The Challenge of Content Creation to facilitate Personalized eLearning Experiences

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Abstract

The runtime creation of pedagogically coherent learning content for an individual learner's needs and preferences is a considerable challenge. By selecting and combining appropriate learning assets into a new learning object such needs and preferences may be accounted for. However, to assure coherence these objects should be consumed within pedagogically meaningful learning activity structures. There are a number of key aspects that need to be addressed in order to perform this kind of personalization, such as the appropriate modelling of the learner's needs and preferences, representation of pedagogical strategies, representation of learning designs and assets as well as the runtime reconciliation of these elements to produce effective and coherent learning activities. Moreover, preferences that teachers may have about the learner's studies should also be considered. iClass, an Integrated Project, funded by the European Commission under the auspices of the IST FP6, addresses this challenge with an innovative and ambitious suite of eLearning services. This paper introduces iClass and its objectives.

1 Introduction

iClass [iClass] has adopted the objective of formulating a new pedagogical approach by exploiting the potential of ICT to support a personalized, flexible and learner-centric approach. This pedagogical approach strives to facilitate empowerment of both learners and teachers, while producing personalized learning experiences. Based on this, the iClass project aims to establish a framework to deliver a personalized, adaptable and adaptive learning experiences in a collaborative environment for learners.

iClass includes a number of services that facilitate the modelling of leaner information, such as the Monitor and Profiler services. These are responsible for completing a model of the learner's abilities, biases, preferences and needs that iClass can utilise as part of the personalisation process. As a complimentary Teacher's Preference Tool enables control over the personalisation features to ensure that iClass is properly integrated with the general managed learning environment in the school and the classroom. These preferences form the boundaries and constraints under which iClass may adapt. Students are allowed to influence these features as well, through the Student's Preference Tool to the extend set by school regulations.

The key services for facilitating personalised eLearning experiences are the Selector and LO Generator. The Selector formulates personalized high level strategies for facilitating learning. These strategies, or Personalized Learning Paths, comprise the set of concepts and learning

activities that are appropriate for the learner's current goals and preferences. The LO Generator is responsible for assembling appropriate Learning Objects to fulfil the concepts and activities described in a learner's Personalized Learning Path [Brady et al, 2004].

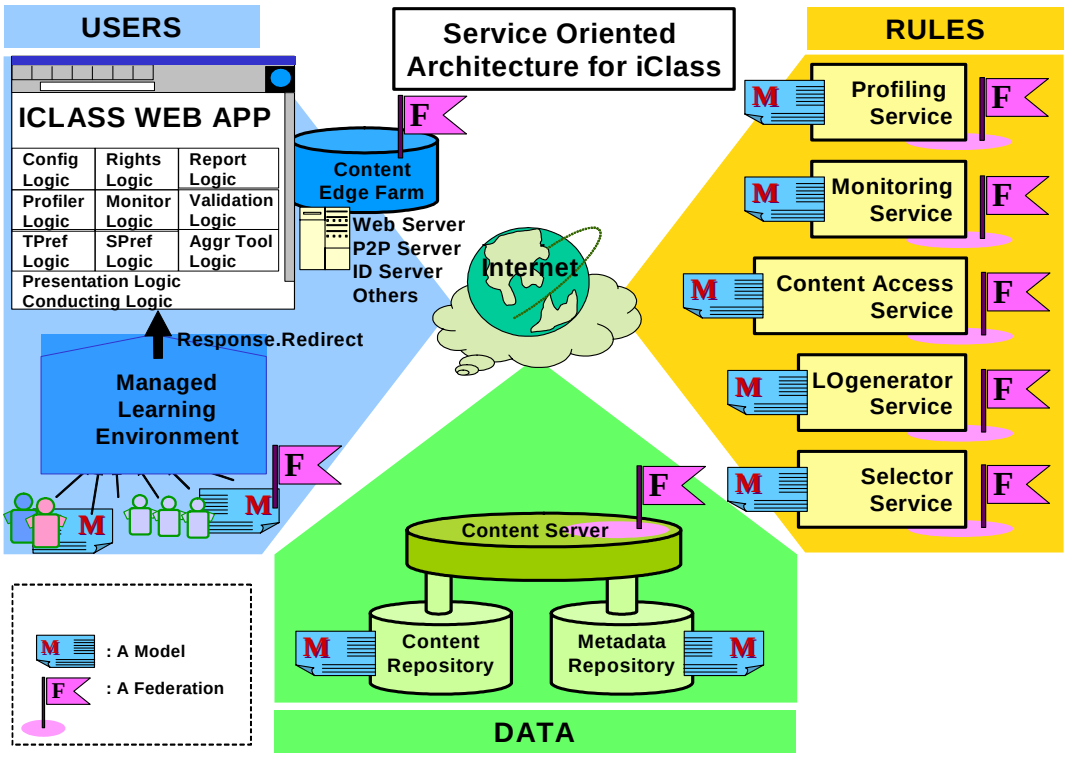

Figure 1, The iClass services and repositories

This paper describes the objectives of iClass with respect to personalization of a learner's experience. Section two describes how iClass will cater towards a learner's needs by providing adaptable, as well as, adaptive solutions. Section three will look at the iClass framework and exemplify some workflows carried out by iClass. Section four will examine content issues that arise when developing personalized content. Finally, section five will conclude the paper.

2 Catering Towards Learner Needs

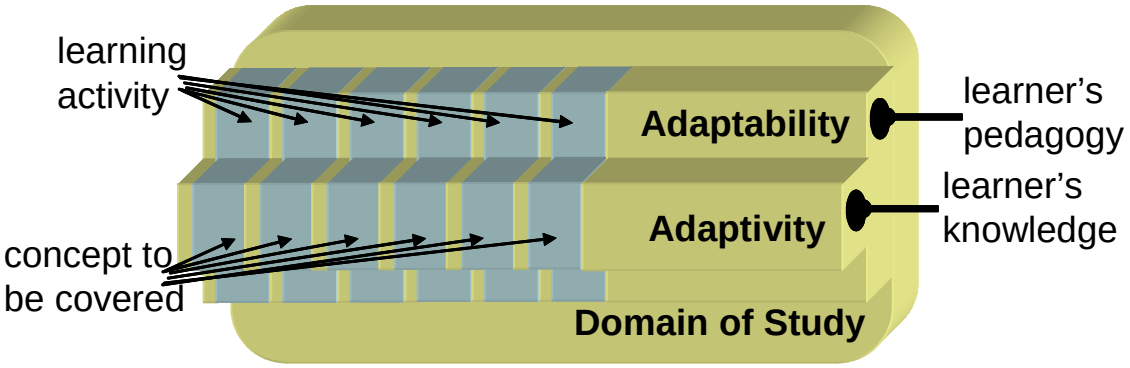

Figure 2, Models of the learner effect the choice of activities and concepts to be covered

Pedagogical and contextual parameters of the learners are inputs to the reconciliation engine that creates the personalized content in the sense of picking the right learning designs and activities [Conlan and Wade, 2004]. Pedagogical parameters comprise the learning styles, habitual properties, and general aptitude of the learners. The aspects like cultural background, place of study, collaboration, timeliness and hour of study are some of the contextual parameters.

Adaptivity in learning experience is accomplished by choosing the learning paths that suit the knowledge level and the acquired competencies of the learner. These are measured by the Monitor service based on the assessment results and learner's consumption performance of the LOs. Learning paths are portions of the concept domain ontologies. These ontologies essentially represent the curriculum constructs. In addition, adaptivity will also have to take into account the learners having off-the-iClass experiences. These are inquired through the Student's Preference Tool and are reflected to crafting of their iClass experiences. In order to achieve adaptivity at runtime, appropriate assessment techniques are continuously employed by iClass and the knowledge representation of the learner is continuously updated.

Adaptability in learning experience is accomplished by choosing learning activities that suit the pedagogical parameters and preferences of the learner. Being adaptable implies that the learners assume responsibility within the designated limits, and have freedom, yet guidance. Providing the learners with the suitable learning tools such as conversion tools, a mind-mapping tool, or a history tool exemplifies this kind of support. The extent of the adaptability provided by iClass, frames the scope of how adaptive iClass will be towards the learners. The strategy of iClass is to be adaptive in its support of the learning activities while remaining adaptable to the learning style variations of different learners. Learners with different learning styles react in different ways and therefore they require different kinds of support when consuming the same learning object. This differentiation in support is provided not only for the search of an appropriate learning object, but also for the consumption of that learning object.

Being both adaptive and adaptable, iClass aims to create learners who have the ability to learn from different types of learning materials even if s/he has a preferred style, yet the learner must remain active in the process of decision making, which facilitates the learner to own the responsibility of his/her learning experience.

iClass employs preferences tools for both the teachers and the learners so as to reinforce the personalization properties. Using the tools parameters such as contextual information, demands for collaborative learning, or preferences on the common practice activity structures can be captured. Moreover, the created learner models are shared with teachers and learners by means of these tools.

3 Example Workflow

Utilizing iClass services and supporting tools a learner will be able to achieve a given set of educational objectives. The overall iClass system is a framework that accomodates certain processes for providing personalized units of study, yet assistance through the study is also provisioned.

Firstly, iClass determines and employs a pedagogical scenario in order to create a structure of activities to cover the unit of study. The unit of study represents a portion of the curriculum

domain map. This portion of the curriculum domain map is evaluated with respect to the knowledge level and acquired skills of the learner in order decide upon the order and occurance of learning objects to be delivered. The type of activities that harbour this chain of objects is determined by using the pedagogical and contextual parameters. For each section of the activity structure, iClass searches and finds learning objects that suit the activities involved. Since the activities suit the learner's model, the learning objects consequently suit the model. Nevertheless, the model comprise a rather large set of pedagogical and contextual parameters and hence some other conditions are still exerted on the objects other then the fitness criterion to the activities. Notice that, primarily the objects will have to suit the corresponding portion of the domain as well, which encompass a set of concepts and skills.

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The workflow presented in Figure 3, below, highlights the personalization process performed by iClass. The process is both standards-based and pedagogically aware. The key stages in creating a personalized eLearning experience are modelling the learner, choosing an appropriate learning approach, selecting appropriate content and activities to perform teaching and finally populating those concepts/activities with customized learning objects. Pedagogical properties of the learner are used in selection of the learning approach that yield a rough activity structure with the incorporation of contextual parameters. This rough structure is populated with best practice activities which in turn are populated with LOs. The selection of both activities and LOs are dependent on the domain and the learner's exisiting knowledge on that domain.

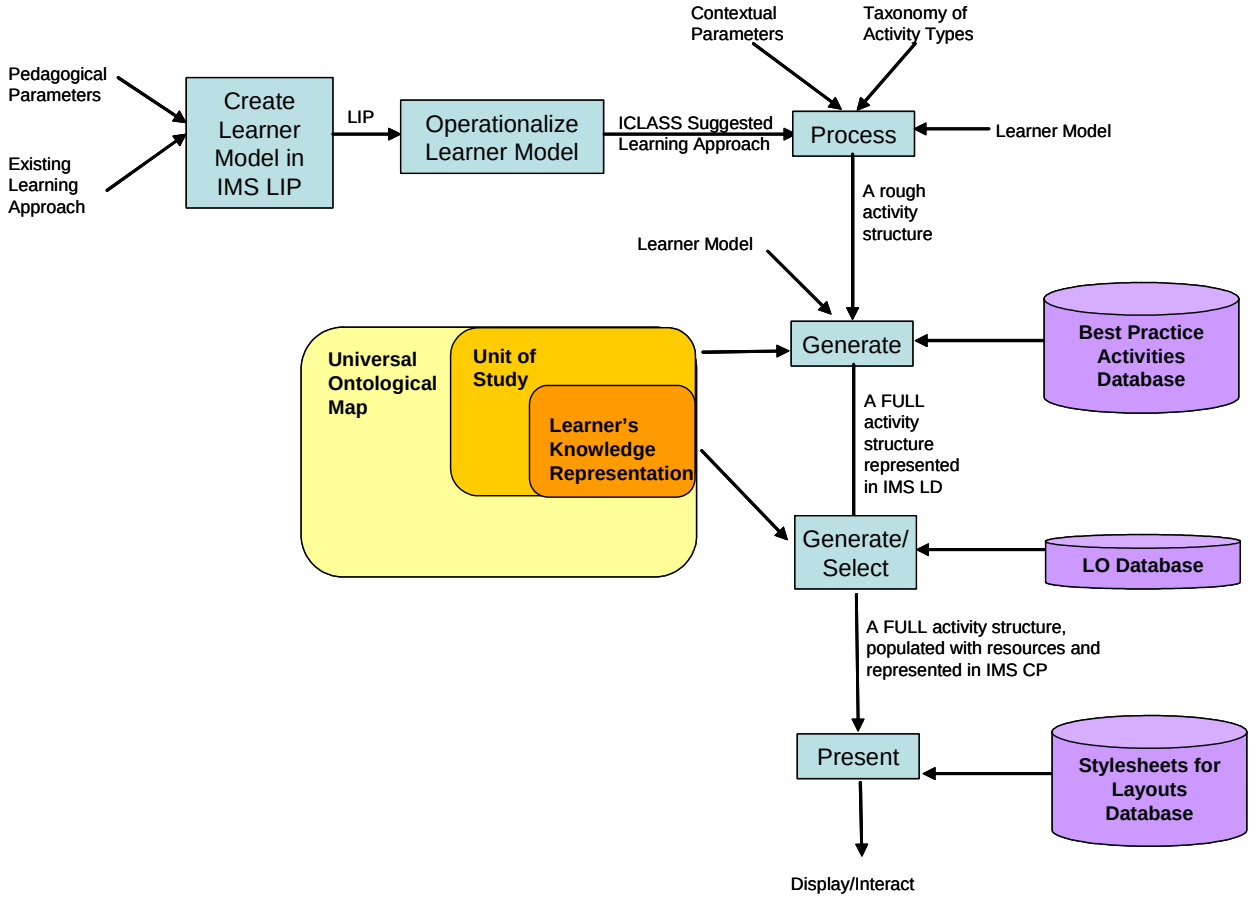

Figure 3, Utilization of content

4 Content for Personalization

Targeting personalization, being adaptive and adaptable constrain the learning content to be developed and exploited by iClass. The content publishers in iClass are in charge of providing both user-readable and system-readable content. Among the system-readable content are knowledge representations, ontological maps for representing a curriculum, instructional and learning designs, metadata and sequences of learning objects, while the user-readable content comprise the learning objects, learning resources and learning tools. iClass employs content formation (such as a video editing and text/graphics overlay tool), content aggregation, ontological map editing and learning activities authoring tools for both types of content. In order to achieve the interoperability of learning systems, iClass exploits the standardized technologies, such as OWL for curriculum domain maps and knowledge representations, IMS LD for activity structuring, SCORM 1.3 for learning objects manifests, and IMS LIP for learner profiling recording.

In order to properly execute the scenario above, both the user-readable and the system-readable content need to be created. The content creation, in this sense, covers the development of learning objects and learning designs that form the pavement of the introduced flow. The development of learning objects and learning designs should be coherent in order to prevent from disharmony between these two. The Frankenstein effect (a.k.a mosaic effect) that may occur due to sequencing learning objects at runtime with respect to a selected learning design implies a real challenge for content creation. When components of a course such as activities or learning objects are assembled by computer algorithms the overall experience can meet objectives in an artificial sense, yet may be annoying for learners. The disturbance may be not only in look&feel but also pedagogical in that individual activities which seem proper can be bothering as they occur one after another. To overcome the Frankenstein effect iClass employs hierarchies in content structuring such as confining LOs within activities, confining activities within activity structures and confining activity structures within learning designs that bear specific strategies.

iClass determines the sequences of the learning objects during the execution of the workflow, even though there are suggestive sequences provided by the content creators. The tool for content aggregation also allows for suggesting sequences. This nature of iClass necessitates a well-formed co-operation between the separate modules of iClass that are involved in content creation. This cooperation is achieved by using a shared and controlled vocabulary of special metadata types specific to iClass.

A primary aspect of content creation involves the curriculum analysis, and accordingly the development of the ontological domain maps. The curricular variations imply a real challenge for this process, particularly for a system like iClass, that is chartered to serve schools in different countries.

Another aspect of content creation is the development of knowledge representations for domains and learners. In order to match learner's knowledge to the knowledge designated for the domain, there should be a common representation model. However the representation for the learner will be let to evolve while the domain representation is binded by the curriculum.

The learning objects are developed according to the created domain knowledge representations and ontological domain maps. As for the creation of learning designs, possible variations in the learner model parameters are taken into account and a suit of generic pedagogical strategies

(scenarios) are developed for iClass. Moreover variations due to cultural and contextual differences are considered.

Finally, a number of learning tools complete the personalized learning experience, and provide feedback to the overall iClass system.

5 Conclusion

This paper has described the role of content in creating an eLearning experience that is personalized towards the learner's needs as part of the iClass project. Specifically it has discussed how the iClass framework facilitates the tailoring of eLearning experiences towards learner's needs with preferences that can be set both by the teachers and also the learner himself/herself. The iClass IST project, funded under the European Commissions 6th Framework, is striving to provide educators and learners with a personalized learning environment built using pedagogically sound principles.

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