



Learning Design Approaches for Designing Virtual Learning Environments

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ABSTRACT

Virtual Learning Environments (VLEs) have provided new perspectives for access to information and enhance learning. However VLE have advantages and positive impact on learning, there are still defies to their design and production. This paper focuses on the presentation and comparison of Learning Design approaches used to design and implement a VLE. In the literature, several Learning Design approaches are presented. This work seeks to make it easier for instructors that want to make the best choice when choosing an approach to design and authoring a VLE by revealing which approach will meet their needs.

General Terms

E-learning, Virtual Learning Environment, Learning Design, Instructional Design.

Keywords

Virtual Learning Environment, Learning Design, Instructional Design, IMS instructional design, OULDI, ADDIE, Dick and Carey, Agile learning Design.

1. INTRODUCTION

The VLEs allow teachers to create resources quickly and without the need to develop technical skills. VLEs provide an integrated set of Internet tools, allow easy upload of materials and offer a consistent look and feel that can be customized by the user [1]. The use of such environments may offers to learners, adaptive content, presentation, and navigation support adapted based upon various such learner's data, usage data and environment data of individual learners.

To design a VLE, several components must be designed with a specific pedagogic intention: learning resources and materials; tools and equipment; learning activities; the learning program or curriculum. One of the challenges faced by instructors of VLE has been how to design and create quality and pertinent component of learning environment, able to build courses based on a model of the goals, preferences and knowledge of an individual user and use this throughout the interaction for adaptation to the needs of that user.

This is due to the fact that VLEs deal with diverse backgrounds, such as software developers, web application experts, content developers, domain experts, instructional designers, user modeling experts, pedagogues, etc. Moreover, these environments have presentational, behavioral, pedagogical and architectural aspects that need to be taken into account. To make matters worse, most VLE are designed and developed from scratch, without taking advantage of the

experience from previously developed applications, because the latter's design is not codified or documented. As a result, development teams are forced to 're-invent the wheel' [2]. Keppell et al.[3] recommend that "Academic teachers should be encouraged to model and share learning designs within their own university, partner institutions and symposiums and conferences in higher education" to enhance learning and teaching through technology-enhanced learning.

Various works have been presented in the literature in order to support the design of VLEs [3][4][5][6][7][8][9]. Thus, there are several Design learning methods presented in the literature, such as ADDIE, OULDI, Design thinking, Xproblem, etc.

The purpose of this paper aims to give an overview and a comparative study of the most used Learning Design approaches in the literature. The remainder of this paper is organized as follows. The second section provides the background and the context of the study. The third section presents the most used Learning Design approaches. The fourth section provides discuss the results of this work. Finally, a conclusion and future work are presented in the last section.

2. BACKGROUND

Software design and related practices and methods have had a significant influence over the learning Design area. Rawsthorn claimed that "computer technologies and related practices and methods have had a significant influence over Instructional Design methods. One of the major trends is the influence of Software Development Life Cycle methodologies over Instructional Design methodologies. This influence is evident in the ADDIE, Dick and Carey, Rapid Prototyping and other Instructional Design methodologies"[10]. In this section, an overview of the two concepts: Instructional Design and Learning Design are presented.

2.1 Instructional Design

The concept of Instructional Design arrived in the literature of technology for learning in the late of 1950. Instructional design is the process by which instruction is improved through the analysis of learning needs and systematic development of learning materials. Instructional designers often use technology and multimedia as tools to enhance instruction [11]. Merrill and al. [12] define the Instructional Design as the practice of creating instructional experiences which make the acquisition of knowledge and skill more efficient, effective, and appealing. For Reigeluth [13], an

instructional design is a theory that offers explicit guidance on how to better help people learn and develop.

In addition, Instructional Design may be supposed of as a framework for developing modules or lessons that [12]:

- increase and enhance the possibility of learning
- makes the acquisition of knowledge and skill more efficient, effective, and appealing,
- encourages the engagement of learners so that they learn faster and gain deeper levels of understanding

2.2 Learning Design

Historically, Learning Design has emerged from instructional design, but with a focus on learning activity as the central concern of the design process [14]. Learning Design was presented as a methodology for both articulating and representing the design process and providing tools and methods to help designers in their design process [15].

Beetham [16] defines the Learning Design as: A set of practices carried out by learning professionals... defined as designing, planning and orchestrating learning activities which involve the use of technology, as part of a learning session or program.

The aims of the learning design are [17]:

- To provide flexible access to resources and tools to enable students to complete individual and group components of the assignment off campus.
- To enable the teacher to monitor student collaborations in group tasks and manage assessment better.
- To enable students to develop personal knowledge management (PKM) skills in Web 2.0.

Learning design can take place at a number of levels: from the creation of a specific learning activity, through the sequencing and linking of activities and resources, to the broad curriculum and program levels.

Learning designs can be represented in several ways; each representation will articulate particular aspects of the learning that the designer anticipates will take place. Four main types of representations are identified: verbal, textual, visual, or data-based. Many tools can be used for implementation such LAMS (learning Activity Management System), MOT+ (Modeling using Object type), Reload, etc.

As presented above, Learning Design and Instructional Design are meticulously aligned but have distinct concentrations. Conole [18] claimed that Instructional designers design instruction to meet learning needs for a particular audiences and setting. Learning design, in contrast, takes a much broader perspective and sees design as a dynamic process, which is ongoing and inclusive; taking account of all stakeholders involved the teaching-learning process.

As the Learning Design is boarder then the instructional Design, in the section below, the term “Learning Design” will be used even if some methods use the term “instructional Design”.

3. LEARNING DESIGN APPROACHES

As highlighted above, the field of Learning Design has gained importance in the literature. According to our reading, the Learning Design approaches could be classified in two large categories. The first one intended at developing a Learning Design Specification for machine interpretation and execution. This was the direction adopted specially by IMS Learning Design. It seeks a formal educational mark-up language that can document a single or multiple learner experience in a computer readable and sharable (XML) format[18] Instructors reapproach to this category, that implementations of the full specification conducted to date are limited. Furthermore, this orientation does not make pedagogic design and learner activity explicit in a human-readable form.

The second category, that matches our vision, adopts a more general interpretation of learning design. It focuses on pedagogy and the activity of the student rather than, say, the content. This approach advocates a process of ‘design for learning’ by which one arrives at a plan, structure or design for a learning situation, where support is realized through tools that support the process (e.g. software applications, websites) and resources that represent the design (e.g. designs of specific cases, templates) [19].

Various toolkit and model for mapping pedagogy and tools for effective learning design were proposed. In the section below, the most cited methods in the literature are presented.

3.1 ADDIE Model.

ADDIE model [20] is the most common model used for creating instructional materials is the ADDIE Model. This acronym stands for the five phases contained in the model (Analyze, Design, Develop, Implement, and Evaluate) (see Figure 1). Each phase has an outcome that feeds into the subsequent phase. Below the explanation of each phase is presented.

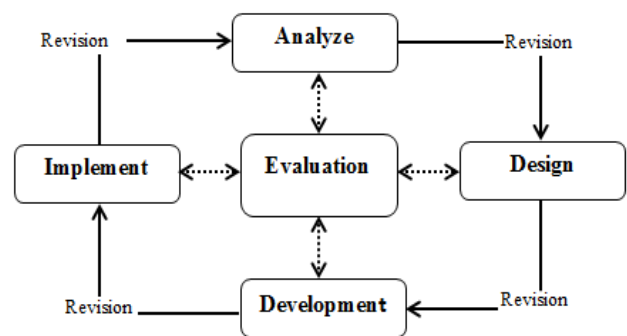


Fig 1 : The five process of ADDIE model

- Analyze: identify instructional goals and tasks, analyzing learner characteristics;
- Design: develop learning objectives, choose an instructional approach, define performance objectives, develop assessment instruments, and develop instructional strategy;
- Development: designers and developers start the production and the testing of the methodology being used in the project

- Implementation: deliver instructional materials; apply instructional activities; formative evaluation.
- Evaluation: consists of two parts: formative and summative. Formative evaluation is present in each stage of the ADDIE process. Summative evaluation consists of tests designed for domain specific criterion-related referenced items and providing opportunities for feedback from the users.

3.2 Dick and Carey approach

The Dick and Carey method [21] is constituted by a series of steps, all of which will receive input from the preceding steps and will provide output for the next steps. All of the components work together in order for the user to produce effective instruction. The model includes an evaluation component that will help determine what, if anything went wrong and how it can be improved.

- Assess Needs to Identify Goal(s) : Determine the instructional goals
- Conduct Instructional Analysis: Determine the required skills, knowledge, and attitudes.
- Analyze Learners and Contexts: Analyze the context in which the learners will learn the skills and they will use them.
- Write Performance Objectives: Determine the conditions under which the skills must be performed, and the validation criteria.
- Develop Assessment Instruments: Develop assessments to measure the learners' ability to perform the skills.
- Develop Instructional Strategy
- Develop and Select Instructional Materials
- Develop and Construct Formative Evaluation of Instruction
- Design and Conduct Summative Evaluation
- Revise instruction

As presented above, data from formative evaluation are used to revise the whole instructional process. The Dick and Carey methodology linearity is broken by the revise instruction phase whose effects pervade the whole process (see Figure 2 page5).

3.3 OULDI approach

Open University Learning Design Initiative was led by the Institute of Educational Technology at The Open University. The initiative aims to provide support for the entire design process; from gathering initial ideas, through consolidating, producing and using designs, to sharing, reuse and community engagement [22]. It specifies five phases for the process of design (see figure 3).

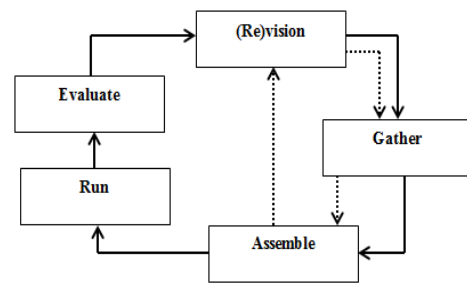


Fig 3 : The OULDI process

The OULDI approach specifies three aspects of design [23]:

- Collaboration & dialogue – mechanisms to encourage the sharing and discussing of learning and teaching ideas.
- Representation – identification of different types of design representation and use of a range of tools to help visualize and represent designs.
- Theoretical perspectives – the development of a body of empirical research and conceptual tools to help guide the design decision-making process and to provide a shared language to enable comparisons to be made between different designs.

OULDI has developed a visualization tool for design, CompendiumLD and a social networking site Clowdworks for sharing learning and teaching ideas linked to design.

3.4 Agile Learning Design approach

The Agile Learning Design is an iterative model of learning design that focuses on collaboration and rapid prototyping. Agile Learning Design can be adapted to fit the needs of the learning and training community by providing an ethos for the design of learning [24].

The flow of agile Learning Design may contain several cycle (See Figure 4 page 5). Each cycle consists of problem analysis in the first phase, followed by the development of a single feature of the final product. Once this single small part of your course is finished you can start testing and evaluating the efficiency and the return on investment of this part. If the results are satisfying a new iteration begins, until the course or the project are fully finished, otherwise the designer has to take one step back, understand what went wrong, and correct.

In the literature, a variety of agile design practices are shown. Each of these practices is important, and each is needed. The agile practices are combined with Learning Design, assisting and guiding the design and creation of VLEs [25]:

- Active users participation : Users are involved in the development process, helping to identify and solve problems and mistakes and providing rapid feedback to the team
- Collaborative development: All team members constantly interact and communicate throughout the development process, promoting a collaborative and productive environment
- Architecture/Design envisioning: Initial software architecture and requirements are designed at the



beginning of a project to identify and think through critical issues

- Iterative modeling/ design: Software functionalities are designed at the beginning of an iteration to identify team's strategy for that iteration
- Model/ Design storming: Software functionalities are designed on a just-in-time (JIT) basis to reflect on specific aspects of team's solution
- Early and continuous Evaluation : Testing and validation activities are conducted at the beginning of the project and extend throughout the development process

4. DISCUSS

As shown above, all of the frameworks presented above are development methodologies that are leveraged to guide Learning Design teams through a project of eLearning. The philosophies of those frameworks methodologies share many of the same practices. All of them include analysis, design, development, implementation, and evaluation as part of their process.

The study of these four Approaches allowed us to make the following comparative table in Table.1 (page 5).

We notice that the ADDIE, the Carey and Dick and the OULDI approaches, although, they aim to make the design more explicit, they don't specify the steps and guidelines for a Learning Design process.

However, the Agile Learning Design approach has distinct characteristics that set it apart from the rest. The use of Agile Learning Design permits an incremental organization, flexible schedule, collaborative and transparent process. Moreover, the Agile Learning Design method allows designs to be modified, repurposed and evolved according to the needs of users emerging during development. Furthermore, it focuses on the final client which is in our case the learners and their interactivity with the system.

5. TOWARD A VIRTUAL LEARNING ENVIRONMENTS BASED ON AGILE LEARNING DESIGN APPROACH

In this section, the first bricks of an experiment that validates the proposed framework through its application in the development and testing of a VLE based on Agile learning Design approach is presented.

5.1 The Design of VLE based on ALD

The agile Learning Design method used to implement a VLE is organized in four phases. We notice that we use the same phases to design all the components of the VLE

5.1.1 Establish the initial content of the VLE

In this stage, an architectural design of the proposed system which is composed by three main components is used as a starting point. In the following, we present these components, their descriptions, their features and interactions between them.

- *The domain package:* The domain package is characterized by its competence in terms of representation of concepts to learn, the resources available to learners and the structuring of various elements of the field.

- *The user package:* The user package allows changing several aspects of the system, in reply to certain characteristics (given or inferred) of the user [26]. It includes two type of information grouped in two domains (1) Domain Independent Data (DID): data related to two elements: the Psychological Model and the Generic Model of the Student Profile, with an explicit representation [25]. (2) Domain Dependent Data (DDD): information referring to the specific knowledge that the system judges that the user possesses on the domain.
- *The adaptation package:* The adaptation package deals with the generation of adaptive content that will be subsequently presented to the learner. This component has four sub components: the navigation model, the presentation model, the content model and the pedagogical rules. Each sub-component contains a set of rules to achieve the adaptation

5.1.2 Plan and create the structure.

In this stage, we agree the content of the three packages in adequacy with our learning context. We highlight that we can refine those packages (add or delete some content) since we can do iterative design.

5.1.3 Implement the component.

In this stage, we start the implementation; we agree the technologies that we will use to implement our VLE and the design of the user interface.

5.1.4 Evaluate.

In this step, we evaluate and approve the work. Some learners create their account in the component of user package, fill in the form and evaluate the initial version of the user package. In this stage, we will focus on remarks and feedback of learners. We will collect all information that could be and used to improve the succeeding iteration and to contribute to the constant enhancement process.

5.2 The first results

The first version of the framework presented in previous section, has already been implemented and tested to validate the proposed approach. We notice that we have tested and validated only the implementation of the user package and the domain package. For the adaptation package, we are still working on it.

For the part tested, we highlight the Agile Learning Design method allows designs to be modified, repurposed and evolved according to the needs of users emerging during development. In terms of the applicability of the method, the preliminary results indicate that the method is useful, easy to use. Furthermore, it focuses on the final client which is in our case the learners and their interactivity with the system.

6. CONCLUSION AND FUTURE WORK

With the increasing number of learning Design methods, it is becoming increasingly hard to know which one to adopt. In this work, first, the most used methods in the literature are presented. Then the methodologies of each method are discussed. The comparison of the four Learning Design approaches shows that each method has its own characteristics that distinguish it from other. We have highlighted that Agile Learning Design is the only approach that focuses on the learners and their interactivity with the system. Indeed, the learner is solicited through the process of design.

For further validation of this approach, actually, we are working on a VLE respecting the Agile Learning Design approach. The preliminary results, based on the results of the experiment and on the feedback from learners, show the

success of this approach in designing and implementation. The final results will be subject of publication in the near future.

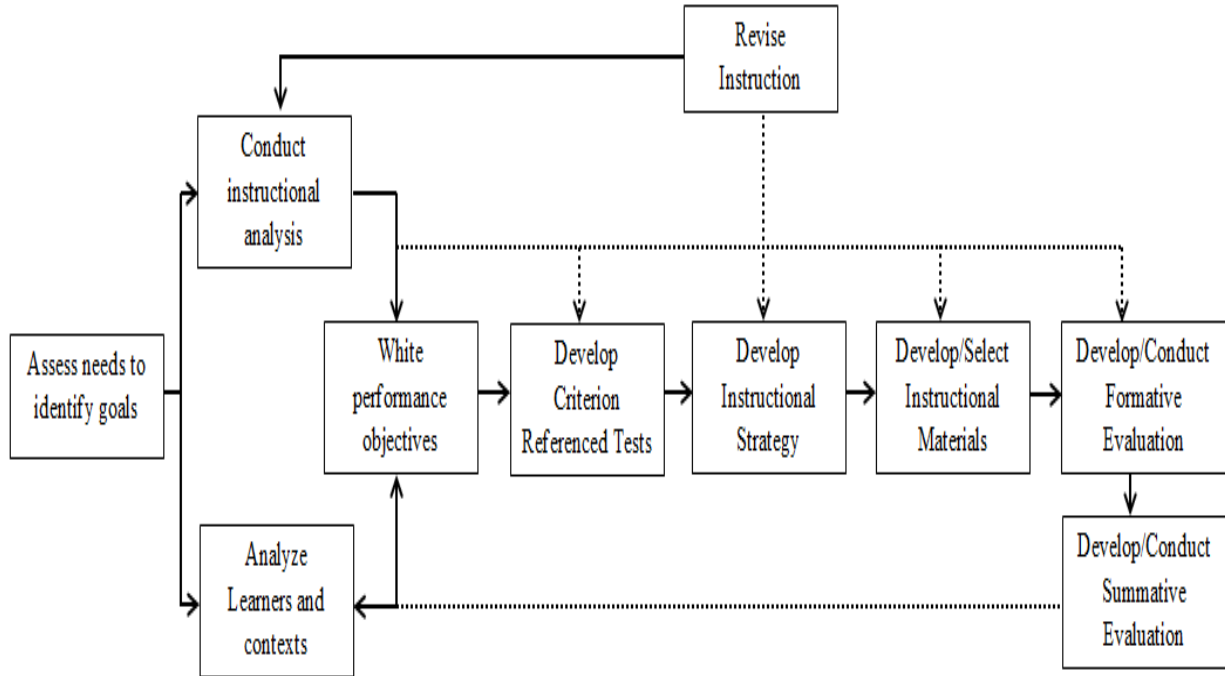


Fig 2: Steps of Dick and Carey model

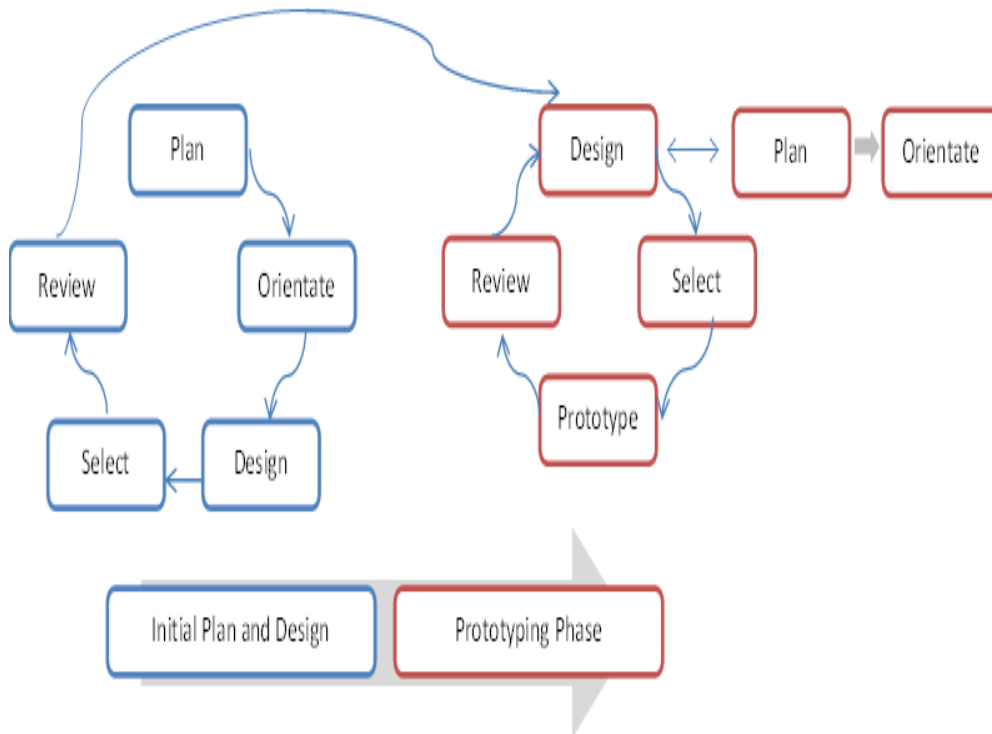


Fig 4 : The flow of Agile Learning Design



Table 1. Summary of the approaches presented above

	ADDIE approach	Dick and Carey	OULDI	Agile Learning Design approach
Process of development	Analysis, Design Development, Implementation, Evaluation.	Identify, Conduct, Analyze, Write Performance, Develop, Design, Revise, Design.	Vision, Gather, Assemble, Run, Evaluate, adapt	Align, Get set & Iterate, implement, Leverage, Evaluate
Type of process	Linear development process	iteratively and parallel	Iteratively and linear	Short iteration
Implication of users	Users specify all requirement at start	Users specify all requirement at start	Users specify all requirement at start	Users embedded throughout the process
Delivery	All at once delivery	All at once delivery	All at once delivery	Constant delivery

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