and added to the LMS. Nevertheless such code extensions are generally allowed by most spread LMSs.

Towards LMS-centred Visual Instructional Design Languages

The explicit formalization of LMSs 'way of designing' will allow tools providers to propose different design tools communicating with LMSs. Some ones could focus on delivering or implementation issues for LMS-compliant scenarios by means of transformations or direct binding facilities. Other tools could focus on LMSs interoperability by translating some source LMS-centred scenarios to a specific targeted LMS language.

In our research work our interest is to help teachers-designers that use to directly design their learning situations from the LMS interfaces. We then aim at developing specific external LMS-centred design tools helping them to focus on design aspects at a sufficient level of abstraction from a considered LMS (e.g. hiding some low-levels configurations required by LMSs). On one hand future-authoring tools could deal with some instructiona design aspects in a first external design-time but, on the other hand, some low-level aspects will still require to be set up in a second design-time on the LMS.

We concretely propose to specify LMS-centred VIDLs and to develop external dedicated authoring-tools. According to the DSM approach we follow, such VIDLs specification can rely on the LMS abstract syntax previously captured by the XML schema. This concrete format acts as a base for the specification of VIDLs metamodels and as a binding target for the serialization of future produced models (machine-interpretable models). The automatic delivering of VIDLs-compliant models will be achieved by the means of both binding facilities (from authoring editors) and importation services (to add to LMSs).

About the Domain-Specific Modeling framework

Domain-Specific Modelling (DSM) (Kelly and Tolvanen, 2008) is a software engineering methodology for designing and developing systems applying principles and techniques from the Model-Driven Engineering domain. It involves the systematic use of graphical DSM languages to represent the various facets of a system. They are specific to a domain and can be defined as the set of concepts and their relations within a specialized problem field. They offer primitives whose semantics are familiar to all practitioners in that domain.

The DSM tools propose meta-modelling techniques capable of expressing domain-specific vocabularies (abstract syntaxes) and propose facilities to construct various notations (concrete syntaxes). Generally they also provide model persistence facilities. These editing frameworks and tools are supporting those techniques and many more customizations with minimal programming effort. As a result, these tools can generate powerful and usable dedicated editors for DSM languages. Because of some past experimentations and studies about using DSM for specifying VIDLs we concluded in (Laforcade, 2010) that such a DSM approach can help the emergence of communities of interests or practices sharing the same domain-vocabulary and formalisms. Indeed, DSM tools can be used to support the specification of VIDLs, with their specific editors.

From an MDE viewpoint, an LMS language could be considered as composed of an abstract syntax (the instructional design entities/properties/relations formalized in a metamodel), one or several concrete syntaxes (visual or textual notations), and semantics (the semantic domain and the mappings from abstract syntaxes to concrete ones). We propose an XML-oriented format in order to act as a concrete format to propose to practitioners (similarly to the Moodle XML format for specifying quizzes).

Such XML concrete syntax will also allow fixing the format for the VIDLs binding.
The main issue for specifying VIDLs on top of the LMS language relies on how their abstract syntaxes, concrete syntaxes (graphical notations) and semantics will be specified in relation to an LMS.

Application to Moodle: first results

We chose to mainly focus our research works on Moodle. Indeed, Moodle has an open source code and has a modular and extensible architecture allowing the addition of new modules. It also has a large community of users and developers. Also, teacher-designers and pedagogical engineers involved in our experimentations are members of Le Maine University that provides them with a Moodle-based LMS (called UMTice).

Identification and formalization of the implicit instructional design language

The identification and formalization of the implicit Moodle instructional design language have already been performed and discussed in (Abedmouleh et al. 2012a) by combining three viewpoints: users interfaces analysis (what designer see), functional analysis (what the LMS can do), and database and other technical sources analysis (how the LMS realizes and persists the design components). The objective is to propose a detailed method in order to help LMS' communities in realizing this step and avoiding the proposition of subjective metamodels.

At first, we have conducted many studies and experimentations from a teacher-designer viewpoint on several platforms and LMS systems (Moodle, Ganesha, etc.). Many uses (as the creation of courses, the specification of quizzes, the addition of learning resources, etc.) were realized in order to appropriate the LMSs. Although every LMS has its specific paradigm and instructional design language, differences were not critical and we were able

to propose a common analysis process according to two strategies: the analysis of an existent course and the analysis of the creation of new courses.

Three main parts compose the analysis process: the HMI-centred analysis (Human-Machine Interface), the technical-centred analysis and the confrontation & formalization. The first one is centred on the HMI analysis. Performed with a top-down approach, it is conducted by three sub-sequential analyses (macro-HMI analysis, functional analysis and micro-HMI analysis). Each analysis has its specific features and provides its own models and formalisms. The composition sub-activity follows the three other ones. It consists in specifying the main model for the HMI-centred analysis. The second step concerns the technical-centred analysis. Several analysis methods could be adopted (data-bases, source code, course backup, etc.). During this step, the focus is put on the data persistence and handling. It results a specific conceptual model. Finally, the last process step concerns the confrontation between the HMI-centred and technical-centred models. The underlying objective is to specify the abstract syntax (e.g. the meta-model) of the instructional design language for the considered LMS. Although we aim at providing a very detailed process dealing with all particular cases in order to avoid a subjective analysis, the final confrontation/formalization step requires some specific skills about meta-modelling to prevent different resulting meta-models. Also the specification of an equivalent XML-schema from the meta-model offers several possibilities due to the XSD expressiveness.

Development of an import/export module

The final XML schema we finally fixed from the formalization of the Moodle metamodel has also been used to develop a dedicated Moodle module allowing importation of course contents (Abedmouleh and al., 2011). This module appears as a block in the course space for a teacher-designer. So it requires the context of an empty created course to be used. The importation/exportation process allows a kind of round-trip design process ensuring that configurations directly made using the LMS designing facilities (including low-level information) will be preserved and merged according to the changes realized outside the LMS.

The realized Moodle API exploited the backup/restore functionalities. Thanks to several hidden XSLT transformations we generate and adapt files compatible with the existent backup/restore PHP functions. Concretely speaking, the API we developed takes into account four possible cases: (a) modification of some information from an existing course concept; (b) creation of a new scenario concept not already presents in course (c) deletion of a course concept (i.e. concept appearing in the course but not in the scenario to import); (d) omission of a concept (i.e. same that deletion but with the additional information that the external tool do not deal with this element).

Exploitation of the explicit language

For a very first experimentation we decided to focus on objectives and practitioners needs allowing the specification/development of a prototypal VIDL and editor in order to verify our DSM approach and tooling (our concrete design rationale). We then discussed and fixed some very basic requirements conjointly with several teachers-designers using Moodle from our university: graphically design sections by spatially arranging them without a definitive ordering; allowing the drawing of connecting arrows between sections to represent their future ordering on the LMS; offering into the palette the basics activities and resources facilities proposed by the LMS; allowing the addition of these activities and resources into the sections to define their use without having to specify all the usual data required for each of them. These practitioners' requirements are offering a weak pedagogical added value in comparison to directly using Moodle but, in contrast, they allow us to test and experiment our approach.

To this end we used the open-source unified set of modelling frameworks, tooling, and standard implementations from the Eclipse Modelling Projects (Eclipse 2012): EMF and GMF. From the XML schema dedicated to Moodle, we automatically generated an equivalent metamodel thanks to the EMF tooling. EMF is a Java framework and code generation facility for building tools and other applications based on a structured model. According to the GMF guidance, we then specified the notation model in conformance with the practitioners needs. It specifies some inter-related drawing primitives (line, rectangle, compartment, etc.). The next step concerns the specification of the tooling model: what users will have at their disposal in the palette, menus, toolbars, etc. Finally, the mapping model is specified. It aims to link the three previous models. From all the previous models (domain, graphical, tooling, mapping), GMF provides a generator model to give access to implementation customizations. Then this last model drives the GMF generative component to generate an editor code directly usable as a plugin for Eclipse (a Rich Client Platform standalone application can be further configured). This code uses the one generated by EMF from the domain model that we have customized to solve some binding issues about the ordering of sections (discussed in (Abedmouleh et al. 2012b)): the VIDL domain

model had been extended to separate the creation order of sections (when created into the drawing space) from their implicit order (deduced from the arrow relations path).

The final editor (left part of Figure 1) can be used for two purposes: (1) to draw and then design learning scenarios as graphical models and (2) to visualize a learning scenario from another tool, which depends on the condition that this file/model is compliant to the schema used by the persistence facility. The models are both visualized by a diagram-oriented view and synchronously serialized as machine-interpretable XML file in conformance with the XML schema we started from. Figure 1 shows a caption-screen of a learning scenario within the editor (left part) and the equivalent result after importing the scenario in Moodle (right part). The illustrated scenario is very basic: 4 sections have been drawn within the editor canvas and composed of various Moodle tools/services; these ones have been parameterized using the property view (only the parameters considered as relevant at this design-time); the sections ordering is explicitly defined by using the next_relations arrows from one section to another. Teachers-designers can complete their design directly on Moodle by focusing on the low-level details not dealt with by the external design tool.

We proposed the several practitioners involved to handle this editor (qualitative evaluation). They considered it with interests: visual notation more flexible to pick and position Moodle resources and tools than the equivalent form-based from Moodle, focus on the selection and ordering of activities rather than focus on their technical parameters. Nevertheless, such approach still requires them to load materials and set up low-level parameters in the Moodle's user interface. They also have to manage two different design environments (one external from Moodle) instead of one. In conclusion they ask for external design tools offering a more important pedagogical added value in order to counter balance the use of a new authoring-tool. We discussed also this point with some pedagogical engineers, from our University, that have to set some Moodle courses for teachers according to information they specified to them using a document-oriented pedagogical method. We identified different Moodle-abstracted pedagogical grains to consider for future: pedagogical activities ("online discussion", "web research", etc.) with different groups/groupings, pedagogical patterns (brainstorming, debate, etc.), courses types (complement to a face-to-face course, training course, etc.), and so on.
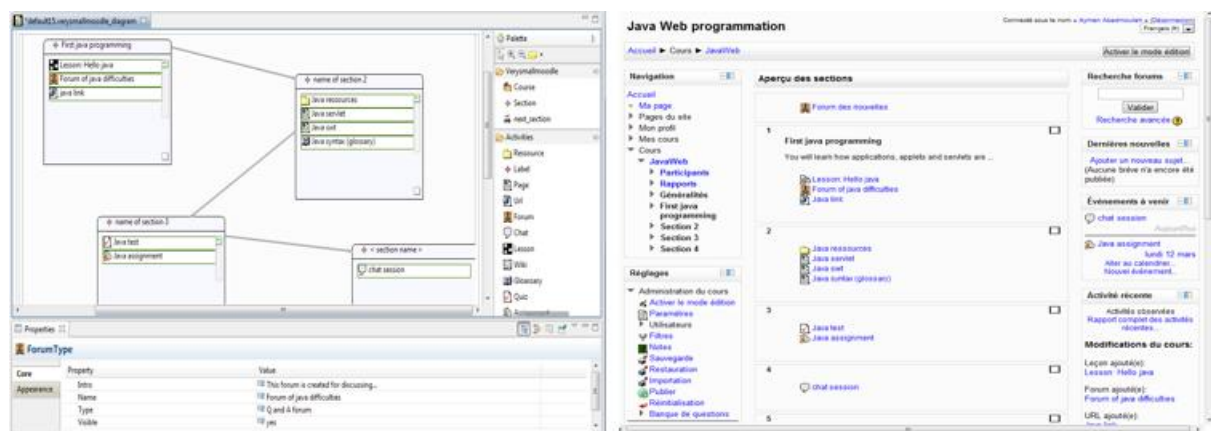
Figure 1: A first DSM-generated authoring tool for Moodle (left part) and the resulting course set up after using the import/export module (right part)

The GraphIT Project

Current results have mainly focused on propositions very close to the Moodle semantics. The specific import/export module has also to be improved for taking into account the global Moodle metamodel we are completing thanks to the application of our analysis process. The very first VIDL we specified and its dedicated graphical authoring-tool has justified the DSM frameworks and the added value of some DSM tooling. Nevertheless the captured and tooled practitioners' needs are very close to the Moodle semantics and the LAMS notation. This proximity allowed us to start with a VIDL abstract syntax (metamodel) mapping the one from the

explicit Moodle language but it also highlighted issues symptomatic of the expressiveness limits one can reach when both fixing the domain model to an existent one (for binding issues) and only trying to abstract the LMS semantics by specifying a specific concrete syntax (and its mapping to the abstract syntax).

Our LMS-centred approach with a DSM framework is original and promising but some further experimentation is required. We have also to shift our current courseware-design position to an instructional design one with more complex and LMS-abstracted practitioners' needs and practices (in relation to some pedagogical approach or educative theories to address). Solutions for specifying LMS-centred and practices-oriented VIDLs have to be experimented in order to increase the semantic gap between these instructional languages and Moodle. Developed authoring-tools usefulness and usability have to be experimented with practitioners.

These research aspects are considered by the GraphiT project that has just started. The project also proposes to focus on design patterns and patterns languages to formalize the identified practices and needs of Moodle teacher-designers communities. This should help in formalizing what future VIDLs metamodels would have to take into account by abstracting building blocks taken from LMS-closer VIDLs/metamodels (analogy with high-level programming languages for which the translation towards machine code is part of their specification: important information are preserved whereas human-oriented structures can be lost when mapped to low-level machine-instructions).

In order to help the specification of metamodels/VIDLs on top of other ones, we plan to study theories and techniques from our Model-Driven Engineering framework. Indeed metamodels weaving and composition appear to address the specification of semantic links between metamodels that will later be used for the generation of declarative rules for models transformation. This research topic is at the intersection of MDE and instructional design domains and has never been addressed or tackled so far. The following issues will also have to be tackled in order to reach our objectives:

- Limits of the meta-model (for formalizing the abstract syntaxes of VIDLs) and visual notations (for the concrete syntaxes of VIDLs) expressiveness specified on top of the expressiveness of the LMS internal semantics;
- Limits of the automatic translation of models from one VIDL to another one with no semantic losses about
- information to bind to the LMS semantics;
- Limits of relations possibilities and expressiveness between two VIDLs;
- Investment cost, programming effort required when following a DSM approach and tooling;
- User-friendliness, appropriation, usability and other validation aspects of propositions by the target-communities.

Conclusion

This article has presented an original approach for improving the focus on the instructional design facets of learning situations to deliver on existent LMSs like Moodle. We propose an external approach for designing, binding and operationalizing learning situations. At first, we propose to identify and formalize the internal and implicit instructional design languages of LMSs, and then to expose them thanks to some specific API/modules available for teacher-designers within their course spaces. These explicit languages will be used as proprietary formats for communicating in and out LMSs. If they could propose such self-format, it would open the range of instructional tools focusing on various aspects (design, interoperability, etc.) and not constraint and limited by the LMSs architecture.

Our next proposition concerns the specification of Visual Instructional Design Languages both based on LMSs' semantics and directed towards some specific practitioners' needs and practices to capture. The Domain-Specific Modelling framework we chose provides a very challenging trend for supporting the specification of such visual languages as well as the generation of dedicated graphical editors thanks to the synchronized representation it proposes: human-interpretable visual models with machine-readable persistence.

Nevertheless, the research works conducted for now, mainly on the Moodle LMS, has also depicted some first semantics limits while reducing VIDLs metamodels to the LMS one. It tackles the binding and operationalizing objectives but also limits the VIDL expressiveness and usages: the learning situations designed are too close to the LMS semantics. We have just started a French ANR funded project in order to study the specification of more complex LMS-centred VIDLs. This research work will be realized in relation to a specific community of

Moodle practitioners from our university: pedagogical engineers (experts) and teachers-designers (novice and regular practitioners). They will be frequently involved in the project realization.

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Acknowledgements

Innovation in Flexible and Collaborative Learning: Moving from theory into practice in Moodle 2.2

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Abstract

This document has been prepared to report on and showcase a variety of e-learning pilot projects and initiatives launched by the IB Online Professional Development department (hereinafter 'IB Online PD') of the International Baccalaureate (hereinafter 'IB') in The Hague, Netherlands.

Founded in 1968, the International Baccalaureate is an international organization that aims to develop inquiring, knowledgeable and caring young people who help to create a better and more peaceful world through intercultural understanding and respect. To this end the organization works with schools, governments and international organizations to develop challenging programmes of international education and rigorous assessment. These programmes encourage students across the world to become active, compassionate and lifelong learners who understand that other people, with their differences, can also be right.1

The IB Online PD department, as an integral global service e provider, offers a wide range of online workshops for new and experienced coordinators, teachers and administrators in all of our educational programmes. Online workshops are available through the open source learning management system, Moodle platform, and tailored for all subject groups in both the Diploma programme and Middle Years Programme, as well as workshops for the Primary Years Programme. The workshops are available in English, French and Spanish.2

Notably, IB Online PD is now in the process of reengineering current processes, methodologies, and systems to ensure high quality, pedagogically sound, innovative and user-centred e-learning experiences. As such, IB Online PD has introduced two multi-faceted projects aimed at [a] innovating the look & feel and instructional design of the current Moodle version (1.9) and [b] strengthening the direct application of online collaborative learning in all IB online workshops so as to ensure a measurable and positive impact.

This document includes a brief description of two projects: [1] Project 1: Innovating content design and development for effective collaborative learning: migration from Moodle 1.9 to 2.2, [2] Project 2: Strengthening online collaborative learning through just-in-time and flexible learning, and highlights key e-learning initiatives that have strengthened the online collaborative learning experience for all key stakeholders involved.

Keywords

Introduction

Fostering global professional development through innovative and flexible learning.

The success and sustainability of online collaborative learning in any online cours offered by any organization is directly linked to five components: [1] alignment with organizational strategy, mission, and resources to support innovation in learning, educational systems, and development, [2] the design and development of a pedagogically sound and stakeholder-focused learning management system, [3] interactive content and up-to-date resources, [4] a well-equipped and highly knowledgeable team of online facilitators and committed

participants and [5] the effective and high quality delivery of support services. These guarantors of success are briefly depicted in the diagram below and explained in the following paragraphs.
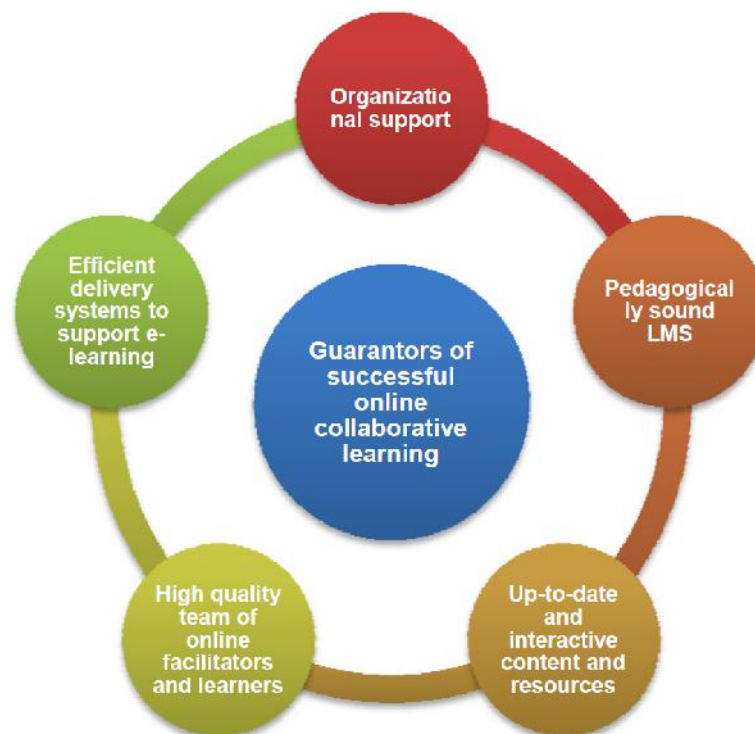
1. Organizational mission and support

The design and development of innovative learning management systems (LMS) requires support from and alignment with the organization's mission and strategy. As an international education institution aimed at providing high quality education to students, schools and teachers worldwide, the IB supports creative and innovative approaches to learning systems, methodologies and resources.

2. Innovative and pedagogically sound LMS

The design and development of a LMS for the purpose of professional development should be directly aligned with andragogical and instructional design principles and methodologies. More often than not, LMS are introduced and launched as a ready-to-go platform without ensuring that the platform meets the needs and common behaviours of its end users. As such, the LMS that is to be used for online collaborative learning should include spaces for this methodology (i.e. peer coaching, self assessment, discussion forums, wikis, blogs, etc).

3. High quality team of online facilitators and lifelong learners

The people involved can either make or break a successful e-learning course. To ensure that an e-learning course is highly collaborative, active and generates knowledge-building, the organization must count on a highly qualified and experienced online facilitation team and hope for a proactive and engaging group of lifelong learners. Both the online facilitation team and the team of lifelong learners should be provided with relevant support and training prior to engaging in a learning activity and during the delivery process.

4. Interactive and up-to-date content and resources

The content and resources of an online course are as important as the people that are required to lead it and learn from it. More often than not, outdated content and material are used to build capacity through state-of-art platforms. The focus tends to be on the learning management system as opposed to the very content that online learners are to focus on. This strategy results in a low acquisition of knowledge and a better understanding of the LMS. The emphasis should be on the balance of both – high acquisition of knowledge and high acquisition of

LMS skills. Content should be interactive and foster collaboration (i.e. group work, wiki-building, debates, case studies, etc) and resources should be up-to-date and readily available to learners at any time and at any place.

5. High quality and efficient delivery support services
In addition to organization buy-in, an innovative LMS, a highly-skilled team of facilitators and lifelong learners, and interactive content and resources, it is paramount that an organization count on an efficient delivery of support services. These efficient support services require [a] an operationally-sound registration system, [b] a customer-service driven technical staff, and [c] a highly qualified training and instructional design team. A breakdown in any one of these services will negatively affect the learning process during the delivery stage.

Acknowledging the importance of global professional development through innovative and flexible learning, the IB Online PD department, in collaboration with the Global Professional Development department, has developed and launched two projects and other e-learning initiatives to address and attend to stakeholders' needs and interests. These pilot projects and initiatives are introduced below.

Project 1: Innovating content design and development for effective collaborative learning: migration from Moodle 1.9 to 2.2

With the aim to improve and innovate the current design and development of IB online workshops, the IB Online PD team has launched Project 1: Innovating content design and development for effective collaborative learning– migration from Moodle 1.9 to Moodle 2.2.

The central aim of this project is to migrate from the current Moodle 1.9 version to Moodle 2.2 and ensure that the new LMS includes the following components and features:

1   Innovative and user-friendly look and feel
2   Increased space and possibility for visual aids and audio streaming (video tutorials, audio files)
3   Personalized learning space for participants and facilitators alike, including the inclusion of the learning portfolio, personal files, personal inbox, and blogs
4   Icons and imagery representing diversity (in age, race, culture)
5   Easy-to-use web display and navigation tools
6   Easy-to-manage and monitor web content, structure, layout, and learner participation

Expected Project Outcome

The intended outcome of this project is to launch a newly improved learning management system that enriches and enhances the online collaborative learning process through personalization and the use of innovative products and tools available in Moodle 2.2 for both online learners and online facilitators.

Implementation Plan

This project is now in the final production phase. Then, the following steps will follow:

- Delivery date for Alpha version of Moodle 2.2: end of May 2012
- Delivery date Beta version of Moodle 2.2: June 2012
- Testing phase: June – August 2012
- Launch date of the newly revised version of IB Online PD's LMS: September 2012

Evaluation Plan

The new Moodle interface for IB Online PD will be tested prior (ex ante evaluation) to its official launch on September 2012 and during the delivery phase. For the ex ante evaluation, key stakeholders including staff members and external coordinators, will be asked to test the functionalities of the new platform. Feedback on the testing will be collated systematically and communicated to the third party provider. For the evaluation during the delivery, participants and facilitators alike will be asked to assess the new platform through an online workshop evaluation survey. Results of this survey will be collated and analyzed in a systematic way.

Success Criteria

The success criteria will be measured on the migration from Moodle 1.9 to 2.2 will be based on the

following components:

- Efficient and easy-to-use access to the new IB Online PD interface
- Stable and effective performance of the LMS
- Qualitative and quantitative feedback received from key stakeholders (learners, facilitators, staff members, and the IB community)

Pilot Project 2: Strengthening online collaborative learning through 'just-in-time' and flexible learning

Centralized on the aim to strengthen active participation and collective knowledge building in online workshops, the IB Online PD team has also launched a *Pilot Project 2: Introducing synchronous interaction to strengthen online collaborative learning.*

The key aims of this *Pilot Project* are to:

1 Assess learner and facilitator interest and demand for synchronous communication tools, like web-conferencing and webinars, in current and future online workshops
2 Build online facilitator capacity in these synchronous tools
3 Develop an integration plan for synchronous tools in Moodle-based online workshops

Expected Project outcome

The proposed outcome of this *Pilot Project* is to test its use and, ultimately, integrate and re-package some components of workshop content through selected synchronous communication tools that are functional and operational in Moodle 2.2.

Implementation Plan

This *Pilot Project* is now in the evaluation phase. Results and future learning strategies will be clearly defined at the end of May 2012.

Evaluation Plan

The integration of synchronous learning in the current online workshops offered by IB Online PD will be dependent on the results of the current *Pilot Project.* The key components of this decision-making process are:

> Perceived benefits and challenges outlined by the focus group involved in the *Pilot* Project, including online facilitators, selected participants, and external coordinators Feasibility and sustainability (directly related to financial and resource allocation) of synchronous learning in IB online workshops and e-learning projects.

Success Criteria

This *Pilot Project* is aimed at strengthening collaborative and active learning in IB online workshops. As such, the criterion for the successful integration of synchronous learning and interaction is directly linked to:

> Improvement in learner participation and knowledge building through asynchronous and synchronous learning activities Positive learner, facilitator, and organizational feedback on the utility and benefits through the end-of- course evaluation surveys.

Other e-Learning Initiatives

Community-building through Social Networking

Community-building through social networking is an essential first step to ensure sustainable success in any online learning experience. Social platforms, like Facebook, Twitter, and My Space, only confirm that individuals share, experience, and learn more rapidly and proactively (fostering active participation) through informal and social interaction. Experience and research studies shows that this is most relevant in e-learning

courses too. As such, learners enrolled in an online learning activity must feel that they belong to a group or community that shares the same or similar objectives and interests and that respect the differences and richness in experience, knowledge, language and cultural.

To address the need for community-building in online workshops, IB Online PD has now repositioned the 'social networking space' (denominated 'Coffee Corner') Moodle discussion forum in all IB online workshops and has trained and sensitized online facilitators and online learners alike on its use and benefits during the delivery of the online workshops.

Capacity-building on Online Facilitation and e-Learning Pedagogy

As briefly mentioned in the *Introduction* above, the roles of the online facilitator and the online learner are key in the successful application of online collaborative learning in any e-learning activity.

To strengthen the expertise and to align the roles and expectations of all key stakeholders involved in any online course, IB Online PD has [1] developed an online facilitation workshop aimed at new and existing online facilitators and [2] developed all-inclusive online learner's toolkit aimed at new and existing online learners. Both online workshops are now in the testing phase. A quality assurance report will be prepared and distributed in June 2012.

Conclusion

Internal innovation embodies the response of an organization or department to stakeholder needs and interests. Improving processes, methodologies, practices and systems to better serve the learner is an important and continuous process that any e-learning provider should invest in.

IB Online PD has refocused its strategy and resources to transfer a theoretically sound idea into tangible and sustainable solutions – from cloud learning to real lifelong collaborative learnin

Electronic references

The following electronic references in preparation for this conference proposal:

International Baccalaureate
IB Online Professional Development

Interactive speaking practice, assessment and exercise sharing with Babelium plug-in

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Abstract

Video and audio recording in Moodle is not an easy task. There are some third party plug-ins that allow teachers to prepare assignments that students have to complete recording themselves either using audio or video devices, in a non-interactive way. This paper reviews current three open source Moodle plug-ins for speaking practice: NanoGong, PoodLL and Moodle Language Laboratory, analysing each one's advantages, limitations and some shortcomings that need to be addressed. In hopes of addressing the lack of those requirements' implementation, we present Babelium, a new plug-in that allows to record and share interactive video exercises that students can leverage to record their own answers, either using their microphone or their webcam. Simultaneously to the answer being recorded, students can get some help and tips, for their oral production, watching a parallel, exercise-synchronized video, that shows images, texts and words that could be useful for the oral communication effort. These video-exercises can be used not only for monologues but also for conversation, dialogue or dubbing simulations, which opens interesting new ways of practising speaking, especially for second language exam preparation. Finally, this paper shows our experience applying this plug-in for Basque speaking teaching and practice, a minority language from the Basque Country (Spain) and presents some examples of video-exercise types that can be reused in any other language learning environment using a Moodle instance.

Keywords

Speaking Practice, Plug-ins, Audio, Video, Recording, Second Language, RIA

Introduction

Every year millions of people take second language classes as part of their efforts to gain the ability to communicate for education, immigration or professional purposes. Language teaching and learning has become a priority for today's worldwide educational institutions. The demand for teaching languages using cost-effective yet innovative technology is on the rise. Many of these institutions have already set up their own learning management system (LMS) and want to integrate some features and plug-ins in it to assist them in their daily labour of language teaching. Nowadays, one of the most extended LMS in the world, and the most extended
open source LMS, is Moodle with more than 58 million registered users in 216 countries and more than 6 millions of courses (Moodle.org, 2011).

Moodle offers a good set of tools for reading and writing skills, however, there are few plug-ins for practicing oral skills, which are normally considered among students as the most difficult to practice and acquire.
Three of the plug-ins with a larger number of comments in Moodle Forums are NanoGong (The Gong Project, 2010), PoodLL (Hunt, 2012) and Moodle Language Laboratory (Thibaudeau & Ipperciel, 2011). Depending on the objective of the course activity, each one has his advantages and disadvantages, but, even so, there are some limitations that need to be addressed.

In order to properly justify this affirmation, the next section shows a technical and functional review of these three main Moodle plug-ins. Common factors and features are summarized, identifying some shortcomings that language teachers have spotted and explaining why those lacking features are important for a better oral speaking experience. In order to overcome these shortcomings, we present the Babelium plug-in for Moodle, showing technical and functional details and comparing it with the before mentioned plug-ins. Finally we comment the first impressions of some experiences carried out in four Basque Language Schools (called euskaltegis in Basque) with the Babelium plug-in for Moodle.

Moodle plug-ins for language speaking practice and assessment

PoodLL, NanoGong and Moodle Language Lab are three of the most popular plug-ins for recording students' vocal production available in Moodle, at least, since 2010.

PoodLL

From the PoodLL website (Hunt, 2012) we can learn that it is a kind of C.A.L.L (computer assisted language learning) system implemented by Justin Hunt and Thom Rawson. Using PoodLL, teachers can create various kinds of activities for their students. These activities include voice and video recording, pair-work and pronunciation practice. It is designed as a series of plug-ins for Moodle, both for 1.9 and 2.x versions. Its main advantage is that it allows to record the user's voice, using the microphone, and optionally also the user's face-image, using the webcam.

It requires the use of Flash plug-in in the client to access the multimedia devices and record the video-responses in an external Red5 server. This server is also responsible for streaming the recordings to the teacher so that he can assess them using Moodle's Gradebook. There is a source code repository in Google Code Project Hosting - GCPH - (Hunt, 2011) but it seems that it is just a work in progress since apparently last plug-in updates from PoodLL's main website are not based in GCPH's source code. On the other hand, the main developer of PoodLL was kind enough to provide the authors of this article a link to the server side's source code that is not published anywhere. Even though their main site states that "PoodLL is and always will be open source and free" no license is specified.

NanoGong

The second plug-in in this study, NanoGong, is a Java applet developed at the Department of Computer Science and Engineering at the Hong Kong University of Science and Technology that can be used by students to record, playback and save their voice inside Moodle. When the recording is played back the user can speed up or slow down the sound without changing it. The speeded up or slowed down version of the recorded sound can be
saved to the user's hard disk, if he wishes.

Last official version dated May 2011, and is only available for Moodle 1.9, although there is a fork in the Bitbucket public repository by Sebastian Berm (Berm, 2012) that allows users to try a beta version of NanoGong for Moodle 2.x. NanoGong does not need an external server to store the audio recordings.

Moodle Language Lab

Last well-established language learning related plug-in for Moodle is the so called "Moodle Language Lab" (MoodLL), developed by Patrick Thibaudeau and Donald Ippercie from Campus Saint-Jean and Oohoo.biz. It is a tool that replaces the traditional cassette tape language labs. With this tool, teachers can prepare oral exercises for students using both video and audio. This plug-in uses the Flash plug-in in order to record the student's input. Furthermore, developers of MoodLL recently released a new Master Track feature that allows teachers to prepare sample sounds with blank spaces. During the blank spaces, students simply record their answers. Afterwards, the teacher can listen to the student's answers while the Master Track is playing, making it easy to compare and grade.

MoodLL plug-in's source code is available at a Github repository and is actively maintained since a couple of years. Nevertheless, it is only available for Moodle 1.9. Authors have a test server for Moodle 2.x version, but it does not work properly yet.

Features and limitations

Table 1 summarizes the most important features of the above explained plug-ins: PoodLL, NanoGong and Moodle Language Lab. Features of all plug-ins are grouped into three common categories: Functionality, Moodle integration and Technical related details. What follows is a brief comparison between the 3 plug-ins, highlighting those points that might be interesting to improve or implement to improve the speaking practice experience of language practitioners. For convenience, we have added a last column that summarizes the same features of the Babelium plug-in that we present in this article.

NanoGong doesn't need a server to save the audio files that students record but it lacks many other features like the ability to simulate a conversation, a main competence that language students have to master. NanoGong's

lack of video-recording support (neither to set out an exercise nor to record an answer) means that students are not exposed to a real-life simulation environment where each of them has to confront face-to-face conversation situations. Moreover, the ability to record student's faces affords teachers to verify student's identity and assess also their gestures and facial movements while speaking.

Table 1: Features and differences between PoodLL, NanoGong, MoodLL and Babelium plug-ins

		PoodLL	NanoGong	LanguageLab (MoodLL)	Babelium
Functionality	Audio and video recording	v	audio only	v	v
	Subtitle editing support	-	-	- (1)	v
	Multiple language support (UI)	en_US	en_US	en_US, fr_FR	en_US, es_ES, eu_ES
	Exercise sharing	-	-	-	v
	Conversation simulation	-	-	v (Using new audio MasterTrack feature)	v
	Visual and auditive tips and help points while recording	-	-	-	v
Moodle Integration	Official plug-in in Moodle	v	v	v	X (waiting for approval)
	Version Compatibility (Moodle 1.9, 2.x)	1.9 & 2.x	Only 1.9	Only 2.x	1.9 & 2.x
	Integrated with Moodle repository	v	v (1.9)	-	-
Technical Details	License	GPLv3 (3)	Apache	Open Source (2)	GPLv3
	Public issues / bug management	-		v (github)	v (Google Project)
	Source code's language of the player/recorder	Laszlo	Java	ActionScript (.fla files) (4)	ActionScript (Flex files)
	Server-based / Standalone recording	Server (Red5)	Standalone	Server (Red5)	Server (Red5)
	Last release date	April 2012	May 2011 (5)	March 2012	April 2012

(1) offers support for subtitle viewing but not for editing them
(2) files from the git repository don't specify the exact license
(3) the link to download the server's source code is missing. We asked for it without success
(4) Using .fla files. These files require proprietary Flash CS application in order to edit them and are not editable in Linux at all (there is no support for .fla editing in Linux)
(5) An unofficial fork of NanoGong for Moodle 2.x is currently being developed in BitBucket by (Berm, 2012)

Both PoodLL and MoodLL consider that in addition to audio it is very interesting to allow also video recordings for speaking practice in Moodle. This practical feature, as explained in (Bello, 1999), (Díaz Cintas & Fernández Cruz, 2008), allows learners to see facial expressions and body language at the same time as they hear the stress, intonation and rhythm of the language. The visual dimension puts conversations in context and makes it easier to understand the dialogue (Talaván, 2006).

Only MoodLL offers the possibility to simulate a dialogue or conversation (audio-only) with a teacher asking questions and the student answering them in a time-framed lapse. This feature is especially interesting according to some of the can-do statements (Jones, 2001) that the Common European Framework of Reference for Languages – CEFR - (Council of Europe, 2001) and the Association of Language Testers in Europe (ALTE) have developed for each language level. These statements describe what language users can typically do with the language at different levels and in different contexts.

For instance, for the language level B1, one of the can-do statements says that if a student has achieved this level, he CAN keep up a casual conversation for a reasonable period of time, provided that it is of a mainly familiar, predictable nature. Or, for level B2, he can keep up a conversation on a fairly wide range of topics. Thus, we consider that having a way to simulate conversations in a plug-in is a crucial feature.

Unlike PoodLL and NanoGong, MoodLL allow teachers to use subtitles in the video-exercises, but it lacks support for editing them. This feature could be also a good resource for students to rehearse and practice listening and comprehension skills. Even more, subtitles are a support for comprehension, for finding new words and for helping to correct misunderstandings (Díaz Cintas & Fernández Cruz, 2008), due to the fact that written and oral words help reinforce what is on screen and vice versa. So, contrary to what people may think, subtitles are not a distraction but a very good help for learning languages, but it is necessary to bear some parameters in mind such as students' level, mother tongue, target language or quantity of visualisations of the video (Winke, Gass, & Sydorenko, 2010).

Knowing the fact that many or most of European language learning institutions' syllabus is based on the CEFR framework, it should be apparent that there is a real need for sharing video-exercises between teachers of the same language level. In fact, many of them are used to the content sharing philosophy that pervades Moodle so it is not surprising that they are willing to apply an open license to their creations (one of the Creative Commons licenses) for sharing among their colleagues. This is in fact one of the objectives of Moodle's Repository feature that both PoodLL and NanoGong leverage but MoodLL lacks of. Apart from Moodle's repository that works properly for sharing inside a Moodle server, we suggest that it should be interesting to have a common global repository of video-exercises available to share between distinct Moodle servers.

Regarding licenses, all of the studied plug-ins use an open source one although MoodLL plug-in does not specify which one applies. Being a real open source project carries on a set of responsibilities that the owner should commit to. For example, despite PoodLL's license is GPLv3, the latest source code of the plug-in is not available in its public source code repository (Hunt, 2011) and the server-side part of the plug-in is missing at all. The bug or issues list in MoodLL and PoodLL is of no use, because the authors do not update it even to reflect the roadmap of the project. For example, MoodLL's repository has 0 issues listed while PoodLL's has only one (acting as a test for knowing if the bug list works or not). Even though it is true that users are not very collaborative with regard to source-code contributions, authors of truly open source plug-ins should inform their user base about what issues and bugs are they working on, which have been fixed, and which are planned for next releases.

Despite the internationalization support of Moodle and the target audience of the plug-ins, only MoodLL has localized its strings to another language apart from English. This limitation is especially significant in the case of English language illiterate users, because it might prevent them from using the application at all.

It is also important to emphasize that plug-ins must be adapted to meet Moodle's evolution across different versions. Only PoodLL is running properly on 1.9 version and 2.x versions. NanoGong works only in 1.9 version and MoodLL apparently works properly in Moodle 1.9 but it only has a test server to check the 2.x version's development stage and we have been unable to use the new "master track" feature, neither in the plug-in's own test server nor in ours.

Nevertheless, in order to stimulate user's oral production, and simulating real life conditions, the plug-in should also offer a way for guiding the user while she is speaking, for example, showing her some difficult vocabulary or displaying images or situations related to the conversation's topic during the recording, so the user can rely on them. The possibility to display this kind of visual tips or guides alongside the recording is an exclusive feature offered by the Babelium plug-in and according to the number of helping video-exercises uploaded to Babelium's website and teachers' and students' opinion, a very valuable one.

Babelium Project

In order to better understand the Babelium Moodle plug-in that we present in this paper, we will first introduce the Babelium Rich Internet Application (RIA) developed by this paper authors (Sanz-Santamaría, Pereira, & Gutiérrez, 2010) at the University of the Basque Country (UPV/EHU). The Moodle plug-in is built around the Babelium RIA and relies on its architecture for delivering the multimedia experience.

Babelium Project RIA

BabeliumProject.com is a standalone web application that allows teachers to upload a wide range of video exercises and add synchronization points inside, so that students can use them for speaking practice. This practice could be with more or less interaction depending on the type of exercise.

When teachers upload a video to Babelium they have to add some metadata like title, description, language, difficulty level based on the CEFR and license, copyright or one of the most used Creative Commons licenses: cc-by, cc-by-sa, cc-by-nc, cc-by-nd, cc-by-nc-nd, cc-by-nc-sa. After tagging the video it will become available to subtitle in a collaborative way: teachers can restrict a video so the subtitling effort is only performed by teachers themselves or open the activity so any student can add subtitles to the video (there is a subtitle version log that allows teachers to easily change from one version to another). Babelium allows users to add captions or subtitles. According to (Markham and Peter, 2003) "subtitles refer to on-screen text in the native language of the viewers that accompany the second language soundtrack of the video material. Captions refer to on-screen text in a given language combined with a soundtrack in the same language". Subtitles have a text, a start and end point and an associated role. These data designates synchronization points in the video to mark when is the turn for the student to record or the teacher to explain a theme or ask a question inside the video. Once students record their answers they become available for others to assess in a collaborative way.

For example, the teacher can upload a short video asking the students to record their opinion about digital ebooks vs. traditional books for 3 minutes. So the original video-exercise can last for 4 minutes length: the first one for explaining the procedure and the last 3 minutes for helping the students with some images related to this topic (digital books high prices, spilled coffee over an ebook, a backpack full of books). The students will watch the video for the first minute and the application will start to record the user's voice and optionally his face starting at the 61 second up to the 4th minute. Simultaneously to the recording, the original video will help the student with some of the aforementioned pictures, some helpful vocabulary, or some grammar constructions that the teacher is interested in. Third figure of Table 2 shows this video-exercise example.

Babelium Moodle Plug-in

Recently we have developed a plug-in for integrating Babelium's video player and recorder widget inside Moodle. Any video available in the Babelium RIA under a Creative Commons license can be reused by any language teacher in her private Moodle server. This way, Babelium aims to become a well-categorized online resource of interactive video-exercises for speaking practice in Moodle.
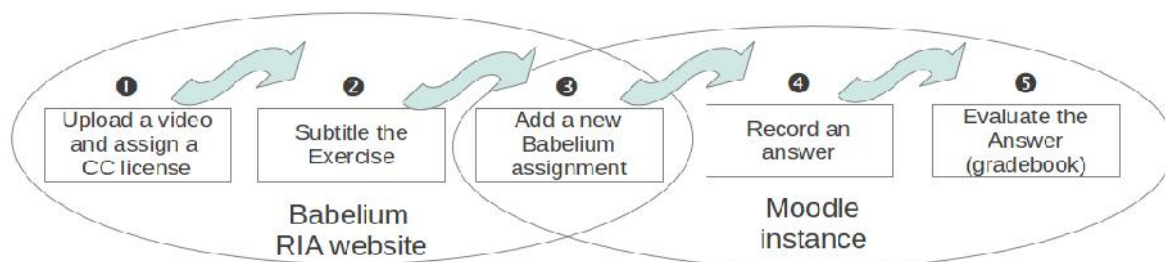
Figure 1: Workflow between Babelium RIA and its plug-in for Moodle.

In order to add a Babelium activity (assignment type) in a Moodle course, as seen in Figure 1, there are some steps to follow: the teacher must (1) upload a video-exercise in Babelium RIA, (2) subtitle it, (3) go to his Moodle course and add a new assignment - configuring its parameters and publishing it-. Later, (4) when the students record an answer for that assignment, the answer will automatically be available for (5) the teacher to assess. The evaluation process is fully integrated in Moodle so it can be done by the teacher using the Moodle Gradebook.

Babelium's plug-in is free software (GPLv3) and is available at https://code.google.com/p/babeliumproject. Like PoodLL, is quite a complex software - yet this complexity is transparent for final users - because parts of it are written in different languages: Moodle plug-ins are written in PHP, the server side is using a Red5 web application written in Java and the recording Flash widget is programmed in ActionScript (unlike PoodLL's counterpart, written in OpenLaszlo). Babelium can be installed in both Moodle 1.9 and 2.x server versions and its user interface is already available in Spanish, English and Basque.

Teaching Basque speaking with Babelium's plug-in

We have been working using the Babelium plug-in for the -minority language- Basque speaking practice in 3 online Moodle servers. Each server belonged to a specific Euskaltegis. Two of them use Moodle in a blended language learning environment while the third one uses Moodle for online learning courses exclusively. The students' profile is similar in all of them, due to the fact that euskaltegis are oriented to adult language learning. Students taking the course were between 18-30 years of age, with a roughly equal mix of males and females. Each school teaches the full range of language mastering levels (from an introductory A1 to a proficiency C1 level) to a total number of nearly 200 students.

This was the first experience that both teachers and students of the Basque schools had had with recording student's faces and voices in an interactive way. One of the euskaltegis had tested before the NanoGong plug-in for recording students' monologues but taking into account that one of the objectives the CEFR proposes is to practice both monologues and dialogues, Nangogong's features were not sufficient.

Using the Babelium's exclusive feature, Basque teachers have been able to help and support their students' oral production displaying visual and written tips simultaneously while a video-exercise is recorded. With this help, students have felt less afraid to get stuck because they have always got continuous tips – images and text - alongside their recording, as shown in figures from Table 2. This was impossible to do before Babelium plug-in and it has being very positively received by the students, mainly due to the fact that this type of exercise can truthfully simulate one of the parts of the Basque oral official exam.

Table 2: Three video-exercise samples using the Babelium plug-in for language speaking practice

	Level: B1 Skill: Spoken interaction Language: Basque ALTE descriptor: "I can start, maintain and close simple face-to-face conversation on topics that are familiar or of personal interest". Exercise description: you have to call your friend and arrange a date and a place for meeting at the pub (specify where exactly)
	Level: B1 Skill: Spoken production Language: Basque ALTE Descriptor: "I can narrate a story" Exercise description: explain by voice your disagreement with one sculpture that the council has built in front of your house. Explain that the sculpture Is quite ugly, that the neighbourhood has not been asked for its opinion and some other explanations about your disagreement.
	Level: B1 Skill: Spoken production Language: Basque ALTE Descriptor: I can express my ideas and opinions clearly and precisely, and can present and respond to complex lines of reasoning convincingly. Exercise description: you will be presented some brief facts about digital versus traditional books. You have to develop that facts, explain them and give your personal opinion about this subject.

On the other hand, Basque teachers already had a great number of video-tapes and digital video excerpts and wanted to leverage them in their online Moodle environment. With the Babelium plug-in they could easily upload them into Moodle. In fact this is one of the strongest abilities of Babelium: anyone can upload a video-exercise and adapt it for students, so they can use the video for real speaking practice.

The three euskaltegis' curriculums are guided by the same European Framework criteria, so they agreed to share their works, publishing all their video-exercises under a Creative Commons license (specifically a cc-by-sa license), and classifying the videos according to the descriptors recommended by the Framework. This possibility was also very good received because allow teachers to save time.

These are just some first impressions of the experience. We are immersed in the experiment that will finish on next July. Then, we will carry out an in-depth survey both with the students and the teachers in order to analyze both the usability of the plug-in and the effectiveness of this new approach for second language speaking practice.

In order to bring the experiment closer to the readers, table 2 shows three samples of the video-exercises created and shared by the three euskaltegis along with the Framework descriptors that those videos try to fulfil. The red arrows mark the turn to speak for the student. The first video shows that the student is supposed to answer to a telephone conversation. The second one asks the student to explain why she disagrees with one sculpture that the council has recently built in front of her house (a fictional situation, of course). The red arrow marks only one turn, but the continuous red strip below warns the student that she must speak for one minute without interruptions. In this second example, the user chose to record an audio only answer. Thus, there is no image from the webcam next to the exercise. In contrast, in the last example, the user chose to record his face alongside his voice. This video draws on an exercise asking the student to expose his opinion about digital versus traditional books. There is only one arrow with a big red stripe below, which indicates that the student is supposed to explain whatever the teacher has asked for without interruptions for nearly 4 minutes.

Conclusions and future work

Until recently, Moodle users studying a foreign language from all over the world could only record their voices simulating a monologue. Nowadays, however, it is possible to install some Moodle plug-ins (PoodLL and MoodLL) that take advantage of the widespread video usage between students' daily habits with the aim to record also the user's face. In this context, Babelium adds a new set of features to these two alternatives, including the ability to guide the language practitioner with some visual tips in the form of a video played alongside the user recording, the option of using closed captions and the feature that allows the teacher to signal speaking turns in a video-exercise. This way, Babelium can be used for practising dialogues, conversations and also guided monologues, following known language learning paths like those pointed by the Common European Framework of Reference for Language Learning. The same video-exercises can be shared and reused by many teachers, students and educational institutions using Creative Commons licenses and a common video-repository (in our case, located at the central Babelium server).

Today, the massive adoption of smartphones, tablets and mobile devices with the same capacities for audio and video recording and playing as desktop computers, connected everywhere and every time to the Internet, are obviously an interesting target to seek by the language learning community. There is a lot of research going on in the field of mobile learning, and Moodle is not an exception with studies like the technical and organizational implications of implementing Moodle on mobile devices (Cheung, Stewart, & McGreal, 2006) or reference implementations like the Moodbile project (Alier, M. & Casany, M., 2008) .

Going mobile is a special challenge in the case of Babelium and other audio and video plug-ins due to their dependence on multimedia recording features not available in current HTML5 implementations. Although there is a good support for audio and video playing in modern mobile browsers using only the HTML5standard, it is not possible to record neither video nor audio without resorting to the use of external plug-ins like Flash, Silverlight or JavaFX. This approach might also not work because either the user has not installed the needed plug-in or because it is not available at all – the case for Flash plug-in banned in iOS is the best known example. The HTML5 developer community is working hard in finishing and implementing a new specification known as Web Real Time Communication, WebRTC (W3C, 2011) that will allow to play, record and stream audio and video directly from the browser, without using any third-party plug-ins, but currently it is a fast-paced work in progress that will not be made generally available until next year. In the meantime, authors are working on an HTML5version of Babelium in order to be ready for the next challenge.

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Acknowledgments

Learning Analytics with Excel Pivot Tables

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Abstract

Different actors like teachers, course designers and content providers need to gain more information about the way the resources provided with Moodle are used by the students so they can adjust and adapt their offer better. In this contribution we show that Excel Pivot Tables can be used to conduct a flexible analytical processing of usage data and gain valuable information. An advantage of Excel Pivot Tables is that they can be mastered by persons with good IT-skills but not necessarily computer scientists.

Keywords

Pivot Tables, Learning Analytics, Usage Data

Introduction

Moodle is increasingly used in schools, universities and companies. There is a large variety of learning objects that can be put into the system. Different actors like teachers, course designers and content providers need to gain more information about the way provided resources are used by the students so they can adjust and adapt their offer better. They have questions like: Do students use the resources at all? When? What are the most, the least popular resources? How are specific contents such as e-books used? Are there resources that are often used together? Do students participate in forums? In Wikis? Is there a link between the use of some specific learning objects and grades in the examinations? Which contents affect learning particularly positively? Are there contents that should be recommended?

To answer these questions, usage data stored by the system needs to be explored and analyzed. In this contribution we show that Excel 2010 Pivot Tables (Jelen & Alexander 2010) can be used to answer many of these questions. An advantage of Excel Pivot Tables is that they can be mastered by persons with good IT-skills but not necessarily computer scientists. This means that a number of our targeted actors know them already or could learn to utilize them with little effort and use them to explore user data thoroughly.

In our approach we do not generate the Excel Pivot Tables using the export towards Excel of reports or grades provided by Moodle. Instead we have developed an application to extract data stored by Moodle towards our own data model presented in (Krueger, Merceron, & Wolf, 2010). There are three main reasons for that. First data is extracted and anonymised, which allows us to comply with the laws concerning data privacy in Germany. Second it is possible to merge data from different learning systems that are used parallel by a single institution. Finally other tables than the two currently available in Moodle can be generated more easily.

There is a number of tools that can be integrated with Moodle enabling teachers to explore user data. (Graf & all 2011) and (Leony & all 2012) present such examples. Our approach is different because our tool essentially provides the desired tables. The analytical processing does not take place inside the tool but relies on the existing Excel Pivot Tables. The desktop application presented in (Pedraza Perez, Romero & Ventura 2011) will allow users to apply a number of different data mining techniques on Moodle data. Their focus is not on a flexible data exploration or the analytical part as we concentrate on but on the data mining part itself.

There is a great number of research works analyzing usage data in Moodle, many of them are cited in (Romero & Ventura 2010). Most of these works tackle a particular problem and solve it using data mining techniques that only specialists can use properly. (Zafra & Ventura 2009) for instance, uses genetic algorithms and students' user data stored in Moodle courses to predict the grades of students in those courses. More recently (Hershkovitz & Nachmias 2011) used statistics and decision trees to analyze online persistence of students during a semester course in a context where Moodle is used to support face to face teaching. It is well known that in the whole
data mining cycle the step of knowing and understanding the data is essential, and this step can be performed by analytical processing (Han, Kamber & Pei 2011). Our contribution is the usage of the Excel Pivot Tables to

perform analytical processing with educational data. Afterwards a proper data mining step can be performed if necessary.

The paper is organized as follows. In the next section Excel Pivot Tables are presented as well as the way we generate them. In the third section we show how we have utilized Pivot Tables to explore how learning material is used in courses and whether the use of specific self-evaluation quizzes has an impact on the final mark. Final remarks and future work conclude the paper.

Pivot Tables

Learning management systems like Moodle store many user data in a database. This data can be analysed to provide information to different actors in the educational field and help them to improve the learning experience of students by optimizing their learning offer. Our approach is to allow actors who are not necessarily computer scientists to perform part of the analysis themselves. We propose Pivot Tables for doing so.

In this section we will first explain why we chose to use our own data structure to export towards Excel and give a quick overview about Pivot Tables afterwards.

Exporting Usage Data towards Excel

Moodle offers export in Excel format at two levels: reports and grades. To investigate the use of a course's learning objects it is best to create a report containing all actions from all users on all objects since the course has been created. With both Excel sheets it is possible to create an Excel Pivot Table.

We encountered some problems with Excel sheets that have been generated with Moodle:

- First the report contains too much personal information like names and ip-addresses. This information can be blocked by the Moodle administrator which however makes it impossible to determine which user has performed a specific action. Unfortunately this determination is necessary to answer questions like "are users who are using self-tests earning better grades than users who don't?"
- Second the relevant information is given in the column 'action' in combination with the column 'information'.
  The 'information' column contains rather general data, so it is necessary to highly filter the given table in order to get the needed values.
- Third log files are deleted on a regular basis. To compare different courses you have to store the data manually. Laws about data privacy in Germany do not allow keeping non-anonymous data for long periods

Due to the reasons mentioned we have developed an application to extract data stored by Moodle towards our own data model presented in (Krueger, Merceron, & Wolf, 2010). This way we are able to keep historical data and provide a reasonable data protection by replacing user names with ids in such a way that user names cannot be recovered from the ids. In addition it is possible to integrate user data from several learning management systems into our data model. Further with this model we are able to create various data source tables for the Pivot Tables making it easier to get different perspectives of the data.

Working with Pivot Tables

A Pivot Table is a highly flexible contingency table. The table can be created from a large dataset and offers the possibility to look at one section at a time. We use the Pivot Table Tool from Microsoft Excel 2010 (Jelen and Alexander 2010). In order to create a Pivot Table it is necessary to have a data source table for Excel. The data source table should have the following format: In the first row you need to include the column's titles. There must not be an empty row or column in the table but empty fields are possible.
Figure 1 shows a small example. On the left side of this figure the source data table can be seen. The first line includes the following columns: 'action' the type of action performed in Moodle, 'date' the date of the action, 'quiz title' the title of the quiz the action was performed on and 'user id' the user id who performed this action. This table was generated by a MySQL query (MySQL 2012) from our data structure. On the right side there are two Pivot Tables generated from this source table. The Pivot Tables are generated by selecting a field of the data source table and choosing insert -> Pivot Table from the menu. For example the top pivot table was generated selecting the field B5 and then the Pivot Table Tool form the menu. Excel then automatically detects the range of the table to use. After this step Excel shows a list of all the headers detected from the data source (in this case 'action', 'date', 'quiz title' and 'user id'). It is then possible to choose which data of this list should be in the row

and which in the column of the Pivot Table (in the Pivot Tables in Figure 1: the column with the action or date and in both rows the quiz title). Last it is required to select which data and which operation should be used in the calculating field. In the example given in Figure 1 we chose to count the number of users, so as an example the field G4 is calculated by all user actions 'attempt' performed on Quiz 1. It is also possible to use other calculations, such as sum, mean, variance, minimum and maximum (but this wouldn't make sense here because the user id´s are no real numerical data). Furthermore own measurement methods can be included.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	action	date	quiz titel	user id									
2	view	07.10.2009	Quiz 1	17380		number of actions							
3	view	08.10.2009	Quiz 1	16955		actions performe	Quiz 1	Quiz 2	Quiz 3	Quiz 4	Quiz 5	Quiz 6	sum
4	view	08.10.2009	Quiz 1	13498		attempt	1	1				1	3
5	view	09.10.2009	Quiz 4	17164		continue attemp		2		1	2		5
6	view	09.10.2009	Quiz 5	14644		view	4	4	1	3	1		13
7	attempt	07.10.2009	Quiz 6	14644		sum	5	7	1	4	3	1	21
8	view	07.10.2009	Quiz 4	17164									
9	continue attemp	07.10.2009	Quiz 4	14644		number of actions							
10	view	10.10.2009	Quiz 2	16972		date	Quiz 1	Quiz 2	Quiz 3	Quiz 4	Quiz 5	Quiz 6	sum
11	view	12.10.2009	Quiz 2	17164		05.10.2009		1			2		3
12	view	05.10.2009	Quiz 2	14944		07.10.2009	3	2		2		1	8
13	view	07.10.2009	Quiz 1	17125		08.10.2009	2	2					4
14	attempt	07.10.2009	Quiz 1	17125		09.10.2009				1	1		2
15	continue attemp	05.10.2009	Quiz 5	17125		10.10.2009		1	1	1			3
16	continue attemp	05.10.2009	Quiz 5	17125		12.10.2009	1						1
17	view	10.10.2009	Quiz 3	17125		sum	5	7	1	4	3	1	21
18	view	10.10.2009	Quiz 4	16955									
19	view	08.10.2009	Quiz 2	16955									

Figure 1: Example of Excel Pivot Tables: On the left is the original data source. On the right are two possible Pivot Tabels that can be created from it

Case Study

In this section we show a case study conducted with the first semester course "Formal basics of Computation" taught in the Bachelor degree computer science and media in face to face teaching and supported through Moodle. The course is organised in a weekly format. The top middle section contains materials for general readings and two forums. Below, each week contains a file with slides and a non-compulsory self-test related to the theme of the week. Each self-test closed after one to two weeks in winter semester 09/10, the user data that we explore here as a continuation of the work started in (Krueger, Merceron, & Wolf, 2010a). The final mark for this course is calculated by equally incorporating the grades obtained at two exams. The first exam takes place in the middle of the semester and the second one at the end of the semester. These exams are not conducted with Moodle. The functionality 'offline assignment' of Moodle is merely used to inform students about their grades. Past exams are uploaded in Moodle in the weeks in which these exams take place so that students can practice and train themselves. In winter semester 09/10, 57 students were enrolled in Moodle for this course.

Analytical Processing of Content Use

First we extract an excel table containing all resources of the course from our database with the actions performed on them and generate the corresponding Excel pivot table with an appropriate query. We adopt the idea "overview first, then zoom and filter, details on demand" of (Shneiderman 1996). Using the function pivot chart with the methods to generate a Pivot Table mentioned in the section before, we obtain a histogram giving the total number of actions performed on it during the semester for each resource. It is possible to sort the table given in the histogram as shown in Figure 2. At a glance it is possible to have an overview of the use of all resources as well as the information concerning most and least accessed resources, shown on the left respectively on the right of the histogram. Note that if a resource is not used at all, it will appear with 0 action because our Excel table is extracted taking not only the log entries but also the set of resources uploaded in that course. This is different to exporting the report table directly from Moodle. Any resource which is not used at all will not appear in the report so that kind of information cannot appear in the histogram.
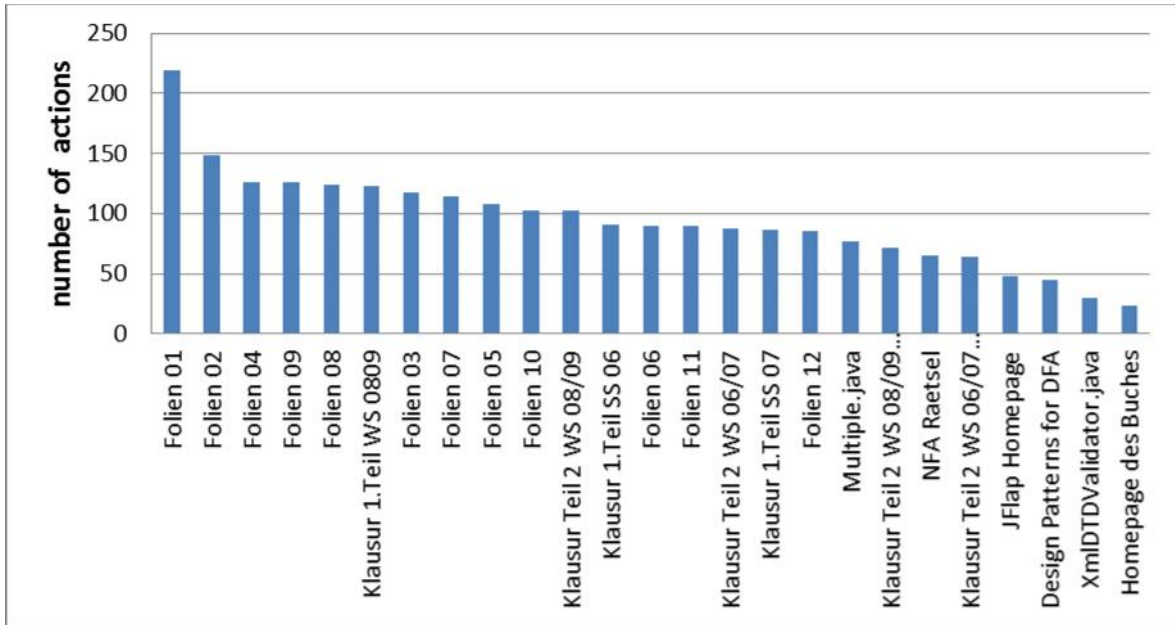
Figure 2: Overview of the number of actions per resource in increasing order

A second useful overview is access over time: When are resources used by students? This is important for reliability issues, when should the Moodle system not be failing for example, and for pedagogical issues. Teachers are interested to get information on how their students are learning: Do they learn regularly during the semester, or only just before the exam? Do they consult special contents to prepare for the next lecture or after the lecture as a review and consolidation? In this case study we were interested to know how the self-test exercises are used. Are they used at all? Are they used before the lecture or after or both? Is there some more intensive use before the exams? We use the filter options to select the actions 'attempt',' close attempt' and 'view attempt' to dismiss access in which students do not actually attempt to solve the tests. We also use the filters within the time range to zoom on a particular time-window. Figure 3 shows the access to self-tests exercises with a daily granularity from November the 1st till December the 4th, the first exam being on December the 2nd as a surface chart. Note that the diagram shows cumulated actions for the time before November the 1st on the Day November the 1st, and similarly for the time after December the 4th. The self-tests are called Aufgabe1, Aufgabe 2 and so on in German. One notices that the use of self-tests generally tends to decrease, the colour is less intense. The self-tests still opened are reused before the exam, see the vertical lines on November the 30th and December the 1st, which suggests to keep the self-tests open during the whole semester. The general decrease of the use of the self-tests was already noticed before. Closing the self-tests after 2-3 weeks was an experiment to investigate whether the behaviour of students would change when the self-tests become more scarce meaning not available all semester. A quick look at the Moodle reports in 2010 could not show a noticeable change.
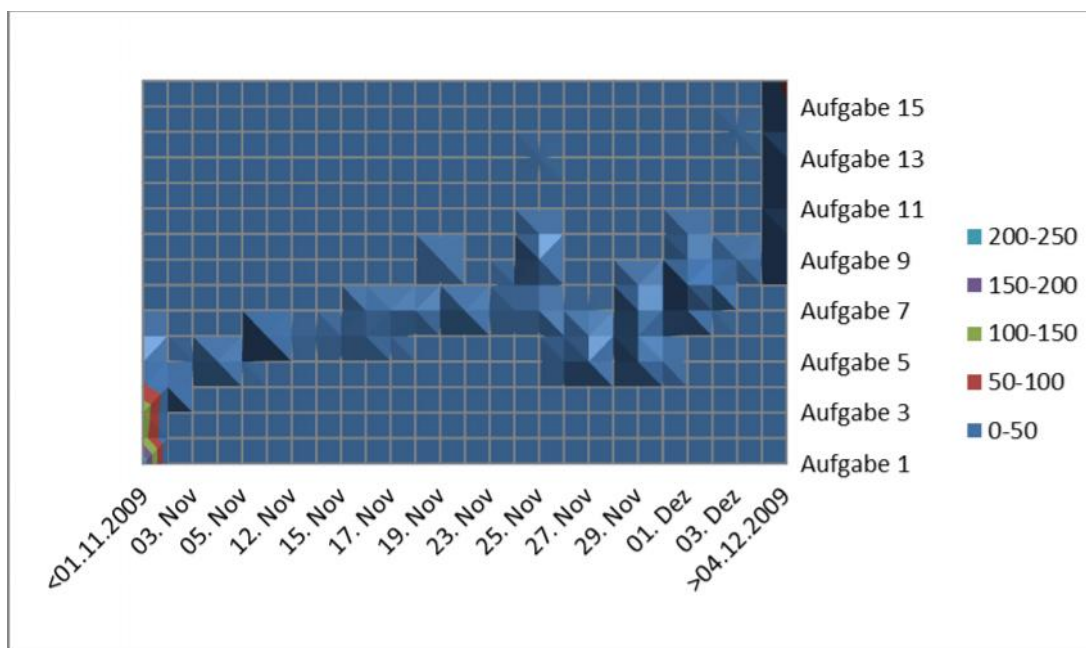
Figure 3: Overview of the use of self-tests before the first exam

It is interesting for teachers to be aware of their individual students: are they homogeneous or do they differ in their use of resources? We selected a surface chart to show the details of individual access to non-compulsory self-tests as shown in Figure 4. Even if the general trend is a decrease in usage, some students like 11373 begin late, which fits into the findings of (Hershkovitz Nachmias 2011) identifying late users in a similar setting, Moodle course to support face to face teaching, though the general trend is less usage as the semester progresses. Note that in our approach the data is anonymised. Teachers cannot control particular students, as it might be possible when working with a Pivot Table generated directly from the Moodle report. Our aim is to get general information about diverse behaviors of students to support reflection and pro-activation, not to follow any particular student.

The exploration presented here investigates the total number of actions on each resource. It is equally interesting to explore the number of students who have used a resource at least once, the total number of actions is not relevant anymore, only the fact that a resource has been used. For this, we would change the query to extract another table from our database. It is also possible to gain that table in Excel directly, but rather complex.
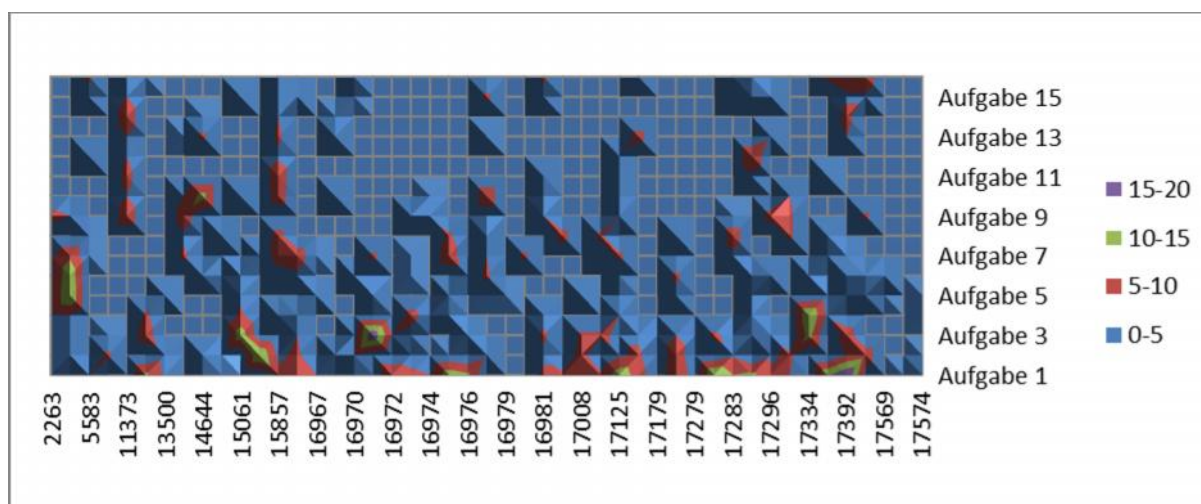

Figure 4: Use of self-tests detailed per student

Analytical Processing of Impact on Success

Using an appropriate query we have extracted the table shown in Figure 5, which is similar to the grades table provided by Moodle except for the anonymised data. The average mark in the first exam, 34.25532915, is shown at the bottom of the column called '1. Teilklausur', German for first exam. To investigate whether attempting some self-test has an impact on success, clicking on the top of a particular self-test we deselect the empty line box. The table only shows the students, who have attempted that particular self-test, here self-test 5. Selecting all figures of the column '1. Teilklausur' gives the average mark for that subgroup in the bottom line below the table, here 34.4814818148. This small difference does not suggest any particular impact, contrarily to the analysis performed on other data in (Krueger, Merceron, & Wolf, 2010). A large difference might suggest an impact, and should be checked for statistical significance if the number of students is at least 30.

user Id	1. Teilklausur	Aufgabe 1	Aufgabe 2	Aufgabe 3	Aufgabe 4	Aufgabe 5	Aufgabe 6	Aufgabe 7	Aufgabe 8
2263	26	10	10	10	10	10	10	10	0
2326	29	0	10	10	10	10	10	10	0
11373	30	0	0	0	0	0	0		
14948	14	0	0	0	0	0	0	0	0
15061	32	0	0	10	0	0	0	0	
15497	0	0	10	0	0	0	0	0	0
16967	50	10	0			0		0	0
16971	0	0	0	0	0	0	0	10	
16972	40	4	0	0		0			
16975	41	0	0		0	10	0	0	10
16076	46	5		0		0	0		
16978	31	0	0	0	0	0	10	10	0
16979	43	0	0		0	0			
16981	50	5	10	0	10	0	0	0	0
17008	36	9	10	0	0	0			
17125	44	4	10	10	0	0	0	0	0
17179	17	0	0	0		0	0		
17217	47	10	10	0	0	10	0	0	10
17283	36	6	0	0		0	0	0	10
17286	46	9	0	10	10	10	10		
17296	36	10	10	10	0	0	10	0	0
17334	37	0	0	0	0	0	0		0
17380	36	4	0		10	0	0	0	10
17392	45	6	10	0	0	10	0	0	
17393	31	10	0	0	0	10	0	0	0
17569	40	0			0	0	10		
17574	48	10	0	0	0	0			
mean	34,25531915	8,66666667	4,545454545	10	6,66666667				

Mittelwert: 34,48148148   Anzahl: 27   Summe: 931

Figure 5: Average Mark in the first exam in general and for students who attempted self-test 5

With another query on our database it would be possible to generate a Pivot Table containing the results of the two exams and the students who have used other learning materials like slides, past exams or complementary reading. The impact of using that specific learning material on the final mark can be investigated in a similar fashion.

Conclusion and Future Work

In this paper we have investigated the usefulness of Pivot Tables to analyse usage data stored by Moodle. For this purpose, after a short introduction to pivot tables, we have shown an analysis performed on the course "Formal basics of Computation" taught at the Beuth University of applied science. The analytical processing shown focuses on use of resources by students and impact of specific learning material, here non compulsory self-tests, on the final exam.

Working with the Pivot Tables is in most cases quite intuitive and allows a flexible analytical processing of user data. Though the present surface charts are enough to grasp the trend, their quality is not optimal. Excel 2010 Pivot Tables lack the facility of a nice hit map (or we have not found it yet).

The immediate next steps go into two directions. One direction is to conduct more case studies with our partners to gain a better overview and understanding of the various learning analysation processes that different actors perform and to establish a kind of roadmap or list of best practices for newcomers. Another direction is to integrate the export towards Excel facility into the tool LAMA we are developing (Dierenfeld 2012). LAMA is a web application that users can access from Moodle over a Moodle block. Its aim is to support different actors to analyse user data from learning management systems. It should be adaptable to and by different kinds of actors according to their needs or skills and therefore have different modes. For the time being we have identified two modes: the simple mode for a quick overview, and the mode for actors with knowledge on Pivot Tables. A challenge is to integrate a mode with data mining techniques that non computer scientists can use in a correct way. We also pursue work in that direction.

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Acknowledgements

Learning and teaching with Moodle-based E-learning environments, combining learning skills and content in the fields of Math and Science & Technology

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Abstract

E-Learning environments may contribute to the teaching and learning process if the integration is done within the framework of proper pedagogy. Building customized E-learning programs places high demands on design, programming skills, and time. An alternative to this can be deployment of courses within learning management systems. One such system that has been gradually gaining worldwide popularity is Moodle (Modular Object-Oriented Dynamic Learning Environment), a course management system for online learning. Moodle is "open source", allowing developers to tailor the system to individual needs. It also communicates extremely well with many web -based resources (Facebook, YouTube, Wikipedia, JClik, Hot Potatoes, etc.), allowing developers creativity and versatility. The design of Moodle is based on socio-constructivist pedagogy. This means its goal is to provide a set of tools that support an inquiry- and discovery-based approach to online learning. Furthermore, it purports to create an environment that allows for collaborative interaction among students as a standalone, or in addition to, conventional classroom instruction.

In this paper we present an overview of E-learning environments that we have implemented using the Moodle platform. These environments include interactive activities combining simulations, short videos, virtual experiments, games and more, in order to enhance interactive learning based on constructivism theory, and allow for students and teachers to learn skills for intelligent use of information and technological communication. The environments have been developed in partnership with teachers, as an enhancement to face-to-face teaching, for both curricular and extra-curricular learning. One main advantage of these environments is the freedom of teachers to add, change or use them as is, according to their needs; hence, the teachers are equal partners in the development. We will also show how these environments supply teachers with many interesting tools that can be used to improve the teaching– learning process, and the students to reinforce their abilities and knowledge, in a user friendly and stimulating manner engaging them in a fun, familiar and modern environment where much of their daily non-school activities take place.

Keywords

LSS (learning Science Skills), constructivism, Course management system: Moodle platform, computer aided teaching E-learning, innovation, 21 century skills.

Introduction

Nowadays, the computer is a significant part of the learner's daily life. It is, by now, inevitable that methods of teaching and learning should include E-learning components that are based on the computer environment and include proper preparation for the 21st century which requires a "new pedagogy" (Martin and Madigan, 2006). This new pedagogy, in the case of math science teaching and learning, employs:

- High-order thinking and learning skills.
- A constructivistic approach to science teaching and learning.
- Information, communication, and scientific literacy skills using digital means and advanced technologies.

Teaching in an E-Learning environment can contribute to the ability to teach, the ability to learn and most important to bridge between two main components in the classroom, the teacher and the learner. E-learning provides different environments for learners with dynamic, interactive, nonlinear access to a wide range of information (text, graphics, and animation e.g. Jonassen, 1996; Jacobson & Archodidou, 2000) as well as to self-directed learning in online communication (e-mail and forums).

E-learning is based on concepts such as independent learning, active learning, self-directed learning, problem-based education, simulations, and work-based learning (Martens, 2004). Most of these models are based on constructivism in which, according to Reiser (2001), learners become responsible for regulating their own learning process. Self-regulated learners are motivated, independent, and meta-cognitively active learners in their own learning (e.g., Duffy et al. 1993; Wolters 1998; Dalgarno 1998; Pierce & Jones 1998; Bastiaens & Martens 2000; Herrington & Oliver 2000).

All these instructional models hold that it is crucial to generate the learner's motivation (Martens, 2004). For this reason, many of the computer-based learning environments constructed present realistic problems, for example through a simulation or a game. Ryan and Deci (2000) distinguish between extrinsic motivation, which refers to the performance of an activity in order to attain some separable outcome, and intrinsic motivation, which refers to doing an activity for the inherent satisfaction of the activity itself. The effort or motivation on which constructivist e-learning environments try to rely is typically intrinsic motivation, with its associated features such as curiosity, deep level learning (aimed at understanding, not rote learning, Marton & Sa¨ljo¨ 1984), explorative behaviour, and self-regulation. Research has shown that intrinsically motivated students show more behaviour that can be described as explorative, self-regulated, aimed at deep level processing, and aimed at exploration and reflection (e.g., Ryan & Deci 2000; Boekaerts & Minnaert 2003). To increase the understanding of the relation between e-learning and motivational processes, it is necessary to gain a better understanding of learning materials that are developed to increase motivation (Martens, 2004).

Moodle allows the integration of a wide range of resources, from chats and forums to online booklets, a variety of questions, collections of problems and exercises, lecture notes; including any kind of text-based or Html-formatted documents, multimedia resources such as graphics, video or audio (e.g., MP3 files), PowerPoint, or Flash-based applications and Java applets (Goodwin-Jones, 2003). Moodle focuses on giving educators the best tools to manage and promote learning and allows teachers to organize, manage and deliver course materials. From a didactic point of view, the usage of multimedia tools to create attractive activities makes the learning process friendlier for students. As a consequence, these activities increase the interest of the students in their studies. Teachers can provide students with a large amount of resources that they cannot usually show in the classroom due to time constraints. Lesson tasks within Moodle can be linked to any resources that are uploaded to one's server or that are available on the Internet. The students' exploration of any of the content-based resources can be easily assessed by using any of the Moodle based evaluation and feedback tools. Moodle is quite powerful in content creation due to its built-in HTML editor. The degree of expertise required is essentially the same as for any word processor. More sophisticated presentations such as animations or text-specific feedback provisions need to be created using exterior multimedia authoring programs. These materials cannot be added in a hard copy booklet.

Moodle has pedagogical advantages since it was built in accordance with the teaching approach which emphasizes the construction of knowledge through active and interactive learning, and learning multi-sensory experience through multimedia. The design of Moodle is based on socio-constructivist pedagogy (Brandl, 2005). This means its goal is to provide a set of tools that support an inquiry and discovery-based approach to online learning. Furthermore, it purports to create an environment that allows for collaborative interaction among students as a standalone or in addition to conventional classroom instruction.
In the Davidson Institute of Science Education, a non-profit organization committed to the promotion and nurturing of science and math education in Israel, Moodle serves as the primary learning platform for o nline learning. Since Moodle was first implemented three years ago, over 100 online math and science courses have been developed with over 5000 school students participating in them annually. A few of the leading programs are Math and Science by Mail, MOT-TEC and Beaver. Since its implementation, we have adapted Moodle for K-12 science and math teaching and learning and added many features, making it a technologically and pedagogically advanced platform (Lachmy et al 2012).

In this paper we present two of our Moodle based courses, "Math-By-Mail" and MOT-TEC, which include an array of activities that combine higher-order skills with content in math, and science and technology for junior and middle school students. In addition, we report on a pioneering attempt to run and evaluate the MOT-TEC environment among teachers and students. We will demonstrate how the MOT-TEC environment provides the teacher with many interesting tools to improve the teaching – learning process, and encourages students to reinforce their abilities and knowledge, in a user friendly, stimulative manner.

Development of E-learning courses on the Moodle platform

To design the environment we developed a model to guide us in the environment design as shown by Lachmy et al 2012. This model borrows from the TPCK model (Koehler, Mishra & Yahya, 2007), which is a framework designated for the three aspects of teacher knowledge and transforming them into design aspects, namely, Technology Content and Pedagogy as shown in Figure 1(Lachmy et al 2012). Technological design refers to the technological tools implemented in the environment and the manner they are adapted to specific requirements. Content design refers to the way the content is integrated with the technological tools and includes task design considerations. Pedagogical design refers to the interrelations of different users (such as teachers and students) and related factors (such as schools) with the environment.
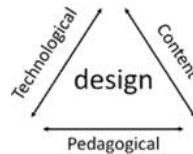

Figure 1: Design model (Lachmy et al 2012)

Math by Mail (MBM)

"Math-by-Mail" (MBM) is one of the most prominent projects of the Davidson Institute of Science Education. The project was initiated 30 years ago targeting elementary school students who are high achievers in math, teaching them extracurricular math topics. The program was inaugurated as a correspondence project that connected students and mathematicians through a series of booklets sent to selected students through regular mail. In 2004, the program was transferred to the internet and correspondence was done vi a online forums. The booklets were available as PDF files which participants downloaded and then sent in via fax or mail. The Math-by-Mail staff reviewed the work done by the students and returned the marked booklets via regular mail. Lately, the program has undergone another major transformation by implementing the Moodle platform (see Figure 2).

Figure 2: Template of "Math by Mail" program in English and Arabic

The transformation was made possible because of the capabilities of Moodle: online wide range system support, 24 hours availability, a variety of network interfaces (Internet explorer, Google Chrome, Netscape, FireFox) and support in different languages. This change enabled enhanced communication with the projects staff at the Davidson Institute, and, more importantly, a completely interactive online booklet, submitted and reviewed online with no hardcopies necessary, in four languages (Hebrew, Arabic, English and Spanish). Close to 3000 participants worldwide registered to the program in 2012 from Israel, Canada, the US, Australia, Mexico, Brazil and Romania (Kotzer and Elran 2011).

Another important change was the feedback capability. Checking the booklets by students and then sending the marked booklets via regular mail takes a lot of time, hence, a lot of patience is required from participants. Students who participate in E-Learning environments often complain about the lack of feedback that is available in conventional classroom settings. In Moodle, almost all modules are designed to allow teachers or course participants to provide feedback in qualitative or quantitative form. For example, both the journal and assignment module gives the instructor the option to provide their comments in a feedback box. The assignment module, which is designed so that students can upload their assignments in any file format to the server, also allows the instructor to upload comments about the student's work in the form of text- or audio-based (e.g., MP3) files. Feedback can be teacher-restricted or made accessible to all participants in both forums. Closed questions in MBM are evaluated automatically using the instant feedback feature (Figure 3). If the booklets include also open questions, the instructor can review and comment on each assignment and even send a personal mail with feedback on the overall booklet. The feedback is given for each student at his or her pace.

The ability to monitor each individual student from amongst a huge number, providing them with the right feedback at the correct time is one of the most advantageous features of Moodle.

Figure 3: Instant Feedback

MBM offers talented and curious children (grades 3-9) extra-curricular activities in recreational mathematics that develop their creative thinking and logic. Activities include four in-depth topics that are spread over the school-year and, once uploaded, can be accessed anytime online, to be done at home or at school. The in-depth topics are exciting, challenging and, most importantly, fun because it is based on the ideal combination of content, pedagogy and technology. The Moodle platform enables this by allowing integration of a wide range of resources; online booklets, a variety of questions, collections of problems and exercises, lecture notes; including any kind of text-based or Html-formatted documents, multimedia resources such as graphics, video or audio (e.g., MP3 files), PowerPoint, or Flash-based applications and Java applets (Goodwin-Jones, 2003) as in Figure 4 (applet from the booklet "Conway's game of life" and applet from the booklet "Graphs and Mazes").

Figure 4: Applets in Booklets

In addition to the in depth topics, participants receive a weekly newsletter with additional riddles and challenges, the Mathletter. The Mathletter challenges and many other topics are discussed in the weekly chat with the MBM team - researchers at the Weizmann Institute of Science (see Figure 5). The chat is a unique opportunity for participants to have a conversation, share their ideas and get feedback from researchers in one of the world's leading science research institutions

Figure 5: The Mathletter and Chat

The Forums and especially the weekly chats eased the interaction with students in real-time and facilitated interaction on an even level allowing students to share their opinions and suggestions; as a learning community, it allowed students to share and discuss their knowledge and difficulties, and also help each other. We noticed that at the beginning of the school year there were few students who participated in the chat, over time the number of students who participated increased and more importantly there was an increase in the number of active students who asked questions and contributed to the discussion (Figure 4).

There are two options for participation in the project: as an independent participant or as part of a class. In the latter case, in addition to the staff, there is a math teacher that follows the students' activities. The Moodle as a learning management system allows the teachers to view the answers, see the dialogue in the forums and chats

and this enables teachers to understand in which part of their course students are experiencing the most difficulties and which parts are easy.

We note that the number of students using internet courses and booklets (such as "Math by Mail"), preferring them to hard copy assignments and booklets, increases over time, which suggest that students have interest in such E-Learning techniques. Last year when we implemented the program in Moodle only 50% of the participants used the internet course and booklets, while this year 90% are using the online booklets. Next school year we intend the program to be a fully online program without any hardcopy booklets. Overall, the perception of students of web-based homework testing was very positive. We implemented a similar Moodle course in Science, "Science by mail", with similar results.

Evaluating MBM environment: MBM course of 2010-2011

The evaluation was a short-term assessment conducted at the end of the period in July 2011. It was carried out in the course of the end of year participant conferences ("treasure hunts"). During the conference:

1 Questionnaires were distributed among the children (119 questionnaires were received from MBM participants).
2 16 parents were interviewed.
3 17 teachers were interviewed.
4 Focus groups were set up and conversations with children were conducted

Questionnaires were distributed to all the children we were able to reach, and most of them filled in and returned the questionnaires. Parents and teachers were selected at random – based on accessibility and the time we had available to us. It should be noted that the teachers and parents interviewed were among those who came to the conference and thus constitute a sample of parents who are involved in the program in some way or another. The findings derived from student questionnaires and from the interviews with parents and teachers.

Student, parent and teacher satisfaction indicate a high level of satisfaction. The students liked the program and its contents to a very large extent. They liked the level of organization to a large extent. Children's satisfaction with the program found expression in their almost universal willingness to recommend the program to others and their almost universal willingness to remain enrolled in the program. Parents and teachers felt that the program is an enriching and innovative one and has a good reputation in general. Many of the teachers have been acquainted with the program for some years and have chosen to continue their involvement with it because of its quality. Teachers commented that the program provides a response to the needs of a unique group of children as shown in Figure 6a.

The essence of the program as perceived by the children is shown in Figure 6b. The children experienced the program from two almost equal perspectives - they perceived it both as fun, and as educational and enriching - a combination of fun, information and interest in both programs. It seems that the program was able to combine a fun experience with the gaining of interesting knowledge. 6th grade MBM students said: "It is challenging because it is hard. It is not something mundane like 15 times 16… there are questions of a different sort- questions that are, let's say, surprising". Other children emphasized the innovative aspects of MBM and that the learning was meaningful rather than technical: "I learned about things that I did not even know existed. Had you asked me who Fibonacci was, I would have said he was an artist, I had no idea what operators were". "If someone were to just tell me to write up a list of Fibonacci numbers, I suppose I might not remember how to do that, but if I were to get the first four numbers in the series and told to continue the series, I'd remember what to do…"
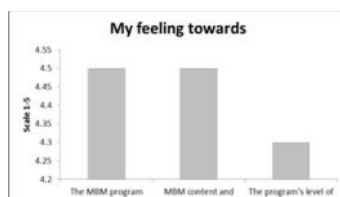

Figure 6a: Average responses to the question – 'Here are a number of faces. On each row, select the face that best describes your feeling towards each of the following items'. Scale of 1-5.
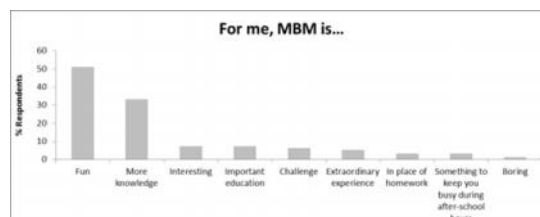

Figure 6b: Distribution of student responses to an open question: "For me, MBM is…" % of students indicating each of the responses

Implementation of Science by Mail (SBM)

"Science by Mail" (SBM) offers school-children in grades 3 to 9 a glimpse of the cutting edge research that is taking place at one of the world's leading research institute, The Weizmann Institute of Science. The program too, includes four in-depth topics, each from a different scientific field and based on the research conducted in a different laboratory at the Weizmann Institute. The in-depth topics are spread over the school-year and once the activities are uploaded, they can be accessed online anytime, at home or at school. The activities are based on simple experiments that can be performed at home, which lead even young participants to a much better understanding of complicated ideas and, equally important, to the process of scientific research and scientific thought. As in "MBM", in addition to the in- depth topics, participants receive a weekly newsletter with additional experiments, riddles and challenges. The newsletter challenges and experiments are discussed and results compared in the weekly chat with the Science by Mail team, researchers at the Weizmann Institute of Science. The chat is a unique opportunity for participants to have a conversation, share their ideas and get feedback directly from researchers of science.

Another program we implemented in Moodle platform is "Beaver". The program is engaged in solving challenging problems of interesting and intriguing in a variety of topics in computers. The purpose of the program is to create a foundation of basic understanding of computer science, development of personal abilities, better ability in solving problems and strategies selection. The program encourages computational thinking and creative and intelligent use of information technology. In the Beaver program a team of computer science teachers from middle and high school write the questions for the competitions. The participation in this program can be also as an independent participant or as a member of a class.

The "Beaver" program is part of an international contest of informatics and computer fluency established by Prof. Valentina Dagiene (http://www.bebras.org/en/welcome). The first Bebras contest was organized in Lithuania in 2004. Today there are students from 17 countries participating and another 6 countries, within them Israel, that are planning to participate. Last year we had two internal competitions with 800 participants all done in Moodle platform (see Figure 7). The first competition was a week long and was held in different schools. The second stage of the competition was at the Davidson Institute of Science Education. Next year we intent to encourage the participants in this program by adding a competition between schools and by adding practicing lessons within school classes supervised by computer –science teachers.

Figure 7: Beaver program

MOT-TEC

MOT-TEC includes an array of activities that combine higher-order skills with content in science and technology to middle school, emphasizing learning and thinking skills such as asking questions and exploration. The MOT-TEC environment has been developed together with teachers as an enhancement of face-to-face teaching. The content of the units were chosen by a team of science teachers (content which was difficult to teach) and various activities were built in collaboration with them. The uniqueness of these environments is the freedom of teachers who teach with them to add, change or use them as is, according to their needs. Additionally, we developed and fitted tools according to the teachers' needs for use in MOT -TEC based on Moodle. MOT-TEC consists of the following components:

- Visuals that combine short films, simulations, animations, and educational games related to the selected science topics.
- Interactive learning activities that support attaining high-order thinking and learning skills combined with scientific content.
- Feedback facilities that enable automated response regarding closed questions as well as teacher's reactions to open-ended tasks.
- Learning management system options that facilitate assessment of learning through questionnaires, statistics, and reports.
- Flexibility for teachers: they can adapt the activities to their needs or the needs of their students and according to class technological conditions.

The first unit we developed in MOT-TEC emphasizes learning and thinking skills such as asking questions and exploration. These skills were incorporated on the subject of "water" in various aspects: water as a solvent with respect to macroscopic and microscopic material, detection of water by its properties, different water sources and the water cycle in nature (these aspects are part of the science and technology curriculum in junior high school). The students visually explore and experience water solubility phenomena of materials such as salt (NaCl), sand, and oil, as well as, their macroscopic explanations (in the case of NaCl). The computerized activities are structured, yet flexible, and lead to a variety of investigation-oriented activities through science films, games, and simulations as seen in Figure 8a. The teacher acts as a mediator and helps the students navigate according to their capabilities (Frailich et al 2011).

MOT-TEC combines computerized applications, such as, simulations, images, videos and games within learning tasks to enhance the understanding of the studied subject in an enjoyable and stimulating manner through inquiry- and discovery-based learning. We fitted the quiz module so that it is shown in the same window as the simulation (Figure 8b). The learning task appears at the top, and the simulation at the bottom. The student can change the sizes of each part according to their needs. The student can advance the task at his/her own pace and answer the questions according to the various conditions and results in the simulation.
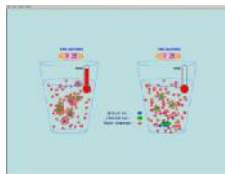

Figure 8a: A dynamic presentation of the particulate model of the dissolving process of Sodium chloride in water (Frailich et al 2011)

Figure 8b: Fitted Quiz module in the first unit: exploration skills incorporated within the subject of "water"

Pilot evaluating MOT-TEC environment: first unit - exploration skills incorporated on the subject of "water"
As shown by Frailich et al. 2011 a pilot program was run with teachers and students who used MOT- TEC as part of learning this topic in their material sciences lessons. The topic "solutions and solubility of materials" is usually studied in the last semester of 7th grade or at the beginning of 8th grade. We administered questionnaires to students who used our environment (3 classes, N=57). The questionnaires included Likert-type items in evaluation scale of 1-4 (1- Not at all, 2 – Slightly, 3 – Much, 4 – Very much) as well as open-ended questions about the E-learning environment, MOT-TEC. (Answers to open- ended questions were tested and classified by category using Shkedi 2003). The purpose was to examine students' attitudes toward the different dimensions of learning in the MOT-TEC environment: The intention was to find out, specifically and individually, the students' attitudes toward various interactive simulations (similar to their favourite video games) and attitudes towards learning tasks that required work practice, thinking, and application of skills and content that were learned.

The results of the students that responded to open feedback which students were asked to comment on MOT- TEC (82%) showed that most of the students (89%) expressed very positive attitudes towards the various dimensions of MOT-TEC (Frailich et al. 2011).

The results from the closed questions indicated that both the computerized applications (such as simulations) and the adjusted tasks contributed equally to students understanding, interest and enjoyment as shown in Figure 9.
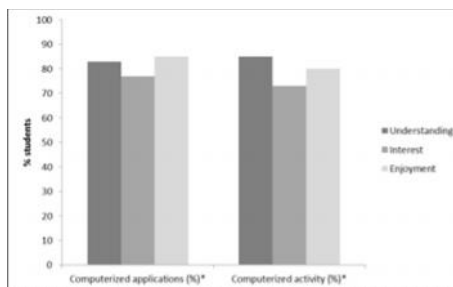
Figure 9: Students' responses regarding their levels of interest, understanding, and enjoyment of learning with MOT-TEC *shown combined percentage of levels 3 (much) and 4 (very much) in a 1-4 Likert-type questionnaire

Implementation of MOT-TEC

Last year we developed a second unit in MOT-TEC (based on the first unit template in Moodle PLATFORM) that combines the skills of scientific explanation and argument with the content in physics - interactions and forces and content in chemistry, material properties and particulate model of matter as in Figure 1.

Figure 10: Fitted Quiz module in the second unit: explanation and argument skills incorporated within content in physics and chemistry

Currently MOT-TEC units based on Moodle platform are embedded in 30 schools. Teachers reported that the MOT-TEC units enabled them to watch students' performance online and to intervene and support their learning processes accordingly. They also indicated that their students were actively engaged in the visual computerized activities and showed a high level of interest. The level of students' understanding of the scientific contents was higher than before.

The MOT-TEC units enrich teacher's repertoires of pedagogical strategies, consequently leading to the design of new and improved pedagogies. Teachers indicated that they wanted to implement similar applications in the future.

MOT-TEC has a unique approach in combining teaching, training and implementing of learning skills with content in science and technology. These reports have encouraged us to expand our design efforts covering a variety of contents and skills, where the computerized environment MOT-TEC stands as a framework for further developing for the following reasons:

- Teachers have need and desire for computerized environment such as MOT-TEC for teaching and learning because of the complication in developing due to lack of resources such as time and money.
- It is important to address the diversity of students, to challenge outstanding students and meanwhile provide good learning skills and knowledge to students with difficulties.
- Responding to existing needs in e-learning for short structured and targeted computerized environments that integrates contents and high-order thinking and learning skills.
- Lack of computerized environments that combine applets (as graphics, animation, audio, and video)
- with activities which enable a better understanding and learning of complex, abstract and molecular content.

We are continuing to develop additional units that combine various skills and content in science, while addressing and responding to student diversity. Additionally we conduct training for teachers on MOT-TEC units including pedagogy of teaching in a computerized environment. Some of the training courses are done in a completely E-learning environment that also was developed on the Moodle platform. The courses were successful and we intend to improve and continue them.

Summary and Conclusion

MBM and MOT-TEC are both models of E-Learning environments developed on the Moodle platform, which is one of the major points of similarity. Other points of similarity are enabling a teaching –learning experience by promoting curiosity, interest, and understanding of the subject.

Development of MBM and MOT-TEC E-Learning environments on Moodle platform has led us to several important principles that need to be considered before developing additional environments:

- There is a huge need in E-learning environments based on curriculum content. The teachers do not have time to build them by themselves.
- It is important to base the environments according to teacher's needs, content based or technology based.
- The environments should address the student diversity
- There should be emphasis on design and simplicity of the environment enabling easy and enjoyable use that leads to understanding and development of interest in subjects that are considered hard to learn.

Comparing the essence of the two models, we noticed the following differences:

1 Educational goals - MBM program is an extracurricular program. Its goals are developing math thinking skills, curiosity and interest in the field of math. The program is not integrated into the curricular school learning. This is its uniqueness and the source of its success. Success in the grades in school is not a goal of the program. MOT-TEC, on the other hand, is part of the curricular program as an enhancement to face-to-face teaching and the opportunity to supply teachers with many interesting tools that can be used to improve the teaching– learning process and there is an importance for grades.
2 Different audiences – MBM focuses on elementary and junior high school students where MOT-TECfocuses mainly on junior high school students
3 Size of the different community - The purpose of MBM is to create an international community of learning science and mathematics in popular areas. MOT-TEC communities consist of a teacher and students in schools in Israel who are learning certain curricular topics.

Overall, the perception of students of web-based homework testing was very positive. We plan to implement Moodle courses in additional subjects such as curricular chemistry and biology in order to improve and homogenize the basic knowledge of the students. We attend expanding the MBM by enabling communication between different schools in different countries and trying to develop a math learning communities .We intend to guide teachers using existing E-Learning environments and building independently new Moodle E-Learning environments for the benefit of their classroom learning.

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Acknowledgements

MOCLog – Monitoring Online Courses with log data

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Abstract

The purpose of the MOCLog project is to develop a tool for the analysis and presentation of log data on a Moodle server. The new idea of MOCLog is to combine in a useful tool a didactical theory with users' data and to serve the needs of four groups of stakeholders: students, teachers, study program managers and administrators. The approach that we followed with MOCLog is the analysis of learning activities in online-courses from a didactical point of view (learning process and outcomes), thus going beyond than simply counting and visualizing the numbers of posts and clicks. For this purpose, a model of the log file analysis was proposed, derived from didactical principles, and an analysis of user requirements. These requirements have been collected through interviews with stakeholders, theoretical studies from the literature, and from the experience of our team members as researchers in eLearning. Based on this, a model composed by a concept map, a solution map and use cases was developed. Implementation started from these use cases and specified a design that allows realizing them within the context of Moodle, either by reusing components available from the GISMO system, or by implementing new ones. After a series of different tests and the implementation of related improvements, the MOCLog system is now available for deployment and exploitation in academic institutions.

Keywords

Students tracking, log analysis, log file analyser, learning analytics, educational data mining.

Introduction

An important aspect of online teaching and learning is the monitoring of student progress and tools utilization in online courses. Educational research shows that monitoring the students' learning is an essential component of high quality education. Using log files of learning management systems can help to determine who has been active in the course, what they did, and when they did it. (Romero, Ventura & Garcia, 2007). Feedback about the status and the history of the activities in online-courses can be useful to teachers, students, study program managers and administrators. For example it can help in better understanding whether the courses provide a sound learning environment (availability and use of discussion forums, etc.) or show to which extent best practices in online learning are implemented (students provide timely responses, teachers are visible and active, etc.). Learning Management Systems provide some reporting tools that aim to monitor students' and tools' usage, but these are seldom used mainly because it is difficult to interpret and exploit them; the obstacles to interpretation and exploitation are the following:

- Data are not aggregated following a didactical perspective;
- Certain types of usage data are not logged;
- The data that are logged may seem incomplete;
- Users are afraid that they could draw unsound inferences from some of the data.

In the attempt of overcoming these difficulties, new reporting functions of LMS have been added, for instance Moodle now provides reporting tools which enable teachers to evaluate the activity patterns of individual students. Moreover in the last few years researchers have begun to investigate various data mining methods which allow exploring, visualising, interpreting and analysing eLearning data thus helping teachers in better understanding and improving their eLearning practice (Romero et al. 2010) (Mazza & Botturi, 2007).

In the project presented here we implemented MOCLog, a monitoring system that helps to analyse log files of Moodle by focusing on a didactical point of view; in this way we hope to provide foundations for improving the quality of teaching and learning. The specific objectives that contribute to reach this aim are:

- A systematic process of log file analysis for online courses (MOCLog-process)
- The definition of a suitable model of log file analysis (MOCLog-model)
- The design and implementation of a monitoring tool (MOCLog-tool) based on the MOC-log-model

MOCLog combines in a useful tool a didactical theory with physical data (log files). By analysing the use of the contents in the online-courses from a didactical point of view, MOCLog allows deeper analyses than simply counting and visualising the numbers of posts and clicks. Another key feature is to avoid using entries by students and to rely instead on log files (obtained from system reports) as an input. The goal here is to measure the status of activities in the online-course as much as possible without distortions, 'objectively', by relying exclusively either on log file data or on planning data provided by the course administrators and by the teachers as reference values. The benefits of MOCLog for the higher education sector are:

- Offering relevant interpretation schemes for log file analysis
- Suitability of the interpretation schemes for transfer to other LMS
- Easier and faster analysing of the log files in the online courses in Moodle
- Feedback (numeric, graphic) for all important stakeholders of the LMS (Student, Teacher, Study Program Manager, Administrator)

Related works

An extensive analysis was performed, searching for software that shares similar goals with MOCLog. Several Moodle plugins (blocks and reports) were found and 29 plugins (15 blocks9, 8 reports10, 6 other types11) examined. None of them covers all 4 user types addressed by MOCLog. Furthermore, 4 papers on this subject were found and examined. Jong, Chan, and Wu (2007) present a learning behavior diagnosis system to study the students' learning status from learning portfolios. The proposed linking layer enables the proposed system to work on various eLearning platforms without reprogramming. Additionally, the use of a supervisory agent enables teachers and students to obtain their learning status or information provided by the proposed system in both Web and e-mail. Günes, Akçayb & Dinçera (2010) is a paper devoted to log analyzer programs and gives general information on this topic. Cocea and Weibelzahl (2009) investigates the possibility of predicting users' level of engagement, with a focus on disengaged learners, using data mining techniques for log file analysis. The paper presents the findings of three studies that refine this prediction approach. Zhang, Almeroth et al. (2007) describes an already implemented Moodle plugin that can send reminder to students about course summary, per-student statistic, per-resource statistics, and time-based statistics. Among the solutions found, GISMO is the tool that provides the most comprehensive set of information. GISMO (Mazza & Botturi, 2007) is a block plugin for Moodle, developed by one of the project's partners. GISMO is a graphical interactive student monitoring and tracking system tool that extracts tracking data from Moodle, and generates graphical representations that can be explored by course instructors to examine various aspects of distance students. Since GISMO provides already several functionalities needed by this project, it was included in the MOCLog tool for the analysis of students' and teachers' data. A related research field, that could make use of our results, is that of "Learning Analytics", where the analysis of LMS logs (and many other methods) are mentioned as useful tools for example for predicting students' success in the context of measures taken for assuring student persistence (Sharkey 2011; Goldstein and Katz 2005). Moreover, one of the findings in Learning Analytics research which needs to be taken into consideration here is that it is difficult to make meaningful comparisons between activity in different courses (Lauría and Baron, 2011).

User requirements

For interpreting the traces of learning activities we need to complement a theoretical understanding of eLearning quality with eLearning good practice, i.e. the experience of our stakeholders (LMS administrator, Study program manager, teacher, student). This is the role that stakeholder requirements play in our MOCLog model: they represent the view from experience in the shape of needs and benefits expected from the MOCLog tool from the different types of stakeholders involved (next is a first list of them).

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[9] The blocks we examined are: ActiveUsers, Completition Report, Course results, Criteria Reference Display, GISMO, Inactive Users, Live Stats, Most active courses, Progress, Progress bar, resource stats report, Sysinfo, Timestat, Usage, Use stats block

[10] Reports we examined are: 5 admin reports (Category Activity Report, Comparative Reports, Course Size Report, Message Log Report, Module Use Report); 2 course reports (Summary Report of Log/activities between sequence of Dates, Use Time Based Progress Report); 1 grade report (Site Wide User Report).

[11] Plugins of other types were examined: 2 patches (Quiz Report Analysis, Progress Tracker); 1 unknown (Statistics in Moodle); 1 package (Checklist); 1 activity module (Course tracking module); 1 extension for administrator reports.

The requirements analysis performed in the beginning of the project was conceived as a case study, not as a representative statistical inquiry; our case study has pointed to some important needs and benefits for our stakeholders, while other were derived from the experience of our team members as researchers in eLearning, as teachers that use LMS systems and as contributors to the management of study programs and to the administration of Moodle sites.

The MOCLog system wants to support four stakeholders that are involved in the monitoring of online-courses:

- Student: focusing on self-monitoring the own learning process.
- Teacher: focusing on monitoring the students' learning process and on didactic-methodical aspects of the online-course.
- Study program manager: focusing on monitoring all courses of the study program and on the usage of the LMS by teachers/students) .
- Administrator: focusing on monitoring all online-courses of the institution and mainly on technical aspects, as well as on general didactic aspects.

In order to elicit requirements from our stakeholders, we conducted an analysis with a number of individuals of each category. Main results of our analysis are summarized here.

Administrator's requirements are driven by annual report and eLearning strategy. The use cases are often very complex. Their main goal is to switch from the current manual and time-consuming process to an automated, complete, comprehensive and consistent, no media break and standardized process. We found that administrators are interested in: compiling reports, identifying usage trends, identification of "good", "active/inactive" or "not used" courses - by parameters, selection, and the analysis of individual courses with the aim to offer individual coaching and to analyse why something happens (e.g. which teacher action generates which students reaction?)

Study program managers want different information about teachers e.g. identification of heavy and weak users. A diagram with the division of the log files in the three elements (distribution, interaction and collaboration) would be useful. In our case study we interviewed 6 study program managers and found out that for them the most important indicators are: the course access (how often teachers access a course), resources usage (see how often they are added or updated), news forum usage (how often teachers post messages) and an overview of the study program (what teacher does what number of courses and how, distinguished in the 3 categories: distribution, interaction, collaboration).

For **teachers** content related issues are more important than interaction related issues. Overall the major aspects of high importance to the teachers related to the course content are: students' course access, resources' visits, resources uploaded by students, course interaction (in which time frame do students upload the assignments, etc.)

Students spend an average of one hour per week on Moodle. The LMS platform is used mainly for test exam preparation, knowledge testing, and assignments. The most important monitoring functions that the students would like to have are: presentation of his test and assignment results, information about which areas he/she has weaknesses, indication about resources visited/unvisited, presentation of his test- and assignment-results related to the average of his class.

A model of log analysis

Based on a review of research literature and the mentioned requirements analysis, we developed the MOCLog model, a combination of a concept map, a solution map and a set of use cases. We wanted our model to act as a guide indicating the goals and direction in which tool implementation should go and what to pay attention to on the way to the implementation of those goals.

Concept Map

We need to clarify in terms of learning theory the monitoring questions by students and teachers. From our research review, the best approach that we have found for this task is constituted by the theory of eLearning functions by Reinmann-Rothmeier (2003) and Reinmann (2006). In order to transfer this model in our log file analysis, we will describe the Reinmann's model in terms of a concept map, and then we extend that concept map to fit it into our monitoring task (connect it with log files and with requirements).

The concept map (Figure 3) gives us a better understanding of log file analysis by clarifying the concepts involved and their relationships. We see on the left end of the map the "learning success" disc (where "success" means to reach the learning objectives) and on the right side the "log file" disc (meaning the collection of LMS

activity traces). Between the two a sequence of 3 elements and their relationships connects the two discs like a conceptual bridge on which to walk for going from one end to the other. The learning success disc is on the left because we start from here and it is here where we want to come back. This map answers the monitoring questions:

- Which way of eLearning enables to reach the given objectives?
- By which means (functions, tools) does the LMS enable these ways of learning

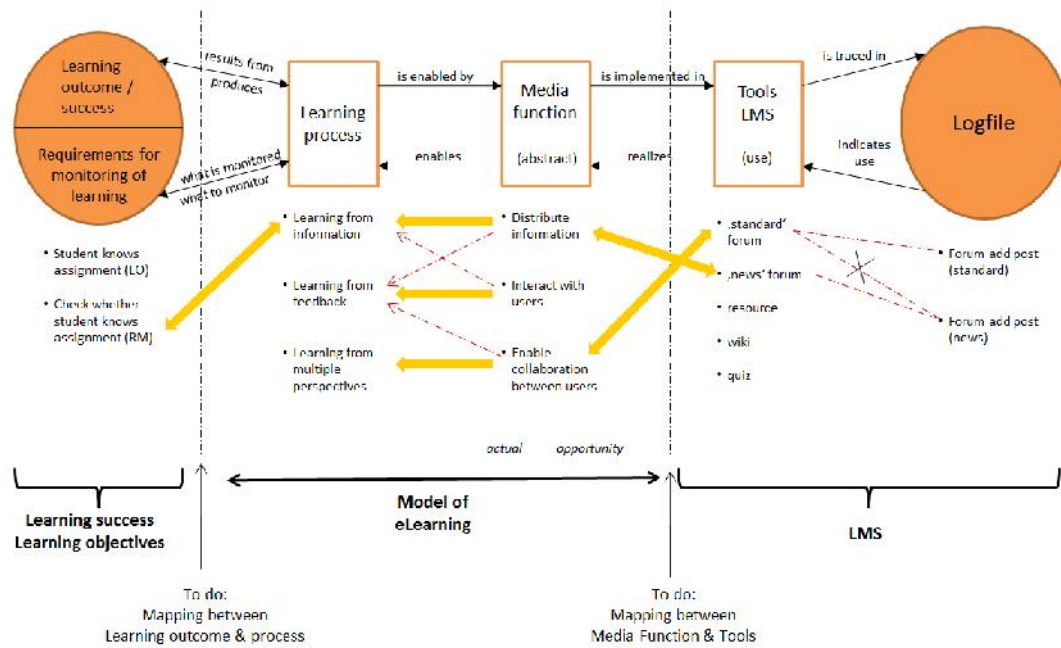How is the use of these means traced in the log files (activity log codes)?

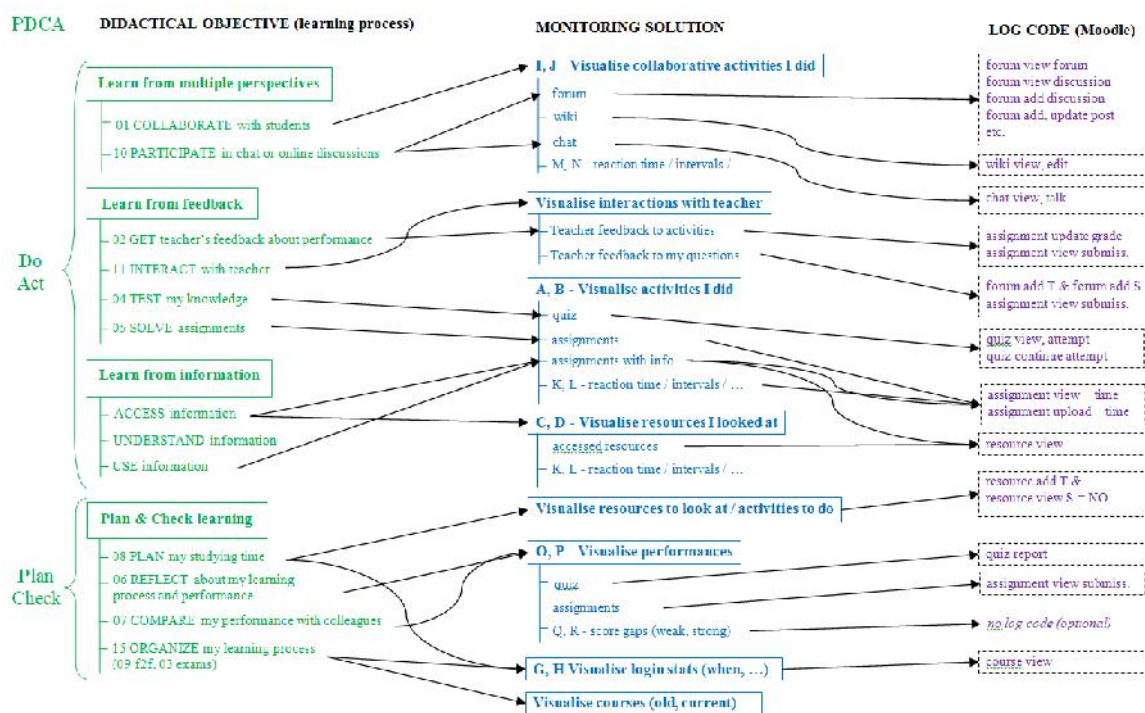

Figure 3: MOCLog concept map

Figure 4: MOCLog solution map

Solution map

The MOCLog research team has defined a model that supports the design of MOCLog functionalities. This model is called *MOCLog solution map*: it is valid for all intended audiences and consists of the definition of functionalities based on the following elements:

1   The first column, "PDCA", specifies which of the map elements belong to the step "performing learning" and which to the step "controlling learning"
2   The second column, "Didactical objective", organizes needs (required "learning methods") in terms of the theory of eLearning functions
3   The third column, "Monitoring solution", displays another set of needs (required "desired functions") and shows with its left side connections how MOCLog could support the monitoring of a specific learning method; with its right side connections this columns shows how the solutions comply with metrics available in the LMS.
4   The fourth column, "Log Codes (Moodle)", displays logs (from Moodle) grouped in terms of the tool for which they are used in tracing the use of the tool.

The MOCLog solution map provides a mean to derive which information should be extracted and visualized from a Moodle LMS in order to satisfy a specific didactical objective. The solution map has driven the definition of the use cases, which are a specification of solution map for some didactical objectives that are requested by stakeholders.

Use cases

Use cases are the third component of the MOCLog model. By the term "use case" we indicate here a specification of how to use the MOCLog tool; it is an outside view (by stakeholders as opposed to the inside view of programmers) that is guided by the concept map, the solution map, and analysis and generalisation of user requirements

Table 2: Use cases for Students and Teachers

Use case	Indicators
Monitor Collaboration Among Students. <u>Objective</u>: to monitor how much the student collaborates with other students	Two different indicators: observations and contributions • Observations: reading of messages (in forum) or content (in wiki and chat). • Contributions: creation of new messages (in forum) or content (in wiki and chat) • Contributions: sum of contributions on forum, wiki and chats over the time
Monitor Interaction Teacher-Student. <u>Objective</u>: to monitor the interactions between teacher and individual students.	• Teacher view of forum • Teacher posting to forum • Teacher posting feedback to assignments • Teacher grading assignments.
Monitor Knowledge testing. <u>Objective</u>: to monitor the student's use of their available knowledge in tests	• Quiz view • Quiz submission • Assignment view • Assignment submitted
Monitor information access. <u>Objective</u>: to monitor the student's access to resources (file, HTML page, IMS package), assignments and quizzes.	• View of resource, also over the time • Submission of assignment, also over the time • Submission of quizzes, also over the time
Monitor organisation of learning. <u>Objective</u>: to monitor how the student organizes her own learning process by planning, preparing for f2f meetings, preparing exams, reviewing learning goals, looking at and comparing performances and reflecting about the learning statistics and outcomes as well as about the process itself.	• Pending resources: resources not viewed out of existing resources. • Pending assignments: assignments not viewed (or not submitted) out of existing assignments. • Pending quizzes: quizzes not submitted out of existing quizzes.

Table 3: Use cases for Administrators

Use case	Indicators
Monitor course activity level. The focus is on the course. The administrator wants to see the level of usage of courses.	• Course observations: activities of users aimed at observing course content (view of resources, reading discussions, etc.) • Course contributions: activities of users aimed at creating new course contents (adding or updating new materials, creation of quizzes, creating a new message in discussions, etc.).
Monitor tool use. The focus is on the tool. The administrator wants to distinguish which tools are used more and which less	• Observation of the use of tools • Contribution to the use of tools.

Table 4: Use cases for Study Program Managers

Use case	Indicators
Monitor teacher facilitation level. The focus is on the teacher. The study program manager wants to identify the level of activity of teachers in facilitating learning with the LMS	• Teacher's facilitation of collaboration: observations and contributions by a teacher • Teacher's facilitation of interaction: usage of assignments and quizzes by a teacher • Teacher's facilitation of information: usage of assignments and resources by a teacher
Monitor Student learning level. The focus is on students (similar to the previous one)	• Students learning by collaboration: observations and contributions by a student • Students learning by interaction: usage of assignments and quizzes by a student • Students learning by information: usage of assignments and resources by a student
Monitor Course learning level. In this use case the focus is on course and on identifying the level of facilitation by teachers and the level of learning by students.	• Sum of Teacher's facilitation of collaboration and Students learning by collaboration • Sum of Teacher's facilitation of interaction and Students learning by interaction • Sum of Teacher's facilitation of information and Students learning by information

Implementation of the monitoring tool

By analysing the use cases for **students** and **teachers** previously described, we can see that the tool GISMO, developed by the University of Lugano, already provides most of the indicators for teachers. The current version of GISMO is aimed to support teachers. Hence, we proceeded with the extension of the GISMO tool to identify the role of the user (teacher, student) in order to propose the proper visualizations. We implemented specific visualizations for each of the use cases identified for students and teachers. For instance, for the case "monitor the collaboration among students" we extended GISMO (which already visualizes data of quizzes and assignments) to visualize data of forum, wiki and chat. The principle behind each use case is that the teacher is able to see data of all enrolled students; whilst a student can see only his own data. Since GISMO is already documented in the previously mentioned publications, we omit here the details.

The use cases for **administrator** and **study program manager** instead require new computations and visualization that are not provided by GISMO. Moodle system administrators have other needs than teachers and students: they are interested in the overall activity of users, the evolution of the LMS's tools usage, and aggregated user or course activity. Study Program Managers are interested in the activities of teachers, or the activities of whole classes. Showing detailed student activity within the context of a specific course over a short period will not be relevant. For this reason, we implemented a specific Moodle block that is accessible only to users having the *administrator* or *manager* role.

Moodle already provides some specific reports for administrators. However, standard Moodle server reports do not contain facilities to configure reports based on user-specific parameters. For this reason, we implemented a customizable reporting system serving to permanently choose and store parameter configuration sets. For instance, we generated specific reports for administrators use case (see Table 2): *course activity* report (which focuses on course and students data), *tool activity* report (which focuses on specific Moodle activities). The

novelties with respect to the existing reporting Moodle server reports are the configurations and the calculation schema that we can set. In particular, for each report, we can set the following configurations:

- Course domain: a selection of relevant courses, based on course categories;
- Date/Period: time or timespan of interest;
- Report settings: layout and data selection of the reports;
- Role: user roles to be included in reports;
- User: user groups (configurable by administrator or study program manager);
- Profile: specific criteria for calculating the usage in tools and courses (each report can have more profiles associated).

Each profile has specific **parameters** that allow an administrator or study program manager to assign weights to the different ways (read, write, update, etc.). Moodle users can apply tools such as assignments, wikis, or quizzes. The system proposes scores, which should be normalized to some constant sum (10). For instance, we can set that reading a messages thread in discussions counts 2 points, while the submission of a new message counts 8 points. Scores are calculated taking into considerantion users' activities registered in log entries and other data registered in Moodle database (taken as they are collected by Moodle, without any data cleaning). Parameter sets can be saved, recalled, and modified. This allows users to **create different profiles that reflect specific use cases** and specific users' needs. For instance, the use case "*Monitor course activity level*" for administrators (see Table 2) requires the implementation of two reports: *course observations* and *course contributions*. These two reports can be obtained by creating two different profiles having the following parameters:

Figure 5: Profile settings for monitoring course observations

Figure 6: Profile settings for monitoring course contributions

These configurations are used to create the course activity reports with two possible configurations: one for course observations and one for course contributions. Reports can be generated in textual format or graphical format, and the choice of the type of visualization is decided by the user (see Figure 7).
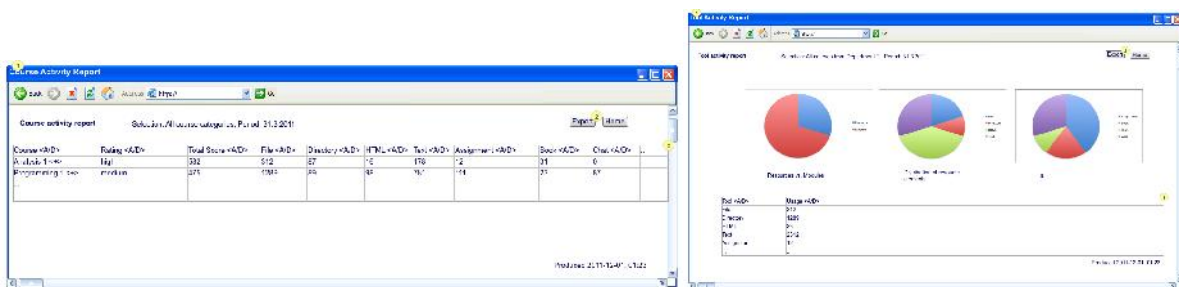

Figure 7: Two examples of reports, textual format (left) and graphical format (right)

Conclusions

In developing the MOCLog system we focused basically on three principles or guidelines: a diversified set of stakeholders, a didactical approach and the reuse of an existing monitoring system. The challenge was how to equilibrate these 3 very different influences into one integrated system. The solution that we found had three stages; first eliciting and analysing requirements from all the 4 envisaged stakeholders groups; then developing an innovative, didactically oriented model of log file analysis; and last but not least implementing a flexible monitoring tools that allows to create different profiles that reflect specific use cases, by configuring specific usage parameters. A preliminary evaluation of the MOCLog tool was performed using two methodologies: an experts analysis and a restricted users analysis. Goal of these analyses was to test if specific users can use the tool to achieve specific goals with effectiveness (task completion), efficiency (task in time) and satisfaction in a specific context of use (ISO 9241-11). Testers tested the tools following a predefined set of tasks included in a given scenario, based on requirements. The next step in this project is the professional analysis of the usability based on scientific methods with objective eye tracking systems/data. The usability testing results will be evaluated and the tool will be revised based on the usability evaluations. With this in the background our next goal will be the exploitation/deployment of the tool both in the institutions of the project partners as well as in other institutions (universities, universities of applied sciences and education that use Moodle).

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Acknowledgements

MonSys - Monitoring System for Students and Tutors of Postgraduate Courses of UNASUS / UFMA in Distance mode using Moodle

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Abstract

The e-learning courses are supported by technological tools that compensate for some limitations, as the distance itself, temporality and emotional issues, among others. It is important that a distance learning course has a proper Learning Management System (LMS) that really supports the teaching / learning process. The work is justified given the need that monitoring teams have to process the information on the courses that are stored in Moodle, which, despite being in a single database, are difficult to recover, but are of great importance to help the monitoring process of the students and tutors. The aim of this paper is to present and evaluate MonSys - Monitoring System of tutors and students - from the implementation of a Monitoring Coordination at UNASUS / UFMA - Open University of SUS of Federal University of Maranhão, in two virtual post-graduation courses using Moodle. To evaluate the MonSys, we measured the time spent by monitoring technical staff of UNASUS / UFMA to process information from Moodle, compared with the time taken to retrieve this information via the MonSys. Using the MonSys, it becomes possible to monitor the students and tutors of the Moodle Learning Management System courses through the online mode, and in a faster way, requiring less effort from the monitoring team for the generation of useful information and allowing greater control and better development of the course.According to the results, the reduction of working time of the monitoring team and the increase in the ability to monitor the access and performance of students and tutors in postgraduate courses were significant, given the demands of UNASUS / UFMA.

Keywords

Learning Management System, Moodle, Monitoring

Introduction

The e-learning courses are supported by technological tools that compensate for some limitations, as the distance itself, temporality and emotional issues, among others. It is important that a distance learning course has a proper Learning Management System (LMS) that really supports the teaching / learning process. The most used Learning Management System is Moodle, which provides numerous features and activities to be used in the teaching / learning process in both classroom and distance learning modalities.

As students, tutors and teachers access Moodle, all data is stored and eventually turn into a real database, which can be used to manage the elements of the e-Learning in accordance with the needs of each institution. Thus, Moodle has the entire history of the students, teachers and tutors, but it is necessary to retrieve online information for the monitoring of this history to be effective. This information is scattered in the pages or predefined reports within Moodle, demanding more time and work of a technical team to properly monitor the courses.

The work is justified given the need that monitoring teams have to process the information on the courses that are stored in Moodle, which, despite being in a single database, are difficult to recover, but are of great importance to help the monitoring process of the students and tutors.

The aim of this paper is to present and evaluate MonSys - Monitoring System of tutors and students - from the implementation of a Monitoring Coordination at UNASUS / UFMA - Open University of SUS of Federal University of Maranhão, in two virtual post-graduation courses using Moodle.

The study follows the structure of the Revision Theory, presenting the basics of e-learning, LMS and Monitoring. Then we present the MonSys - Monitoring System of UNASUS / UFMA, and details of its modules. Below we detail the methodology used in this work and its results. Finally we describe the completion of the work, from the study and the references cited.

Theoretical Grounding

The e-learning can be defined as a "teacher-student relationship, or a pedagogically mediated teaching and learning, multimedia, composed of various instructional materials and tutorial guidance. This applies to both traditional educational environment and such as those that use new technologies" (Riano, 1997, p. 20).

Distance Learning has specific characteristics, disrupting the concept of presentiality as an indispensable factor in the process of teaching and learning. For e-learning, the pedagogical act is no longer centered on the figure of the teacher, and no longer assumes that learning only happens when a class is performed in the presence of teacher and student.

Its design is based on the fact that the teaching-learning process can be seen as seeking "an autonomous learning, independent, in which the students govern their own learning and becomes the center of the entire system" (Riano, 1997, p. 21).

Moran (2002) describes e-learning as a teaching-learning process, mediated by technology, in which teachers and students are not in the same place at the same time. Bentes, (apud IAHN, 2002) points out, symbolically, the components of e-learning as the tips of a star, to help in understanding.

They are interrelated in an integrated manner, with the support of ICT - Information and Communication Technologies, which enables the effectiveness of the educational process at the same time that conquest and fix its position in education (Figure 1). This means that a star with less than five points does not shine, so, it does not exist.
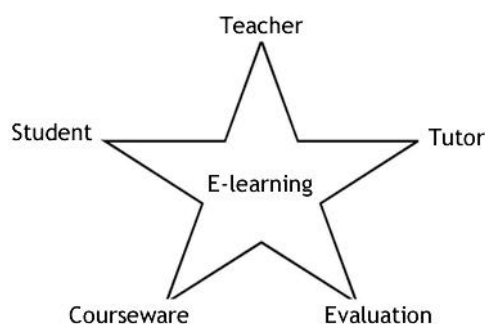

Figure 1: The components of e-Learning - Source: Bentes, (apud IAHN, 2002)

One of the main actors of e-learning is the tutor, who must guide the students in activities, not only showing the right answer, but offering new possibilities of information, interpretation, reflection, understanding and knowledge construction. From this perspective, it is essential that the tutor is aware of his role, which is not only master the content worked, but to know "why" and "the significance of the proposed."

According to Emerenciano et al (2001), "the tutor should establish a relationship with the students in order to create a cordial, human and provocative atmosphere, to help solving doubts of the learning process, as long as provide feedback about academic work done, always motivating students .

The importance of the role of the tutor in e-learning is due, among other things, the fact that he is the immediate contact of the students, being the representative of the institution offering the course, being the representative of the institution offering the course, which will provide the tools students need.

In order to enable all components to be integrated to each other and so that the tutor can play the role entrusted to him in a satisfactory manner, several ICTs are used in distance learning. Among them is the Learning Management System (LMS), which enables the development of more flexible activities in terms of time, space and rhythm.

This provides teachers and tutors the ability to create and conduct distance learning courses, through activities that require the action of the student, such as searching for materials of consultation and participate in evaluation and training activities, following the teaching plan.

The LMS is composed of several tools that enable the publication, interaction and evaluation of resources and activities in the teaching and learning process, as books online, tagging, wikis, chats, forums, journals, quizzes, assignments, among others. For example, a teacher and / or tutor can provide materials, texts, videos, audios and activities. Students access these resources from any location with Web access, exchange ideas, materials, information, answer activities and forums, and interact with tutors, among others. Thus, the LMS enables activities that promote these actions and possibilities are proposed, but requires the centralized model, which emphasizes the transmission of knowledge, is abandoned, becoming a shared process in which the teacher acts as a member of the group, leaving the community the leadership of intervention, monitoring and construction of knowledge activities.

According to Ribeiro et al (2007), the LMSs:

> "[...] Provide participants with tools to be used during a course to facilitate the sharing of study materials, hold discussions, collect and review tasks, record notes, and promote interaction, among other features. They contribute to the better use of education and learning."

Moodle is among the most popular LMS, translated into several languages and used in hundreds of countries. Despite having a lot of tools, several data must be processed into information, which is quite time consuming and work of a technical team that collaborates with the coordination of the course, concentrating efforts to monitor students and tutors and guide them on how to participate in a distance learning course.

Monitoring is an essential task for the investigation of extreme situations and to promote improvements in teaching and learning in e-learning. Especially taking into account students who have difficulty participating in problem-solving dialogue, in activities that require synchronous or asynchronous interaction mediated by LMS.

Under the pedagogical point of view, monitoring requires systematic observation of progress of activities, in accordance with the key objectives and concepts. "The reporting allows all the information gathered to be used in making decisions for improving student performance, a task for teachers and tutors to make" Barttle (2007).

MonSys – Monitoring System

The MonSys - Monitoring System was developed in PHP with MySQL database and uses the tables in the Moodle database to retrieve the information needed for monitoring the activities of students and tutors.

The MonSys is designed to monitor the performance of tutors and student activities in Moodle, in accordance with the guidelines established by the UNASUS / UFMA Monitoring Coordination. For example, the number of accesses of tutors and students, students' grades, activities that were not evaluated by the tutors and activities not posted by the students. The MonSys has only one type of user are the technicians who track and monitor students and tutors in Moodle. The MonSys has only one type of user: the technician who accompanies the students and tutors in Moodle.

Figure 02 below shows the user login screen. The user doesn't need to create another account to access it. All he needs to do is enter the Moodle access data, which means that the MonSys already has integration with the Moodle database for user authentication, which facilitates access.

In order to access a trial version of MonSys, simply enter the following address http://www.unasus.ufma.br/beta/central/; user: testeadmin; and password: 123456.

Figure 2: MonSys's User login screen

After the user logs, he can see the initial screen of the system, with options such as: courses, users and notifications, and the categories of courses created in Moodle (Figure 03).

Figure 3: MonSys's initial screen

Courses Module: this area is designed to manage the information of the courses and their respective disciplines (rooms) within the LMS. In this module the user can:

- view the courses (number of students, beginning date, location, closing date).
- get a summary of the course (start date, number of ratings, number of accesses, average number of accesses);
- view the students' grades in each discipline;
- view tutors' access in the discipline, according to an specified number of days;
- view students' access in the discipline, according to an specified number of days.

As can be seen in Figure 04 below, the Courses Module lists registered rooms and presents a summary of information such as room name, number of students, course start date, if it is visible or hidden, its status and the date scheduled for closure.
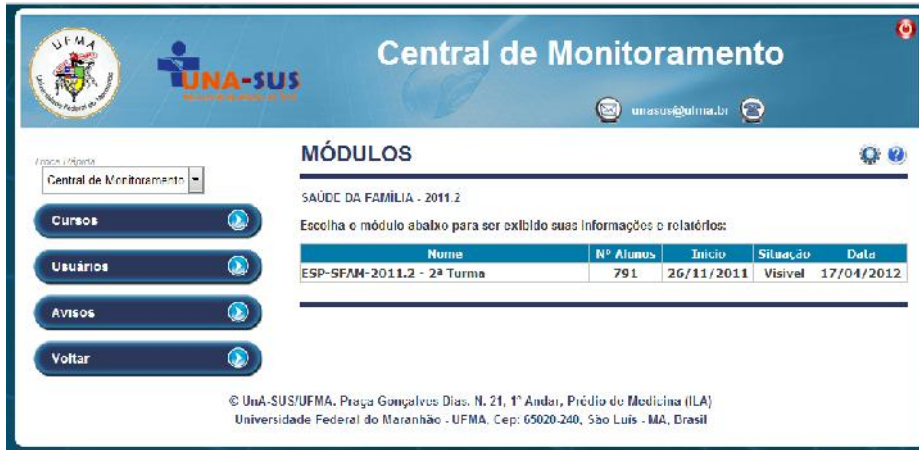
Figure 4: Courses Module lists registered rooms

When the user clicks inside the room, he can see the summary of the discipline or course in a virtual classroom of Moodle, with information such as the start date, number of students, number of ratings, average number of accesses since the room was opened (Figure 05).

Figure 5: Courses Module - view summary information of a course or discipline in a virtual classroom of Moodle

In this module the user can see, beyond the summary, four tabs with information about this course or discipline, as also shown in Figure 05, which shows students' grades in all course or discipline activities. An important detail to note is that we use a hidden activity for the record of classroom activities, and the Moodle calculator for processing the final grade of the student. The online activities have a weight of 40%, while attendance is worth 60% of grade.

Tab Tutor-Access has an option that make a list by the amount of days on which they didn't access Moodle. The MonSys user can configure the number of days according to his needs (Figure 06).
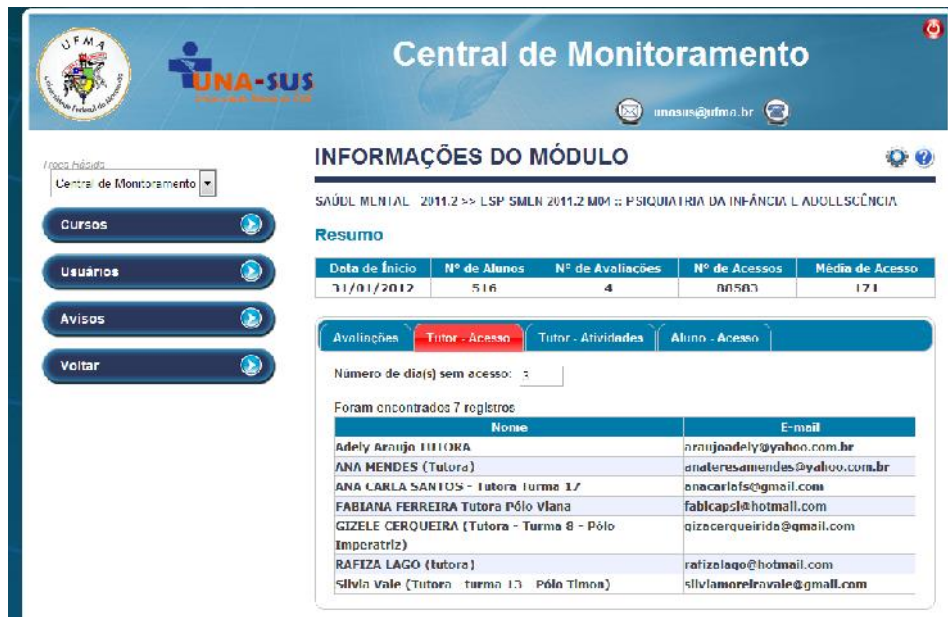
Figure 6: Courses Module - Preview of tab Tutor – Access

Tab Tutor - Activities offers the possibility of listing the tutors who did not rate at least one of the activities of students in the Moodle class (Figure 07).

Figure 7: Courses Module - Preview of tab Tutor – Activities

Finally the tab Student - Access of the Courses Module offers a list of the students from their number of accesses, according to the number of days they were without accessing Moodle. The MonSys user can configure the number of days as needed (Figure 08).

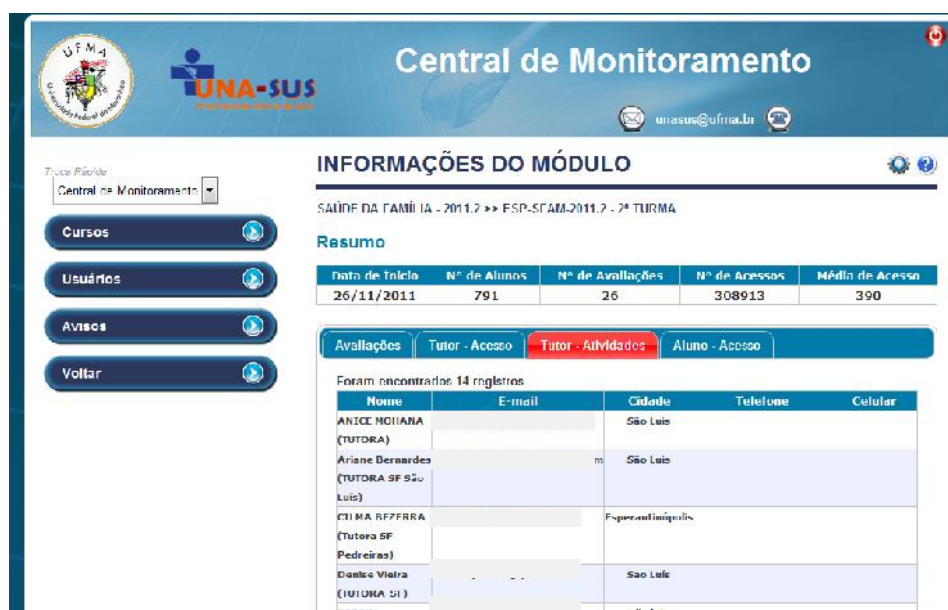**Figure 8: Courses Module – Preview of tab Student – Access**

User Module: MonSys area to list the names and logins of users of Moodle.

Alerts Module: area to configure the alerts to students and / or tutors who do not access the LMS for a certain period of days. In this module, the user can:

- create, edit, view and delete alerts;
- enable or disable warnings;
- determine the number of days without access and the message that will be sent to tutors and / or students.

Settings Module: area to set some parameters of MonSys. In this module, the user can:

- tab General - set the parameters of the site, the e-mail and the SMTP server for sending e-mail notifications through the Notices Module.

Methodology

The MonSys has been tested by a qualified monitoring team of the UNASUS/UFMA - Federal University of Maranhão - in two post-graduation e-learning courses during the period of 30 days. Both courses have 46 tutors and 1.390 health care students, distributed in 15 presence support poles in the state of Maranhão, Brazil.

In order to evaluate the MonSys, we measured the time spent by technical monitoring team of the UNASUS/UFMA in processing information from Moodle, compared to the time taken to recover the same data through the MonSys.

A pilot study was conducted by a technical specialist and team member of the UNA-SUS/UFMA's Monitoring Coordination, in order to generate the preliminary results of one of the post-graduate sensu lato courses in health offered in the distance. This course is currently in its sixth module, and has 590 students and 19 tutors. It is available on the Moodle of UNASUS / UFMA, and uses a structure of a class (course) for each module in a single category in Moodle, and the resource Groups to carry out the division of work among the tutors.

Measuring productivity of the Monitoring team was done by timing, which is determining the amount of time through chronometric surveys. In addition, we measure the physical effort expended, to compare the performances of economy of motion introduced in a job.

According to Xavier and Silva Seine (2001), by means of timing, one can determine the amount of time required to perform an operation, by measuring the working time spent in elementary operations. According to Barnes (1999), to determine the execution time of an operation, one must take into account the speed at which the operator or technician performs the operation.
The evaluation of the duration of activities in the Moodle environment was made so that the task was timed at normal time, according to the speed of Monitoring team technician. In this study, we used only one technician, so it was not necessary to compare his speed and knowledge with another professional.

During a week of May 2012, specific measurements were performed, using a stopwatch to track the time spent by the technician of UNASUS / UFMA's Monitoring team to do the processing of student information through Moodle, measuring the normal time for the execution of the activity.

Later, during another week, we timed the time spent by the same technician to do the processing of student information through the Monitoring System (SIM).

The same physical environment, hardware and software were used for the study.

Results

As a result, we obtained the times of measurement regarding the specific steps undertaken. Using the VLE (Moodle), were recorded 21m53s for the processing of information of "students' access to the module 6" (Activity A), and 44m18s referring to the "sending activities of Module 3" (Activity B). With the Monitoring System, the measured times were 09m51s and 17m21s respectively.

The comparison between the data collection instruments used allowed observing a decrease in the time spent by the Monitoring System in processing activity, rather than the performance of Moodle. There was a reduction of 54.99% of the time spent on data collection of the variable "Activity A", and 60.9% about the "Activity B".

Further, improvement was observed significant improvement in the following daily UNASUS / UFMA's monitoring of courses through Moodle:

- quick identification of students and tutors with access difficulties or problems to attend.
- reduction in the time of the search for students and tutors who do not access the Moodle;
- reduction in the time of the search for students who didn't do a certain activity in a Moodle course;
- reduction in the time of the search for tutors who did not address a particular activity in a Moodle course;

Conclusion

The MonSys provides the ability to monitor students and tutors on courses based on Learning Management System Moodle in an online and fast way, requiring less effort from the monitoring team to generate useful information for greater control and satisfactory progress of the course.
As shown by the results presented here, reducing the time spent by the monitoring team of UNASUS / UFMA and greater access and monitoring the performance of students and tutors in postgraduate courses were significant in view of the demand.

As future work we are implementing new screens in the MonSys, according to the needs of the monitoring coordination; statistical analysis of time spent in the recovery of information from students and tutors; and the impact of the MonSys to control the dropout of students in UNASUS / UFMA's courses.

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Moodbile: a Moodle web services extension for mobile applications

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Abstract

The Moodle 2.0 Web Services architecture has been designed to optimize bulk operations or administrative tasks. Therefore, it does not support external applications accessing activity modules. For this reason, the Moodbile project aims to provide an extension of the Moodle 2.0 Web Services architecture in order to provide access to external applications such as m-learning applications, from within Moodle.. To validate this extension, three m-learning applications have been developed: an HTML5 client that may be used from most mobile browsers, an android-native app and an iOS-native app.

Keywords

E-learning, m-learning, web services, integration, Moodle, mobile apps.

1. Introduction

Over the last 10 years, the Moodle community has shown a huge growth. Moodle.org proudly shows updated statistics of community members, servers installed and other data about the registered sites, which is just a subset of all the Moodle installations out there. The number of Moodle's usage scenarios is only limited by the imagination of every teacher using Moodle. Moodle.org hosts hundreds of third part plug-ins (activity modules, courses, blocks, themes, integrations and hacks), and the contribution base has been growing so much that a new database and quality assurance procedures had to be set in place.

The evolution of the official Moodle distribution is (and needs to be) determined by the decisions of Martin Dougiamas, who has to care for the product quality, relevance in the state of the art, wishes of the community and sustainability of Moodle. With each new release, decisions that affect the presence or absence of features, capabilities, interfaces etc. are made. And while the result is good enough for a large base of users, third party contributions show up with requirements that are not fulfilled by the standard distribution.

The M of Moodle stands for Modular because in its earliest version Moodle was already designed to be extended with activity Modules, Blocks, Lang extensions, course formats etc. But non-standard plugins are not always a clear shot. Moodle extension developers have their work cut out for them trying to assure the quality of their code and achieve compliance with every possible Moodle setup while maintaining compatibility with the new Moodle versions. An extension developer must take into account all upcoming upgrades and bug fixes, ensuring stability and data integrity. Despite that, a lot of members of the community continue creating, maintaining and using extensions (Cole & Foster, 2008).

This paper is about the research our group has been doing the last 5 years in the problem of enabling Web Services for Moodle. Section two summarizes previous work we participate to extend Moodle functionality by means of external application integration. Section three describes the Moodbile project putting special attention to the extension we propose to the Moodle Web Service Architecture. Finally, we conclude with the main conclusions and further work.

2. Related Work

This section summarizes the main LMS's services and functionalities that some initiatives propose to extend the scope of the LMS to the world of mobile devices.

- Lehner and Nosekable (2002) did one of the first studies about mobile devices interacting with virtual campuses. The Welcome system offers access to certain contents and services (such as calendars or events) of the virtual campus using mobile devices, and interacting by means of SMS messages.
- Triffonova and Ronchetti (2004) and Colazzo, Molinari, Ronchetti and Trifonova (2003) identified LMS's services and functionalities that may more relevant to be accessed from a mobile device. They also identify the main issues of a LMS's architecture to be considered from a mobile device. These architectural issues are: 1) context discovery (the system must check automatically the mobile device features and decide which services may be provided), 2) adaptation of contents, and 3) synchronization between the mobile device and the LMS. They have developed a mobile prototype based on this architecture.
- Hinkelman (2005) developed a Moodle 1.6 module to do testing using mobile devices. This version mainly offered testing services and feedback to students. Due to technological issues, this project was developed to work with Japanese mobile phones (because the tool is based on CHTML and 98% of the Japanese mobile phones supported this language). Afterwards, (Cheung et al. 2006) presented a study to adapt Moodle to mobile devices centred in the adaptation of contents.
- The Open University has been working on Moodle extensions to mobile devices for quite long time..At 2009, they proposed a Mobile VLE for Moodle, a m-learning application to access Moodle from mobile devices. This application provides a subset of Moodle functionalities selected by popular polls to students (mobile users). These LMS's functionalities were: assessment scores, messages (read course messages and unread forum posts), tasks ('tick-boxes' to see the progress of course activity), tasks planning and resources (read and download if it is supported) (Thomas, 2010).
- Momo (Mobile Moodle) and MLE (Mobile Learning Engine) projects developed m-learning applications to access some Moodle 1.9 functions (Momo, 2008), (MLE, 2009). Both m-learning applications are is based on J2ME, while the MLE project developed a client application and an additional web version to access Moodle courses from mobile browsers. Some of the Moodle modules/activities supported by this project are: lesson, quiz, task, resource, forum, survey, choice, wiki (read only), database (search and query) and message.
- Project MPage develops a Moodle 1.9 client for iPhone (MPage, n.d.). Some of the Moodle modules and activities supported by this project are: view course categories, access MyMoodle, edit events, access to resources in different formats, chat, choice, forum and quiz.
- The MLE and Mpage projects are designed as Moodle hacks. Both systems offer their main functionality using Moodle blocks. MLE re-implements the logic of some Moodle services to be offered to mobile web clients using XML and CSS mobile. The Mpage system offers two proprietary mobile applications that access the Moodle data using a proprietary web service. It rewrites part of the Moodle code to offer its functionality to mobiles.
- Moodle.org has identified main functionalities for an iPhone client for Moodle: 1) to upload video, audio and other file formats to the user's private space in the Moodle server. 2) to view users enrolled in courses where the user also be. 3) to view and download activities and content of a course. 4) to view student grades, to make grade assignments and to download them. 5) to receive notifications from the Moodle server and send internal email. 6) to view forums, discussions and to create and reply posts. 7) to view calendar events and assignments deadlines. However, the current version of the prototype designed by Moodle.org only allows uploading files to the user's private space in the Moodle server, view course participants and view the list of activities and contents of a course.

3. Previous work

3.1 The Campus Project

The Campus Project (http://www.campusproject.org), was the initiative of several Catalan universities to come together and create a virtual open source campus infrastructure. The Campus project had to bind in the same Virtual Learning Environment (VLE) up to 23 different educational existing applications developed by the project partners. The open source LMSs used in the campus project were Moodle and Sakai (Santanach et al. 2007) The purpose was to be able to launch external applications from the LMS providing them with the basic user authentication and authorization information. Besides, the external application had to provide logging information (i.e students activity) to the LMS.

The Campus Project was designed as an integration platform of e-learning applications and was based on a service-oriented architecture (SOA). Part of the architecture consisted in the creation of a web service layer for Moodle so that it could provide external applications with authorization and authentication information. The OKI (Open Knowledge Initiative) OSIDs (OKI, n.d.), IMS TI (IMS TI 2012) were used as framework to integrate these applications in the LMS.

3.2 The Moodle 2.0 Web Services Architecture

Moodle is composed of the Moodle Core and several subsystems around it. Moodle Core includes the basic functionality of the learning platform (users, courses, groups, etc) and since Moodle 2.0 these functionalities are offered as a more structured API (Application Programming Interface). The other subsystems implement specialized functionalities and features such as activities, repositories, filters, blog, messaging or tags.

Based on the experience of the Campus project, in 2008, the SUSHITOS research group designed a solution to enable Moodle to provide some of its functionalities using web services. This solution was the Moodle Web Services Architecture, which has been implemented for Moodle 2.0 and released in late 2009 (Alier et al. 2010a), (Alier et al. 2009). Moodle 2.0 provides tools to extend web services in a standard way so that third-part web services could be added to the system.

The Moodle Web Services Architecture adds two logical layers to Moodle's architecture (shown in Figure 1). The first one, called Moodle External API Layer includes the logic of each service. The second one is the Web Services Connectors Layer. The Moodle Web Services Architecture is not bound to a specific web services protocol; it is designed to be protocol independent. For each supported protocol (SOAP, REST, XML-RPC and AMF) there is a specific web services connector module in this layer. Each web services connector implements the translation of the methods implemented in the Moodle External API to the specific protocol and syntax. The Web Services Connectors layer is an extendible layer that allows the addition of new communication protocols.

A key element in the design of the Moodle Web Services Architecture is its extendibility based on plug-ins. The Moodle External API can be extended in a safe way, giving full security control to the Moodle administrator. If a new service or a new kind of web services protocol is needed, a developer may define and implement it as an extension to those provided by Moodle.

3.3 Projects using the Moodle Web Services Architecture

Several research projects in which the Moodle Web Services architecture was used have been proposed recently. In each project, additional services had been added to the external layer, and new custom web services connectors to support specific web services and authentication protocols. For example, Layers4Moodle project allows the students to create annotations and embed content over Moodle and share it with the rest of the course in a social stream, using OAuth authentication. Moreover, the TRAILER project uses a Moodle activity module that gathers informal learning activities through web services.

3.4 The Moodbile Motivation

Moodle 2.0 shipped with the Moodle Web Services Architecture but providing a limited amount of services and connectors, enabling mostly web services and security strategies for server administration and bulk actions. However, it came with very limited support for accessing information from activity modules, contents and other components required to implement a Mobile client. Moodle HQ has released an official Moodle app for iOS and Android, but their functionalities are very few and the set of services are limited.

There are several proposals trying to bring Moodle to the Mobile-Learning space. Moodle needs more than the official Moodle mobile application, it is necessary more research and developer groups working in this direction, as for example, exchanging ideas at the "Using Moodle" course and the "Moodle for Mobile" forum (www.moodle.org). This kind of research and development activity will benefit the Moodle community.

With the Moodbile project we wanted to aggregate all the developments on Moodle web services extensions, documentation and mobile clients, providing a stable API of web services, protocols and authentication methods that will be independent of the underlying Moodle version. This API aims to be a valuable contribution for the Moodle community and a platform where other groups can build their own mobile clients.

4. Moodbile Project

4.1 Moodbile Research Goals and Requirements

Our goal was not to create a web service layer to access every single Moodle activity feature, but to design an extension of the Moodle Web Services Architecture that provides access to the most suitable Moodle features for mobile applications. To gather these features, a log analysis of the Moodle server of our university (UPC)

has been performed. This analysis considered two data sources: the web server logs and the Moodle log. From both sources, we have been analysing which activity modules and actions performed on the Moodle platform where used more often from mobile devices (Casany et al. 2012). An additional data source for requirements has been the previous projects described in section 2.

The Moodbile extension has been designed considering user needs instead of optimizing bulk operations or administrative tasks. This is why this extension does not follow many of the premises used to develop the Moodle Web Services Architecture. Besides, the Moodle Web Services Architecture provides only basic services such as course enrolment, group and user management, etc. It does not provide services to access additional Moodle features such as activity modules or other plugins.

4.2 Moodbile Architecture

This section describes the proposed extensions to the Moodle Web Services Architecture to provide additional web services for mobile applications (Casany et al. 2012). This involves extending the three layers as shown in Figure 1: the Core extension re-implements some features that Moodle does not provide in the proper way to be used by web services. The External API layer is where the actual services for mobile integration are defined and implemented. The Connectors layer is used to provide additional web service protocols. Moodbile also includes some new authentication plug-ins, such as OAuth (OAuth, 2010) (more suitable for mobile devices), some Moodle blocks and new administration and user panels, among other features and improvements
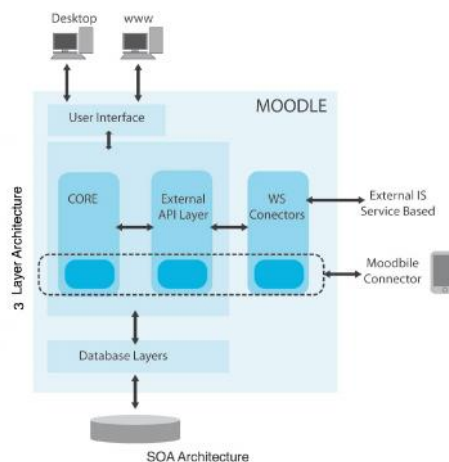

Figure 1. Moodbile architecture

The External Layer extension is implemented as a Local Moodle plug-in avoiding collision with Moodle External files and other extensions. The rest of the features are implemented through the extension mechanisms offered by Moodle. Our extension is based in the following additions:

New authentication method.
Moodle Web Services are oriented to academic management and bulk operations such as course creation, new user registration and student enrolment. Moreover, Moodle services consumers are under control of the same organization, so complex authentication methods are not required. Moodle users authenticate with their username/passwords or with special access tokens. To secure the connection, it may be enough to restrict IPs that will be able to invoke this web service.

In a mobile environment, such IP restriction mechanisms are not enough, since user/password or token authentication is not secure since this information is sent in each web service invocation from a mobile device, and it is not possible to establish a white list of authorized IPs. To solve this problem, Moodbile project applies an OAuth authentication mechanism (OAuth, 2010) allowing teachers and students to access Moodle using third-party applications in a secure way.

New Connectors.

Moodle offers several web service protocols but some of them are not suitable for a mobile environment. For this reason, Moodbile proposes several new connectors. To give support to HTML 5 Moodle extensions, an AJAX compatible connector with JSON messages was implemented. This connector uses the Moodle session, so the user must be logged in to use an HTML 5 client. In a similar way, JSONP allows HTML 5 external applications to access Moodle web services using OAuth authentication. Moreover, JSON-RPC connector was implemented to add a lightweight protocol that can be used effectively from a mobile phone. This connector uses Moodle web services authentication methods. Finally, another JSON-RPC connector and a new REST connector were implemented using OAuth authentication. These connectors are the most commonly used for Moodbile clients for their ease of use and their security improvements.

New Services.

New services are defined into the External layer in several components. Components are classified into Basic Services, Course Content Services, Personal Content Services or Platform Services.

- Basic Services. Course component provides basic services to retrieve user course information. User component provides services to list course enrolled users and their profiles. Group component gives services access to groups and their group members.
- Course content services. Services in this group allow the interaction with course content and activities.
- Thus, Assignment component provides services to get assignment information and to submit homework. Forum component facilitates management of forum information, discussions and posts. Resource component provides all the services related to digital resource access. Quiz component services are used to export quizzes to XML and QTI formats.
- Personal content service. Services in this group provide access to users' personal content. Blog component allows read, write and access to Moodle blogs. Calendar component gives access to user calendar, scheduling and events. Grade component allows retrieving users grades and outcomes. Message component allows using the internal messaging system.
- System Services. Lang component provides I18N services to develop clients that use the same terminology of the host. File component allows the upload and download of files from Moodle in a secure way. And finally, System component provides host and system information services.

Moodbile Clients.

Three mobile clients have been developed to test Moodbile architecture and services, and to conduct research in m-Learning topics. These client's interface are shown in Figure 2.

Figure 2: Moodbile client apps: Html5, Android and iOS Clients.

- Moodbile HTML 5 Client. It is a Moodbile client that runs on most mobile browsers. Moodbile HTML 5 Client runs on the same web server as the LMS and provides a mobile web friendly limited front, using the Moodbile web services specification.
- Moodbile Android Client. This client is an Android App that provides a limited front end to the LMS written on native Android code. The android-native application supports online and offline work when network coverage is not present or expensive. This application has a persistent data storage for the contents retrieved from the Moodle server. When working offline this feature allows a quick access to the local contents using a memory cache. This app can also connect to different Moodle servers using two different authentication protocols (OAuth or username and password). Synchronization is still under development.

- Moodbile iOS Client. This client is an iOS app that provides a limited front end to the LMs written on native Objective C code. Like the Android client this app supports online and offline work when networked coverage is not present or expensive. This application has a persistent data storage for the contents retrieved from the Moodle server. When working offline this feature allows a quick access to the local contents using a memory cache.

Moodbile Spec.

The Moodbile Spec is the result of a service modelling and engineering process. SUSHITOS Research Group has designed and optimized Moodbile Web Services with the objective to give specialized support to external applications. Moreover, this engineering process also takes into account how Moodbile objects are modeled. Moodbile objects are designed using the respective Moodle ones as a starting point to obtain new objects independent of Moodle internal features. This process has resulted in a web services API that can be used and understood by a non-Moodle programmer. The detailed description and specification of Moodbile services is shown at http://docs.moodbile.org/index.php?title=Moodbile_WS_Latest_Version_Documentation.

4.3 Service definition

External Layer Design

One of the requirements of Moodle Web Services was to support a variety of web service protocols. To decouple External Layer from connectors, a protocol independent service description mechanism was designed.

```
class moodle_group_external extends external_api {
    public static function get_groups($groupids) {
        ....
    }
    public static function get_groups_parameters() {
        return new external_function_parameters(array(
            'groupids' => new external_multiple_structure(
                new external_value(PARAM_INT, 'Group ID')
                ,'List of group id. A group id is an integer.'),
        ));
    }
    public static function get_groups_returns() {
        return new external_multiple_structure(
            new external_single_structure(array(
                'id' => new external_value(PARAM_INT, 'group record id'),
                'courseid' => new external_value(PARAM_INT, 'id of course'),
                'name' => new external_value(PARAM_TEXT, 'course unique name'),
                'description' => new external_value(PARAM_RAW, 'group description text'),
                'enrolmentkey' => new external_value(PARAM_RAW, 'enrol password'),
            )));
    }
}
```

Figure 3: Moodle External API example (Moodle_group class).

Every Moodle component that wants to provide any service must implement a componentname_external class and place it in a file called externallib.php. This class will be responsible for implementing and describing as many services as the component wants to provide. Every service provided by the External Layer is described and implemented by three methods. The service itself is implemented in a first method. A second method describes the service parameters and a third one describes the service return. By convention, if a service is implemented by the servicename method, the method that describes service parameters must be the servicename_parameters method and, the method that describes service returns must be the servicename_returns method. In Figure 3, we show an example of a service description from the Moodle_group component. With this technique, protocol connectors may provide and access services of the External Layer.

```
public static function get_group_by_groupid($groupid) {
    ...
}

public static function get_group_by_groupid_parameters() {
    return new external_function_parameters(
        array(
            'groupid' => new external_value(PARAM_INT, 'group id',
                VALUE_REQUIRED, 0, NULL_NOT_ALLOWED),
        )
    );
}

public static function get_group_by_groupid_returns() {
    return Group::get_class_structure();
}
```

Figure 4: Moodbile External API example.

An important difference between our proposal and the Moodle definition of services by means of classes is the existence of the static method get_class_structure. This method is defined to support the service definition so that it is more reusable and maintainable, since it permits to define in a more transparent way complex parameters and returns of Moodbile services. In Figure 4, we show how to use it.

New web services connectors and authentication

As we have mentioned before, Moodle Services are designed for academic management and do not require to apply complex authentication methods. However, in a mobile environment, security issues are more critical and new protocols and authentication methods are necessary. To solve this problem, we have proposed and developed an OAuth authentication plug-in, as a part of Moodbile project, to be used in combination with web service connectors. Our intent was to not modify Moodle's internal code. Therefore, we have designed an extension of the Moodle connector architecture as it is shown in Figure 5.
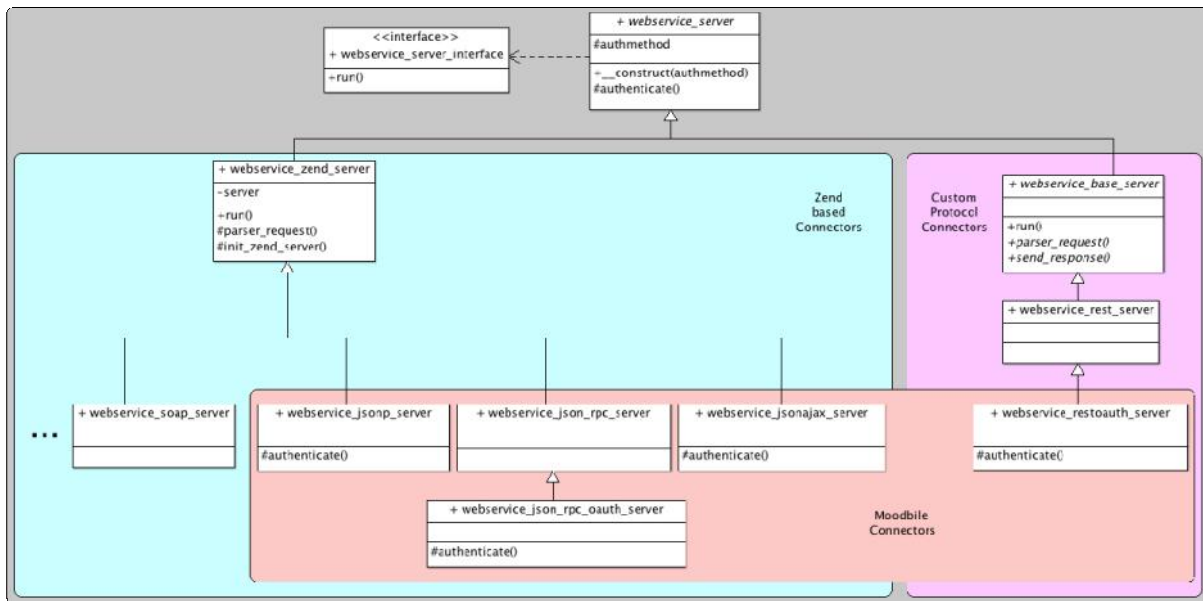

Figure 5. Moodle connector architecture

Moodle architecture proposes the webservice_server_interface to allow the implementation of two types of web service protocol connectors: Zend-based connectors and Moodle custom connectors. Connectors for XML-RPC, SOAP and AMF protocols delegate the protocol management to the implementation that offers the Zend Framework (http://framework.zend.com/), meanwhile the REST connector is a custom connector implemented by Moodle.

Our proposal has been to use the abstract class webservice_server that all Moodle connectors inherit to define new web service protocols. Moreover, its authenticate() method implements the logic to authenticate users using either username-password or token methods, which are the traditional authentication methods supported by Moodle. However, taking advantage that this method is defined with a protected visibility, we propose to redefine and implement additional authentication methods like, for example, OAuth.

The Moodbile project offers several new connectors, but only some of them can be used in combination with the OAuth authentication. The first one is a REST/OAUTH connector that extends the Moodle REST connector re-implementing the authenticate() method to support OAuth. The second connector is a JSON-RPC/OAUTH connector. Notice that in this case, this connector is a specialization of the JSON-RPC to which delegates part of the protocol logic definition, but it re-implements the authenticate() method to support OAuth. The JSON-RPC protocol inherits traditional Moodle authenticate methods. The new implementation of these authenticate() methods and of other scripts use OAuth-php libraries (http://code.google.com/p/oauth-php/) with some minor modifications to fully integrate with Moodle and Moodbile. Like almost all Moodle connectors, all JSON based connectors are based in Zend Framework.

The new protocols that the Moodbile project supports are used in different client implementations. For example, our Moodbile Android Client uses indistinctly the JSON-RPC and JSON-RPC/OAUTH protocols and our Moodbile HTML5 Client uses the JSON-AJAX protocol. In this latter case, the JSON-AJAX uses an authentication method based on the Moodle session. Finally, the custom REST/OAUTH protocol is used in a pilot we use to test our Moodbile web services. Some of these protocols are also used to integrate external applications. For example, the Layers4Moodle project uses JSON-P with OAuth authentication for its Chrome version, while its HTML5 Moodle plug-in uses the JSON-AJAX protocol.

5. Conclusions

The Moodbile project provides an extension to the Moodle web services designed to build mobile clients. We provide an HTML5 Mobile client and Android clients as reference implementation that will be used in learning experiences in the next academic course. Moreover, we see the best value of the Moodbile project in the Moodbile Spec, a web services API designed around the requirements of several projects that can be used as a platform to connect external applications, specially mobile ones, with Moodle.

The current implementation of the Moodbile spec does not yet comply with the necessary coding standards for it to be included in the Moodle core. This is an aspect to be improved and we hope the community can help here. We plan to start building new features such as Quiz support for the Moodbile clients to keep the Moodbile Spec API growing. As further work we also plan to test the clients and validate the Moodbile architecture by designing several pilots for students and teachers.

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Acknowledgements

Moodle Plugins for Highly Efficient Programming Courses

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Abstract

This paper introduces three Moodle plugins, Online Judge Assignment, Moss Plagiarism and Github Assignment, which are designed for courses involving programming, such as CS1, Data Structure, Algorisms, Compilers and Operating Systems. Online Judge extends the advanced uploading of files assignment to instantly compile and run submissions against predefined test cases. According to the number and weights of passing test cases, it can grade submissions automatically. Students who do not reach the maximum grade can improve and upload their programs again and again for higher grades. It supports more than 40 kinds of programming languages. Moss is a plagiarism plugin. It compares all submissions in the same/related assignments, lists the most similar pairs and let teachers to confirm who are cheating. Its underlying engine is designed to parse source code but this plugin extends this ability to support pdf, doc, docx and odt documents. Github, as an assignment type plugin, can synchronize commits from git repositories in github.com and store them as submissions. Therefore, teachers can track student projects in details and grade them directly in Moodle. Moreover, for team-based projects, each group uses one shared repo and the plugin can statistic workload percentages of every group member. It has been proved that these plugins can significantly reduce teachers' labour and improve students' enthusiasm, make programming courses more efficient. All of them are open source and free. You are welcome to download them from http://git.io/hmdl .

Keywords

Moodle, online judge, Moss, plagiarism, Github, team-based projects

Introduction

Moodle is a great universal platform with many build-in tools to construct online courses. It is suitable for nearly all kinds of courses for any person, any institution and any discipline. But different courses usually have different requirements. In department of computer science or software engineering, most of the courses are related with programming and teachers wish Moodle can provide these features:

First, grade assignment submissions by online judge. Online judge systems can compile and execute submissions, and test them with pre-constructed data to judge correctness. This method is widely used in many programming contests, such as ACM International Collegiate Programming Contest (ACM-ICPC, 2012) and TopCoder(Inc., 2012). There are also many online judge websites (Wikipedia, 2012) provide huge problem sets. They are so attractive that many students take initiative to practice programming skill on them. Naturally, online judge is applied in courses and has been proved to be successful (Kurnia et al., 2001)(Cheang, Kurnia, Lim, & Oon, 2003).

Second, detect plagiarism behaviours in assignments. Most of our courses have more than 100 students. Some teachers even need to instruct more than 400 students in one course. It is impossible for teachers to find plagiarism manually. Turnitin (August, 2010) has been integrated with Moodle well but it is expensive and not suitable for source code. There are several tools (Hage, Rademaker, & Vugt, 2010) designed for code, and Moss (Aiken, 2012)(Schleimer, Wilkerson, & Aiken, 2003) is the most popular one.

Third, track the procedure of student projects. Some courses require students to do projects in groups within 4-16 weeks. Usually, 1-3 checkpoints are set at which students make presentations and teachers give evaluations. There are two problems are hard to solve:

1   Teachers don't know what happened between checkpoints. Is there any procrastination?
2   Teachers don't know whether the division of labour told by students is true. Is there anybody in the group who did only a little or even nothing?

Github.com makes it possible to track the whole history of projects. But github is not designed for courses management. Tutors, students, groups and grades are better to be managed in Moodle and Moodle should synchronize students' activities with github and present them to teachers in more convenient interfaces.

This paper introduces Online Judge Assignment, Moss Plagiarism and Github Assignment plugin for Moodle. We have been using them in C/C++ Programming Language (CS1) course since 2006 and in Operating Systems course since 2008. There are also many users from different countries. Feedbacks show that they can give great convenience, fairness and efficiency to both teaching and learning.

Online Judge

Moodle Online Judge contains two plugins:

1   A local plugin implements an online judge library called judgelib. It contains three modules: judge engines, judge daemon and library API.
2   An assignment type plugin provides UI and invokes judgelib to judge submissions.

Figure 1 is the architecture of Moodle Online Judge. The client (we implement only one client - online judge assignment type) submits judge tasks to judgelib through API. Each task has source code, test data, resource limits and which judge engine should be used. Tasks are written into database and marked as ONLINEJUDGE_STATUS_PENDING. The judge daemon always resides in memory and regularly check database for pending tasks. When one pending task is found, it is marked as ONLINEJUDGE_STATUS_JUDGING and sent to specified judge engines. The judge engine will take some time to judge and return the result. Then the task's status is set as the result. Finally, an onlinejudge_task_judged event is triggered so that the client can know the result. The judge daemon is tricky. It can work in parallel mode. So it is safe to concurrently run several judge daemons for higher throughout.
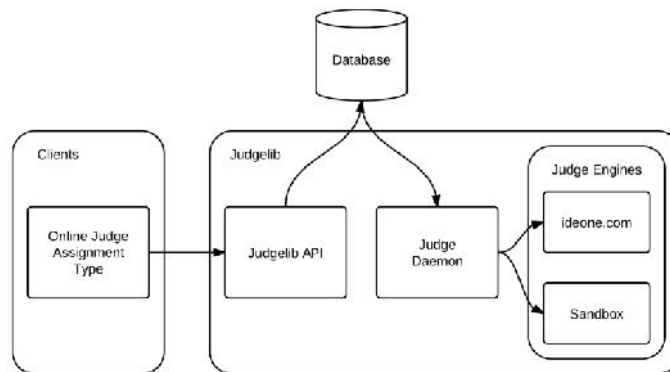

Figure 1: Online judge architecture

The assignment type is extended from Moodle's official advanced uploading of file assignment type, and inherits most of the standard features such as uploading file, due time limit, grading manually and feedbacks. In its setting page, teachers can choose programming languages, set memory and CPU time limits. Its settings block can direct teachers to rejudge all submissions or configure test cases. Each assignment may have several test cases which consist of input data, output data, grade and feedback for error. Submissions are judged separately against each case. If one case is passed, its grade is added up to the final grade. Otherwise, the feedback is shown to students as hint (see figure 2).

Figure 2: Online judge result of a submission

Judge engines are designed as subplugins. Therefore, it is easy to integrate more engines. Now there are two judge engines: sandbox and ideone. Sandbox uses libsandbox(Liu, 2012) as a restricted environment to execute C/C++ submissions on Linux. It can monitor the behaviour of target programs in runtime. When program's execution exceeds the specific time or memory limit, or it calls a disallowed system call, sandbox will terminate it immediately. Ideone engine supports more than 40 programming languages (e.g. Java, Perl, Python, C#) by calling the web services of ideone.com. It is safer but has longer latency than sandbox. Moreover, ideone allows only 2000 submissions/month for one free account. But they are considering providing big quota to users of Moodle Online Judge.

Moss Plagiarism

The official website of Moss (Aiken, 2012) says:

> Moss (for a Measure Of Software Similarity) is an automatic system for determining the similarity of programs. To date, the main application of Moss has been in detecting plagiarism in programming classes. Since its development in 1994, Moss has been very effective in this role.
> The algorithm behind moss is a significant improvement over other cheating detection algorithms (at least, over those known to us).

It supports dozens of program languages: C, C++, Java, C#, Python, Visual Basic, JavaScript, FORTRAN, ML, Haskell, Lisp, Scheme, Pascal, Modula2, Ada, Perl, TCL, Matlab, VHDL, Verilog, Spice, a8086 assembly, MIPS assembly and HCL2.

Moss works as a service with a client program written in Perl. This client can (a) upload files; (b) specify in which programming language the uploaded files are; (c) specify a set of files as the skeleton code which will not be considered as plagiarism; (d) set the maximum number of times a given passage may appear before it is ignored. On succeed, it will print an URL and exit. Accessing the URL in any web browser can get the plagiarism detection result pages, which show the possible cheating codes side-by-side and highlight the similar code segments.

Moss had been used in our courses for 2 years before Moodle was applied. Therefore, the requirement of integrating them is straightforward. The first version of Moss plugin is implemented as a block. After Moodle 2 introduced the Plagiarism API("Plagiarism API," 2012), it was migrated and upgraded to Moodle 2. The new version not only inherits all the abilities of Moodle Plagiarism API and Moss, but also introduces four significant features.

The first feature is confirmation. The results of Moss are only reference. Teachers must check the results manually to confirm who is cheating. Moss plugin adds a confirmation status on each submission. Teachers can look up a sorted list of potential plagiarism (figure 3) and click to see the side-by-side comparison. If they are sure that there must be someone involving cheating, they can press the confirm button and related students will be notified through Moodle message system. They can also easily give a punish grade to confirmed students in the same page. And of course, there are unconfirm buttons if they changed their minds (e.g. students give a reasonable explanation. In figure 3, the first pair of person with 99% similarity is unconfirmed because one of them occasionally uploaded another person's file. He presented his own file and can explain every detail in it to prove it belongs to him.)

User1	ID number1	Confirm ⓘ	Similarity	Matched lines	User2	ID number2	Confirm ⓘ	Similarity	Matched lines
		✓ ( )	99%	87			✓ ( )	99%	87
		✓ (-)	78%	102			✓ (-)	78%	102
		✓ (-)	66%	102			✓ (-)	66%	102
		✓ (-)	43%	75			✓ (-)	44%	75
		✓ (-)	50%	62			✓ (-)	57%	62
		✓ (-)	46%	57			✓ (-)	52%	57
		✓ (-)	46%	67			✓ (-)	55%	67
		✓ (-)	62%	63			✓ (-)	53%	63
		✓ (-)	36%	52			✓ (-)	37%	52

Figure 3: Moss Plagiarism plugin results page

The second feature is support of pdf, doc, docx, rtf and odt documents. Although never mentioned in homepage, Moss's client supports plain text. So Moss Plagiarism plugin parses out plain texts from common document formats and let Moss do the rest.

The third feature is history. Moss engine never stores files for long. And teachers usually reset their courses at beginning of new semesters to clean all submissions of unenrolled students. Moss plugin can keep those files and will include them in future measuring. Moreover, assignments in different courses with the same moss tag (set by teachers) can also be measured together.

The fourth feature is multi-configures. Since the advanced uploading of file assignment allows multi-files submissions, the plugin gives the ability to use different configure for different files. For example, an assignment requires three submission files. One is report file and the others are Java source code files. Teachers can set *.doc, *.pdf and *.docx to be measured as plain text, and *.java to be measured as Java source code. The result page can show the results of the two configure together or separately.

Unlike turnitin("Plagiarism Prevention Turnitin," 2012) and crot (Butakov, 2012) plugin who show result immediately after uploading files, Moss does detection only at specified time (default to the due dates of assignments) because Moss requires that all files must be submitted together. Another weakness is that Moss does not do web search. Only files submitted to Moodle are measured. But this is not a big problem because it is common that more than one student copy the same origin. They cannot hide from Moss.

Github Assignment

Github.com is not only an amazing website for developers, but also a helpful tool for teachers and students. Some supervisors require their students to host graduation projects in github. So that supervisors can watch the projects to know the latest updates and commented on commits to give advices. For supervisor, everything is easier and more trustable than before. For students, the public projects can be impressive show to their future employers. Therefore, github should also be helpful for course projects.

However, github is not designed for courses. Github assignment type plugin fills the gap between courses and github. It allows teachers to track projects without leaving Moodle. The features are:

1 Collect students' github usernames and repository URLs.
2 If the assignment is in group mode, group members share the same repository. Otherwise, everyone has his/her own repository.
3 Synchronize all commit histories of all repositories and cache the logs.
4 Statistic workload percentages of group members.
5 List all repositories by optional sort order (name, last update date).
6 Direct links to github pages those teachers & students may concern.
7 Inherits standard functions of assignment type, such as grading.

Figure 4 shows a project named taskmanager-for-linux-chengjisihan. Two group members were contributing to it.

Figure 4: Project status page of github assignment type plugin

This plugin has a simple architecture. Besides the user interface, it provodes a command line synchronization script which invokes git command and Github API (Duplessis, 2012) to fetch data. Git working directories are cached in Moodle temporary directory and logs are stored in database. The CLI script can be run through crontab in any period.

Now, the plugin only supports public repository. Github has an educational plan which gives teachers free accounts to create as many private repositories as need for courses. Since perhaps some teachers or students want the code to be private, the plugin will support private repository in the next version.

Case Study

Online Judge, Moss Plagiarism and Github Assignment plugin have given significant contributions to our courses. They can be used together or separately. Some teachers said they change the way of teaching and learning in programming courses. Moreover, most students are also happy to accept them.

Online Judge

In 2006, Online Judge plugin was first applied in C Programming courses for Computer Science and Software Engineering students. Now it has been widely used in other majors and courses and also other institutions and countries. Some users even contributed Polish and Portuguese translations.

In our university, every semester, there are more than 2500 students will enrol C Programming Language courses which are instructed by no more than 10 teachers. Some teachers must instruct more than 400 students concurrently. But school only supports 1-4 teaching assistants for each teacher. In the days without Online Judge, there were less assignments and only part of them could be graded because teachers could not afford the workloads. But recent years, it is normal that a student who gets a pass have to code more than 50 programs. And all the programs are graded well. Although teachers must spend time to design assignments and test cases, the assignments can be easily shared among teachers and reused in the future. Therefore, teachers are much happier than ever. Somebody even added "infinite" online judge assignments and announced that only the student who conquers the most number of the assignments can get 100 points and so on.

Most of students also enjoy the procedure of conquering online judge assignments. They treat it as an adventure of online game. If the grades are not satisfying, they have the chance to retry. As their codes get better, they get more skills, experiences and higher grades. At last, the maximum grades will draws upon them and satisfy their

achievability. In the course forums, we can easily find posts about their enjoyments. Somebody even required more assignments. In last year, the average submitting time per student for one assignment was 6.97. The most persistent student submitted 816 times for one assignment.

One professor began to use Online Judge since 2010 spring. In the four semesters before that, the average grades of her courses had been 75.3, 67.2, 67.8 and 70.3. In the following semesters after using Online Judge, the average grades were 89.6, 86.6 and 83.7. She said that she decreased difficulty only in 2010 spring. After that, both difficulty and quantity were increased much. The numbers show the significant improvement on quality of teaching and learning.

Moss Plagiarism

Plagiarism is a big problem for nearly all courses. Since the dead of paper-based homework, copying has been zero cost. The sources of plagiarism include classmates, upperclassmen and Internet. Some graduate students estimated that there are only no more than 10% undergraduate students have never do plagiarism before graduation.

In our university, Moss Plagiarism plugin is mainly used in C/C++ Programming and Operating Systems courses. All C submissions are pure original source code so the default setting works well. The assignments of Operating Systems require students to modify Linux kernel and write reports. Therefore, in submissions, there are test reports and source code files which contain Linux code base and students' patches. So each assignment has two configures. (a) *.c files are measured as C language and using Linux code base as base files so that they are ignored in results. (b) *.pdf, *.doc and *.docx files are measured as plain text.

Moss gives out up to 250 potential plagiarism pairs no matter what the percentage and how many lines are detected similar. Only part of them can be real plagiarism. So the confirmation step is the most sensitive. Teachers must carefully check the pairs in the top of the result lists. The default sort order of Moss is correct enough so that it is usually safe to ignore all pairs following the first pair that teachers believe it is not a cheating. As reports, only a very little number of students could successfully challenge the confirmations.

Many students said that Moss gave them so much pressure. Since only a few courses are using this plugin, teachers of these courses are common to get complain during the first halftime of courses. However, after the halftime, when students feel that they do learn something under the pressure, they begin to love and support teachers. In 2010 autumn semester, at the end of OS course, a survey asked "Do you support to use Moss Plagiarism in the following courses?" There are 91.7% students chose "Yes".

Github Assignment

Github Assignment plugin is still under development and was first used in March, 2012 in the course Software Design and Development Practice III. SDDP is a series of courses. They require the 200+ undergraduate students to design and develop a software project in 2-5 member-sized groups in 16 weeks. A survey shows that, In SDDP I & II, only 19.27% groups can pay attentions on projects through all time, and 49.4% groups started their jobs even in the last 1-4 weeks. Moreover, many students complained that some group members did not contribute to the projects but they can get the same grade as others. SDDP III is trying to change something in Moodle way.

First students and tutors (teachers or graduate students) were added into Moodle groups. Then one forum called "Weekly reports" and one github assignment were created in separated group mode. The forum's maximum grade was set to 20, and the assignment was set to 80.

Students must weekly post in the forum to report what they have done in the past week and what were the problems they could not solve. Tutors should read posts, join discussion, and grade posts upon the quality of works. Therefore, students keep doing something; tutors know the progress and problems are solved quickly.

In the Github assignment, students must setup github repositories and account in the first week, then commit and push code to github in following weeks. Git logs were synchronized and shown in the assignment. Tutors could read logs, click the github links and enjoy the github features such as inline comment and statistic graphs. Instructor of the course concerned about all groups. So he could usually check the repository list sorted by last commit date to learn where the students had gone to.

In the last week, students made presentations and demos. The instructor listened, asked questions and graded directly in the github assignment. He also checked the git logs and statistics to know who exactly did what.

For most students, it was the first time they met Git & Github. There was no training about them except some links to ProGit and Github documents. Students must learn by their selves. At the end of this course, a survey asked "How about git?" 36.14 % students chose "It's helpful", 27.71 % chose "More troubles than solutions", and 36.14% chose "I don't care". So there should be some training to cover troubles in the next usage. Another survey question asked "Which trouble is the most often to make you say the F-word?" The top two troubles are "Cooperation problem" and "Push rejected". So the training should pay more attentions on these problems.

Conclusion

All these plugins are published in GPL license and free to download at http://git.io/hmdl . Since the first release, we have got many feedbacks, suggest and patches from many instructors, administrators and researchers around the world. Their experience and ours proved that these plugins can make courses involving programming more efficient and effective.

Moodle 2.3 changed the assignment module. Online Judge and Github will be migrated to it. And there are also many improvements under plan. We'd like to keep upgrading them and make them free.

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Acknowledgement

Supporting Problem-based Learning in Moodle using Personalised, Context-specific Learning Episode Generation

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Abstract

Providing learners with a list of disparate search results is not always conducive to learning. In particular, this approach lacks learning structure, and learners have to sift through lists of resources in order to make sense of them and to find the level of detail they require. In this paper we outline the Moodle Help Block, a Moodle block plug-in that provides learners with Just-In-Time context relevant learning material using a defined pedagogical strategy. The Moodle Help Block uses a combination of Semantic Web, Social Web and learning composition technology to generate learning episodes as needed by learners. The Moodle help block conducts a dialogue with the learner to extrapolate where a given learner's knowledge gaps lie and generate learning episodes with learning material to help the learner overcome their knowledge deficit. It is thought that the Moodle Help Block can assist learners with targeted help when a teacher is not available.

Keywords

Moodle block, search, semantic web, social search, personalization

Introduction

Continuous assessment assignments provide students with opportunities for self-directed, autonomous learning which enables them to consolidate prior learning and provides them with opportunities for discovery learning. (Savery & Duffy, 1996) Teachers are aware of the pedagogical benefits of problem-based discovery learning but are also aware that students can waste considerable time searching the Web or Learning Object Repositories (LOR) because they cannot quickly find resources that meet their specific learning needs or learning context. This results in students becoming frustrated and negatively impacts both the pedagogical potential and motivation associated with problem-based discovery learning. In contrast, systems that enable students to quickly find resources personalised to their learning context and knowledge level can have profound pedagogical benefits; for example, enabling students to identify and plug learning gaps, consolidate prior learning, problem solve through focussed discovery learning and become self-directed, independent, motivated learners. Such a system would provide an authentic content discovery learning environment where deep, meaningful learning could occur.

In this paper we introduce the Moodle Help Block. The design and implementation of the Help Block was driven by a real-world use case scenario to ensure that it was fit-for-purpose and pedagogically effective. The Moodle Help Block includes a number of innovative technologies to deliver the most pedagogically effective learning resources to the learner and to present this material in a pedagogically sound manner in the form of a "learning episode" that is personalised to the needs of that learner and their learning context. The use case revolved around a large repository of disparate teaching and learning resources, a cohort of final year

engineering students and a lecturer keen to apply problem-based discovery learning strategies to continuous assessment.

In this paper, we outline the design of the Moodle Help Block application and also outline the results from our evaluation of the tool using a live user trial. A detailed description of this trial can be found in (Brabazon et al., 2012).

The structure of the paper is as follows. A brief overview of related work is presented in Section 2, followed by a description of the design of the application in Section 3. Section 4 presents the User Interface. Section 5 looks at each of the components that makes the Moodle Help Block possible. In Section 6 the findings of our evaluation and conclusions, and directions for future work are given in Section 7.

Related Work

The vast quantity of learning resources available on the Web and in learning repositories is driving research into technologies that facilitate the discovery and retrieval of resources that are personalised to the needs and attributes of the querying user.

Adaptive hypermedia is one such technology. Traditional one-size-fits-all hypermedia present all users with the same hypermedia document irrespective of their information needs. This can increase the cognitive load on a learner as they must not only attempt to learn the subject matter but also successfully navigate the hypermedia to find the most appropriate content. Adaptive hypermedia attempts to address these issues by adapting the hypermedia to the individual user based on various properties of the user; for example, the user's goals, prior knowledge or preferences (Brusilovsky, 2001; Lawless et al., 2005). Several systems have been successful in demonstrating the real benefits that personalization can provide through the adaptive selection and sequencing of multimedia content to meet the needs of the learner (Smits and De Bra, 2011).

In recent times, there has been a shift towards the separation of personalisation and adaptivity information from the physical learning content (Henze and Nejdl, 2001). Content can be selected regardless of source and inserted into an e-learning experience in a sequence that suits each individual learner. Research is also being carried out into ways of improving search using personalisation (Zhou et al., 2012). The work focusses on a novel query expansion framework based on individual user profiles mined from the annotations and resources the user has marked. The proposed approach appears to significantly benefit personalized Web search by leveraging users' social media data.

Adaptive hypermedia research typically involves closed systems which lack the ability to pull in open content such as that found on the Web or in repositories. The use of adaptive hypermedia in the Help block plugin is novel in that it leverages both semantic and social search technology to access open corpus content. The incorporation of pedagogical strategy also differentiates the Help Block plugin from other adaptive hypermedia systems such as GALE (Smits and De Bra, 2011), which do not have an associated pedagogical framework.

Moodle Help Block Design

The aim of this work is to support learners by providing them with selected access to trusted Learning Object Repositories for the purpose of targeted self-directed learning. The research problem addressed is driven by an industry-defined use-case, whereby the Moodle LMS must be able to support the learner with targeted help in scenarios where a teacher is not available. The premise is that it should be possible to map conceptual gaps in a learner's knowledge to an ontology and that this ontology can then be used to locate semantically annotated learning resources to help the learner overcome their knowledge deficit.

As part of the design a detailed process flow was defined outlining the interaction between the Help Block and the learner. The interaction model is illustrated using an UML activity diagram in Figure 1. As outlined, the interaction model is based on establishing the concepts that the learner was having difficulty through dialogue with the learner and then locating resources associated with those concepts in a trusted LOR(s).
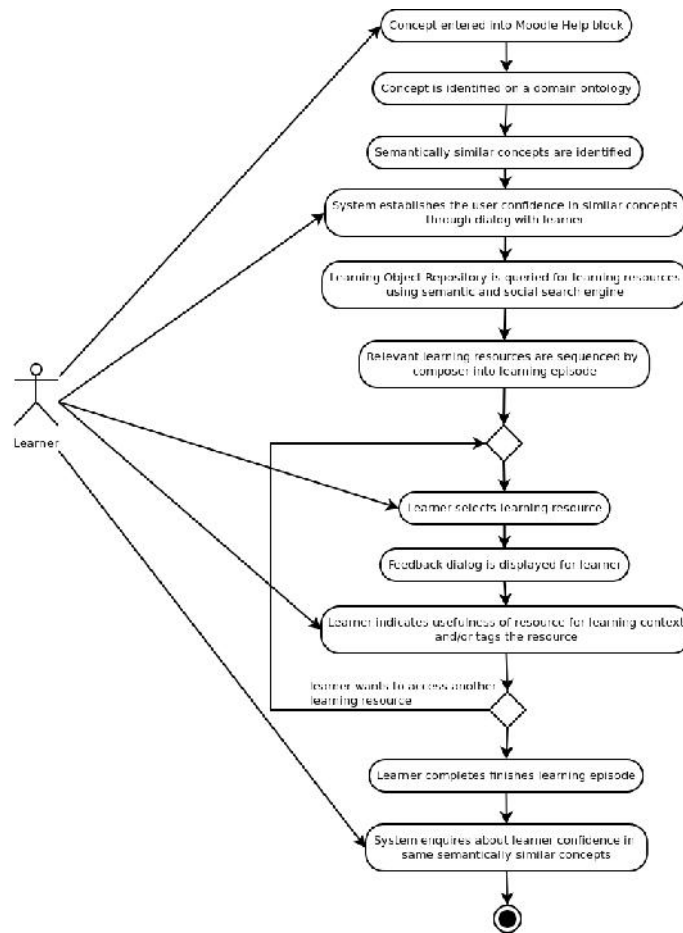
Figure 1 UML Activity diagram outlining process flow of the Help Block

As mentioned, the Help Block was designed as a Moodle plug-in known as a "block". Blocks are small widgets at the side of the screen in Moodle that generally provide some auxiliary function to learning or learning management (such as a calendar or progress bar). Moodle blocks were chosen as they were seen to facilitate a seamless learning experience for the student whereby the block does not interfere with learner's learning until its functionality is called upon by the learner.

User Interface Design

Figure 2 illustrates the key features of the user interface design. In this section each of the main user interaction steps are briefly described.

Concept Identification & Pre-confidence Scores

This interaction is designed to match the learner's free-text search query to concepts defined by the domain ontology. The ontology is itself a key component of the system; it formally represents knowledge as a set of concepts within the domain and defines the relationships between those concepts. A bespoke ontology containing 188 concepts was developed for this application. The purpose of concept identification is two-fold; first, it represents a form of query expansion – helping to address the well-known vague query problem frequently encountered in Web search (Smyth et al., 2004) – and second, it facilitates personalisation as described below.
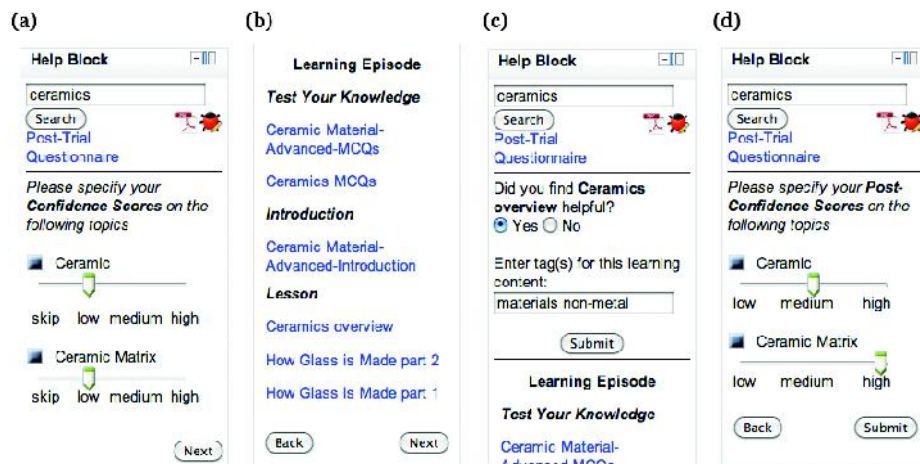
Figure 2 The Help Block user interface design: (a) pre confidence scores, (b) learning episode, (c) user feedback and (d) post-confidence scores.

Following concept identification, learners are requested to specify their degree of confidence with respect to each concept found. Confidence scores facilitate the personalised retrieval of resources, tailored to suit the knowledge levels of each learner in relation to each concept. Learners can specify low, medium or high confidence for concepts or choose "skip" to exclude concepts from further consideration. In Figure 2(a), for example, the concepts "Ceramic" and "Ceramic Matrix" have been identified for the search query "ceramics" and low confidence has been specified by the learner for both concepts.

Learning Episode Composition

Rather than presenting traditional unstructured result lists to the learner, this component is designed to dynamically generate a personalised learning episode based on the learner's immediate information needs and their confidence indicators for concepts in the subject domain. Resources selected by this component are sequenced according to the domain pedagogical strategy which, as shown in Figure 2(b), consists of three steps: "Test Your Knowledge", "Introduction" and "Lesson". In essence, for each step, relevant resources for each concept/confidence score are retrieved using a combination of semantic (Tummarello et al., 2007) and social (Smyth et al., 2009) search technologies. Briefly, semantic search returns resources that match the concept in the domain ontology while social search leverages user feedback to return resources that were found to be relevant for similar queries in the past. Learners are free to navigate and select resources from the learning episode as they so choose.

User Feedback

Once a resource has been selected from the learning episode, feedback is requested from the learner as shown in Figure 2(c). Learners can indicate whether they found the resource to be helpful or not; further, learners can assign free-form tags to a resource to facilitate its future retrieval. This feedback is leveraged by the social search component to identify and promote those resources in future searches that have received positive feedback from the wider learning community.

Post-confidence Scores

Finally, the user can optionally specify their post-confidence scores for concepts (Figure 2(d)). The objective is to encourage the learner to reflect on their learning experience and to adjust their confidence scores as necessary. All pre- and post-confidence scores for concepts are captured by the system's user model component for each learner; thus the system learns over time the degree of confidence and knowledge that learner's possess regarding domain concepts.

Learning Episode Generator Components

The diagram in Figure 3 outlines the various components on in the Moodle Help Block (client side) and the server side. In this section we will look at the server side components needed to allow for the generation of context-specific learning episodes through the Moodle Help Block.
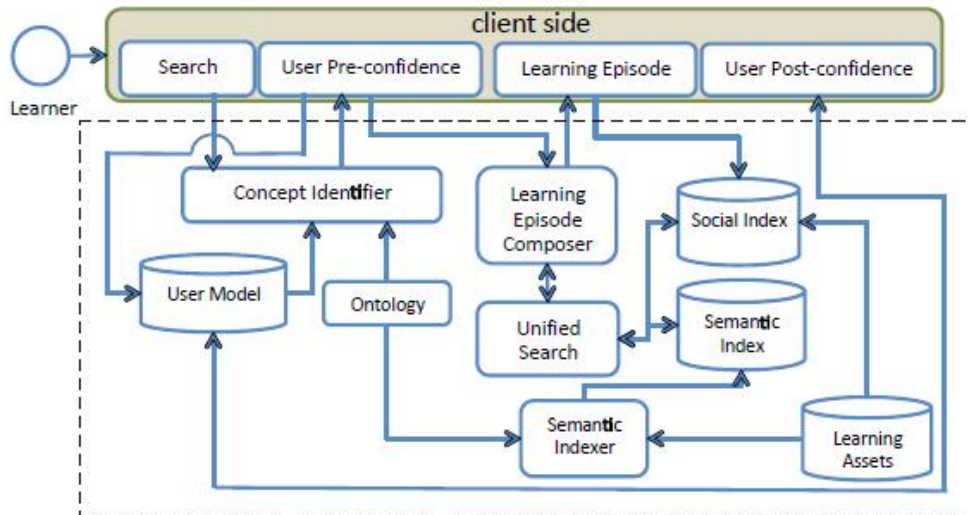
Figure 3 Moodle help block and learning episode generator archtecture diagram

Concept Identifier

The Concept Identification component is designed to identify appropriate concepts, defined in a domain specific ontology, based on a free text search query. Based on the input provided to the service it searches across the predefined domain model, implemented as an ontology, in order to identify domain concepts that correspond to the information needs of the learner as specified by the search query terms. Once appropriate concepts are identified, the service then interacts with the LOR (labelled "Learning Assets") in order to retrieve the current user's confidence scores for those concepts, where available.

This component simplifies the user's experience by automatically mapping the user's free-text search query to domain concepts. In this way, the component facilitates the use of the semantic technologies that underpin other system components.

Learning Experience Composer

The Learning Experience Composer is a web service designed to dynamically generate a personalised learning experience based on the learner's immediate information needs, as expressed by their search query, and their prior experience in the subject domain. Resources selected by this component are sequenced according to a pedagogically informed composition strategy.

The Learning Experience Composer is based on a state of the art Adaptation Engine, which has been integrated with the Semantic Search and Social Search services in order to facilitate the generation of learning experiences that incorporate content from a trusted LOR.

Based on the concepts that the learner has identified as being of interest to them, the Learning Experience Composer adaptively sequences the concepts according to the pedagogical strategy. Within the constraints of this strategy the sequencing of these concepts is adapted based to better suit the needs of the learner. This is achieved by considering the learner's confidence in their knowledge of the respective concepts as specified by them through a set of confidence score indicators. Appropriate content from the LOR is then dynamically selected by the Learning Experience Composer in order to build a personalised learning episode. In selecting appropriate content the Learning Experience Composer again takes into account the needs of the learner based on their confidence scores. Appropriate content is identified by dynamically generating tailored search queries that describe the content that the Learning Experience Composer needs for a given concept, for example "Introduction Beginner Superalloy". The learning episode generated by the Learning Experience Composer is in the form of a model that can then be interpreted by a client application and made available to the Learner.

Semantic Search

Unlike a standard free-text search, semantic search is a concept search (Hogan et al., 2011). It searches for resources that match a concept in an ontology. An ontology represents knowledge as a set of concepts within a domain, and defines the relationships between those concepts. For example, 'metals' and 'ferrous' may be defined as concepts in an ontology, and they may be defined as having a parent-child relationship conceptually.

To provide for contextulised help, there are two parts to a query: a domain concept and pedagogical concepts.

Domain Ontology: A domain ontology designed for the Higher Education use case defines a subset of concepts in the domain of Advanced Manufacturing Processes and Materials, and the relationships between them. The NDLR resources in the Percolate project have been tagged with these concepts where appropriate.

Pedagogical Concepts: A simple ontology of pedagogical concepts used to annotate learning resources.

Social Search

The Social Search component leverages community feedback to return search results that were found to be relevant for similar search queries in the past (McNally et al. 2010). Social search operates as follows.

Social search maintains a set of staks, where each stak stores resources that are related to a particular type or topic. Each stak is associated with an index, in which each resource is represented by a set of index terms and relevance indicators. Examples of relevance indicators include the number of times the resource has been selected, the number of votes (both positive and negative) it has received and the number of times it has been tagged, while the index terms for a resource include terms extracted from the resource title and text and the set of terms that have been used to tag the resource by the community.

At search time, the user's query is first matched against the stak indices, and any resources with index terms that match that user's search query are considered as recommendation candidates. Then, a set of evidence filters is applied to each of the recommendation candidates to determine which of these should actually be returned to the user and in what order. For example, resources that have been selected many times in the past or resources that have received many positive votes are ranked higher than those with few selections or votes. Further, evidence thresholds can be applied to ensure that resources with less than a certain number of selections, for example, can be discounted. In this way, the Social Search service leverages community feedback to identify those resources that are most likely to be relevant for a given search query.

User Trial

To evaluate the Help Block, 4th year Mechanical Engineering students from an Irish university (Dublin City University) were requested to use the system to source reference material for a module assignment. Over approximately three months prior to semester starting, appropriate resources were gathered and associated with appropriate metadata to allow for semantic searching as described above. The assignment involved selecting an advanced material and a corresponding advanced manufacturing process. Of the 19 registered module students, 18 interacted with the Help Block and 12 students completed a post-trial questionnaire.

Usage Statistics

In total, 841 searches were performed using the Help Block during the 6-week trial period. Figure 4(a) and Figure 4(b) show the distribution of searches across time and trial participants, respectively. There was a spike in search activity on each side of the assignment due date (December 6th). Over the course of the trial period, the median number of searches recorded per day was 12.5. The distribution of searches across participants was long-tailed as can be expected in such a trial setting, with a small number of participants making regular use of the Help Block while most participants used it less frequently.
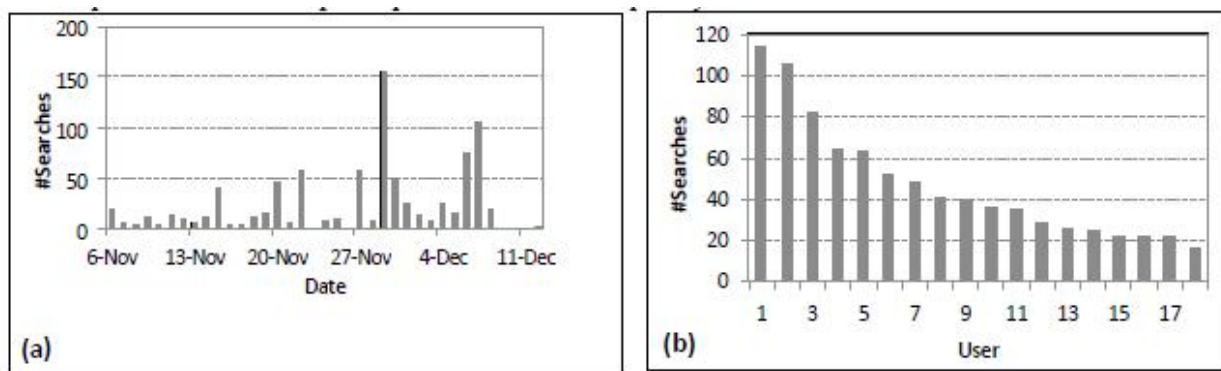

Figure 4 Help Block usage statistics (a) by date and (b) by user

For this trial, 129 resources were available for retrieval by the Help Block. The majority (114) of these were Lesson resources, which represented the core learning material for the assignment. All available resources were selected at least once during the trial and in total resources were selected on 419 occasions. As expected, Lesson resources were selected most frequently (264 occasions), while Introduction and Test Your Knowledgeresources were selected on 119 and 36 occasions, respectively. In the next section, the learners' questionnaire responses in relation to these resource types and the functionality provided by the Help Block are presented.

Qualitative Analysis

To evaluate the effectiveness of the Help Block, trial participants were asked how often the Test Your Knowledge, Introduction and Lesson resources were relevant to their search requirements. Overall, Lesson content was found to be the most relevant, followed by Introduction and Test your Knowledge (Figure 5(a)). However, it can be seen that, overall, more negative than positive responses to this question were received. A possible explanation for this is that the available quantity of Help Block resources influenced the above findings (129 resources in total were available) but this requires further analysis. In contrast, most questionnaire respondents (58%) did feel that the level of difficulty of resources was 'just right' (Figure 5(b)), which highlights the benefits of providing personalised (via confidence scores for concepts) learning resources tailored to suit the particular needs of learners.
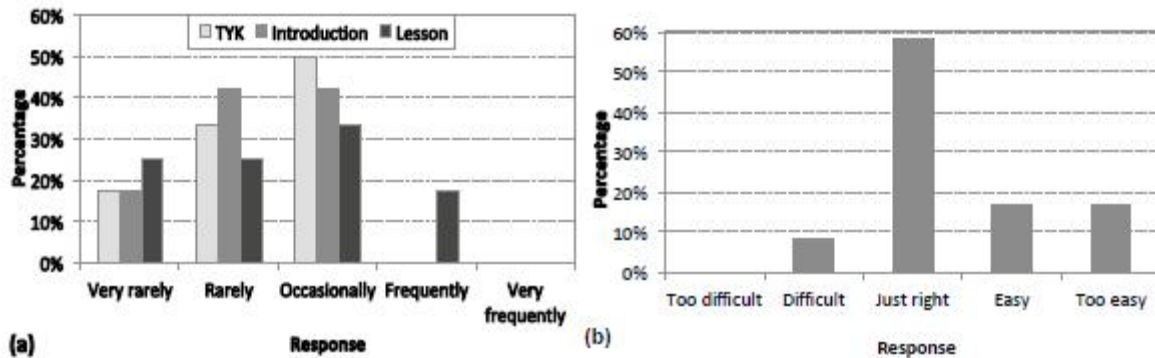

Figure 5 Questionnaire responses: (a) How often were Test Your Knowledge, Introduction and Lesson resources relevant to your search? (b) How would you describe the level of difficulty of Learning Episode resources?

Finally, in terms of ease of use of the application, Figure 6(a) indicates that the majority (50%) of respondents agreed that the sequencing of resources in the Learning Episode facilitated easy navigation. Further, some 42% of respondents agreed or strongly agreed that the system can be learned quickly, with a further 33% of respondents neither agreeing nor disagreeing (Figure 6(b)). These are encouraging findings and provide evidence for the effectiveness of the system design and user interface, particularly as the Help Block brings some unfamiliar functionality (e.g. concept pre-confidence scores) to learners.
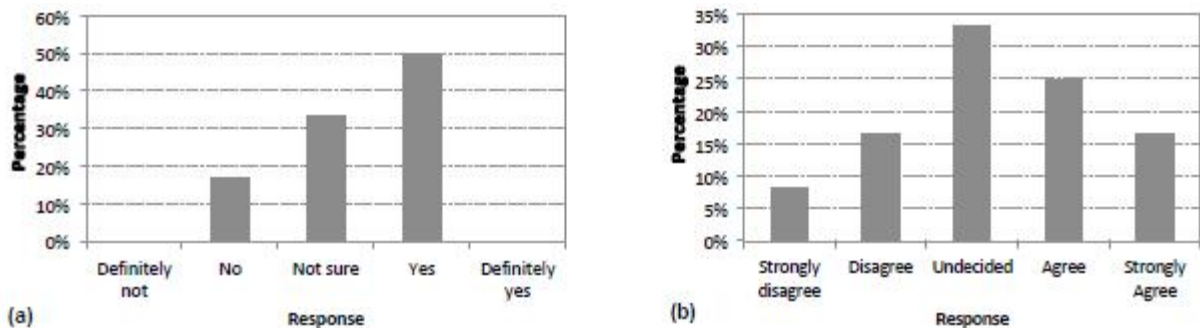

Figure 6 Questionnaire responses: (a) Was the Learning Episode easy to navigate? (b) I would imagine that most people would learn to use this system very quickly.

Conclusions

In this paper, the Moodle Help Block application has been described which was designed as a Moodle plugin to integrate seamlessly into the Moodle LMS. The application incorporates a number of innovative technologies to address the just-in-time learning needs of students in a personalised manner. For the purpose of the application trial, the Help Block was made available to students to assist them in completing a continuous assessment assignment. From the lecturer perspective, the Help Block facilitated the linking of a particular set of relevant resources to course content, thereby providing guidance to students and allowing them more time to focus on learning what was relevant, to analyse the material and to present their work to the required standard. Regarding the application design and user interaction modes, overall the trial participants found the Help Block easy to use. However, there is scope for improving the system; for example, by enhancing the look and feel of the user interface design and providing additional functionality, such as the ability to save and retrieve one's previous browsing history. Furthermore, while personalisation proved successful in providing resources tailored to learner ability, participants expressed dissatisfaction with the need to explicitly provide confidence scores for concepts. Future implementations will consider user modeling techniques to implicitly capture learners' knowledge levels based on their interaction with the application, and thereby remove the extra task of providing confidence scores associated with the current design. Also we would like to look at improving the flexibility of the system allowing by allowing it to easily integrate with other domain ontologies and LORs.

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The Inter-Orthodox Center of the Church of Greece (DKEE) online courses using the moodle platform: presentation of a primary and secondary education teachers' training good practice

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Abstract

The Inter-Orthodox Centre of the Church of Greece (DKEE) under the auspices of the Pedagogical Institute took the initiative for a teacher training program of primary and secondary education teachers focused on new technologies and the latest educational theories. The training program follows the basic principles and methodological applications of elearning, has 3 stages of development and it is estimated than more than 3,000 teachers will be trained. The design of the training was based on previous surveys and studies on the Greek educators' needs and the experience gained during the implementation of online courses in Greece and abroad. In these online courses the moodle platform along with other technologies compatible with moodle were used so the environment could offer a number of different stimuli. The instructors acted as facilitators, in the context of learning theories related to adult education. This training

program which supplemented other educational training programs of the Greek Ministry of Education has the following benefits: access to learning regardless of time and place limitations, individualized learning, updating the learning object, flexibility in shaping the work environment and the educators' work. The evaluation showed that Greek teachers can work effectively in an online training environment.

Keywords:

Online education, teacher training, technology, digital classroom, moodle

The designing of the courses

The design of the online training courses for primary and secondary education teachers by the Inter- Orthodox Center of the Church of Greece (DKEE) was based on research, case studies and previous implementations of online training of teachers. Most of the data was gathered from surveys conducted by the Greek National Support Service of the eTwinning Action, in 2007 and more systematically in 2010, which focused on the needs of teachers enrolled in the action. Also, the implementation of the first online eTwinning courses, as part of the above mentioned action, have been a valuable experience for the overall design of the DKEE's training, since the instructors who designed the courses for DKEE played an active role in the above mentioned surveys and implementations of the online training in the eTwinning actions but also to online courses offered by European Schoolnet (EUN).

The model used in the design of the first round of courses was the ADDIE, as described by Rothwell and Kazanas (2004), and included the following phases: analysis, design, development, implementation and evaluation. As the DKEE courses are becoming more and more complex, the course development team

examines the use of a more complex model, such as the "Rapid Prototyping" of Tripp and Bichelmeyer (1990). Apart from the eTwinning surveys and previous experience of the trainers who designed the DKEE training, a small scale needs analysis, due to limited time and resources, was conducted on the target group (Vergidis & Karalis, 1999). Its purpose was to gather information on the needs of various teacher groups, their skills and the required training that would enable them to attend the courses, the time they would have at their disposal and their access to technology. At this phase the course developers selected the general and specific objectives of the training and the appropriate educational models for each case.

Based on the above, the first round of DKEE courses was created. A different educational model was used in each course, according to the course content, but also the needs and the skills of the participants. Each phase of the implementation had a common structure that included the preparation of participants, the presentation of the content, the participation in groups or individual activities, the practical applications followed by the instructors' feedback and self evaluation of trainees (Coldway, 2005). To test the effectiveness and integrity of the course, the phases of implementation and evaluation were integrated into one.

Before making the courses available to the educational community, a group of five teachers, with expertise in e-learning, were asked to attend the training in half the normal time and to evaluate the content. The evaluation team received a questionnaire to rate all parts of the training and in the end to propose changes. The criteria for evaluation of the course were drawn largely from the "Suggested Principles for Online Learning in Canada» (Canadian Recommended E-Learning Guidelines) of Barker (2002), which was closer to the philosophy of the provided training, according to the trainers' decision.

Technologies and the Digital Classroom Organization

Technologies

The technologies selected were aiming to give access to all the teachers who wanted to participate in the training program. Access to a computer with an internet connection was necessary. For reasons of economy and as all the learners didn't have a broadband connection (adsl) at home or at school, the course material was designed to be accessible even from low-speed dial up services (pstn / isdn). For the asynchronous online part of the courses, instructors chose the moodle platform of the Greek School Network (GSN). This service is free for all educators to create online classes and host courses. The DKEE instructors took advantage of the moodle's functionalities, to create the structure and organize the courses on the platform, to create a digital library of e-books and texts for compulsory and optional study, to plan with the help of the integrated agenda the activities, to announce upcoming events on the notice board, to host online discussions, to enhance collaborative learning and to strengthen the relationship of the learning community. Also, the platform gave opportunities for the creation of a register, to record the progress of learners, to post assignments for evaluation, to form work groups and allow access to assessment tests (Kabourakis & Loukis, 2006). A series of the moodle functions, such as the "choices" made it possible for designers to develop courses for a variety of teaching methods such as role playing or the development of "competitive" techniques (eg group work assessment ballots).Other functions used were the quizzes, which supported self-assessment techniques.

The increased demand for a high quality modern synchronous e-learning platform, led to the use of "Wiziq", that is compatible with the moodle platform, in order to host some interviews/ lessons with experts in real time. These videoconferences were accompanied by online presentation slides and charts, the use of digital white board, the direct sharing of documents and the bilateral communication between trainers and trainees (Terpstra, 2007). These sessions were recorded using "Wiziq» tools, were linked with moodle's online class and the trainees could access them anytime and anywhere (either to refer to those presented or because they were unable to attend the sessions).

Besides ""Wiziq"", a number of tools were used to create the learning material. The most popular tool was "eXe", which exports learning content to SCORM format and allows easy uploading into the moodle without any problems or confusion for the participants due to the variety of software in use. "Articulate" (presenter and engage) was also used by the course developers for content creation and then exported to SCORM. Both "eXe" and "Articulate" made it possible to create educational material that combines images, sound, and high interaction with the learners. To create educational instructions (tutorials) "eXe" and "Jing" were used, as well a number of video and audio files. An important advantage of the moodle platform is that all these tools are compatible with it and the participants can have a number of different stimuli without leaving the course environment. In general, the course creators considered the moodle environment learner-friendly, and easy to create different educational models courses, its great advantage being the option to combine moodle with other online learning tools to create learning material or videoconferencing.

Organizing the digital classroom

The development of the digital classroom was the primary concern of the instructors, in order to create an innovative learning environment that would target the learners and their needs. To design an effective digital class, the course developers had to take into account the absence of face to face contact, which often leads to limited participation and or early dropout. Researchers have observed that a dropout rate of 30% is considered "justified" (Annual Report of elearning eTwinning Events by the eTwinning CSS, Riga 2010). The course developers organized the digital classroom, using best practices from the international bibliography and based on previous experience of online courses in Greece and abroad. Thus, a simple and repetitive structure was selected, which though it requires much preparation and detailed planning, it has been known to help learners to function effectively in the e-learning environment. More specifically: Before participating, the participants were given detailed instructions for the course, regarding the subject, the aims and the objectives, the time needed to devote to complete the activities, important dates, the software and hardware required and the necessary ICT skills, in order to avoid struggling with technology (Dotson, 2003). Apart from a manual (in an ebook format) and the informational brochure, there were explanatory video (tutorials) for every activity required and for the easy navigation in the moodle platform. The developers' main priority was to make the environment easy to use and to limit the participants' dropout due to problems in using the platform (Anderson, 2004).

Following the suggestions of Palloff and Pratt (2007) a welcoming space for the trainees was created. It included a section for important announcements and any additional instructions, besides those sent initially to the students, prior participation. In addition, a forum was integrated, where educators and learners could socialize and get know each other better and forge the relationships of the learning community. The educational content was organized in modules revealed to the participants every second or third day, depending on the course timetable. The instructors had a forum, visible only to them (teachers' office), where they discussed the progress of the course, the trainees progress, decided and discussed problems or difficulties that arose from time to time.

The implementation of each course was based on the organization into modules, which followed a fixed layout: learning stimulus, formulating objectives, presentation of the learning material, assignments, reflection. It was noted that this layout, repeated in each module was easily "recognizable" by the participants who felt that there was a logical sequence that helps the e-learning environments. A case study in a course that had a less organized layout and more freedom in the material navigation and activities led to confusion among participants. Inertia was noted in the case of the implementation of self-adjustment in a course, especially at the beginning in terms of formulating personal goals and expectations.

Particularly, the reflection of the trainees in the various activities and the group feedback, besides the personal that each trainee received separately, were very important. For this purpose a forum was created, where everyone who participated could comment about its progress. Finally, the questions about the course forum, where questions and problems concerning content and the technology were asked and solved both by the trainers and the trainees, were greatly important.

The role of educators - researchers in an innovative distance learning environment

Teacher training seminars in DKEE were visualized by instructors with training and expertise in distance e-learning and adult education. According to Hedley's instructions (2005), the DKEE instructors undertook specific roles during these seminars. In the beginning they designed and created an interactive learning environment designed to promote interaction and network socialization of the participants. The participants had the opportunity to meet each other, to get to know the instructors and the requirements of the course and the content of the training through a series of activities. The continuous web presence of all those involved in the training was the key to success because most activities followed the philosophy of the social constructivism on the web (McMahon, 1997), where instructors and learners 'built up' knowledge and skills through workgroups. The instructors' philosophy in the training planning reflects the principles of the moodle platform design, as it is stated by its creator M.Dougiamas (Dougiamas & Taylor, 2003).

In all the first cycle of the training courses, the instructors set the learning pace and acted with the dual role of educator and researcher. During the design the video and audio files as well as the electronic books or articles the participants had to view or study were timed. Specifically, reading text on the computer screen was calculated at 180 words per minute (Ziefle, 1998) and the necessary time was allowed to the participants. In this context, and in accordance with instructions the trainees received, they were asked to dedicate 12-15 hours in

twelve to fifteen days that each course lasted, depending on their familiarity with computers. If the participants were late to submit their work, the instructors contacted them through e-mail or instant messages via moodle, to help them or solve any problems (Pallof & Pratt, 1999). The moodle platform offered the educators important data on the participants' activities (pages visited, time spent in these etc.) to form a more complete picture of where there were difficulties or problems. Those who stayed behind in the training were transferred, after contacting them, in a separate group and the seminar became individualized for them.

In all the first cycle courses, the instructors acted more as coordinators and facilitators, rather than preaching teachers. With a series of auxiliary documents and tutorials for using the moodle platform, posted answers to frequently asked questions (FAQ) and solutions to potential problems, the participants adapted as smoothly as possible in the e- learning environment. For the better communication between the trainers and thetrainees, a considerable amount of time was devoted to the creation of personal profiles, meeting activities and exchange of views on the course, but also on issues of broader interest. In each course there was a forum for any kind of discussion (Café Corner), so that trainers and trainees interacted in matters unrelated to the lesson. Thus, the fora, not only facilitated cooperative learning but also communication and friendship among the participants. Finally, the educators followed the principle to answer in a period of twelve to twenty four hours to questions in the fora or in personal emails (Waterhouse & Rogers, 2004) and meeting times via phone or Skype were planned.

Regarding the role of the instructors as researchers, it has started with their assistance in the creation of courses and teaching materials, continued with the critical data processing in the implementation of courses and after the completion of the courses, with the statistical analysis and case studies. The design of the course was such that the instructors had to take a series of successive roles (team coordinator, activities facilitator, animator, etc.) so different data was collected on how the trainees interacted with other trainees and the trainers (Rakalidou, Komninou 2007), and data concerning the interaction with the educational material and exploit the capabilities of the moodle platform was collected. All these elements formed the basis for a comprehensive evaluation of the training.

Evaluation Method- Evaluation Model

Regarding the evaluation of the digital teaching media, we see that almost the same methods used for the evaluation of any software are used: inspection by specialists, inspection by ordinary users, and observation of the criticism given by others, observation of the use in real life. Unfortunately, most of these "classic" methods of evaluation can hardly be adapted for the evaluation of collaborative learning through computers (Computer-Supported Collaborative Learning, CSCL). Thus, we can ask a specialist to participate in the educational process as a viewer or to learn some information giving an online questionnaire, or even through the log files, regarding how users learn, what they see, how much time they are online, etc. (Crawley, 2006). It is interesting also to consider how often and for what reason the help pages are sought. (Rahkila and Karjalainen, 1999). In the case of the DKEE online courses, we used as many of the classical methods that could be adapted: we asked the trainees of the pilot implementation of the courses to test the platform and its use and to report their observations, we daily checked the trainees actions in the courses and we gave an online evaluation questionnaire in each course, using the Likert scale. But these were not sufficient, as in the Computer-Supported Collaborative Learning, results cannot be measured based on one variable only, but a chain reactions takes place, in which each event gives meaning to the next one (Salomon, 1992). Therefore, it was imperative to find new methods that take into account the reactions of trainees and the usability of tools during the evaluation (Laurillard, 1993).

Our assessment was based on the division of digital teaching media in 4 categories:
In the discursive, in the adaptive, in the interactive and in the reflective media (Laurillard, 1993). The moodle covers all four categories above mentioned. Thus, trainers and trainees have the opportunity to exchange views freely, the trainers can offer assistance and feedback on the trainees actions and, according to the degree of understanding, to adjust the thematic objectives of the next unit, while the trainees can act to achieve their thematic objectives (eg through the different fora, personal messaging, individual and team workplace, etc.). Significant is the feedback which is individual but also group activity in each module.

In the DKEE courses we used a complex development and evaluation model. Apart from the model proposed by Laurillard, Scardamalia and Bereiter (Scardamalia & Bereiter, 1994) identified 3 characteristics of such a dialogue of knowledge construction:

1. The center of the learning process are more the problems and the deeper understanding, rather than the mechanical reproduction of knowledge.
2. The learning activity is decentralized free construction of knowledge, with particular emphasis on collaborative learning, where questions and reflections aim at a deeper understanding.
3. The knowledge affects the wider community and it is not limited to trainers and trainees.

Considering the above we arrive at a new model with small but significant variations from the "interactive framework" developed by Laurillard. The new model is obviously decentralized free-construction of knowledge through the relationship between the individuals of a group and the group itself (Crawley, 2006).

These principles are the DKEE courses cornerstone as: a) in each module the objective is the reflection of those involved for the modern educational needs and the integration of the new technologies into the educational process, not just the knowledge itself of a particular subject, b) the search for knowledge and the desire for deeper understanding comes from all sides with the contribution and expertise of various specialties teachers, while those who lack such knowledge have an important role in indicating what it is not easily understood and therefore should be explained further, and c) the participants come from many different levels (primary and secondary education, school advisers, educational managers, etc.) so nobody can be complacent shielded behind the traditional model of teacher-student, but all are shareholders in a highly dynamic environment, where after someone's actions, all the rest have to readapt their attitude and activities.

In conclusion, we have ensured the assessment and support of specialists concerning the open and distance learning if the program results were going to be monitored in the future and their availability to be used by other trainers (Komninou et al 2008).

Connection to other Teachers' Trainings

The Greek educational community has only a few choices when it comes to lifelong learning and training. As for the ICT training there are only two certificates available for teachers (Level A and B). Attaining the so called "Level A Certificate" doesn't include anymore any kind of training and teachers can only take exams to be certified. Some of the main aims of the "Level B Certificate" are for teachers to understand the prerequisites and the potential of the development of ICT for educational purposes, to get a general idea of the available software, the internet and web2.0 services and be able to choose and use the most adequate e-material and tools in their classes. Furthermore there is also "The Major Training Program" which was offered on a pilot basis for a limited number of teachers. In this training program a general reference to the value of ICT and its educational uses is made as well as its implementation in "The New School" while no specific competencies or training is offered to the teachers involved in this program (Mikropoulos et al, 2011). Both the "Level B Certificate" and "The Major Training Program" are intended for a limited number of teachers not covering all the specialties.. The DKKE seminars take full advantage of the basic competencies gained by teachers during "The Level A Certification". Teachers can now concentrate on the effective pedagogical use of ICT in their classes. In comparison to "The level B Certification", teachers specialize in certain tools, create their own teaching material and distribute it to their classes. Each course focuses on one or a series of tools that follow the same principle, to create an interactive learning environment for students.

As for "The Major Training Program, the DKEE training materializes the vision of "The New School" for lifelong learning of teachers and the former Minister of Education thesis that teacher training supports the implementation of the "New Curricula" (Diamantopoulou, 2011). The educational community is constantly informed and trained in innovative practices for the optimal and most effective classroom teaching. Moreover, teachers are getting more and more familiarized with synchronous and asynchronus e-learning methods so that they can put them in practice in the eras of "The New School", European projects, school projects and also for their own academic development. As it is described in the "The Major Training Program" educational material these technologies are already used by schools in Europe, America and Australia and by several Greek teachers informally (Mikropoulos et al, 2011).

The Benefits of the DKEE Courses

The DKEE seminars have always been open to all specialties and to all teachers that have personal email accounts in Greek Schools Network. The only condition needed for the participation of the teachers is to apply electronically filling a form for the course they wish to participate. The trainees have 24 hour, 7 days a week access to the course platform, with no place limits, since they can work from their home or their school.

In this form of in-service training there are neither transfer expenses, nor any disturbance in the school timetable. The training material is constantly being updated and the instructors can modify it according to the needs of the trainees. The trainees are more able to control their learning process, as a big part of the material is modulated according to their needs and interests. Activities like case studies, demonstrations, role games, internet sources with further visual material and activities with individualized learning, internet forum discussions, group projects etc., form an interactive learning environment, aiming at the stimulation of the trainees and their participation in the electronic class.

According to (Race, 2001), the benefits of the planning and the implementation of the courses, such as the ones held in DKEE, are great even for the instructors. Initially, they do not need to instruct and repeat the same things and go back to explanations that have already been given. All the material is uploaded in the platform, as well as the answers and the clarifications. They can also focus more on the issues on which the trainees need more help and individualized training. During the courses, the instructors can travel, if it is required due to personal or work obligations, without disturbing the function of the electronic class, since they can access to it from anywhere they might be. Finally, the instructors had more time at their disposal for the evaluation processes and the trainees' feedback.

At the end of each course, the trainees get an attendance certificate from the DKEE and the Pedagogical Institute. As part of the self – evaluation, the creation of a portfolio proving the process of the teacher in these courses is created. Projects and activities completed by the teachers, the teachers' feedback, the evaluation with the use of rubrics and other things, are part of the material included in the portfolio and can be used by participants, since this is a detailed record of the professional progress of the trainees.

Regarding all the above, the benefits from this type of training are sufficient and this was proved by the findings of the quantitative evaluation. Indicatively, we mention some of them: 1.The courses corresponded to the needs of the trainees. 81% thought that the course corresponded totally to the trainees expectations and 17% found it quite sufficient. 2. According to the evaluation the instructors, fulfilled their tasks: 74% judged that their needs have been totally covered and 21% found it sufficient in a big extent. 3. As for the efficiency of the electronic platform (moodle), 57% judged that it covered totally the needs of the class whereas 23% judged that the platform has been quite sufficient for the needs. 4. The educational material has been appropriate for the needs of the course: 81% said that they were very satisfied; whereas 17% answered that they were quite pleased. 5. As far as participants' time management: 48% managed their time very effectively, whereas 29% answered that they managed their time quite effectively. 6. The trainees have been very positive concerning the attendance of other courses: 88% said that they would attend more DKEE courses by all means, and 11% said that they would like it very much. 7. Regarding the re-implementation of the courses for other teachers, 87% said that they would recommend it by all means to other teachers as well and 13% said that they wound agree to the re-implementation of all the courses for all teachers. As far as the log in visits to the platform, it has been noticed that in a 15 days course, the trainees visited the platform pages in an average of 748 times, whereas 63% had been visiting the course pages up to three months after its completion.

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Short
Papers

Intercultural Telecollaborative Exchange between China and Japan

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Abstract

This presentation is a progress report on a study being carried out to explore the possibilities of telecollaboration in education. The two teachers from China and Japan have launched an intercultural exchange project between Chinese students learning Japanese as their third language and Japanese students learning cross-cultural communication. The telecollaboration has been implemented in a non-traditional way, which does not involve language exchange as its essential part, in order for both the groups with different learning needs to benefit from these activities. A pilot project conducted from October 2011 to January 2012 revealed some of the promises and challenges. Selecting and setting up the platform was the biggest challenge, which led to other challenges and issues. Based on the lessons learned from the pilot project, the project has been redesigned. A Moodle course has been set up for this project, and several functionalities and the arrangement of the activities have been planned and tested for use, including using Forums for in-group discussions, using NanoGong in forum posting, and using Choices for a warm-up. The Moodle course, the arrangement of the activities, and what the authors are trying to achieve with them will be discussed.

Keywords

Intercultural Exchange, Telecollaboration, Moodle

Background

Intercultural telecollaborative exchanges can have multifarious pedagogical benefits, including promoting learner autonomy, fostering language awareness and fluency, developing learners' intercultural communicative competence, and facilitating learners' critical reflection on their own culture (O'Dowd & Eberbach 2004:7). Most studies in the area of intercultural telecollaboration to date have a central focus on language learning through "peer" interaction between two groups of "learners of different native languages work together to help each other learn the other language" (Cziko, 2004:25). However, considering the multifarious nature of telecollaboration, the partner groups do not necessarily have to share common learning objectives, if both sides appreciate what they expect to gain from the collaborative project. This applies to our context. On the one hand, Chinese students learning Japanese at the University of Nottingham Ningbo China (UNNC) are enthusiastic to use the target language outside the classroom, but there are only limited opportunities. On the other hand, Japanese students learning cross-cultural communication at Chiba University of Commerce (CUC) tend to be too afraid of encountering language difficulties to join international communication, and most of them seem to have given up learning a foreign language. An intercultural telecollaborative project between China and Japan using mainly Japanese is beneficial to the UNNC students. It also makes it easier for those hesitant students at CUC to step out of their world, and actual experiences of international communication are expected to help stimulate their curiosity, which may help motivate them to learn another language.

Pilot Project 2011, without Moodle

With these different educational goals for UNNC and CUC students, a pilot project of the non-traditional implementation of intercultural exchanges was conducted from October 2011 to January 2012. Starting by exchanging power point presentations to introduce themselves, the students first posted their comments on each other's self-introduction presentations to a blog set up for this project. After a brainstorming session in each class, they posted questions about each other's culture and replied to them. In the final phase, they had a

synchronous communication session on Skype. The pilot project revealed some of the promises and challenges of this non- traditional implementation of telecollaboration.

This intercultural exchange provided opportunity for the Chinese students to use Japanese to communicate with the native speakers, which helped them feel more confident about their Japanese. Also it led to more active student participation in class discussions, where they explored the topics to find out information on their own. The CUC students appreciated the real communication with non-Japanese, without worrying about the language barrier. Although not all of them actively participated in blogging sessions (partially due to the technical problem described below), the Skype session brought in their unusually active contribution to the conversations.

The biggest challenge was finding a right platform. Using the existing class blog on Blogger or Facebook used at CUC would have been the easiest way, but neither was available in China. As setting up a Moodle site only for this purpose seemed too much work, we tried several Chinese blogging services and started to use one that seemed okay, only to see the service provider deleted the CUC students' first comments. This technical problem led to less frequent interactions than expected, and left little time for the students to discuss the topics in depth. Also, the platform allowed us to have only many-to-many conversations, which might have hindered them from building personal relationships.

Cross-Cultural Communication Project 2012, with Moodle

Based on the lessons learned from the pilot project, we have redesigned our project, which starts in October 2012 and lasts nine weeks, to maximize the intercultural telecollaboration. (i) We found that Moodle would be the best available platform for an exchange project between China and Japan, and have set up a Moodle course in Yamauchi's Moodle instance for this project, where activities will be done mainly through discussion forums. (ii) Six mixed groups consisting of students from both the classes will be made for in-group discussions, which is expected to help increase student interactions. (iii) Skype video calls, proved to be beneficial to both UNNC and CUC students, will be used as a starter, as well as at the end of the project. An overview of activities is given in Table 1.

Table 1. Activities Overview

Weeks	Forums & other Moodle functionalities	Outside Moodle	Focus
W1-W3	**Forum**: Self-introduction slides with voice (groups) & Responses in voice with **NanoGong** (groups/*individual)	Skype	Socialization Personalization
W4-W8 Discussions (2 Topics)	**Choices**: Teacher-generated warm-up questions **Forum**: Inter-class questions & answers (groups/*individual) ***NanoGong**	In-class discussions	Learning Understanding
W9	**Forum**: Writing about the project (individual/*groups)	Skype	Reflection

(* = optional)

To conclude

The focus of this presentation will be on the Moodle course set up for this project, its features being tested for use, the arrangement of the activities, and what we are trying to achieve with them. To discuss evaluation methods, the pre- and post-project survey questions will be shown, and other methods including the students' access-log data (Activity Report and Course Participation) and their behavior observed in the classroom will be mentioned. Also, we will briefly discuss anticipated difficulties in implementing a Moodle course, which made us not to choose Moodle in 2011, although it turned out to be the best available option for us.

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Acknowledgements

IT or not to be: The impact of Moodle in the education of developing countries

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Abstract

In this paper we show how Moodle can be used to improve the quality of education in developing countries and, even more important, how can be used to turn the educational system more sustainable and effective in the long-term. We describe our experience in implementing a programming course in Moodle for the Higher School of Informatics at the Université Polytechnique de Bobo-Dioulasso, in Burkina Faso (West Africa), joining efforts with local professors in designing and implementing the learning system. We finally discuss how the teaching effort is reduced, the students' knowledge and capacity improves, and the institutional academic model can be guaranteed with the proposal. For this reason, we claim that information technologies in developing countries are a cost-effective way to guarantee the objectives originally defined in the academic curricula and, therefore, deal with the problem of the education.

Introduction

Recent years have witnessed considerable enthusiasm regarding the role of information technologies (IT) in addressing educational challenges in Asia (UNESCO, 2004) and in Africa (Unwin, 2008). Although there are few experiences to develop online courses to support blended learning in developing countries (e.g. Sife et al., 2007), there has been limited opportunity to gather data regarding the state of e-learning in this continent. (Andersson, 2010) presents a framework of e-learning enablers and disablers to identify the major challenges for e-learning in developing countries. It seems that in developing countries, learning management systems (LMS) could be used to offer a real opportunity to stabilize the educational system at a very low cost. As a real example, a cooperation project between the Universitat Politècnica de Catalunya (UPC BarcelonaTech) in Barcelona, Spain, and the Université Polytechnique de Bobo-Dioulasso (UPB) in Burkina Faso, is described in this paper, implementing on Moodle a computer programming course for the computer science engineering degree. The process of adopting Moodle as LMS at the UPB seeks to solve specific problems: massive classes, lack of lecturers, excessive teaching hours for lecturers, coordination difficulties, and lags in studies for lack of teachers, to name a few.

Case study: Implementation of a first year programming course

1. Current course organization

In an instruction unit, the working time of a student can be organized in several parts:
- Classroom lecture (CM, le Cours Magistral en présentiel);
- Problems (TD, les Travaux Dirigés en présentiel); and
- Work practices (TP, les Travaux Pratiques en présentiel); and
- Personal student work (TPE, le Travail Personnel de l'Étudiant).

Problems (TD) are interactive sessions. Before a TD class, a list of exercises is provided to the students and, during the TD class, the exercises are corrected with the students' participation. Work practice (TP) sessions consist in giving the students a practical subject matter. The teacher in charge of the laboratory must be

physically present to provide guidance and to make sure students really work. Unfortunately, teachers do not always have sufficient time to follow the evolution of the work done by each student. Personal student work (TPE) represents a significant fraction of the total working time for each unit, being in theory close to 40%. However, the real situation is that TPE time is not devoted for the purpose assigned to it. In practice, all activities are conducted without regard to the personal student work, so there is a loss of 40% in the development of the instruction unit.

In addition, the lack of teaching resources and materials, such as video projector, or text books, slides, or even photocopies, causes huge waste of time. The lecturing task requires an oral dictation (DO, le Dicté Orale) in order to give as much formal information and detail to the students. The DO phase, on average, takes one third of the total time devoted to lecture. So this time, together with the TPE time, represent a sharp loss for the teacher and students times that, ideally, could have been leveraged to do more activities. As a consequence, there is not only a lack of teachers, but the time devoted by each of them to lecturing is highly inefficient. From the student point of view, beyond the lack of optimization of their working time, the training is incomplete, frustrating, and they do not receive any feedback for the activities eventually performed outside the class.

2. Opportunities with Moodle

Innovate in education does not always requires large amounts of resources. A LMS, such a Moodle, can be used through a local network. In addition, even though Moodle implements a large number of functionalities, only a reduced number of them are required to fulfil the objectives of our project. Services that can be of interest are:

- Course materials repository, available anytime, anywhere, although with the tight limitation that it will only be inside the campus area;
- Course organization, so that students will know exactly the type of activity and the amount of time to devote to the studying of each course module;
- Communication utilities, to allow collaboration between students and facilitate the interaction between students and lecturers;
- Assessment utilities, so that assessment can be carried out more often, the students can receive instant feedback and, in addition, the correction process by the teacher can be performed automatically.

Creating course materials and adapting them into a self-contained format can be a time consuming task. However, this effort will be transferable and reusable and, therefore, pays-off the invested time. The scheduling of course activities and associated times is a task that requires accuracy, ensuring that the time devoted to each concept is proportional to its contribution to the course objectives. However, one of the most important tasks to be performed is to wisely select the activities to be performed and the assessment mechanisms to be applied. Moodle offers several options to support the assessment process. For instance, keeping a repository of questions of different types (test, multiple-choice, exact text answer, and others) for each subject module allows the lecturer to choose each course a set of questions to be used for assessment.

3. New course implementation

A fist year programming course has been implemented, using Moodle in a local network, and only using a reduced set of its functionalities. To ensure the success of this integration into Moodle, the implementation has to be tested for several semesters and tuned according to the eventual gaps and deviations. Meanwhile, a preliminary analysis of the expected teacher and student workloads can be made.

According to the former course implementation, the time spend in each type of activity (as described in subsection 1) in some typical weeks during the course can be seen in figure 1. For each regular week, there are 1,5 hours for oral dictation (DO), 2,5 hours for classroom lecture (CM) and 2 hours for problems (TD). Some often, there is a week where a 3 hours evaluation (EV) takes place.

Figure 1: Typical course workloads

Figure 2 shows the accumulated time for each of these activities in a whole semester. These times are the same for both lecturers and students, because all activities carried out by the students need the participation, or assistance, of a lecturer. Note that, as discussed in section subsection 1, the personal student work time (40% of the expected time) has been excluded from the planning, as it was observed students do not spend any time in it.

Figure 2: Course workloads for a semester

The new planning for the proposed course implementation can be seen in figure 3. The upper figure corresponds to the lecturer workloads, and the lower figure corresponds to the student workloads. Notice that the oral dictation time (DO) disappears from the planning. Instead, the student can devote the same time to: read (not copying) the documentation and, therefore, pay attention to the concepts comprehension, and start doing some work practices (TP) what is a substantial qualitative improvement. From the lecturer point of view, the workload has been greatly reduced.
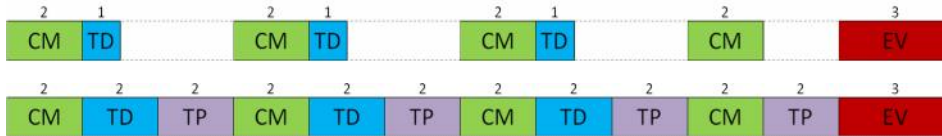

Figure 3: New course workloads

Figure 4 shows the accumulated workloads for both, lecturers (up) and students (down), with the new course implementation. The professor time is concentrated in lecturing, clarifying concepts and organizing classroom problems, leaving some time for personal student's activities. The total professor lecturing time has been significantly reduced by about 50%. As discussed earlier, this time could be used to improve and update the course contents and, additionally, have some time to devote to other academic tasks. With respect to the student's workloads, even though the total time is very similar to the former course organization, the type of activities are more interesting academically and, therefore, the learning process will be more efficient.
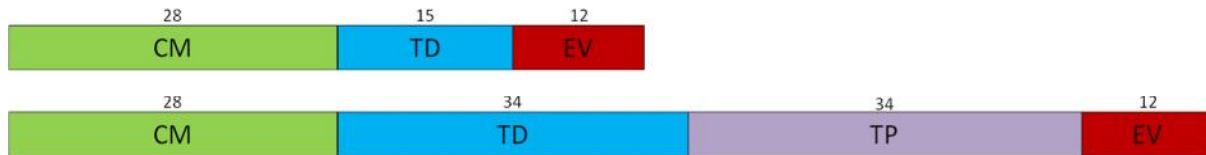

Figure 4: New course workloads for a semester

Expected benefits

The process of adopting Moodle as LMS at the Université Polytechnique de Bobo-Dioulasso does not seek to create a more democratic and participatory learning process and synergies of cultural transformation; it just wants to solve specific problems: massive classes, lack of lecturers, excessive teaching hours for lecturers, coordination difficulties, lags in studies for lack of teachers, to name a few. In the future, it may also catalyse changes, but today this is not their goal. The expected benefits of this project are:

1. Students

Quantity of contents
The main problem with teaching material in developing countries is the accessibility to it, or lack thereof. Having all the information online (even locally in the campus internal network) would be an important timesaver for all, and will provide students with a wealth of contents that they could not have access before.

Quality of contents
The digitalization of all the teaching resources into the LMS will drive a quality control process that will greatly benefit students. A lot of the teaching material used in developing countries has remained stagnant for a number of years due to different reasons. We believe that the process of content digitalization, coupled with the wealth of material freely available for most LMS on the Internet, will help increase the quality of the offered courses.

Easy of access
Contrary to developed countries where access to the Internet is granted, the majority of the students from developing countries face important connectivity limitations. Having an LMS complete with courses and teaching material at the university campus would provide all the necessary resources needed by the students and would facilitate access to a much more important amount of information.

Practical activities
LMS provide a wide array of practical activities such as quizzes, workshops, assignments and forums that can be incorporated in the courses. This aspect is very important for developing countries as the education system tends to be a lot more practically oriented than in developed countries. In addition, the LMS will allow the

performance of new and more dynamic activities, including group work and cooperation. The students will be able to share and discuss exercises, experiences, works, and so on.

Novelty

Finally, the novelty of the digital teaching process will be in itself a strong incentive for the students to dedicate time to their studies, navigating the LMS and accessing all available content. For this reason, it is important to strive for a complete implementation of the LMS taking advantage of as many features as possible, capturing their interest and helping them to take advantage of everything that is offered.

2. Lecturers

Reduced effort

Porting a course to an LMS requires some extra work for the digitalization and the adaptation of the contents to the new format, but this task has to be done only once. In addition, the time and attention required by the lecturer is greatly reduced. Quizzes and tests can be automatically generated from a pool of questions, activities can be carried out by the learners with minimal supervision and in many cases the existence of an LMS would enable the lecturers to engage in distance learning if they are unable to attend the class personally. This saved time can be invested in other activities like research, or further self-education.

Quality improvement

The digitalization of all the teaching resources will drive a quality control process in the course documentation. In addition, the existence of an important number of courses available freely from many institutions online, along with the ease of organization an LMS inherently provides, will help the lecturers raise the quality of their courses by using new teaching material that would otherwise be complicated for them to get their hands on. Having more sources on which to base their courses, as well as a point of quality reference, will help them build their courses at a level that will be on par with the courses taught in developed countries.

3. Management and organization

The existence of an LMS guarantees some level of organization for the courses taught at a school or institution. The course format can be easily defined and controlled, courses end up being better formatted and most importantly, the course is always there available for teaching, even when the professor is unable to attend. This last point is particularly important according to our experience offering teaching assistance at the UPB. Due to their lack of teaching staff, they are heavily dependent on visiting professors to fill the curriculum. However, there is no guarantee that a certain professor will be able to visit every single year to give the same course. This obviously introduces a lot of teaching inconsistencies among students of different years, since courses available each year may vary. Having a course setup at the LMS can provide a lot of stability in that regard, since it will be a lot easier for a different professor to teach it with a minor amount of preparation or, in the future, use distant learning to complement some parts of a course when the teacher is not available. It is also important to stress that an LMS is not only a platform for having digitized courses on a server accessible over a network. LMSs are potent management tools that can be used to take care of human resources management, wages, curriculum organization and other management task that could greatly benefit any learning institution.

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Acknowledgements

MCCC in Certification Central Administration

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Abstract

Moodle Course Creator Certificate is the official Moodle Certificate provided exclusively from Moodle Partners. Human Resource Development New Zealand Moodle Partner is the Certification Central Administration. This Certification is running since 2006. It started as Moodle Teacher Certificate and renamed to Course Creator's when Moodle development forced it. While Moodle is growing and becomes more and more complex the need for organized trainings and a reliable and effective certification scheme becomes imperative.

In this paper we will present the history of MCCC and its evolvement during the years.

Keywords

MCCC, Moodle Course Creator Certificate, Moodle, HRD, Human Resource Development International Limited, Moodle Partner, Certification Central Administration

Introduction to the MCCC

Learning has been steadily growing in the past decade (Karr, 2002) across the globe. It is estimated that elearning platforms and courses are being delivered to almost every country with an increase in the number of available material, as well as a positive impact on the participants (Joseph, 2001). Online classrooms offer flexible learning for all people, regardless of position, occupation or age and it is gaining more ground year after year (Thompson, Winterfield, Flanders, 1998). With the rise of eLearning comes the need to ensure the quality of the material and services offered (Gilhooly, 2001) as well as cope with the growing numbers of e-dropouts through such measures as creating effective online communities (Jun, 2005).

The Moodle Course Creator Certificate - MCCC (former Moodle Teacher Certificate - MTC) is a way for everyone to demonstrate his/her skills in using Moodle as a teacher. It is actually an assessment scheme, that contains a course project, a short narrative document and an online exam. "*The MCCC is intended as a way of bench-marking staff skills.*" (http://moodle.org/course/view.php?id=48). It is exclusively provided by Moodle Partners, while the content of the certification is designed and provided by the Moodle community at Moodle.org, where candidates can find all the information needed thourgh the discussions, the documentation and the preparation guides provided.

History of MCCC

Research has clearly shown the benefits of online learning (Ching & Cheng, 2000) and Moodle has been one of the leading Learning Management Systems since its early inception, offering a set of tools to help trainers develop and deliver quality material and training (Brandl, 2005). It was built on the premises of social constructivism (Vygotsky, 1978), offering trainers and trainees the tools to interact with the content as well as form online communities with a great impact on learning (Scott & Johnson, 2005).

With the rise of the popularity of elearning courses, scientific evaluation techniques were created to ensure the quality of the content and the instruction (Winfrey, 1999). The European Commision (2003) has recognised the importance of online learning, and is investing heavily on ensuring that Europe will have a major role as far as elearning is concerned.

As a certification programm, MCCC, has been created by and it is affiliated with Moodle community, in an effort to raise standards in the use of Moodle. The idea for a Moodle Certificate is credited to the Global

Certification Manager, Stuart Mealor and had been welcomed by Moodle Headquarters and Martin Dougiamas (Moodle Founder and Lead Developer) its self.

The development of the Certification program began sometime during 2004. In August 2005 the first draft scheme was ready thanks to the initial certification team constituted by Stuart Mealor (New Zealand), Frances Long (Canada), Alicia Wyatt (USA), Ralf Hilgenstock (Germany) and Ramesh KG (United Arab Emirates). This international team worked on creating the structure, identifying the skillsets, writing the documentation and developing the question banks. The first group of candidates began the pilot administration on 1st April 2006. The official low-key launch made on 1st May 2006, while Moodle Partners began the certification process officially in June 2006.

The MCCC Scheme

MCCC scheme assess Moodle skills, which have been organized in 8 Skill Sets and consists of three parts: the project course, the narrative questions and the online exam.

The project will be set up as a shell course, in a Moodle Partner's site with standard Moodle installation. The course that candidate creates must demonstrate that he/she can use all of the various Moodle Skill Sets and no existing courses can be used by restoring or importing from other location. The narrative is a collection of essay type questions that evaluate candidate's ability to demonstrate that he/she can use Moodle not only technically, but that he/she understands the various situations and scenarios to appropriately select the correct tools and functions. The online exam is a one hour online quiz, with different type of questions, yes/no answers, short answers, matching and multiple choice. It is password protected and it is taken online in Moodle.org Certification area, utilising Moodle quiz activity. Candidates need to achieve the passing score in both project and narrative before they are allowed take the exam.

The passing mark is 80% and candidates must reach this score in every step. When someone passes the certification he/she is given a code that lets him/her -or anyone else who has the code- to download his/hers personalised certificate as a PDF.

Moodle Partners

The certification process is administered exclusively by Moodle Partners to ensure the reliability of the process. It has been expected from the very beginning that Moodle Partners will offer the Certification and they will be the 'primary providers' of mentor-assessors and there are three reasons for that.

Firstly Moodle Partners are by definition experts in the application. The process to become a Moodle Partner and provide Moodle certification service is demanding and mandatory for Partners. Secondly Moodle Partners are local to their community and clients and thirdly, although certification has not been designed as a cost effective process, it is a source of revenue for Partners. MCCC costs (on 2012) between AU$200-AU$800 in the local currencies. Moodle Partners in each country set the local rate. Of course the fees are shared between Partners, Mentors and Moodle HQ.

Mentors-Assessors

As candidates register and begin the certification process, they are provided with several mechanisms for support in the MCCC area at Moodle.org: resources, forums, the project wiki, the orientation quiz. Though the the most important supporting mechanism is the personal Mentor-Assessor.

As Bonk, Wisher and Lee suggest (2004), *"online instructors need to facilitate student generation and sharing of information, while assuming the role of learning coach or mentor to provide needed leardership and guidance"* and MCCC could not be a "self" case.

Although Mentor-Assessors are not expected to teach the candidate on how to use Moodle, they do provide information and encouragement if the candidate finds that they are under-prepared in a particular area. MCCC candidates are guided through this process from a Mentor-Assessor. Mentor-Assessors are assigned from the Moodle Partners and are qualified MCCC holders. After successfully completing the MCCC, the prospective Mentor-Assessor takes short training on coaching. The Mentor-Assessor is an important member of the certificate process. These individuals not only guide candidates and answer questions, but they score the project course and narrative responses when they are completed.

Requirements for an individual to become a Mentor-Assessor are specified to ensure the professional credibility and ongoing quality of the MCCC. Although Partners are given free choice in who they use, the following is the likely profile of Mentor-Assessors:

- Have extensive experience / background in education
- Have extensive knowledge of Moodle
- Have previously supported learners within a Moodle environment
- Have completed the MCCC themselves

MCCC in Certification Central Administration

During the first years (2005 – 2008) of MTC's implementation a Mentor-Assessor should monitor candidate's work while he/she was building up the project and then evaluate it according to the Skillsets criteria. Then assess Narrative questions and if candidate completed the above with a score higher that 80%, Mentor-Assessor could provide the password for the final online exam.

While the above procedure was very effective with well prepared candidates, it proved too expensive specially for candidates who were not prepared or had over-estimated their own abilities. Although it was -and still is- clearly stated that MCCC is not a training course and that candidates must be experienced Moodle teachers in order to participate in Certification, people often expected to learn more than they already know by taking the MCCC. Moreover, although the Certification it is not meant to be a profit mechanism for Moodle or Moodle Partners, the cost of a Mentor-Assessor for them is always a reality.

The above considerations led Central Administration and Moodle Partners to find a more effective way to substantiate Certification: to combine it with a training course. Specially from 2009 in Central Administration MCCC has been merged with MoodleBites for Teachers training course series. MoodleBites used to be and still are training courses, where candidates can actually study, interact with peers and facilitators and learn about Moodle. In order to easily guide and assess candidates' knowledge Central Administration has also set up another course the MCCC course, were specific skillsets and narratives are assessed. This course is actually an examination course, organized in a weekly format and dues of course eight weeks, like the MoodleBites courses. The successful completion of MoodleBites and MCCC courses equates with the completion of the project and narrative.

Moodle Certification is following Moodle's development by definition. Thus from January 2011 Central Administration among with a small team constituted by Ralf Hilgenstock (Germany), Kim Salinas (USA) and Maryel Mediola (Mexico) updated the Certification scheme to Moodle's new version. Some Skill Sets have been removed, some new added, some others just adjusted. Narratives have been checked and questions banks had been informed and updated with questions that addressed to the new version, while the same time questions referred to the old system have been deleted. New Moodle tools and facilities in the training and examination course have been also used, like conditional activities, progress tracking and rubrics to offer a more comprehensive experience of the new version to the candidates.

While the main structure of the scheme and the guiding principles of it remain the same, the new scheme that MCCC is provided by seems to be much more effective. Certification was always a candidate centred process but now evidences from candidate's feedback show that the whole process is more engaging, more interesting and enjoyable for candidates, maintaining the flexibility of e-learning.

From Mentor-Assessor's point of view things have been also improved. Candidates are taking the MCCC as an e-class and not as individuals which is much easier to manage. Candidates of low-interested can be early detected, progress can be forced and controlled and much better time management can be achieved.

Conclusion

During the years there have been times that a question of necessity of Moodle's Certification has been arisen. Since Moodle Documentation is freely accessible and effective Moodle courses can created using only the basics, what is the point of creating and maintaining Certification?

Well, the dialect is clear. Certification benefits individuals in several ways. First of all, it is an external and carefully planned validation of an individual's skills and therefore can be used to support hiring and promotion decisions. Secondly the process itself is challenging and stretches the candidates knowledge of the system's

potentials. Thirdly, having combine Certification with training, individuals with low knowledge of the system can quickly -within eight weeks, expand significantly their expertise on Moodle. Fourthly it is a globally recognisable Certification. No matter the individual's location, his/her ability to work effectively with Moodle will be recognised from all over the world, providing him/her opportunities to work within or without of his/hers country frontiers.

From 2006 until now (31st of May 2012) there have been certified more than 550 Moodle Course Creators from all over the world, among them Moodle Developers too. The 30% of them has been certified during the period January 2011 to May 2012. Note here that from 2011 Certification is provided for Moodle version 2. This clearly states that the need for an organised training and valid Certificate on Moodle is increasing as Moodle is developing over the years.

Last but not least, Moodle Certification is a supporting to the Moodle process, not just because a portion of the certification fee goes back to Moodle and is used to underwrite continued development, but also because it increases awareness of Moodle as a leading course management system.

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Mobile media apps for Moodle

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Abstract

Recent advances in mobile multimedia technology have brought about fundamental changes to both education and entertainment. Institutions are now grappling with ways to bridge existing course management systems (CMS) with mobile technologies using native mobile apps as well as web apps (Daniels, 2012). This poster demonstration will introduce a suite of mobile apps that interact with specific Moodle CMS modules to reinforce oral production activities for language learning purposes. The suite includes a VideoBoard app, a VoiceShadowing app and a SlideShow app. The VoiceBoard app allows learners to record video or audio on a mobile device and to submit the media directly to a

'VideoBoard' module within a Moodle course. Using the VoiceShadowing app, learners can simultaneously listen to sample target language audio files, record their 'shadowed' speech and upload their recording to the Moodle 'VoiceShadow' module. Finally the SlideShow app provides a simple mobile interface for learners to capture images and recorded captions, which are then automatically converted to an online slideshow in Moodle. These mobile apps are currently available on the Apple App Store for free and require the installation of accompanying Moodle modules. Development of an Android-based version of each app is underway.

Keywords

Multimedia, Moodle, mobile apps.

Mobile apps and Moodle

Moodle is a viable platform for deploying mobile learning, either though the development of web-based apps or native mobile apps. Moodle 2.2 core now ships with a standard mobile theme that is custom- designed for users accessing courses via a mobile device. Using the mobile theme, the layout of the Moodle course content and the navigation buttons fit neatly within smaller mobile screens. In addition, there are a number of mobile applications available for iOS and Android devices to support mobile users accessing Moodle. The official My Moodle app is a modest attempt to create a more mobile-friendly Moodle environment, but as mobile usage continues to escalate, the need to develop custom mobile apps that augment Moodle also intensifies, perhaps much in the same way that the development of custom plugins and modules has evolved over the years. The main focus of this poster session is to demonstrate how a suite of custom mobile media apps were designed to work with Moodle to better support the integration of Moodle, mobiles, multimedia and language learning. The 3 apps, the VideoBoard app, the VoiceShadowing app and the SlideShow app were created to assist learners to seamlessly upload images,

audio or video from a mobile device to a Moodle course. Each app is designed to supplement a customized Moodle activity module and requires the installation of an accompanying module. The customized Moodle modules can be downloaded from moodlemodules.netcourse.org and can be used with or without the mobile apps. The apps are currently available on Apple App Store and Android-based app development is proceeding.
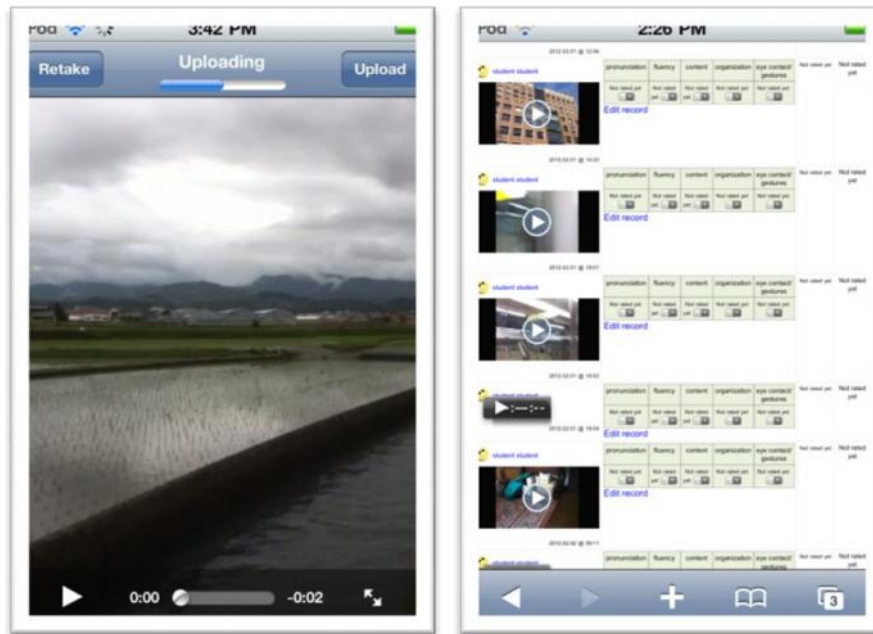
Moodle VideoBoard

VideoBoard Module

Video projects (Sildus, 2006), student documentaries (Yamak, 2008), and drama production (Nikitina, 2011) are just a few examples of how learner generated media is used to construct authentic learning environments. More recently, with the advent of video-enabled mobile devices, learners are able to effortlessly capture and share media online.

The VideoBoard is a simple module that allows students to upload short audio or video clips to a course 'video board'. The VideoBoard design encourages both self-evaluation and peer evaluation of learner produced content. Video can be recorded online, uploaded from a previously recorded clip, or captured on a mobile device

to be uploaded directly to Moodle. Video files uploaded in different formats are automatically converted on the server to an MPEG4 format using FFmpeg.

Mobile VideoBoard App

The VideoBoard mobile app, shown in figures 1-2, supports video upload from a mobile device to the VideoBoard module. Using this app, video can be recorded directly from a mobile device and sent to a VideoBoard within any online course. The recorded video is automatically resized and compressed to a web-friendly format on the server.

Figures 1-2: VideoBoard mobile app & Moodle VideoBoard module

Moodle VoiceShadow

VoiceShadowing Module

A number of studies have evaluated the effectiveness of voice shadowing as a language acquisition tool (Murphey, 2001; McMillan, 2008). Voice shadowing is a language practice activity where a learner listens to a target language and attempts to repeat or 'shadow' the language. Using the Moodle VoiceShadow app, target language is uploaded by the instructor as an audio file to the Moodle VoiceShadow activity. Learners can then access the activity to simultaneously listen to the audio file and record their own speech. The student-recorded speech is uploaded to Moodle for teacher- as well as self-assessment of the target language.

Mobile VoiceShadowing App

The mobile VoiceShadow app allows learners to practice voice shadowing with a mobile device using the built-in audio player and audio recorder. The audio files recorded on the mobile device are submitted directly to the appropriate voice shadowing activity within a Moodle course as shown in figures 3-4.

Figures 3-4: VoiceShadow mobile app & Moodle VoiceShadow module
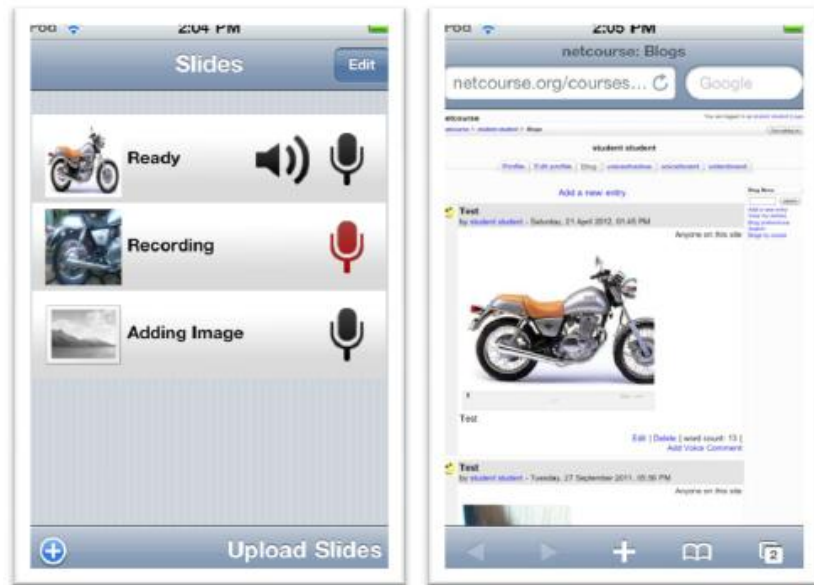
Moodle SlideShow

SlideShow Module

An important component to instruction is the ability to bring authentic and relevant content from outside into the classroom (Chen & Brown, 2011). The slideshow module was developed to simplify the process of synching voice narrations with images in order to create an online slideshow. A simple web-based user interface is used to select images and to record audio for each image or frame. A narrated slideshow is automatically generated as an HTML5 package on the server-side. Images are resized and audio is synched with each slide using server-side scripts, thus maintaining a simple and clean user interface, an important element in a language learning environment. Learners can also attach a set of multiple choice questions to their presentation and can post comments to other users' uploaded presentations. This module is used for presentation speaking practice, as a shared presentation 'board', or as a portfolio where uploaded presentations are shared within a particular course.

Mobile SlideShow App

The mobile slideshow app, shown in figures 5-6, was designed to help bring the real world into the classroom. Using the mobile slideshow app, learners are able to capture images from outside the classroom to share with other classmates and to support authentic classroom interaction.

Figures 5-6: Slideshow mobile app & Moodle Slideshow module

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OU Mobile VLE: extending the reach of studying through the mobile web

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Abstract

This poster illustrates the enhancement of the 'OU Mobile VLE', originally delivered through highly-customised Moodle v1.9, through to release of a more standardised approach for Moodle 2.x. This case study builds on student feedback, both unsolicited and in student surveys. Combining with usage analysis, key features were refined and optimised for delivery and contribution via the mobile web.

Support for distance education requires more narrative, signposting and scaffolding of the learning design to be available. A package of discrete resources and activities structured through a 'study planner' approach, coupled with 'alternative formats' covers the on/offline blend. Formative self-assessment was extended – from reflection in course texts through to simple quiz question types.

Keywords

Mobile VLE, mobile web, Moodle 2.x, distance learning, strategy, mainstreaming.

Enhancing existing provision

The OU has been tracking mobile use since 2006 to revise the student portal – with more significant usage and expectations arising from 2009. In a corresponding timeframe, the OU had been moving more of our teaching material online, customising our own Moodle VLE and gradually introducing an increasing range of e-learning activities, according to blended learning design as appropriate – approaches outlined by Kukulska-Hulme & Jones (2011). At a later stage in this Moodle implementation, a 'beta' version mobile-optimised interface was released and refined over a number of development cycles running from March 2010. Direct student feedback was elicited during this period, via online surveys to establish expectations, priority features for development and later on, an evaluation of the interface – a process outlined by Thomas (2010, Spring).

A drive to provide a user experience sufficiently consistent with the desktop was followed – making use of the central 'study planner' route through the learning journey, and providing a 'launchpad' view to quickly gain an overview of current activity, messages and tasks to complete. This work took place alongside other resource and app prototyping, as illustrated in Thomas (2010). Review of work in related areas led us to confirm that we couldn't follow an app-based strategy for core services, at scale, with uncertainty then around new platforms and changing markets. The OU needs to be device-agnostic in the mobile space, responding to bring-your-own-device [BYOD] models in a distance education environment. Apps or simpler text-based modes previously encountered were not as suitable for an online narrative, embedded and signposted materials. Other approaches favour a discrete, modular and tool-driven structure better suited for some face-to-face mediation.

With the advent of an accelerated development programme to introduce Moodle 2.x, reconfigure and upgrade a number of modules - alongside the intention to standardise rather than customise - the mobile approach was also revisited. Ongoing research with student and practitioner input validated the central designed path of the 'study planner', and this time desktop and mobile (and tablet) interfaces were revised simultaneously – with mobile use informing some key navigation decisions. Following earlier work, a number of principles were refined: Delivery via mobile web – to better provide for the range of technologies OU students use, incl. HTML5; Designing for distance learning – similar to desktop provision embedding discrete resources and activities; Contribution and collaboration – providing opportunities to do more than passively consume and browse.

Design, development and testing

As part of the approach taken across all Moodle VLE interfaces and modules, a design, usability and accessibility review process took place prior to development on Moodle 2.x, starting in October 2010. To continue to support students in "keeping up with their studies" and provide appropriate signposting to activities, resources and forums (in particular) - the prior 'launchpad' approach was retained along with the consistency

provided through the central 'study planner' and progress tick-boxes. This approach was validated by user testing of wireframes and prototypes, with key stages noted by blog posts on Mobile Learner Support (2012).

Extending mobile learner support

Taking advantage of a concerted development period, including significant code refactoring, it was also decided as part of a sustainable strategy to ultimately mainstream mobile delivery into the different features and project teams. As such, mobile access was better supported through Moodle 2.x renderers and styled themes, with individual module improvements maximising the use of the available screen size; where possible bridging the common experience from the desktop, with behaviours consistent with smart/touch classes of mobile device.

Toolset of online activities

Specific enhancements for Moodle 2.x include better Forum threading layout, posting and replying. Reliance on mobile plain text editing meant that initially only blog commenting could be supported and more complex wiki structures were made read-only so as to avoid unintentional corruption of styles/layouts. Improved navigation and delivery of curriculum web content was followed by gradual inclusion of alternative formats, including PDF and eBook options. Simple quizzes are now available to use for the first time, comprising: multiple choice, list selections and simple text box answers, as well as question types using audiovisual playback.

Support for a wide range of user experiences

The Mobile VLE is device-agnostic, with higher-end devices able to access a tabbed view of key features, while legacy devices with simpler web browsers can get a read-only overview of their activities on the 'launchpad', as seen in Figure 1. As courses transition to the new VLE, mobile usage is steadily increasing beyond 18K users, and we have an established platform for curriculum teams to build more mobile learning opportunities upon. Thin-client or 'shell' app approaches will be considered for the future, incorporating device-native functions.

Figure 1: OU Mobile VLE demonstrating launchpad, study planner and quiz

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Acknowledgements

pdf2submission: a Moodle Plugin for Partially Integrating Moodle into Offline Courses Where Handwritten Document Submissions are Required

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Abstract

We have developed a Moodle plugin called pdf2submission for utilizing Moodle also for teaching at ordinary classrooms. The plugin is based on opensource libraries and tools. With the plugin, handwritten paper documents can be easily accepted in Moodle as if they were submitted online. Though the original version of the plugin is available only for Moodle 1.9, a new version for Moodle 2.2 has been developed.

Keywords

plug-in for Moodle, PDF documents, QR Code, paper-based assignment submission, scanned documents

Introduction

In the environment such as online universities, an LMS like Moodle is regarded as the core part of the learning environment. Also in the teaching that is done at conventional style classrooms without any computers, features available in an LMS can be supposed to be helpful and effective for more efficient and engaging teaching.

pdf2submission block is a Moodle plugin that can handle reports or exam answers which were written on paper sheets. With this plugin, only by converting reports (on which handwritten letters, figures and illustrations were drawn) into a PDF file with a scanner, the reports are automatically accepted in Moodle as if they were uploaded by each student as a Moodle Assignments activity (of the 'Upload a single file' assignment type). Therefore, in conventional style courses using paper sheets for assignment or examination submission, teachers can also manage the handwriting materials on Moodle.
The screenshot example of a pdf2submission block on a Moodle course is shown in Figure. 1.

Figure 1: pdf2submission Block

How to use this plugin

Installation of pdf2submission is straightforward. Just as ordinary block installation, copy the files, and when you login the Moodle site as admin, pdf2submission block will be installed. At each course, you can add a block named pdf2submission as shown in Figure 1.

You can use pdf2submission as follows:

1. As a drop-down list of the assignment names is displayed like Figure 1, each student (who submits a report or something) chooses an assignment to use as the submission destination and clicks on the 'Create' button. Then, Like Figure 2, a PDF file that includes the information of the user ID of the student and the

assignment in the header part is thereby displayed. The student prints this out and uses it as a cover sheet of the handwritten report. (Or writing or drawing only on the cover sheet and submitting it is also possible.) If you have the Teacher privilege of the course, the cover sheets for all the students is generated and displayed. Teachers can print them out and distribute them to each student in their class to let students use the sheet as the cover sheet for report submission or use it as exam answer sheets.

2. The teacher collects the handwritten reports that students submitted using this cover sheets and scans them with a scanner to convert them into a PDF file. The PDF file is automatically (by a function of the scanner) or manually uploaded to some directory (that is specified at the pdf2submission configuration) of the server that Moodle is working on.

3. The uploaded PDF files are checked by the Moodle cron job to extract the information of the user ID and the assignment number printed as a QR code at the header part of each page.

4. According to the extracted information of the user ID and the assignment number, it is submitted to the corresponding assignment activity on the Moodle site.
(pdf2submission script copies the PDF file to the directory that the assignment activity uses and also writes submission information into the database table.)

Figure 2: Example of a generated cover sheet header (in PDF format)

How it is implemented and coded

It is assumed that your Moodle is working on a Linux server. The plugin is solely based on opensource tools and libraries indicated in this section.

For generation of the cover sheet, PHP libraries of TCPDF and FPDI+FPDF TPL (Setasign, n.d., Suganuma, 2009) are used in combination. QR code generation is done by a method of TCPDF called `write2DBarcode()`(Asuni, n.d.), like the following:

```
$obj->write2DBarcode('Datato be coded','QRCODE,M','','',38,38,$style,'N')
```

For recognition of QR codes, zbarimg command (Brown, n.d.) is used. The CUI version of zbarimg command can be easily be built by the following command:

```
./configure --with-x=no --enable-video=no--with-python=no --with-gtk=no --with-qt=no
```

Because, in the case of the PDF files that the authors' scanning machine creates as the scanned result, `zbarimg` command often failed to recognize QR codes, we added some preprocessing such as converting the scanned image into JPEG format by Ghostscript, and burying local small holes in the image by `convert –blur 2` (ImageMagick command) before the decoding process of QR codes by `zbarimg`.

`pdftk` command (Steward, n.d.) is used to divide and merge PDF files. For most of the Linux distributions,you can easily install pdftk command using a command like `apt-get install` or `yum install`

In ordinary face-to-face lectures, teachers often require students to submit paper sheets of reports or essays, which are handwritten or printed based on a word processor file. Of course it is possible to let students submit assignments as electronic document files or as postings in an LMS if the assignments can be completed only by writing letters, but there are also needs to make use of "handwriting taste" when letting students submit reports on their ideas about a good cityscape or graphic designing using illustrations. If it is possible to collect also such paper-based reports in an e-learning system, teachers can manage the reports without time-consuming work and can easily set up some kind of peer learning by sharing reports among students.

In addition, if such reports or examination answers are to be preserved on the viewpoint of quality assurance, it is thought that there is much more advantage of storing and managing such reports or exam answers on LMS than storing them into a single-purpose dedicated system.

That is the background in which the authors have developed pdf2submission block for Moodle.

Improvement from the prior version

Not a QR code but alphabet letters and numbers were used to print the cover sheet header in the very early version of pdf2submission and the information included in the header was recognized using an opensource OCR tool, but there was a problem that the around 10% of scanned sheets were not recognizable (i.e., the OCR tool misrecognize the letters), therefore manual correction was necessary to store the scanned documents on Moodle correctly. By adopting QR codes, the rate of unrecognizable headers has become almost zero and even for a large-scale class pdf2submission can be used without problems.

One of the improvements from the previous version is handling of a PDF file that includes plural users' reports. If you scan the reports from many students and make one big PDF file having many pages, pdf2submission automatically divides the PDF file into each user's report as one PDF file to be stored in Moodle separately. Also PDF template insertion feature was added, which is useful for, for example, generating examination answer sheets for each student by inserting an answering form PDF file.

In addition, the former version supported only Moodle 1.9, but the current version of pdf2submission works on Moodle 2.2, the latest version of Moodle.

Usages

Using this plugin, for example, the following usages are possible:

Learning by submitting handwriting reports
You can manage an assignment that requires handwritten or hand-drawn report submissions (e.g., a report on the ideal scenery of your town with illustration) on a pdf2submission-installed Moodle course. The reports collected and stored on Moodle can be nice instructive materials if you share the reports among all the learners and let the learners make peer reviewing with them.

Preserving and rearranging of handwritten examination answers
If you have a number of handwritten documents or examination sheets to be preserved and rearranged, this plugin will be helpful. It was actually tested for 80-student course by converting manually graded examination sheets into PDF files and storing them into Moodle with this plugin, and everything went fine.

Conclusion

The pdf2submission plugin enables online management of the paper documents submitted by learners on Moodle without requiring students to digitize documents and upload them online. It in turn makes the introduction of effective activities such as the peer reviewing of the submitted materials by students possible and easier. It should be also helpful for collecting and storing various kinds of sheets that students submitted through their learning activities. This plugin is potentially applicable to various purposes. The authors would like to hear about nice and practical applications from users.

The previous version of pdf2submission is downloadable at a Japanese developer forum thread (Kita, 2011) of moodle.org and has been already downloaded about 40 times. In some organizations it is in trial or practical use.

The author would like to improve this plugin according to the users' comments and feedback. The current version that works on Moodle 2.2 is going to be released in Moodle Plugins Directory.

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Acknowledgements

The Virtual Course-Room as a Complement to Face-to-Face Tuition

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Abstract

In this presentation the term Virtual Course-Room (VCR) is used to describe a structured Moodle-room offered as an additional service for students attending Goethe-Institut language classes. It consists of 3 levels: Level 1 is mainly course documentation, level 2 offers students a choice of online resources for independent language learning, and level 3 makes full use of the interactive tools of the VCR, integrating online activities into face-to-face tuition. Together with interactive whiteboards becoming standard equipment of the classrooms, the aim of this concept is the hybridization of classroom learning.

Students benefit from the possibility to keep up with their course in case they miss a lesson as well as from additional training opportunities and detailed information on the Goethe-Institut's examinations. The electronic course book makes course targets and progress transparent. Students can, and many do, subscribe to the course-book, thus getting new entries as soon as they are posted. Moreover the virtual course-room can help to achieve a genuine pedagogical objective, which is a more learner-centred approach and personalized learning, often difficult to be realized in face-to-face classes.

An important advantage of working with the VCR is the improvement of the teachers' ICT knowledge and abilities. Being familiar with some major developments in the field of learning and teaching allows them to keep a high degree of professionalism and they more readily accept that their role as teachers is changing. New ways of learning and communicating are not envisaged as threats but as a chance to make the lesson more attractive and to feel part of the modern teachers' community.

Keywords

virtual course-room, online course-room, hybridization of classroom training

From the Electronic Course-Book to the Virtual Course-Room

In 2007, when the Goethe-Institut adopted Moodle as a tool for language classes and teacher training, the reactions of the Goethe-Institutes abroad varied, as could be foreseen, from interest to disapproval. For those who had already experimented with different forms of digital lesson documentation, Moodle seemed to be the tool they had been waiting for.

One of these was the Goethe-Institut in Athens, which will serve to illustrate how the Virtual Course-Room (VCR)was implemented. From October 2008, all language courses in Athens were enriched with an electronic course-book (ECB), which was a Moodle-room in a weekly format; all classrooms were equipped with internet access, a laptop and a video projector, and all teachers were expected to document their face-to-face lessons in their Moodle-rooms. To this end they were introduced into editing a Moodle-room and also, but mainly through a technical approach, into the use of what we considered basic tools: They were shown how to upload a file or link a website, how to add a glossary, a discussion forum, a wiki and a chat-room. They were given printed instructions with step-by-step screenshots and some examples of how these tools could enhance learning and teaching. They were also encouraged to ask two colleagues who were more familiar with Moodle for help, either individually or at two fixed appointments per week.

The results were ECBs varying from very plain to quite elaborate, depending not only on the teachers' commitment to informational content, clarity and aesthetic sense, but also on their readiness to explore new teaching tools and to offer their students new ways of learning. In the meantime, Goethe-Institutes in other countries had also started courses with ECBs. As a result a variety of different ECBs were being used worldwide; e.g. in Rome the lesson's documentation was sent as a forum post, thus keeping the course's homepage the size of the browser's window. The fast and manifold development of ECBs led to the question of

how quality standards regarding content and design could be assured for the 149 Goethe-Institutes in 93 countries around the world. Clearly this could only be achieved by means of a course room template, applicable to all Goethe-Institut language courses. That is how the structured, 3-level Virtual Course-Room (VCR) came into existence.

The 3-level structure of the Virtual Course-Room

Level 1 includes the documentation of every lesson, stating its learning targets, content, extra material and homework for the next lesson. Other features are teacher forums, attendance records, links to online services of textbooks, information about aspired examinations (if applicable) and rss feed of the local Goethe-Institut's cultural program. Teachers may use the platform to help students with their homework.

Level 2 gives students access to online exercises and dictionaries, to informational websites related to Germany and to the questionnaires "Evaluation of the Language Course" and "Evaluation of the VCR". Although the exercises are self-correcting and categorized according to levels of language competence, teachers are expected to make collective or individual recommendations to their students.

Level 3 includes the use of Moodle's interactive tools, where teachers (and sometimes students) generate their own tasks and activities and students interact with their teacher and peers. To this end, abundant material and support is being produced and will soon be available, together with new (VCR-) tools, such as learning cards and tools for easy audio recording, mind mapping and collaborative writing.

Challenges and potentials for Goethe-Institut's language classes

When introducing the VCR into all courses of a Goethe-Institut simultaneously, regardless of how familiar teachers were with ICT, the structured VCR was a great help. Of the 3-level template only level 1 is obligatory for teachers while the other levels are hidden by default. In this way teachers could become familiar with their Moodle-room at their own pace. The first challenge for all of them was the change from printed to electronic course books which was more than a change from handwritten to digital editing (Chen et al., 2005). Goethe-Institut language classes have always been documented, but the ECB implied a shift of perspective: Printed course books documented lessons in a minimalistic way, intended to inform a substitute teacher in case of absence and to allow a supervisor to track the progress of a course program. The ECB still serves these needs, but must also be comprehensible to students.

While this objective was soon achieved, the major challenge of course was to introduce the meaningful use of interactive tools into face-to-face tuition, to exploit their full potential and add new possibilities of communication, collaboration and self-determined learning into the classroom (McBrie & Jones, 2009). Despite the teachers' professionalism in terms of conventional language teaching and despite specific training material, relatively few teachers made extensive and regular use of Moodle's interactive tools (VCR level 3). It became obvious that Moodle-workshops, even if they went beyond technical aspects, could not bring about the necessary skills and expertise. What we really needed was a new approach to classroom learning and teaching, in which the web would be integrated into face-to-face tuition.

That is why this year a group of expert teachers were assigned the development of course material for hybrid classroom activities. At the same time and in close cooperation with the teachers, a group of professionals in both conventional and digital didactics took up writing a teacher's handbook on how to hybridize classroom learning. It will provide explicit answers to what, why and how to use interactive tools and contain detailed lesson scenarios.

With interactive white boards having become a standard in most Goethe-Institut classrooms last year, all technical devices are given for a systematic introduction of online activities into face-to-face-tuition. Our vision is that students and teachers will freely move between the sheltered world of the classroom and the open universe of the internet.

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Position Papers

FreeMoodle.org as an example of Moodle-based free LMS.

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Abstract

Over the past few years we have seen the emergence of numerous free education sites. Initiatives such as Khan Academy, Coursera, MIT OpenCourseWare, and Wiki Educator all demonstrate that the face of technology enhanced learning is changing. The Libre knowledge movement (free knowledge) and OER (Open Educational Resources) are examples of the paradigm shift in perceptions and practices around knowledge and education.

What has been missing from the landscape is a similar service that is totally free, learner focussed, and based on Moodle – the best Learning Management System in the world today.

FreeMoodle.org was started in mid-2011 by an official Moodle Partner, and intends to address this by providing completely free Moodle hosting for individuals and organisations, provided that the courses are open and free to others. FreeMoodle.org is unique in being Moodle based (bringing with it the pedagogically sound principles) and supported and managed by an official Moodle Partner (HRDNZ). FreeMoodle.org fundamentally provides a single Moodle-based learning destination for learners – whoever and wherever they are.

Keywords

The future of the LMS, Free Moodle, International collaboration.

Challenges for FreeMoodle.org

Wiki-based open education initiatives whilst interesting, are often teacher focussed, and output is largely text based. In terms of user experience these environments are a long way behind Moodle. FreeMoodle.org is unique in that it is always up-to-date, Moodle Partner supported, will never become a commercial service (or feature distracting advertising), and is free from localised political influence.

There are real challenges around the funding, control and management, and business models when considering free online learning. To create a credible, professional and resilient long-term site using Moodle requires more than just knowledge of the LMS; it requires a commitment to the worlds learning community (potentially every single human being), and an ethical contract that will maintain and grow a truly valuable resource. For this reason, I maintain that a Moodle based free education site must take it's mission, and strategic direction from a community of teachers.

FreeMoodle.org is a project of the Haidee Foxwell Educational Trust (Charitable Trust status pending). This allows the project to receive tax free donations, and apply for funding from external bodies. Currently the project is funded by HRDNZ (Moodle Partner).

Example of the new paradigm

Recently we have seen a wonderful example from Greece of how FreeMoodle.org can be used collaboratively by teachers. The Greek FreeMoodle team has entered into agreement with the Association of Greek Users and Friends of FS/OSS GreekLUG (NPO/NGO for the adoption of Open standards and the promotion of Free Software) to join forces and complete an extensive series of additional modules on the basic use of computers during 2012 to complement the already successful LibreOffice Calc and Presenter courses.

Future development and direction

The future of the open LMS must stimulate more collaboration between teachers in similar subjects, but questions remain about how we encourage and achieve this in a free environment.

The ultimate aim is to position FreeMoodle.org to sit alongside YouTube, Flickr, and Facebook in the minds of internet users, and be recognised as the place to go if you want to learn something effectively, in a true learning environment, and at no cost.

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Acknowledgements

Moodle 2020: A Position Paper

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Abstract

We address key aspects of the future of Moodle in the context of types of change in technology environments, in particular Christensen's distinction between sustaining and disruptive innovations. Our focus is higher education worldwide, and our primarily interest is in Moodle or its successors in 2020.This paper reviews the competition Moodle currently faces, and goes on to outline four potentially competing forms of learning environment architectures. Particular attention is paid to the implications of the semantic web. We conclude with a recommendation that the Moodle community needs explicitly to set up processes which in parallel to continuing evolution of Moodle 2.X and 3.X, systematically seek to design a next-generation learning environment This will be based on semantic web-based technologies and pedagogies of the mid-21st century, rather than non-semantic technologies derived from the end of the 20th century, and pedagogic mindsets derived from the 19th century.

Keywords

Moodle, Virtual Learning Environments, e-learning futures, disruptive innovation, proactive learning

1. Introduction

The Moodle community is large and vibrant and has grown to be a major educational software provider. Moodle is a stable product, firmly positioned in the virtual learning environment market, with a clear roadmap for its steady evolution. However, its long-term future is far from assured, and a central aim of this paper is to review alternative ways in which the changing needs of the Moodle community, present and future, may be fulfilled.

In general Moodle is challenged on the one hand by other open source products, including even generic content management systems such as Drupal, and on the other hand by proprietary products, most particularly BlackBoard. This is a relatively mature market, dominated in the USA by Blackboard, whose share of the campus-standard LMS market fell to 51% in 2011 from 71% percent in 2006 (Campus Computing Project, 2011). Moodle had a 19% share of this increasingly competitive market. The historically rapid growth in Moodle new registrations now seems to have entered slow decline (moodle.org, 2012).

There are starkly different views about the future of learning environments, some of which were accentuated in the "VLE is dead" debate at ALT-C in 2009. This debate included advocates of personal learning environments (Tosh and Werdmuller, 2006), often focussed on informal learning, and critical both of formal learning and of tools such as VLE's which are closely associated with formal learning. More recently, others argue that the evolution of open courseware and MOOC's will challenge higher education traditions. Moodle is further challenged by elearning products which make little or no claim to be comprehensive (Pearson Education, 2012) and by innovative cloud based educational applications. Finally, it is challenged by university strategists who envisage a wide constellation of learning technologies and tools, with the VLE being "merely" one type of specialist application. This has been very clearly articulated at the University of Southampton (Millard et al, 2011).

Christensen (1997) is well known in the business strategy domain for his discussion of the "innovator's dilemma", where he distinguishes between evolutionary, "sustaining" change, and radical, "disruptive" change.

Disruptive change has the potential to alter the landscape of a business sector in ways that can threaten the most strongly established players and a concern explored here is whether the Moodle community could be threatened in this way. The term 'disruptive' is in practice often used in many different senses in the technology industry, most typically not based on Christensen's quite precise conceptualisation. A key feature of Christensen's disruptive technologies is that when they initially are invented, they are not only less attractive to existing users, they may well be more expensive and less functional as well. They do, however, tend to have characteristics which will in due course become attractive to a new type of user, and will subsequently displace the existing products.

Most of the challenges outlined above are essentially tactical, concerned with products available today and meeting today's problems and aspirations. But technology is a fast-moving area, and a key dimension of this paper is how technologies to enhance learning may develop over the next decade, and the implications of this for the Moodle community today. We argue that the community needs now to initiate its own disruptive activity, even though pedagogic mindsets in a typical university are currently perhaps geared more to the 19th than the 21st century.

2. Learning environment architecture options

This paper reviews a variety of VLE architectures and develops one that could be expected to emerge by 2020. We can divide the resources needed to implement a VLE into three types. Firstly, infrastructures are the basic level, most typically institutionally or even national; relatively static; commodity. Secondly, there is content, more related to the needs of schools, programmes and individual faculty and groups of students; relatively dynamic; often customised/proprietary. Finally there are tools – this particularly includes apps available to users to process and customise content, either traditional PC apps, tablet or cloud based.

Today we can consider three alternative VLE architectures, and also predict a fourth "next generation" one. A Transmissive architecture is reflects the traditional teaching approach in most societies. A Constructivist architecture supports the learner to construct their own knowledge perhaps implying a more flexible, lightweight institutional learning environment (ILE) with VLE as one of several components. An Informal architecture rejects formal structures and processes, being auto-didactic and social. A Proactive architecture requires a semantic approach, highly personalisable, involving semantic web and agent-based applications, anticipating needs then fulfilling them instantly. The Proactive Pedagogy is not currently feasible, but may be by 2020 with advances in linked data standards and in artificial intelligence.

3. Semantic web for learning

The Semantic Web (SW) was first proposed by Tim Berners-Lee (Berners-Lee and Fischetti, 1999). There was a subsequent initial wave of interest not least in the computer science community, which fed through into the educational technology community. But despite individual initiatives, pilots, experiments and technological developments, the early interest seems to have slowed due to the considerable conceptual and practical problems of implementation. In the medium term (up to 2020) there will continue to be huge barriers to cross-institutional evolution of the semantic web, both due to reluctance to change and for competitive reasons. So in that interim period a minority of technologically competent universities will start setting up technology and information infrastructures which support SW activities. They will start experimenting with user-orientated software which does build up a cumulative picture of user actions and responses. They will also be developing intelligent agent software which when related to the SW-compliant data, and to the user activity records, will begin to show real benefits to learners in terms of both the efficiency and effectiveness of their learning.

The SW Learning Environment offers major possibilities. Firstly, a significantly increased chance of precisely finding relevant content online because there will no longer be reliance on crude sledgehammer search engines. Meaning as opposed to text will now be much more readily accessible. Secondly, the long standing educator's dream of personalised learning experiences will become entirely feasible. This may relate to prior knowledge, to perceived difficulty with already viewed resources and/or to learning style preferences. Though we will most likely retain student cohorts for sound social and administrative reasons, ten students sitting in a row in a classroom may have totally different data and information experiences in any given module. Finally, there will be continual absorption of individual learner behaviour and preferences, and also about the collectivity of learner behaviour and experiences

It can be seen that in terms of content the SWLE needs to move away from the fixed formal content so typically seen in the VLE's of 2012, towards exploitation of the almost unbounded resources that will eventually be

accessible via the SW. This will not alter the need for human teachers, coaches, mentors, learning designers but it will potentially radically change all of these roles. One particular strand of work, building on the concept of proactive computing (Tennenhouse, 2000), is proactive learning (Coronado and Zampunieris 2010), which has particularly involved developing software that is activated by actions or inactions by students in Moodle.

One possible future scenario, raised by the authors at the Dublin Moodle Moot in 2012, was the prospect of the emergence of a parallel learning environment to Moodle, to be known as "Eldoom!", Here we provide a small fictional cameo taken from the predicted launch speech of Eldoom! in 2020:

> Eldoom! has also just been launched. As you know, this is a greenfield learning environment with no code or concepts from Moodle, but has been developed in the spirit of and as part of the wider Moodle family.

> It is vital to emphasise that Moodle and Eldoom! are not in fact alternatives. Frankly, the major users of Moodle really did not want even to consider Eldoom! It has appealed to only a minority of Moodle users, but it has appealed to them very much. In the long run there is little doubt that Eldoom! will displace Moodle as its tangible benefits become understood by both learners and institutions.

> Eldoom! is a S2LE, a Social Semantic Learning environment. It was conceived by a small but articulate sub-set of Moodle users who were un-interested in the PLE, with its hostility to formal learning, but who also felt that the classic VLE was an insurmountable obstacle to pedagogic innovation.

> Eldoom! is an unashamedly web 3.0 application. It has semantics as its very heartbeat - the social dimension is secondary and was really retained for sentimental reasons to echo the original 20th century idea of "social constructivism", itself obsoleted by the revolutionary development of the semantic web, also a 20th century idea from Berners Lee (1999) "The day to day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines" .

> Machines talking to machines means that almost everything in life is tracked/sensed. We understand what happens if a student has not opened the module handbook within 3 hours of start of module. An intelligent agent identifies this and takes action until the student does view. Eldoom! makes heavy use of ambient media. So that action about the handbook is communicated next time that student's RFID shoe activates a personalised message while walking past a public display.

van der Hijden (2012) concludes that to cope with strategic threats, such as those prefigured in this paper, the Moodle community collectively needs to take responsibility, eg via an International Moodle Association based along the lines of one already set up in the Netherlands. We would certainly concur that a specific and additional capability centre needs to be created by the Moodle community in order to progress disruptive Moodle 2020 scenarios such as Eldoom! This needs to be quite separate from existing structures which are of necessity concerned with evolving the current "sustaining" Moodle 2.X and most likely Moodle 3.X infrastructures.

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Moodle as a the Central Hub of Learning with Tools Plugged in - Learning Tool Interoperability

Gavin Henrick

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Abstract

At its core Moodle is a user management system, with course areas to which users are given roles and permissions, to access content, and activities and receive grades. These are the core aspects of learning management. However it would not be possible for the Moodle platform to include every possible feature inside the product – there are simply too many tools being created by specialists around the Globe.

With the external tool in Moodle 2.2, it aims to bridge that gap – being able to reach out to those tools which others create and connect seamlessly to provide access to the users inside Moodle to an external tool or content.

Keywords

IMS LTI, Learning Tools, Interoperability, Integration, Moodle

Background

The IMS Global Learning Consortium (IMS GLC, 2012) is a global, non-profit, member organization that strives to enable the growth and impact of learning technology in the education and corporate learning sectors worldwide. The IMS name originates from the initial name of the organisation which was a bit specific – Instructional Management Systems.

IMS is developing Learning Tools Interoperability (IMS GLC, 2012) to allow remote tools and content to be integrated into a Learning Management System (). So basically it is a set of standard integration methods that enable two systems talk to each other in a common language/protocol.

But before we go through the use cases and applications, what is an LTI Tool?

The LTI Provider is an application which provides features that other people want to and can connect to from their own LMS.

The LTI Consumer is an application which can connect to the 3rd party Provider system to avail of the features it has.

Onto Moodle

So learning tools now have a set way in which they can seamlessly connect to each other or to a learning management system like Moodle. In practice what does this mean? Well, while a user is logged into an LMS (Moodle for example) they can then connect over to the other tool (a wiki or blog) and be automatically authenticated providing a seamless experience.

When Moodle 2.2 was released it contained the new External Tool (Moodle HQ, 2011) activity which acts as an LTI Consumer. This enabled a teacher to configure the connection to the external tool (LTI Provider) as a link within the Moodle course area – all they needed was the URL, Key and secret which the owner of the tool can provide.

So for Moodle, this extends the feature set of Moodle through the use of tools and activities outside of the platform and without the developer of the activity having to make it work inside Moodle.

This has two direct benefits firstly to the developer of the tool and secondly to the Moodle Teacher. The developer just needs to implement the IMS LTI standard and provide the connection details to those who want

to use it (paid for on subscription or whatever business model they choose to use). The teacher does not need to ask to get a new plugin or integration installed into their Moodle site, which can have impact on support or cost of hosting, they just connect and go (Henrick, 2012).

It really is a win win situation.

So one example would be this:
A teacher sets up an External Tool activity in the Moodle course for the students. This then connects them to a blog site (like Wordpress). The process automatically authenticates them and gives them whatever permissions required on the Wordpress installation so that they can use the external blog. This single sign-on is important to the process as it makes it seamless for the end-user.

This could be used for any standalone learning tool which implements LTI.

Think about the possibilities – someone builds a really cool maths engine and instead of having to make it work inside Moodle, all they do is implement the IMS LTI standard(IMS GLC,2010) and provide connection details to those who want to use it.

One aspect not mentioned yet is that through privacy controls on the External Tool, you can choose to allow the external activity to pass back grades to the Moodle course – which would be great for tools that do assessment!

There are a number of useful Tools out there which provide IMSLTI compliance already:

ChemVantage.org

ChemVantage is a free resource for science education which includes grade exercises, homework exercises, practice exams, video lectures and free online textbooks. It was created by ChemVantage LLC which was founded by Prof. Chuck Wight, who has taught General Chemistry at the University of Utah since 1984(ChemVantage, 2011)

Wordpress Multi-User / Network

One example is turning Wordpress Multi-user into an activity for Moodle. The below image shows Wordpress site embedded within Moodle with the teacher automatically logged in.

Mediawiki

You can use the External Tool to embed a Mediawiki site into Moodle. The category it goes to is determined by the course shortname and the students then have editing rights to that area.

Musicflight

Noteflight an online music writing application that lets you create, view, print and hear music notation with professional quality, right in your web browser. There is a free version and a subscription version(Noteflight, 2012).

Web-PA

Web-PA is an online peer assessment system designed to help students assess their own, and their teams, performance in group-work activities. It is an open source tool that enables every team member to recognise individual contributions to group work.

Others

However I know of a number of other assessment and content companies in the process of implementing IMSLTI access which is a very exciting prospect!

What are the benefits of having the tool outside of Moodle?

Learning Tool Producers

Organisations who want to provide their tool into Moodle now don't need to learn Moodle, they just learn and implement the standard. Where before each system released an integration activity or block for Moodle and

other LMS they wanted to support, now this means less cost for them in supporting and maintaining those connections. They can focus on their product – the tool.

Institutions / Teachers

If a teacher, or an institution has an idea for a tool but want to ensure it is usable with Moodle, it won't matter if they are Perl, Java or Python developers – they don't need to learn how to program in PHP, nor how any of the APIs in Moodle works. All they do is code their tool to the standard.

Training Companies / Content Providers

In the past training companies provided a set of learning objects (usually Scorm or full course backups) which users installed into their LMS. IMS LTI will provide them with an alternative strategy.

They will now be able to keep all the content centrally, and provide LTI access to it. This offers the training company and the end users many benefits. These benefits include:

- Any fixed or small changes can be done centrally, and benefit everyone without having to distribute a new copy of the learning object
- Any improvements can again be applied centrally
- The ability to provide test access is much improved, and does not compromise the security of the content, so it will be easier to get to test something out without having to install it locally.

Moodle administrators / Teachers

Up to now, if you wanted to add a tool into Moodle you usually went through a vetting process with IT – which could include many technical, functional and security type tests such as

- Is the code written in a secure way
- Is the code maintained
- Does it work with our version of Moodle?

Now it will be easier to test and check out the tools (when they implement the LTI connection) without having to worry so much on the technical side

Moodle as Provider!

With the release of a plugin by Juan Leyva from CV&A the Moodle partner from Spain, Moodle can be the LTI Provider now too as well as consumer(Leyva, 2012).

This plugin provides a few other features which are more Moodle related

- The option to provide access to a single activity or a full course
- The ability to modify the page for hiding headers, footer, and right/left blocks
- The ability to change the navigation block of a course or activity for showing just links related to the activity/course in question.

However, it also allows for some business / management options:

- Enrolment duration
- Enrolment start and end dates
- Enrolments quota

The Future

Between the External Tool and the LTI Provider plugin, IMS LTI support within Moodle is moved forward significantly and opens the door for real course sharing and collaboration across multiple LMS.

A course ran on a Moodle site in Australia could have students from classes in many other institutions all collaborating together in the one area. This can be accomplished using the IMS provider and the built-in External Tool, but without having to handle user lists, or authentication or enrolment. The potential is just huge.

But equally, this really does open up easier content selling as a service too. A training company can set up their course in Moodle. When they sell access to a company for it, they provide the URL and Secret and it all just works after that(Henrick, 2012).

So Moodle can now reach out across the net to embrace the new features as they are being developed.

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Moodle Research Dissemination and Exploitation

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Abstract

The objective of almost all research is its dissemination and, ideally, commercial exploitation. In this paper we describe key channels of dissemination and exploitation of Moodle research.

Keywords

Moodle, research, dissemination, exploitation

Introduction

Moodle thrives on a buzzing global community that contributes to the overall project. This is true for code contributions in the form of patches and plugins of all kinds, solutions to problems raised in hundreds of forums, and new features being discussed in the Moodle tracker. This also holds true for research contributions, but their quantity is nowhere near the aforementioned contributions.

Almost all research is funded, either internally by an employer or externally through public or commercial funding bodies. There are a number of criteria for funded projects to be approved such as technical feasibility, uniqueness, and sustainability. There are two further critical aspects that take place either at the end of a project lifetime or after thereafter: **dissemination** and **exploitation**.

Moodle Research Dissemination

Dissemination is all about telling others what has been achieved. This ranges from solving a new or existing problem using a novel approach to best practise implementations of processes or a project. Typical paths of dissemination for research output are the following:

- Publication in relevant, hopefully peer-reviewed, research journals
- As a poster or a talk at a conference in an attractive and / or remote location
- Others, such as book chapters, internal research reports, blog posts, and public speaking engagements

There are usually three types of foci of any of the above mentioned dissemination channels:

- Education
  The majority of research falls into this category where Moodle is used as the vehicle to demonstrate new pedagogical approaches for certain aspects of e-learning. An example is a new type of collaborative authoring, which is prototyped as a Moodle activity.
- Technology
  Some technology-driven research is being incorporated into the Moodle context. An example is a new artificial intelligence-driven algorithm for personalisation that is then being implemented in Moodle's course framework.
- Subject-matter
  A substantial body of research is taking place in 'foreign' domains that is applied in VLEs, for instance, yet another economical model to deal with financial crises, implemented as a new Moodle Loan Calculator ;-)

Any of the above dissemination channels accounts for a valuable contribution to the overall Moodle project as it leads to new or improved functionality, better workflows, support for new technologies and standards, and, ultimately, to a better Moodle ecosystem.

While almost all research manages to be disseminated in one way or the other, the vast majority has absolutely no hope to be commercially exploited. Büchner & Patterson (2004) is a great example of such work. Now let's have a closer look at Moodle research that *is* worth exploiting further.

Moodle Research Exploitation

Exploitation is concerned about the commercialisation of the work carried out. This is often a much-debated topic as there are a number of issues that prevent this step, for instance technical shortcomings, idiosyncrasies that don't allow for generalisation, constraints imposed by the funder, and so on. In the Moodle context an additional stumbling block is present due to the open-source license of the software. Having said this, substantial revenue is being generated worldwide by different types of businesses that rely on Moodle in one way or the other. Let's look at different routes to exploiting your Moodle research:

- Set up your own business
  A lot of Moodle-driven ventures have an academic background as has Moodle itself. This might start off as a part-time company providing a unique solution integrating Moodle with your research outcome and lead to a fully-grown business offering related services.
- Go freelance
  If setting up a business sounds too daunting, going freelance is a viable alternative. Whether it is offering development services to Moodle users, designing themes for existing sites or consultancy to Moodle prospects, all will benefit from the Moodle-related research that has been carried out.
- Work for a Moodle Partner
  The ultimate! Exploiting your Moodle skills acquired throughout your research can be highly beneficial to a Moodle Partner. To the researcher it provides the unique and paid opportunity to work on a wide range of challenging real-world Moodle projects inaccessible in academic contexts.
- Engage in a joint venture
  A partnership with an established business – Moodle Partners being the preferred option, of course – will potentially provide solid research a platform for exploitation.
- Sell your research
  Depending on ownership of the research outcome, there might be demand to acquire the technology developed and incorporate it in a commercial services or products offering.
- Others
  There are other avenues to exploit Moodle research, such as applying for a patent or rolling your own Moodle distribution like Totara.

A note of care: whatever route of exploitation is chosen, the Moodle copyright must not be infringed.

Summary

The most dreaded section in most research papers is the one labelled "Application"; the one just after experimental results and before the long-awaited summary. This is where the boys are separated from the men. It has to be demonstrated that the entire theoretical conundrum can actually be applied in the real world.

Commercial entities on the other hand are reluctant to fund any blue-sky research, especially in a field that changes rapidly. However, there is a substantial body of research out there that is worth exploiting. Equally, there are a significant number of commercial routes that allow for commercial exploitation. Bringing these together is a key facet of the success of the overall Moodle project.

This paper presented a number of routes to disseminate and exploit Moodle research. The next step up would be a cluster of Moodle-related research activities being carried out. Maybe, as a result, one day we will see the first Moodle Business Incubation Centre.

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Authors

Day 1, Friday 14 September 2012

8:30 - 9:15	**Registration**
9:15 - 9:30	**Welcome speech by Petros Georgiakakis.**

9:30 - 10:20	**Keynote speech – Martin Dougiamas.** "Back to the classroom..." Chair person: Symeon Retalis

Session 1: Tools & Plug-Ins I
Chair person: Clive Holtham

10:20 - 10:40	**Myse Elmadani, Moffat Mathews and Tanja Mitrovic.** "Concept Tagging in Moodle"
10:40 - 11:00	**Juan Antonio Pereira, Silvia Sanz, Inko Perurena and Julián Gutiérrez.** "Interactive speaking practice, assessment and exercise sharing with Babelium plug-in"
11:00 - 11:30	**Coffee Break**

Session 2: Case Studies I
Chair person: Tabitha Roder

11:30 - 11:50	**Mark Melia, Michael P. O'Mahony, Dermot Brabazon, Barry Smyth, Lynda Donovan and Andrew Egan.** "Supporting Problem-based Learning in Moodle using Personalised, Context-specific Learning Episode Generation"
11:50 - 12:10	**Mark Paynter and Neville Bruce.** "Case Studies: Using Moodle for Collaborative Learning with University and Senior Secondary Students"
12:10 - 12:30	**Ioanna Komninou, Konstantinos Antoniou, Xanthi Chouliara and Maria Frentzou.** "The Inter-Orthodox Center of the Church of Greece (DKEE) online courses using the moodle platform: presentation of a primary and secondary education teachers training good practice"
12:30 - 14:30	**Lunch**

Session 3: Learning Design
Chair person: Jonathan P. San Diego

14:30 - 14:50	**Virginia Rodés, Luciana Canuti, Alén Pérez Casas, Nancy Peré and Regina Motz.** "Categorization of learning design courses in virtual environments"
14:50 - 15:10	**Michail Boloudakis, Mary Katsamani, Symeon Retalis and Petros Georgiakakis.** "CADMOS: A learning design tool for Moodle courses"
15:10 - 15:30	**Carlos Alario-Hoyos, Juan A. Muñoz-Cristobal, Luis Pablo Prieto, Miguel L. Bote-Lorenzo, Juan I. Asensio-Perez and Eduardo Gómez-Sánchez, Guillermo Vega-Gorgojo, Yannis Dimitriadis.** "GLUE! - GLUE!-PS: An approach to deploy non-trivial collaborative learning situations that require the integration of external tools in VLEs"
15:30 - 15:50	**Pierre Laforcade and Aymen Abedmouleh.** "Improving the design of courses thanks to graphical and external dedicated languages: a Moodle experimentation"
16:00 - 16:40	**Coffee Break**

Session 4: eLearning Strategies
Chair person: Alex Buchner

16:40 - 17:00	**Shulamit Kotzer and Yossi Elran.** "Learning and teaching with Moodle-based E-learning environments, combining learning skills and content in the fields of Math and Science & Technology"
17:00 - 17:20	**Tabitha Roder and Nicoletta Rata-Skudder.** "A Community approach to staff development in eLearning"
17:20 - 17:40	**Analourdes Herrera.** "Innovation in Flexible and Collaborative Learning: Moving from theory into practice in Moodle 2.2"
19:00	**Dinner at Cochlias atmospheric water front restaurant**

Day 2, Saturday 15 September 2012

Session 5: Learning Analytics
Chair person: Gavin Henrick

9:30 - 9:50   **Riccardo Mazza, Marco Bettoni, Marco Faré and Luca Mazzola.**
"MOCLog – Monitoring Online Courses with log data"

9:50 - 10:10   **Jonathan P. San Diego, James Ballard, Stylianos Hatzipanagos, Mary Webb, Ehsan Khan, Philip Blake, Tom Dore, Andreas Konstantinidis and Ian Barrett.**
"Do Moodle analytics have a role to play in learning design, feedback and assessment?"

10:10 - 10:30   **Rômulo Martins França, Ana Emília Figueiredo de Oliveira, Alessandra Dahmer and Lina Sandra Barreto Brasil.**
"MonSys - Monitoring System for Students and Tutors of Postgraduate Courses of UNASUS / UFMA in Distance mode using Moodle"

10:30 - 10:50   **Helena Dierenfeld and Agathe Merceron.**
"Learning Analytics with Excel Pivot Tables"

10:50 - 11:30   **Coffee Break**

Session 6: Tools & Plug-Ins II
Chair person: Kita Toshihiro

11:30 - 11:50   **Mike Churchward.**
"ELIS – Managing Enterprise Level Learning Programs with Moodle"

11:50 - 12:10   **Jordi Piguillem, Marc Alier Forment, Maria Jose Casan, Enric Mayol, Nikolas Galanis, Francisco Jose Garcia Penalvo and Miguel Angel Conde.**
"Moodbile, a Moodle web services extension and mobile apps"

12:10 - 12:30   **Zhigang Sun, Xiaohong Su, Ning Zhu and Yanyu Cheng.**
"Moodle Plugins for Highly Efficient Programming Courses"

12:30 - 14:30   **Lunch at Estia restaurant**

14:30 - 15:30   **Idaia Bar Poster Session**

Session 7: Case Studies II
Chair person: Paul Daniels

16:00 - 16:20   **Mohammed Nashbat.**
"Case Study of Integrating Moodle into University Teaching in an Islamic Environment"

16:20 - 16:40   **Marigianna Skouradaki, Christos Nikolaou, Mary Kambouraki, Themistocles Kutsuras, George Koutras, Michael Damanakis, Aspasia Chatzidaki, John Spantidakis, Antony Hourdakis, Anna Chatzipanagiotidou and Vasileia Kourtis-Kazoullis.**
"Building a Moodle front-end for Greek language learning"

Session 8: Moodle & the eLearning Roadmap
Chair person: Symeon Retalis

16:40 - 17:00   **Alex Büchner.**
"Moodle Research Dissemination and Exploitation"

17:00 - 18:20   **Discussion panel: The future of the use of LMSs for supporting technology enhanced learning models.**
Speakers: Gavin Henrick, Clive Holtham, Stuart Mealor, Petros Georgiakakis, Martin Dougiamas.

18:20 - 18:30   **Closing & Conclusions**

Poster Session / Saturday September 15th, 14:30 -15:30 Idaia Bar.

P1 Gabriele Frank-Voutsas.
"The Virtual Course-Room as a Complement to Face-to-Face Tuition"

P2 Paul Daniels.
"Mobile media apps for Moodle"

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