A Tool for Developing Design-Based Learning Activities for Primary School Teachers

Tilde Bekker[1(✉)], Saskia Bakker[1], Ruurd Taconis[2], and Anika van der Sanden[1]

[1] Industrial Design, Eindhoven University of Technology, Eindhoven, The Netherlands
{m.m.bekker,s.bakker}@tue.nl, anikavandersanden@gmail.com
[2] Eindhoven School of Education, Eindhoven University of Technology, Eindhoven, The Netherlands
r.taconis@tue.nl

Abstract. The paper describes the iterative design process of a tool to support primary school teachers in creating Design-Based Learning (DBL) activities. DBL is a promising approach for teaching 21st Century skills. In developing DBL activities teachers face challenges such as determining the right level of openness of the challenge and mapping appropriate learning goals to activities. The DBL tool is being developed in collaboration with three primary schools. The process has led to user requirements for such a tool, and an understanding of how to map curriculum/learning design decisions on a design process.

Keywords: Design-based learning · Learning design · Teachers · Properties of design-based learning

1 Introduction

To prepare adequately for future work life, children are more and more encouraged to learn '21st century skills' such as collaboration and problem solving. Teachers face the challenge to incorporate these skills in their lessons while also reaching classical learning goals. A suitable approach to teach 21st century skills is *Design-Based Learning* (DBL) [1, 2]: a teaching approach in which students learn by collaboratively creating solutions to open (societal) challenges by means of design. DBL allows students to work on authentic challenges, which often leads to intrinsic motivation, and increased insights into how the learned knowledge and skills can be applied in practice.

DBL has been identified as an innovation with the potential to provoke a major shift in educational practice and constitute a new pedagogy, which might transform education [4]. Although teachers are key to successful implementation of DBL, there are practical obstacles, which often prevent them from (successfully) applying DBL in their classrooms. The teacher needs to adopt a coaching-role rather than a traditional teaching role and the teaching materials usually need to be developed by the teachers themselves [3]. The development of appropriate DBL teaching materials, however, is challenging and time-consuming; teachers often are unacquainted with the concept of DBL, unable to pinpoint the appropriate level of openness of the challenge given to students, and experience difficulties matching the activities to the development of crucial basic skills (such

as mathematics or language skills). Hence, teachers need tools, exemplars and professional development opportunities [5].

This paper presents a web-based tool which supports primary school teachers in creating DBL learning activities. This DBL creation tool particularly focuses on supporting the integration of particular learning outcomes in DBL activities, and aims to achieve this by encouraging teachers to frequently and critically reflect on the DBL activities they are developing.

2   Background and Related Work

A variety of educational frameworks for developing learning materials is available, such as the curricular spider web [8]. Such frameworks can help structuring educational processes and their design. In this study, it was used for developing the practical tool for teachers to design DBL learning activities. Combining 21st century skills and traditional learning goals is a main aim of DBL. The DBL creation tool presented in this paper is grounded in a theoretical framework to lead to successful learning activities which also take into account the appropriate educational context including the student, the school, and the social and economic ecosystem in which learning activity is situated.

In order to develop a tool to support the creation of DBL learning activities in primary education it is important to ensure that the crucial components of DBL are considered. A starting point for determining the properties of DBL, was the empirical work by Gomez and colleagues who first determined properties of DBL through an extensive literature review and subsequently conducted an empirical validation of DBL characteristics in higher education [7]. We examined how the framework could be adjusted and extended for use in primary and secondary education [1].

3   Development of the DBL-Creation Tool

To develop a successful DBL-creation tool, we adopted a design research approach [8], an educational methodology which comprises cycles in which – after an initial start design – 'experimental teaching and evaluation' and 'redesign' alternate.

At the start of the development of the tool we examined how to link the structure of a design process to topics and practices normally occurring in a primary school class. We **collaborated with three schools of the PlatOOlab organization** in the design process. The second phase consisted of the following activities:

- Two design workshops with teachers and directors to examine how a DBL activity would be organised in practice and requirements for a DBL creation tool.
- An expert review by educational experts to determine the support for the teacher's reflection process.
- Observations of three teachers using the tool and observations of children engaging in the DBL activity created by the teacher.

The web-based DBL creation tool supports teachers in mapping learning design decisions to a design process. The tool provides support for (see Fig. 1): (1) handling

the openness of design activities, (2) linking a design problem/challenge to a theme and learning goals, (3) building up a set of learning activities linked to concrete learning goals, (4) selecting design methods related to design phases, (5) selecting collaboration forms for the different learning activities.
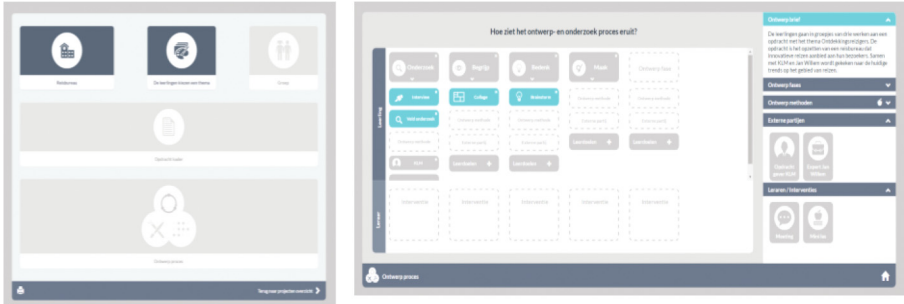

Fig. 1. The topics to be considered in the web-based tool (left). Clicking on the main blocks gives access to more detailed decisions: e.g. deciding on design phases and activities (right).

4   Conclusion and Discussion

The DBL creation tool was developed with input from practitioners and experts. We conclude with the main insights of our design process.

The importance of a good structure for a DBL creation tool. While in early explorations teachers liked a structure that followed the design process, later observations of the web-based tool showed this structure did not work well for considering the basic learning design components. A re-design has been made where a mapping is provided between the learning design components and a design process (see Fig. 2).
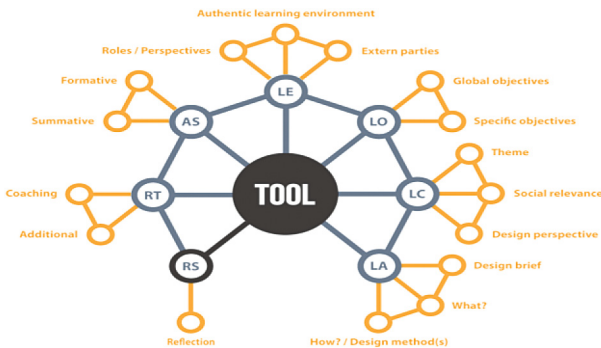

Fig. 2. The curricular spider web (according to [6], extended with components related to design-based learning activities (RS = Role Student, RT = Role Teacher, AS = Assessment, LE = Learning Environment, LO = Learning Objectives, LC = Learning Content, LA = Learning Activity).

DBL related properties that need special attention in the tool.   From the evaluation of the tool, we learned that teachers frame a design brief in terms of a specific domain and related themes. To result in a design challenge with the correct level of openness, it is important to provide a balance between open design challenges with enough guidance to ensure pupils reaching learning goals. Other support by the tool supports translating a design brief to detailed learning design decisions: such as working from a global domain, to more detailed themes, with roles and perspectives to be taken by children, and defining possible involvement of experts and other people from the school network.

How the tool supports teachers in developing DBL activities.   The tool provides good support for teachers to develop a learning activity integrated in a design process. The observations of the tool's use showed that improvements can be made to the outcome of using the tool in terms of the presentation of the learning activities: so that they are readily usable in class.

The collaboration with the three schools has been very valuable in developing an understanding of the challenges of getting DBL activities embedded in school contexts. More research is needed to determine how to adjust the amount of explanation teachers to develop high quality learning activities to the experience and affinity they have with design-based learning.

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