SUPPORTING INSTRUCTIONAL DESIGN IN FORMAL LEARNING

A Knowledge Management System for Planning, Implementing and Evaluating Courses in Traditional Classrooms

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Abstract: Instructional Design is not an exact science, especially in a traditional classroom context. Teachers plan, perform and evaluate their lessons in an ad-hoc manner. Their decisions, however, share a common basis, which includes but is not limited to didactic methodologies, past courses experience, students' characteristics and prior knowledge, available material and time, goals to be achieved and expectations to be fulfilled. All this information is fragmented in various and heterogeneous material, ranging from tests and evaluation reports to classroom management software and administration documents. It is proposed to apply ADDIE Instructional Design Model to the context of formal learning. Based on the processes identified by ADDIE, a knowledge management system is designed to enable assessment of the past decisions and facilitate the forthcoming.

1 INTRODUCTION

Instructional Design is the process through which an educator determines the best teaching methods for specific learners in a specific context, attempting to obtain a specific goal (IEEE Reference Guide for Instructional Design). It is a descriptive rather than a prescriptive definition, in other words it addresses what should be done but not how.

As it is the right decisions that determine the effectiveness of a design, Knowledge Management Systems have been designed to support Instructional Design. They primarily focus on content sharing (Learning Management Systems), but also Knowledge Management Systems have been introduced that target collaboration between teachers (Marshall and Rossett, 2000).

A Knowledge Management System that can ease and evaluate an instructor's choices is proposed. In order to design a system targeting teachers' work, a certain workflow must be issued. Many methodologies, known as Instructional Design Models, have been proposed, which provide a step-by-step process to designing an instruction. Each model may be more or less applicable to a learning context. In order to choose the appropriate Instructional Design Model, the particular features of formal learning must be identified and evaluated.

2 FORMAL LEARNING CONTEXT

Although a clear distinction between formal and informal learning is hard to make (McGivney, 1999, p1), the former typically describes a structured process in terms of objectives and time. Teachers are to enable their students to reach didactic goals already defined by an institution in accordance with a strict timetable.

On the other hand, no particular assumptions can be made as to what Instructional Design Model a teacher should be consulting, since none of the models proposed in bibliography has been proved more efficient than other. What is more, a model that was proved successful for a particular teacher or class, may fail in another situation.

Despite the differences in the way teachers work, researches have reviled common steps that instructors take when planning their lesson. According to a research performed by the University of Vienna, "Comparing Instructors' Approaches to

Course Design across Europe", six typical steps were adopted by more than 50% of participants during Instructional Design. These are design/select material, define content-oriented structure of the course, define learning outcome, design teaching method, set up learning management system and define time structure of the course. No important differences between countries were detected.

A model that can typify these common steps must be chosen. ADDIE is a generic model. It is used to describe a systematic approach to instructional development, virtually synonymous with instructional systems development (Molenda, 2003). As the majority of Instructional Design Models can be easily deducted to it, ADDIE does not enforce a specific workflow to the instructor and is most applicable for a context as vast as formal education.

3 ADDIE ADAPTATION

ADDIE is short for Analysis, Design, Development, Implementation, and Evaluation, that is five, flexible, context-free phases that can describe an instructor's steps. Each of the first four phases has an outcome that feeds the next one in the sequence, while evaluation phase occurs throughout the process and may affect one or more of the outcomes of the other phases.
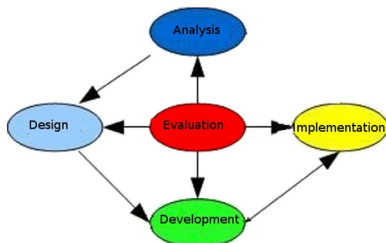

Figure 1: ADDIE Instructional Design Model.

3.1 Analysis

This is where the outline of the course is considered. The system must report to the instructor the scope and objectives, as they were officially stated by the institution responsible for the course. Analysis phase also keeps track of the typical audience, the common characteristics that learners of this course usually share, such as age and prior knowledge.

3.2 Design

Design phase includes a prototype Instructional Design for a course not yet planned. Based on the information provided by the previous phase, the system must store educational resources and prototype workflows, referred to as Learning Designs, which correspond to one or more objectives of the course. Information about the time and the place the course will occur are not yet addressed.

3.3 Development

In development phase the actual place and time of the course is inserted in the system and specific learners are registered. In other words, a new classroom in created. The teacher sets up plans according to learning designs of the previous phase that are most applicable for the situation. The appropriate educational resources are chosen and matched to plans.

3.4 Implementation

At implementation phase the course takes place. During implementation, the system should allow the instructor to make alterations on the outcomes of the previous phase, as well as report classroom incidents, like absences and drop-outs.

3.5 Evaluation

Evaluation phase typically occurs during any of the other phases, for example a revision of the outline of a course at analysis phase will result to modifications at design phase and so on.

Evaluating an Instructional Design is difficult as many parameters have to be considered and measurable evidence can not always be provided. It is however possible to evaluate each element of the Instructional Design based on the including elements. For example the effectiveness of a Learning Design may be evaluated from the level of success of the derived plans and the plans may also be evaluated by the lessons they consist of.

The system must provide the instructor with specific metrics that can be used to choose educational material, plans and learning designs both absolute and in relation to the audience and other features of the implementing course. These metrics will be useful when new decisions are made.

4 SYSTEM DESIGN

ADDIE was used to identify the main issues that the system must tackle. Only for the sake of

presentation, the design of the system is broken into the five phases. No entities or separate modules will be created for each phase, as it must be as model-unaware as possible.

4.1 Analysis

A course outline (Course) may have zero or more objectives that can be shared with other courses. Course can also be related to zero or more typical audiences (Audience). An Audience describes the typical characteristics of a type of learners, for example 5-year-old pupils.
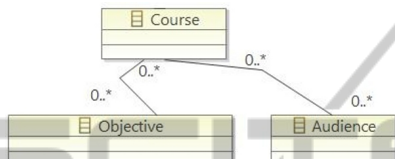
Figure 2: Analysis phase.

4.2 Design

An educational resource (Resource) may be a test, a presentation, an exercise, a link to educational software and anything content-specific material. A Learning Design describes the course workflow as a prototype design, without specifying date, place or participants. A Learning Design may have zero or more objectives and resources. It is important to note that Resource and Learning Design are not directly linked to Course, as the same material may be reused in different courses. Resources in learning designs may overlap, as each one may be chosen at the next phase.
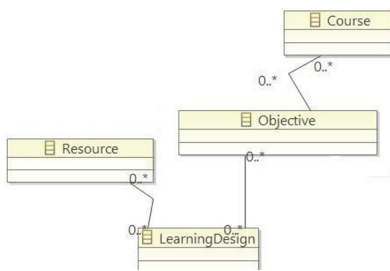
Figure 3: Design phase.

4.3 Development

A classroom entity (Classroom) describes the actual course that is implemented and stores information like date and time. A course may have more than one classrooms, for example mathematics A' grade at school years 2011-2012 and 2010-2011.

Learners are registered (Registration) to a classroom and may belong to zero or more groups (Group).

A classroom has plans (Plan). Plans are learning designs that have been adapted to the specific context and include references only to the chosen resources. A plan may originate from a prototype learning design. A learner may have zero or more roles (Role) in a plan.
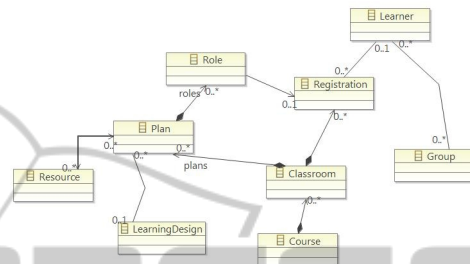
Figure 4: Development phase.

4.4 Implementation

A plan consists of lessons (Lesson) which is a fixed time event. A teacher may note attendances (Attendance) according to the registrations made.
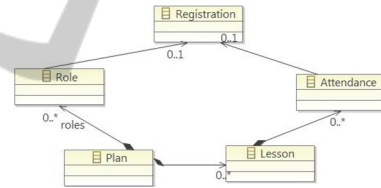
Figure 5: Implementation phase.

4.5 Evaluation

Both evaluations, given manually by the instructor and derived by the system, must be supported. Instructor may use a grade or a description to evaluate:

- Attendance: learner's comprehension during a lesson
- Lesson: effectiveness of a lesson
- Role: learner's participation in a role of a plan
- Registration: overall learner's outcome during a specific classroom

Evaluation may be derived from associated elements, for example the effectiveness of a lesson may be calculated as the means of the grades of the attendances. Table 1 demonstrates the evaluation input by an instructor and derived by the system. Weights are also applicable when the means of associated elements is calculated.

Table 1: Evaluation table.

Element	Evaluation	
	Instructor	Derived by means of associated elements
Attendance	Yes	-
Lesson	Yes	Attendance
Role	Yes	
Registration	Yes	Attendance
Plan	No	Role
Leaning Design	No	Plan
Classroom	No	Attendance, Lesson, Registration, Plan
Course	No	Classroom

5 CONCLUSIONS

Although there are almost as many instructional
design models as there are practitioners of
instructional design, teachers' decisions in formal
learning context are based on common factors.
ADDIE model of design was used to classify most
commonly addressed factors. A knowledge
management system that presents available material
and estimations, along with the results of the
learning process which was designed according to
them, integrates information crucial to an instructor.
Therefore it may facilitate decision making process
and raise productivity.

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