

Fitting Extended Blended Learning and Multi-Dimensional-Personalization into Learning Management Systems

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Abstract

Extended Blended Learning (EBL) consists of modules based on e-learning (e-L), face-to-face learning (f2f-L) and project based learning (pro-L). The mix of these ways of teaching for a learner depends on the learner type and the phase of the course, module or degree programme the learner is in. In order to recommend the learner a path which not only suites his learning style but also meets his interests as well as the requirements and the appropriate way of teaching Multi-Dimensional-Personalization (MDP) could be used. Nowadays LMSs are targeting mainly e-learning and their Meta data schemas have to be extended to allow mapping f2f-L and pro-L into them.

Keywords

Blended learning, e-learning, project-based learning, face-to-face learning, Multi-Dimensional-Personalisation, personalisation, Learning Management System, LMS, IMS, LOM

1. Introduction

The following section describes the different approaches which will be combined to achieve a new quality of learner support. Learners differ in their goals, background, interests and knowledge. To optimise the effectiveness of the learning process a modern educational or learning management systems should adapt to these learner characteristics.

1.1 Extended Blended Learning

EBL as described in papers by Bleimann (Bleimann, 2004; Bleimann and Röhl, 2006) consists of Learning Objects (LO) or learning units based on different delivery methods:

- e-learning (e-L) – e-learning content – delivered via an online platform. These units are usually managed with an Learning Management System (LMS) which also manages the available Meta data about each unit.
- face-to-face learning (f2f-L) – the traditional style of teaching to 1 to N learners. The characteristic can be in the form of a seminar, class room lecture or lab. The main point is that people will have to attend a session at a certain time at a certain place.
- project based learning (pro-L) – similar to f2f-L one of the issues is that this type of learning requires the learner to do something or to be somewhere at a certain place. It does not require all the participants to be at the same place as projects can be run in an international context.

The clear advantage of EBL is that different learner types can be served. Depending on the preferences or likes / dislikes of a learner for a certain teaching style the system could adapt to

the learners preferred way of learning. In addition the stage of the programme in which the learner is in can be taken into account. I.e., a first year student needs more f2f-L than a mature student in an executive style of programme. With EBL it is possible to support a learner by various ways. Summarizing the claim of the educational psychologist William Glasser on how we learn and remember:

- 10% of what we read
- 20% of what we hear
- 30% of what we see
- 50% of what we see and hear
- 70% of what we discuss with others
- 80% of what we experience or practice

We can see that this claim supports the extended blended learning approach as EBL offers not only e-Learning (e-L) but also the other ways of teaching which offer a greater deal of support for the learning and remembering to the learner.

1.2 Multi-Dimensional-Personalization

MDP is a new approach of personalisation which not only takes the interests of a user into account but also his schedule and the past and future location of the user (Schilke et. al, 2004). These parameters are referred to as dimensions hence the term. Personalization or adaptive systems "... are systems which can alter aspects of their structure, functionality or interface in order to accommodate the differing needs of individuals or groups of users and the changing needs of users over time" (Benyon and Murray, 1993, p. 199). Oppermann (1994, p.456) writes that a system is called adaptive "if it is able to change its own characteristics automatically according to the user's needs"

This MDP approach allows spanning recommendations across from the online world to the offline world. This makes the MDP approach suitable as a personalisation concept for Extended Blended Learning. The learner will get recommendations based on his interests, i.e., the course, module or programme he is enrolled. Besides that this dimension in addition the learners preferred EBL style of delivery will be used for the recommendation. By doing so the system can adapt to the users preferences and needs. This supports to "build a model of the goals, preferences and knowledge of the individual user and use this through the interaction for adaptation of the hypertext to the needs of the user" (de Bra et al.,1999) but extending it to the offline world as well.

Depending on the chosen or recommended EBL style the physical location of the learner will be taken into account as well. As the MDP approach is based on an evaluation of past movement patterns of the learner as well as using information from the schedule of the learner (to assess future timeframes and locations where the learner will be) the recommendation can be spun from the online world to the offline world.

The usage of the right EBL component depends on different factors or dimensions. First of all there is the learner type. Some students prefer traditional classroom style learning (face-to-face learning (f2f-L)). Because of their situation and preferences some students prefer e-learning (e-L). Whereas others are more the "hands on" type of learner so they better are suited by the project based Learning (pro-L) approach.

In addition there is the phase dimension of the programme the student is in. A first year undergraduate student has to be treated differently then a mature graduate student in an executive master programme.

Another dimension is the situation the student is in (e.g., part-time, full-time, undergraduate, graduate, mature student, executive education ...). This dimension is reflecting the location part of the personalisation which is the key differentiator of the MDP approach. Depending on the teaching way the recommendation can span across the online and offline world. During a module the student could attend f2f-L sessions as well use e-L material and after having gathered a certain knowledge the learner could move on to pro-L.

As the historic data of the learner is available this data can be used as a source for recommendations as well. This would support usage of a learner type by analysing the learner's success in the past depending on the type and delivery mode of the module studied. The resulting data would be used to update the learners profile / type.

1.3 E-Learning Standards & Learning Management Systems

Educational Modelling Languages are "a semantic information model and binding, describing the content and process within a unit of learning from a pedagogical perspective in order to support reuse and interoperability" (Rawlings). Most e-Learning standards are targeting mainly "pure" e-Learning systems. This means they are not really targeting f2f-L or pro-L scenarios. Some of the Meta data used in these standards could already be used to describe f2f-L or pro-L learning units but in their Meta data definition some important fields are missing. The main standards used in e-Learning and for Learning Management Systems (LMS) are SCORM (Sharable Content Object Reference Model; SCORM (2004)), IMS (IMS, 2001), ARIADNE (Ariadne Webseite, 2005) and LOM (IEEE Learning Object Metadata, IEEE 1484.12.1-2002).

As parts of SCORM are based on the LOM model (Meta data) and IMS (content packaging and sequencing information) all proposed changes respectively additions to LOM could be integrated / used by SCORM as well (based on SCORM 2004 standard). SCORM could be seen as a container for exchanging e-learning content which is using the other standards for the representation of the data. The IMS standard is actually an extension to the LOM standard as well. The European ARIADNE foundation, which provides and collects interchangeable e-learning content, has chosen to transform their existing ARIADNE metadata into LOM objects as well (Ariadne Webseite, 2005).

In the scope of this paper we will concentrate on the standard LOM to describe which extensions to this standard would be necessary to allow the use of a wider context which not only covers Extended Blended Learning (EBL) but also allows serving the learner via the Multi-Dimensional-Personalisation (MDP) approach. Rawlings et al. describes that OUNL-EML can "describe personalisation aspects within units of learning, so that the content and activities within units of learning can be adapted based on the preferences, prior knowledge, educational needs and situational circumstances of users" but this EML is targeted "only to traditional" e-L.

The e-learning related components are covered by the LOM standard but the Meta data for describing face-to-face learning (f2f-L) and project based Learning (pro-L) are not fully available.

In the modern society following a life-long learning approach the blend of different learning methods as proposed and described in the Extended Blended Learning approach (EBL, see Bleimann, 2004; Bleimann and Röhl 2006) are much more suitable to the modern learner. Besides this EBL allows being responsive to the different learner types (see Bleimann and Röhl, 2006). A CEDEFOP report mentions that "Adaptive Hypermedia Systems (AHSs) are "particularly suited to implementing lifelong learning ... because they can tailor the learning environment and content to each individual learner's needs and aptitudes" (CEDEFOP, 2003). This supports to extend the approach towards other learning units delivery methods as well.

In addition by applying the Multi-Dimensional-Personalisation (MDP) approach it will be possible to recommend the learner the right learning unit based on it's interests (and programme of study), it's learner type (preference for e-L, f2f-L or pro-L) and it's schedule and location. Especially the last point spans a bridge between the online world with e-learning to the offline world of face-to-face learning and project based learning (pro-L).

A modern LMS (Learning Management System) used in an Extended Blended Learning context must be able to manage all different kinds of learning modules and has to allow a mix between them to be able to offer tailored courses for each learner. This leads to the need that LMS's must be able to cope with courses and learning modules span across the online and

offline world. In order to allow this the meta data has to be able to map not online e-learning units but also face-to-face learning and project based Learning units. By doing so the necessary data will be available to allow a MDP module to tailor or recommend learning units to the learner which map his preferences regarding the mode of delivery, his course, his schedule and location.

As the Meta data we refer to is describing only the learning units the learner type has to be stored in a separate object which describes the user (a.k.a. learner). Standards in use nowadays for storing information about the learner are for example IEEE Public and Private Information Specification (PAPI, IEEE P1484.2.x , 2000) which is a standard format for the representation and communication of student profiles, IMS Learner Information Package (IMS LIP, 2005) and the GESTALT (GESTALT, 1999) user model. These standards will not be in the scope of this paper so we assume that this data is available for applying it in the MDP context.

The LOM standard is a definition to describe the Meta data of a learning unit. LOM was designed with e-learning environments in mind. In order to enable them to map f2f-L and pro-L learning units they would have to be extended to allow it to store the necessary Meta data.

2. Extending Meta data

To map f2f-L and pro-L learning with the Meta data certain extensions have to be defined. The main difference between an e-L unit and an f2f-L / pro-L unit is that an e-L unit can happen anywhere at anytime as long as the learner has access to the system which provides the unit. There might be some time constrain, i.e., the timeframe in which a learning unit has to be studied or a deadline for results.

F2f-L and pro-L have requirements in common which are usually not reflected by the standards. As they happen mainly in the offline world there is an issue about the time when such a unit happens. Naturally these units happen at a certain place (a class room, a lab or a project or seminar room). These units usually have a repeating time slot where they happen (the lecture, the lab or project meetings).

Building up on the vcal / iCalendar standard (see Vcalendar, 1996) and the RFC 2445 – Dawson and Sternerson, 1998), , RFC 2446 (Silverberg et al, 1998, RFC 2447 (Dawson et al., 1998) the extension to this standard could be based on this definition. Conveniently this definition not only allows defining recurring events but it also has a property for a geographic position. For the GEO property the ISO 6709:1983 (Standard representation of latitude, longitude and altitude for geographic point locations) would be appropriate to use. As in vcal the implementation of this property is optional it would be mandatory for the use in an extended blended learning field. In the case that a “pure” e-L unit is described these fields would not be used. For f2f-L and pro-L these fields would be mandatory. In order to allow the learner to understand the location information a human understandable description must be available as well.

2.1 XML-enabling the extension

As the vcal / iCalendar definition is not based on XML the properties would have to be defined as XML tags in an own namespace in order to use them with the existing LMS standard LOM.

2.1.1 EBL Namespace

The namespace for the Extended Blended Learning extension of the Meta data standards could be named EBL. In an XML file the section which contains the data to describe f2f-L and pro-L learning units would bracket by <ebl:ebl> and </ebl:ebl>.

2.1.2 F2f-L property

The information about f2f-L units would start with the <ebl:f2f-l> tag. Within this tag all necessary tags describing the face-to-face learning units would appear. The description of the unit would end with the closing tag </ebl:f2f-l>.

2.1.3 Pro-L property

The description of the pro-L units would be bracket by <ebl:pro-l> and </ebl:pro-l>.

2.1.4 Descriptive properties

The following properties would be used to describe the location or scheduling of a learning unit.

2.1.4.1 Geographical property

The geographical information about the f2f-L or pro-L would be described by the GEO property:

```
<ebl:geo>
  27.987778, 86.944444,8850
</ebl:geo>
```

The value of the tag should conform to the ISO 6709 standard. Except for the altitude value which should be optional. As every occurrence of the f2f-L or pro-L can take place at a different place this property can have a different value every time.

2.1.4.2 Location property

In accordance to the calendar specification an additional LOCATION property could be used to either refer to a location:

```
<ebl:location>
  Drake Building, 2nd Floor, Room Francis
</ebl:location>
```

Or a vCard (Vcard, 1996 and RFC 2425 Howes et al.,1998, RFC 2426 Dawson and Howes 1998) of the location:

```
<ebl:location href="http://www.drake.edu/vcards/francis.vcf">
</ebl:location>
```

Especially the first version would make it easier for a user to understand where the unit will take place. Whereas for the second version the LMS has to offer the details from the vCard accessed by the URL (Universal Resource Locator).

2.1.4.3 Categories property

The CATEGORIES property of the calendar format could be used to provide additional information about the specific unit:

```
<ebl:categories>
  <string language="en">Project Meeting</string>
</ebl:categories>
```

```
<ebl:categories>
  <string language="de">Abschlusstest</string>
</ebl:categories>
```

If the nature of the whole module could not be expressed in the standard Meta data of the LMS standard this property could be used to be more specific about the units. The language of the text would be given as tag following RFC 1766 (Alvestrand, 1995).

2.1.4.4 Description property

The DESCRIPTION property is used to provide the user with more information about the specific learning unit:

```
<ebl:description>
  <string language="en">The unit will allow the participants to understand the Quality
  Control aspects of project management in IT projects. Besides participation it is
  necessary to read the appropriate sections of the PMBOK. </string>
</ebl:description>
```

Like the categories tag this tag mainly provides human readable information for the user of the system. For applying the MDP approach this data is not necessary.

2.1.4.5 Scheduling properties

In order to be able to schedule f2f-L or pro-L learning units the XML extension to the standards must be able to provide properties to store this information. For example by using the vCal / ICalendar properties like DSTART (start date and time of a unit) or RDATE (recurrence date and times of units) which are using ISO 8601 for the values, RRULE (the recurrence rule) and SEQUENCE (for sequencing units) the occurrence of a learning unit can be described. Other schedule related properties from the vCal / iCalendar could be implemented as needed.

2.2 Extending LOM

LOM XML allows specifying own namespaces and vocabulary extensions. The extensions described below would confirm as LOMv1.0 base schema vocabulary data type extensions:

These properties are mainly the fields in section 4 (Technical) which are solely used for giving information about technical requirements. In section 5 (Educational) the controlled vocabulary for section 5.1 (Interactivity Type) would have to be extended to be able to reflect the new types of learning units. This could be achieved by extending the value space with face-to-face-learning and project-based-learning. For the section 5.2 (Learning resource type) the terms project, seminar and workshop could be added to the value space. This information would be used for the MDP process as well to recommend the best fit for a learning unit for the learner.

Besides the vocabulary extension by using the above described EBL namespace and extensions would allow the extended learning units to be described in LOM XML. There has to be mentioned that certain standard properties of the LOM XML will not apply for f2f-L or pro-L units. The proposed extensions have to be supported by the LMS in order to benefit from the extension and allow managing EBL and MDP with it.

3. Applying MDP in an EBL context

As the LOM standard was now extended to be able to cope with all different types of the learning units defined by the extended blended learning approach a learner could use the MDP approach to get personalised recommendations. The LMS will have all available data about

the student in the context of the LMS. By using this data and MDP the student could be offered courses which fit his interest (course / programme), his learner type and his whereabouts. If the learner has an entry in his schedule that he will be in a town where a partner college is based the system could recommend the learner to attend a seminar or workshop which not only would fit his schedule but also his course and his preferred way of learning. The same applies to a learner which seems to be a learner type which prefers e-L units. Based on the past performance of the learner the MDP could suggest additional pro-L or f2f-L unit for a course to support the learner to achieve his goals. The advantage of the approach is to allow the LMS to manage different ways of delivery methods of learning units (e-L, pro-L and f2f-L) instead of only e-L units. Besides this the learner will get the best support to achieve his goals by support him in with the right delivery method for the learning unit.

4. Further Outlook

The extension to the LOM standard would have to be established and a LMS would have to be enabled to use this standard. As the EBL concept originates in the Atlantis project this could be done on the Atlantis platform. The first application of this concept without the support of the Atlantis LMS showed that the EBL approach is very successful even when used in a class which is spanned between two countries. Especially the mixture between the different modes for single units seems to be well accepted by the learners. This will be investigated further to support the research.

The MDP approach allows a LMS system to take not only the past performance in different units into account but also allows the LMS to suggest learning units for a specific learner which are not e-L based. If the system is linked or synchronised with the schedule of the learner a recommendation can even be made for the offline world by recommending f2f-L or pro-L units. Based on the results so far it seems feasible to assume that the combination of the different learning styles in an LMS will be beneficial for learners. Especially as the personalisation aspect of it would take the learner type and its movement patterns in the offline world into account.

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