Digital Learning Design Framework for Social Learning Spaces

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Abstract

The recent technological advancements provide many opportunities for improvement of learners' experience. The social nature of modern educational systems and the blending of formal and informal learning enable for more situated and personalized learning experiences. Moreover, the vast amount of data about learning activities can be utilized in a proactive manner to enable data-informed instructional interventions and attainment of learning outcomes. However, the present instructional and learning design approaches do not take into the account the potentials of digital data and analytics. In this paper, we introduce the Digital Learning Design framework which enables the development of course learning designs in a manner that incorporates evidence-driven nature of modern analytical systems with the sound pedagogical underpinnings of learning design research.

1. Introduction

While technology has always been an integral part of teaching and learning, recent developments of information technologies and abundance of digital data brought substantial changes to the educational landscape. The recent 2017 NMC Horizon Report (Adams Becker et al., 2017) identified online, mobile, and blended learning being among the ten critical components of higher education, stating that *"if institutions do not already have robust strategies for integrating these now pervasive approaches, then they simply will not survive"* (Adams Becker et al., 2017, p. 2). The same report also notices the high potential of digital data and analytics for driving the evidence-based educational innovation and advancement of learning (Adams Becker et al., 2017).

The successful learning experience not only depends on the adopted technologies, but it also requires significant time and effort to be put into the design of appropriate learning activities (Anderson, 2008). In this regard, the fields of learning design (LD) (Koper, 2005) and instructional design (ID) (Gagne & Briggs, 1974) provide two complementary approaches for the design of the overall learning experience. Generally speaking, instructional design primarily focuses on designing instructional approaches that improve human performance and lead to desired learning outcomes (Rothwell, Benscoter, King, & King, 2015), while learning design more broadly focuses on devising the overall learning experience (Mor, Craft, & Hernández-Leo, 2015).

However, most approaches for both LD and ID do not acknowledge the transformative power of analytics and data in guiding learning in modern digital environments. The research in the field of learning analytics (Siemens, Long, Gašević, & Conole, 2011) provides many accounts of the benefits of analytics on learning outcomes and learning experience (Gašević, Dawson, & Siemens, 2015). Moreover, the ubiquitous presence of digital information networks shifts the focus of learning towards the development of knowledge and information graphs that capture the social and distributed nature of learning with modern technologies (Siemens, 2005). The new software technologies also provide opportunities for blending formal and informal learning contexts, thus enabling a shift towards more situated and personalized learning approaches. In this light, there is a need for an integrative approach which ties together the experience-driven view of learning design and analytics and data-informed analytical approaches in a framework for learning design for modern digital learning age.

In this paper, we introduce the Digital Learning Design (DLD) framework which explicitly focuses on integrating analytics and big data into the overall design of learning experience. The model is based on the widely used Evidence-centered design (ECD) model (Mislevy, Almond, & Lukas, 2003) and existing models of instructional systems design (ISD) (Gustafson & Branch, 2002), explicitly focusing on modeling learner experience with

modern, socially-enabled educational systems. The focus of the model is to define a structured approach for designing learning experiences in modern, socially-enabled learning spaces and platforms that leverage the available big data and analytics for guiding instructional approach and interventions.

2. Digital Learning Design Framework

The Digital Learning Design (DLD) Framework (Figure 1) centers around four central components (i.e., *Student model, Artifact model, Task model,* and *Evidence model*) which together define learning context, drawing from the theory-driven and data-informed perspective. This definition of student, task, and evidence model is directly based on the conceptual assessment framework (CAF) layer from the Evidence-centered design (ECD) model by Mislev et al. (2003) which is a widely used for educational assessment development. **Student model** captures four dimensions of learning, accounting for affective, cognitive, metacognitive, and social aspects of learner engagement within socially shared educational environments. **Task model** further defines different learning activities in which learners engage during the learning process. Those include activities related to learning networks (e.g., network awareness, network formation, network communication), learning artifacts and resources (e.g., creating, utilizing), and discourse (e.g., creating, utilizing). **Evidence model** provides analytical measures of constructs defined within the Student model that are captured during learner engagement with activities defined in the Task model. Those include 1) different network-related metrics, 2) discourse-related metrics, 3) metrics relating to learners' interaction with various learning artifacts, and 4) various self-reported measures collected before, during, or after the course (e.g., pre-course demographic surveys, post-course feedback surveys). In addition to these three models that are defined in the original conceptual assessment framework (Mislevy, 2003), we also included the fourth, **Artifact model**, which captures the different types of learning artifacts and resources that learners *use and create* during their learning.

The outer layer of the model provides an iterative process in which the student, task, evidence, and artifact model are designed. The outer cycle is based on the general model of instructional systems design (Gustafson & Branch, 2002) that captures the core steps of analysis, design, development, implementation, and evaluation of any instructional approach. These iterative steps include selection of data that will be collected during the process of learning, as well as metrics that measure dimensions selected within the student model (e.g., cognitive or affective dimensions). Moreover, design model also assumes design and selection of tasks and learning platforms that would allow for collection and storage of the data necessary to assess learning. The proposed framework further account for the analysis of requirements of the particular learning context, as well as the evaluation of the proposed design. Finally, in the proposed model we consider the implementation of the specific course materials necessary for achieving defined learning goals.

It should be noted that the proposed framework serves as a blueprint upon which different learning design models can be developed. For example, the various elements of student model (i.e., affect and emotion, cognition, metacognition, and social interactions) can be differently operationalized depending on the particular learning context and instructional focus or completely ignored. Similarly, the specification of task, evidence, and artifact models depends on the particular learning goal and outcomes, as well as the choice of learning technologies and software platforms. As a result, the described framework enables the development of learning design which caters to the particular learning scenario while, at the same time, accounting for the interdependency between pedagogy, technology, and data.

It is also important to realize that besides the above-mentioned dimensions of the learning process (i.e., affective, cognitive, metacognitive, and social) there is a significant number of related constructs that have a substantial effect on learning experience (e.g., learning self-regulation, self-efficacy, prior knowledge, goal orientation, motivation). However, the focus of the presented framework is on the constructs upon which the learning designer have a direct impact and which can be assessed through the available educational data. As a result, learning designs developed using this framework must be aligned with the sound pedagogical principles provided by the model educational theories.

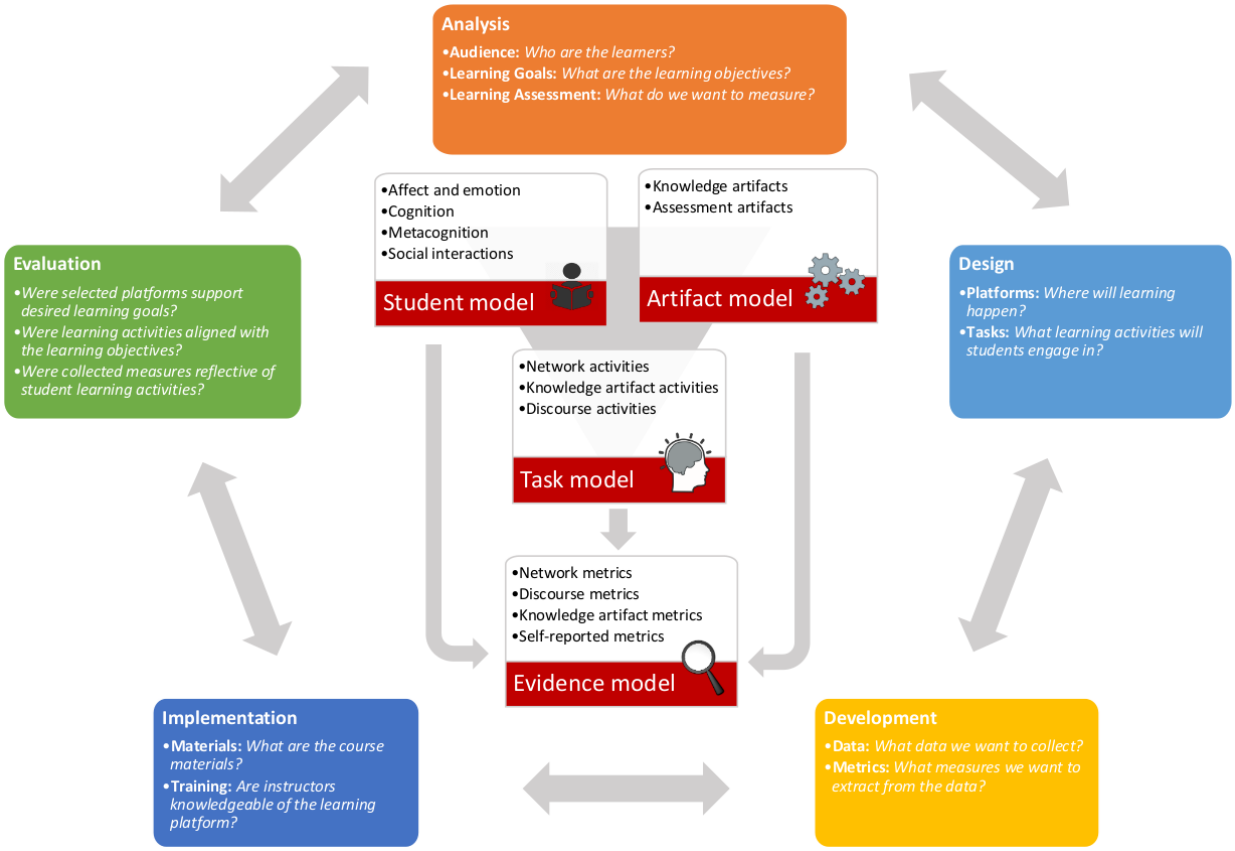

Figure 1: Digital Learning Design (DLD) Framework

3. Summary

In this paper, we introduced the Digital Learning Design (DLD) framework which enables the development of learning experiences focusing on social aspects of modern learning systems and which leverages the vast amounts of data about learning for driving instructional design and interventions. Building upon the Evidence-centered design (ECD) framework, the model provides the blueprint for defining affective, cognitive, metacognitive, and social dimension of learning experience (student model) that are operationalized in a set of learning activities (task model) and learning products and resources (artifact model) that provide evidence through a set of analytical measures (evidence model).

Being based in existing educational theories and driven by available educational data, the proposed design model departs from more traditional learning and instructional design approaches (Gagne & Briggs, 1974; Goodyear & Carvalho, 2004). Focusing on dimensions necessary to understand learning and their operationalization in a given context, the proposed model aims at bridging learning analytics and traditional approaches to building effective learning environments. As such, DLD framework allows for incorporation of (semi-)automated methods for feedback provision using tools and techniques emerging from the learning analytics research field.

4. Acknowledgement

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