Approaches to Design for Learning

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Abstract. Over the last fifteen years, the field of Learning Design has gained considerable attention among researchers aiming to promote pedagogy informed learning design, and technology-enhanced learning. From the pedagogical perspective, various learning design approaches have been developed within the field. In this paper, we investigate learning design approaches by conducting a systematic literature review, and present key theoretical concepts that underpin their development. Also, we link these approaches with key learning theories, including behaviorism, constructivism, cognitivism, and connectivism. The findings of this study can inform future research in the field of Learning Design.

Keywords: Learning Design · Learning theories · Learning design approaches · Technology Enhanced Learning · Pedagogical planning

1 Introduction

Over the last fifteen years, the field of Learning Design (LD) has gained considerable attention among researchers aiming to promote pedagogy informed learning design, and technology-enhanced learning. The underlying motivation of the LD field is to find appropriate, systematic ways to represent teaching and learning practice in order to support a process of reuse of learning designs and ultimately improve them. To this end, there is a growing body of studies focusing on the development of learning design approaches to extend and empower learning, teaching, and assessment [1]. In this context, there have been also many attempts to develop learning design support tools adopting theoretical models, such as the METIS[1], the GLUE!PS[2], and the LDSE[3]. The richness of the LD field, in terms of variety of perspectives represented in the available LD tools and approaches in general, contributes to advancing this field further, but at the same time creates additional challenges for LD tool users and researchers. Among the very few studies that attempted to use and compare various learning design approaches in real world contexts, a study by Persico et al., [1], focused on designing a learning activity about "healthy eating" using five different learning design approaches, including 4Ts, 4SPPIces, e-Design Template, the Design Principles Database, and Design Narratives, and examined the tension between them. Based on these approaches'

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[1] https://www.metis2020.com.
[2] http://www.gsic.uva.es/glueps.
[3] www.ldse.org.uk/.

underlying assumptions, their usage and benefits to the practitioners, the authors attempted to make a fair comparative evaluation. In the companion paper, Prieto et al. [2], use these LD approaches to model the "healthy eating" activity and describe how this scenario is implemented in five learning design tools, namely The Learning Designer, OpenGLM, CADMOS, Web Collage, and ScenEdit. Lastly, in another work, Sanagustín et al., [3], modelled an educational scenario using ISiS and 4SPPIces conceptual frameworks to illustrate their differences.

In this paper, we define learning design approaches by a systematic literature review; illustrate theoretical assumptions of these approaches, and present them according to key learning theories that they relate to. The aim is to provide a new basis that could enable future research to further advance the field of LD.

The rest of the paper is organized as follows. In Sect. 2, we present methodology of the study. The findings are reported in Sect. 3. The paper ends with conclusions and future work in Sect. 4.

2   Method

The method of our study comprised of the following stages: (1) a systematic review of LD approaches following the principles of Kitchenham [4]; (2) an analysis of the approaches according to underlying theoretical assumptions.

To identify the primary studies, we used the following strategies: keyword search of electronic databases and journals, hand searching of conference proceedings, and scanning of the reference lists. The search terms used are LD approach (es), behaviorist, constructivist, cognitivist, connectivist learning design approach (es). Science Direct, Wiley Online Library, Taylor and Francis Online, ACM Digital Library, Google Scholar, ERIC Institute of Education Sciences, JSTOR, Science Direct, LearnTechLib, and EBSCO are among the databases included. The journals searched are Computers and Education, Journal of Computer Assisted Learning, Research in Learning Technology, Technology, Pedagogy and Education, British Journal of Educational Technology, ACM Transactions on Computing Education, Journal of Educational Technology and Society, and Distance Education. The conferences searched include European Conference on Technology Enhanced Learning, International Conference on Web-based Learning, International Conference on Advanced Learning Technologies and Technology-enhanced Learning, and Association for the Advancement of Computing in Education Conference.

We include papers focusing on a specific learning design approach, model, or framework. We excluded papers that focus on instructional design approaches, model, or frameworks because of the ongoing debate about the distinction between "learning design" and "instructional design", and multiple approach, model, or framework.

By using systematic review strategy, we identified 17 papers. In the screening of the titles and abstracts process, two of these papers is eliminated. Also, we excluded a paper that did not meet our inclusion criteria.

We extracted data from the papers using a data collection form (see Table 1). In the next step, we explored the theoretical basis underlying each LD approach described in

the papers. In the final step, we organized and presented these approaches according to the key learning theories underpinning their development.

Table 1. Summary of the papers and approaches identified.

ID	Author(s) and dates	Approach name	Type of the approach
A1	Pérez-Sanagustín et al. (2012) [5]	4SPPIces	Conceptual framework
A2	Laurillard (2012) [6]	Conversational Framework	Framework
A3	Pozzi et al. (2016) [7]	4Ts	Model
A4	Chatti et al. 2010 [8]	3P	Model
A5	Walmsley (2015) [9]	The e-Design Template	Template
A6	Gagnon and Collay (2005) [10]	Six Elements	Model
A7	Wang et al. (2013) [11]	Constructive alignment	Principle
A8	Kali et al. (2009) [12]	Design Principles Database	Infrastructure
A9	Mor (2011) [13]	Design Narrative	Paradigm
A10	Conole (2014) [14]	7Cs	Approach
A11	Emin (2008) [15]	ISiS	Approach
A12	Sener (2005) [16]	Quality Matters	Rubric
A13	Smyth (2012) [17]	3E	Framework
A14	Hung (2014) [18]	Learning Ecosystem	Model

3   Findings

Fourteen articles that focus on a specific learning design approach are included in this study. Table 1 presents the papers, and their associated information.

We found that the identified approaches are relevant to constructivist and connectivist theories. Below, we introduce constructivist and cognitivist theories, present these theories' principles that are directly related to the learning design process, and organize learning design approaches according to the theory that they relate to.

3.1   Constructivism

Constructivist theory argues that learners and environment interact with each other and through this interaction, learners build their knowledge. Principles of constructivism that relate to LD are: an emphasis on the context in which the behaviors will be learnt; the use of learnt skills in other situations; presenting context in different ways; supporting learners to go beyond the acquired knowledge using problem solving skills; presenting assessments that help transferring knowledge and skills.

The 4SPPIces Model. The model supports teachers in the development of the computer-based collaborative blended learning scripts. Space (S), Pedagogical Method (P), Participants (P) and History (I) are the factors considered in the 4SPPIces model.

The 4Ts.   4Ts model is created to support Computer Supported Collaborative Learning design process in terms of decision-making and pedagogical planning. Within the model,

the Task is created by teachers to be achieved by learners, the Team refers to a group in which learners brought into in order to achieve the Task, the Time in which activity was done by the learners, and the Technology used in the whole activity [7].

The Conversational Framework. This model has been developed by Laurillard for teachers [6]. It is a contemporary learning design model that focuses on creation and sharing of learning designs using online learning design support tools to make learning and teaching pedagogy informed. The framework comprises of four components: teacher's concepts, teacher's constructed learning environment, student's concepts, and student's specific actions [6].

3P. 3P model is "characterized by the convergence of lifelong, informal, and personalized learning within a social context" [8]. The model comprises of three components that support each other: Personalization, Participation, and Knowledge-Pull.

The e-Design Template. This template is produced according to principles of constructivist theory. It aims to develop teachers' self-regulation in the process of learning design, and help teachers in designing e-learning. The stages included in the models are active induction, guided exploration, facilitate investigation, and self-organized learner.

Constructivist Learning Design Model. Two educators developed this model analyzing constructivist theory in terms of learning design perspectives [10]. Situation, Groupings, Bridge, Questions, Exhibit, and Reflections are the elements of the model.

Constructive Alignment. Constructive alignment is an outcome-oriented learning and teaching approach. It stresses out the systematic design of learning, activities, and assessments [11]. The key component of the approach are learning outcomes, teaching and learning activities that will help student to learn, and assessments that consider measuring students' learned knowledge.

The Design Principles Database (DPD). DPD model is developed based on socio-constructivist learning theory's extensive principles as an infrastructure to enable practitioners publishing, discussing, and reviving ideas of learning designs. Meta-principle, pragmatic principles, and specific principles are the cornerstones of this model.

Design Narrative Approach. The approach's focus is the "design in the sense of problem solving, describing a problem in the chosen domain, the actions taken to resolve it and their unfolding effects" [13]. Context, challenge, theoretical framework, events, actions, results, and reflections are the elements considered within the model.

The 7Cs of LD Framework. This framework is developed based on a socio-cultural approach at the Open University. It demonstrates the key steps involved in the learning design process, "from initial conceptualization of a learning intervention through the trialing and evaluating it in a real learning context" [14]. These steps are conceptualize, capture, create, communicate, collaboration, consider, and consolidate.

ISiS. ISiS is a goal-oriented conceptual framework developed to help teachers in designing, sharing, and reusing learning scenarios [15]. This framework highlights the intentions, strategies, and interactional situations.

Quality Matters. The model is developed as a rubric for promoting quality improvement in online courses [16]. It highlights the course overview and introduction, learning objectives, assessment and measurement, instructional materials, learner interaction and engagement, course technology, teacher support, and accessibility.

3E. The 3E Framework is developed to provide teachers samples of pedagogic learning, teaching and assessment activities, and guidance. The elements of the framework are enhancing, extending and empowering.

3.2   Connectivism

Connectivist learning theory has been developed for digital age learners recently by extending learning theories of cognitivism, behaviourism, and constructivism [18]. The following principles of connectivist theory are directly relevant to the learning design: knowledge produced by diversity of opinions, continuous learning requires connection, technological tools affect learning, up-to-date information is important, decision making is also part of the learning process.

The Learning Ecosystem Model. The model uses principles of the system theory [18], networks and groups' principles. It comprises of four main parts including Learning Content, Learning Context, Learning Subjects, and Learning Technology.

4   Conclusions and Future Work

This paper presented an attempt to identify learning design approaches by making a systematic literature review. We looked at the theoretical assumptions behind these approaches, and organized them according to their relation to learning theories.

   We identified fourteen learning design approaches, and most of them were related to constructivist theory. Only one of these approaches was related to connectivist theory, whilst there were no approaches related to behaviorist or cognitivist theories.

   Moreover, this investigation revealed that Sequence, Learning Activity Flow, Collaborative Development, Assessment, Learning Analytics, Meaningful Context, Technology Adaption, Resources, Tools, Roles, Environment, Objectives, Recall of Prerequisite Skills, and Learners Analysis are the set of common characteristics that are directly linked to the process of learning design among the learning theories.

   Our future work will focus on investigating and analyzing teachers' perceptions of the advantages and disadvantages of these approaches, and on identifying additional approaches used by teachers in every day practice.

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