Identifying design principles for learning design tools: the case of edCrumble

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Abstract. Despite the existing variety of learning design tools, there is a gap in their understanding and adoption by the educators in their everyday practices. Sharing is one of the main pillars of learning design but sometimes it is not a sufficient reason to convince teachers to adopt the habit of documenting their practices so they can be shared. This study presents the design principles of edCrumble, an online learning design platform that allow teachers the creation and sharing of blended learning designs with the support of data analytics. The design principles have been learned and extracted from a participatory design process with teachers during the conceptualization and ongoing development of the tool. Several workshops including interviews were carried out as part of a design-based research iteration process. Later analysis has been done to extract and highlight those design principles aiming informing the development of learning design tools towards better learning design adoption.

1 Introduction

Learning Design (LD) tools have been conceived to support teachers in the process of documenting their teaching practices, making their learning design ideas explicit and sharable [1][2][3]. Despite the existing variety of learning design (LD) tools, there is a gap in their understanding and adoption by the educators in their everyday practices [4][5]. Sharing is one of the main pillars of LD [6] but sometimes it is not a sufficient reason to convince teachers to adopt the habit of documenting their practices so they can be shared. Thus, one of the near-future LD challenge is reducing this gap and providing LD tools that can facilitate their adoption [5]. Moreover, despite existing proposed representations of pedagogical practice are varied, some are too specific for particular pedagogies and general approaches are not sufficiently accessible for teachers that do not have the required technical skills [7]. More intuitive visual representations of LD are needed [2]. [1] distinguishes two types of LD tools: "tools for visualizing designs" (which can be used to visualize and represent LDs) and "pedagogical planners" (which can guide and support educators in making informed LD decisions).

In this line, we have conceptualized and developed a generic LD tool that aims fitting in both categories bringing together the advantages of both types of tools. ILDE2/

edCrumble can be considered a pedagogical planner which provides an innovative visual representation of the LDs characterized by data analytics with the aim of facilitating the planning, visualization, understanding and reuse of complex LDs (available online at https://ilde2.upf.edu/edcrumble/). This study presents the design principles of edCrumble, extracted from a participatory design process with high school teachers during the conceptualization and ongoing development of the tool (Fig.1).
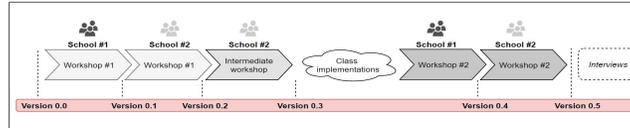

Fig. 1. edCrumble development versions regarding the participatory design workshops outputs.

2 Methodology

The development of edCrumble is part of a design-based research project which integrates several iteration cycles [8]. In this paper, we will present the design principles extracted from a complete cycle of this process which has the aim of prototyping and assessing the preliminary versions of the authoring tool. Within this cycle, 24 high school teachers from two different school communities have been involved in several participatory design workshops [9] between October 2017 and February 2018. Those teachers were participating in the context of a Teacher Professional Development program which had the aim of training teachers as designers of TEL and facilitate their inquiry practice with the collection of student data. For this reason, workshops were structured based on the following pattern: (1) **Workshop#1(2h):** teachers had to design a LD using edCrumble, with the help of the researchers (participants were asked to come to the workshop with a concrete LD idea); (2) **Class implementations (9 and 4 weeks respectively):** teachers had to implement their LDs in class and collect students' data; (3) **Workshop#2 (2h and 1h respectively):** joint reflection about the implementation phase and possible redesign (using edCrumble) of their original LDs. In the case of the second school, they had an intermediate 2h workshop because they needed more time for designing the interventions.

At the end of the workshops phase, we carried out seven semi-structured face-to-face interviews of about 45 minutes each (three teachers from School#1 and four from School#2 -due time and resources constraints we could not interview all 24). The interviews consisted of a series of open-ended questions that invited participants to share their perspectives regarding (1) how they used to design and document their educational practices before knowing our tool and (2) how was the design process they followed during the workshops using the edCrumble (see the demographics of participants and interviews questions in [10]). The resulting qualitative data were coded, analyzed and triangulated by two researchers familiarized with the data. An open coding was used for identifying the main topics, extracting design principles and highlighting those aiming at informing the development of learning design tools towards better learning design adoption. Specifically, in this paper we will focus on

describing the design principles learned and extracted from the steps' outputs from the first version of the LD tool –conceived from the existing theory of the research field and our previous studies [11][12]– to the current version (v.0.5) –developed based on the workshops' outputs during this cycle (Fig.1).

3   Design principles regarding edCrumble development process

3.1   Content and Activity centered planning

When we asked teachers "How do you usually design or prepare your courses?" they did not answer from a pedagogical point of view, instead they answered first from the content perspective – i.e. they explained how they structured the content without mentioning any pedagogical details (e.g. how the activities were designed: if they used collaborative learning or any pedagogical model…etc.). On one hand, five out of seven teachers said that they start preparing their courses examining the content that they must deliver and then filtering this content depending on the learning objectives. On the other hand, one participant said that she first starts looking on the objectives and then she plans the content. Last, one said that her preparation consists on a revision of the last year course and the re-adaptation of the content to the current objectives, as she has been teaching the same course for some years. This result is aligned with findings from related research. First, [13] state that the starting point of the design process depends on the nature of the design problem, identifying also three distinct starting points: from the learning outcomes, from a content-area focus and from a direct re-adaptation of previous LDs. Second, there is a need of describing teaching and learning activities as the "content" dimension of education is already captured in books, websites, etc. [14] for the later sharing and reuse of LDs. From our results we have observed that teachers need support to adopt and switch between these two approaches. **Implications for LD adoption:** From the above discussion we argue that it is important to foster the use of activity-centered model for capturing pedagogy beyond the content-based approach. But, at the same time, it is necessary to allow teachers to connect with their content-based approach whereas they adopting the LD aims (e.g. allow them to upload content related with their activities).

3.2   Planning tool based on a timeline

All teachers stated that they design their courses based on time using different tools: paper-based calendars or notes with dates, online calendar applications, LMS which organize the content based on time…etc. The time-based design approach used by teachers is aligned with Laurillard research insights in [6], who point out that the learning sequence is essentially time-based and that a LD does demand a plan. Other research findings also highlight the importance of the time and activity-sequence in course planning [15][3]. **Implications for LD adoption:** we argue that LD tools which act as pedagogical planners can serve users in connecting their current planning practices with LD as they can foster the LD approach adoption by offering pedagogy support and helping in taking design-informed decisions during the design process.

3.3   Facilitate the design in a community of educators

Most of teachers stated that they plan their activities alone, showing a high level of autonomy in deciding what and how to teach –results in line with [13]. The main reason is that usually there is only one teacher per topic and educational level in the school and there is no chance for co-design between teachers of the same educational context. Moreover, from the participatory workshops they highlighted the sharing and reflection phase they had during the second workshop as they really appreciated having found a space to talk with and learn from others' practices –despite they were LDs from other topics. It is known that the sharing is one of the most important aspects of LD field [15], but still there are few learning design tools that offer a social platform for exchange LDs. **Implications for LD adoption:** we argue that is necessary to have LD tools that facilitate the sharing of the created LDs between educators –creating spaces for sharing LDs and support the seeking of similar topic LDs cross education-communities (open community instead of institutions-based closed communities).

3.4   Usability matters: the Google apps effect

When we asked teachers about the weaknesses of the edCrumble, we detected what we name as the "Google Apps effect": they were continuously referring to Google apps (calendar, drive, etc.) features for suggesting usability improvements to our tool. This result suggests, as other research findings pointed out, that usability is one of the two most important things (together with the usefulness) for users adopting a new technology [1]. Teachers are used to commercial applications, and existing LD applications are far from them in terms of design appeal and usability. **Implications for LD adoption:** Aesthetics and usability are an important factor to consider in the design of LD tools to facilitate their adoption.

3.5   Increasing the utility perception solving teachers' real problems

General opinion of teachers regarding edCrumble was positive despite most of them recognized that it will be difficult for them because of lack of time (as they put LD approach at the bottom of their list of day-to-day priorities). **Implications for LD adoption:** We argue that offering LD tools that can solve some of their day-to-day problems can be a way of adopting the LD approach –as it can increase their utility perception of the tools.

4   Decisions and implications for the edCrumble development

Content and Activity centered planning: (1) The LD is based on defining a sequence of activities which are composed by tasks. User can indicate for each task: the cognitive process level associated, the students type of work, the teacher's presence and the evaluation mode; (2) Users can provide the detailed list of learning objectives and relate them with the activities; (3) Users can upload all the content necessary to

carry on their courses. **Planning tool based on a timeline:** The main element of the LD tool is a timeline where users can place their activities sequenced depending on their schedule and type (in-class/out-of-class activities). **Facilitate the design in a community of educators:** edCrumble has been integrated as an authoring tool within the Integrated Learning Design Environment (ILDE2) [16] allowing practitioners to co-edit, share, remix and comment their designs and others' designs within a community of educators. Once teachers have implemented their LDs, they can upload their evaluation, helping others understand their impact and facilitating the adaptation and reusability of their LDs (e.g. describing the challenges found or uploading links to the resulting learning analytics). **Usability matters: the Google apps effect:** edCrumble must be improved in terms of design aesthetics and usability (i.e. allowing users creating grouped activities which follow a certain time pattern as Google Calendar automatically does when you want to create the same event at the same day every week). **Increasing the utility perception solving teachers' real problems:** During the interviews we have detected some teachers' needs arising during the LD process which edCrumble can solve: (1) the need of having a syllabus of the course for sharing it with students and institution (online and printed version) –*edCrumble can generate a LD summary including a printable syllabus with the activities description, the resources' plan and a report with all the analytics generated. Also, it provides an interactive visualization of the LD to be embedded or shared with the colleagues but also with the students to help them organize their courses.* (2) the interest of sharing the plan of the out-of-class activities between the different colleagues of the same educational level to leverage the "homework" of their students in a certain period –*the tool enables users to generate aggregated LD analytics from all the LDs placed in a folder (named as community analytics), supporting teachers' decision making during the LD process not only at their individual level but also allowing the possibility of considering the colleagues' LDs analytics in their community;* (3) the need of decreasing the time needed to document their practices in edCrumble as it is an entry barrier for those teachers that do not plan but only need re-adapting LDs –*further work has to be done to improve the flexibility and connection with existing tools (LMS, calendars…).*

5   Discussion and conclusions

In this paper, we have extracted some design principles from interviews with high school teachers involved in participatory design workshops with the aim of informing the design and development of the edCrumble learning design tool. Of those design principles, we can highlight two rules which we think they can facilitate the adoption of the LD tools by educators in their daily practices: LD tools which seek to connect with teachers' existing practices and LD tools which seek for solving teachers' day-to-day problems [13]. From the first one, the following design principles are derived: *Content and Activity centered planning, Planning tools based on time, Usability matters: the Google apps effect*. And from the second one: *Facilitate the learning design in a community of educators* and *Increasing the utility perception solving teachers' day-to-day problems*. The final evaluations of ILDE2/edCrumble are part of an ongo-

ing cycle of a design-based research process. Further research is needed to evaluate the edCrumble adoption by educators and inform the redesign of the existing identified design principles for supporting the development of future learning design tools.

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