DFL

Levinsen, K. T., & Sørensen, B. H. (2019). Teachers' Designs for Learning Practices when Designing for Students as Learning Designers. *Designs for Learning*, 11(1), 30–39. DOI: https://doi.org/10.16993/dfl.111

METHOD

Teachers' Designs for Learning Practices when Designing for Students as Learning Designers

Karin Tweddell Levinsen and Birgitte Holm Sørensen

This paper contributes with elements of an emerging designs for learning-methodology and takes as its starting point the concept of Students as Learning Designers, which was developed by Sørensen and Levinsen and based on more than a decade of research-and-development projects in Danish primary schools (first to 10th grade). The research focussed on the integration of information and communication technology (ICT) in learning situations framed by the Scandinavian tradition of Problem Oriented Project Pedagogy (POPP), Problem Based Learning (PBL) and students' production. In recent years, the research projects that provide the theory's grounding have focussed specifically on designs for learning that constitute students as learning designers of digital subject related productions aimed at peers. These may be both multimodal communication productions and coded/programmed productions such as games and robots. This includes designs for learning that contribute to students' empowerment, involvement and autonomy within the teacher-designed frameworks that simultaneously scaffold students' subject-related inquiry, agency, reflection and learning. Research have documented that this approach constitutes arenas that support students' deep learning and mastery of both transdisciplinary and subject matter, along with acquisition of digital literacy and 21st-century competencies. As this theory and its operationalization in practice have proven useful, it makes sense to move from researching the WHY of students as learning designers to look into HOW, that is the methodology of teachers practicing designs for learning. For this purpose, we use the lens of the concepts metaphor and metonymy and interaction design theory to explore our empirical studies and previous findings and identify aspects of designs for learning practice that teachers can apply as methods when creating designs for learning aimed at students as learning designers.

Keywords: Learning design; students as learning designers; design methodology; design for learning model; teacher agency; student agency

Introduction: Designs for learning

This paper is based on our concept of Students as Learning Designers, which we developed based on more than a decade of research-and-development projects in Danish primary schools (first to 10th grade) all running over 2–3 years and involving 3 to 11 schools. All studies were conducted according to the Danish ethical research legislation at the time of the actual study.

Traditionally, approaches to and research in designs for learning have been preoccupied with teaching and designs for learning, which are considered the teacher's domain (Sørensen, Audon & Levinsen, 2010; Sørensen & Levinsen, 2015). However, since the introduction of critical theory in Danish and Scandinavian school development, schools have focused on project work and the participation of learners combined with the gradual introduction of information and communication technology (ICT). As a result, learners have gained increased influence over designs for learning categories, including objectives, content and work methods, which includes the use of ICT. In the wake of these changes, the scope of our projects shifted to include the research and development of designs for learning for students' digital-production projects (Sørensen, Audon & Levinsen, 2010). The designs for learning in question were based on the Scandinavian tradition of Problem Oriented Project Pedagogy (POPP), the core principles of which are experiential approaches to the social and material dimension, abduction, knowledge-sharing and meaning-negotiation (Illeris, 2006). The integration of ICT into POPP was based on Computer Supported Collaborative Learning (CSCL), the core principle in which is participation, which means the learners' active and social construction of knowledge and the negotiation of meaning (Koschmann, 1994). Our previous research (Sørensen, Audon & Levinsen, 2010) documented that students from first to 10th grade are able of operating as learning designers at Dale's (1997, 2000) first two levels: 1) practice and 2) organizing and planning. Our later research found (Sørensen & Levinsen, 2014) and

Aalborg University, DK

Corresponding author: Karin Tweddell Levinsen (kale@learning.aau.dk)

confirmed by means of a comprehensive project (Sørensen & Levinsen, 2015) that even young students operate at the third level, due to the teacher-designed framework, which centres the students' learning process and subject-related reflections. Based on these findings, we modified Dale's model by dividing theoretical reflection into two: practical and theoretical **Table 1**). Theoretical reflection belongs solely to the teacher's professional domain. Therefore, we consider four levels (Sørensen & Levinsen, 2014), which we regard as composing an interrelated whole: each level is a prerequisite for and interacts with the other levels.

Hereafter, we refer to Designs for learning as a professional domain aimed at students as learning designers of subject related digital productions aimed at peers, with the overall *bildung* objective that students participate and develop competences that empower them to become self-programmable members of a democratic, network-and-knowledge society. Given this, designs for learning draws on 21st-century competences (OECD, 2008) and Manuel Castell's theory of the self-programmable individual, who meets new challenges in informal ways (Castells, 2000). In addition, we understand the practice of performing designs for learning for students as learning designers as one that invites and facilitates students' empowerment and co-constructive influence (Sørensen & Levinsen, 2014a, p. 11).

Students as learning designers

Based on the understanding of designs for learning as both a domain and a practice, and in relation to both teacher and students, we expanded the scope of our latest research-and-development projects. Instead of focussing on the teacher's product-oriented designs for learning, we included process-oriented, ongoing learning-design practices that concerned both teachers and learners, and we began to explore the concept of Students as Learning Designers. The model in **Figure 1** (Sørensen & Levinsen, 2014, 2015) represents this approach.

Table 1: The four levels of the Designs for Learning model, which is our modified version of Dale's model of competence levels.

1.	Practice	teacher	student
2.	Organisation and planning	teacher	student
3.	Situated and practice-based reflection	teacher	student
4.	Theory-based reflection	teacher	

The teacher's framework (shown in orange) includes decisions regarding objectives, content, organisation and planning, learning resources and evaluation. Within this teacher-defined framework, students act as learning designers (shown in blue) and address the same categories.

This model addresses the process-entity paradox (Schoeneborn, Vásquez & Cornelissen, 2016) of how a phenomenon may be conceived as both an object/thing and as a process. Within the domain of organisational theory, Schoeneborn, Vásquez and Cornelissen addressed the paradox not as a dichotomy but as flux, meaning an ongoing flow of transformations within a field of forces in which the fluid process over time alternates with temporary stabilizations (Callon, 1992). Given this, we understand design in general, and students as learning designers in particular, as flux, meaning a mutual constitutive intertwining of the design process and the emergent production (Tosca & Sørensen, 2017). The model encompasses the complexity of designs for learning as product-process flux for both teacher and students.

In their respective PRE phases, teacher and students either alone or in collaboration, develop their framework-as-process towards a formulated, shared version of the expected way of doing things in order to achieve the expected goal. In this sense, the framework-as-process becomes a stabilized description and vision of the expected process and its subsequent outcome: framework-as-product. This stabilization acts as a temporary entity that *consists of* the elements contained within the framework-as-product. In practice, the actual performance of any design differs from the designer's expectations and intentions. When users encounter the framework-as-product, they decode and construct the realisation of the framework in their own way (Laet & Mol, 2000). Thus, during realization in the phases PRACTICE-IN-CLASS and PRODUCTION, the stabilized entity, framework-as-product, once more becomes flux, a destabilized framework-as-process in which the users and the framework mutually *constitute* each other (Barad, 2003; Orlikowski & Scott, 2008) in an iterative dialectic alternation between the expected and the actual. In the concept of Students as Learning Designers, the destabilization and ongoing co-construction of framework-as-process takes place in the teacher's PRACTICE-IN-CLASS phase and in the students' PRODUCTION phase. In the latter, the expected design of the students' digital subject related production (both multimodal communication productions and productions that are coded/programmed by the students (e.g. games and robots)) undergoes a similar process of alteration between temporary, stabilized design-as-product and

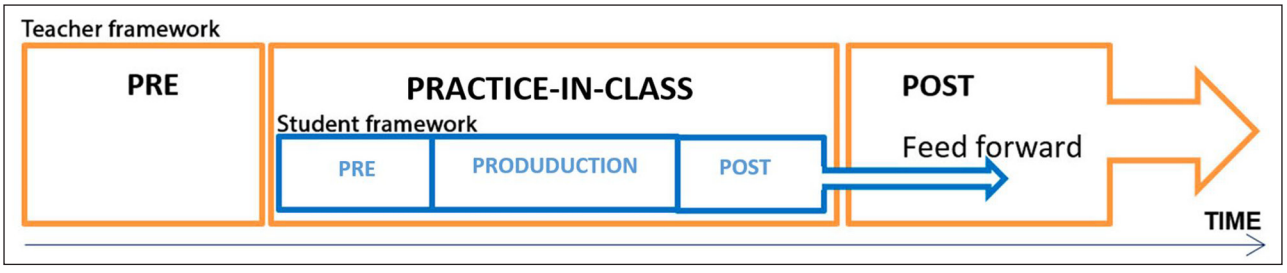

Figure 1: The relationship over time between the work of the teacher and of the students as learning designers.

design-as-process. In the POST phase, both the framework and the digital production once again become stabilized entities that can act as objects during a final evaluation and feed forward.

Theory

The operationalization of the concepts of Students as Learning Designers has proven useful, so this paper aims to contribute to the field of designs for learning studies by looking into HOW teachers practise designs for learning for students as learning designers. Using as a starting point our understanding of design as a process-product flux, our empirical studies and our previous findings, this paper aims to formulate elements of an emerging designs for learning practice-methodology for teachers to apply when creating designs for learning aimed at students as learning designers. For this purpose, we draw on the tropes metaphor and metonymy (Lakoff & Johnson 2003), which are originally defined in relation to linguistics and semiotics as identifiers of the fundamental ways that messages preform referential functions (Saussure 1916/1977; Jakobson and Halle 1956). We also draw on thoughtful and participatory interaction design theory (Löwgren & Stolterman, 2007; Sharp, Rogers and Preece, 2007) in order to identify design aspects of designs for learning practices, which may constitute elements of a methodology for design practice.

Metaphor and metonymy

According to Lakoff and Johnson (2003), metaphors transfer meaning between two domains, one of which is the target domain that is understood by being represented through the source domain. In other words, we understand one thing, or domain, in terms of another, but we do not see the two as identical. Lakoff and Johnson claimed that metaphors are hard-wired into the human brain, thus permeating all aspects of everyday life, meaning that humans fundamentally think and act metaphorically. This is why humans universally share many simple metaphors as embodied experiences and why, although complex metaphors differ significantly among cultures, they are negotiable. It also explains why metaphors are strong conveyers of communication no matter the medium. In contrast, Lakoff and Johnson (2003) define metonymy as relating to only one domain, which is the immediate subject matter. Herein, the metonymic source maps to the metonymic target, so one item in the domain stands for the whole, and accordingly, metonymy has a primarily referential function.

These tropes are, however, not limited to linguistics. In physics, Niels Bohr used the well-known image of *Rubin's vase* (source) to convey the complex meaning of his theory of complementarity (target). Rubin's vase appears either as a vase or as two profiled faces but not simultaneously. Likewise, in physics light is experienced as both particles and waves but not simultaneously. Motion pictures are rich in examples of metonymy. One often-used example is the close-up image of marching boots (source) in Sergei Eisenstein's classic 1925 silent motion picture *Potemkin*, in which the boots of a few marching soldiers represent the entire approaching army (target). Inspired by Jakobson, Claude Lévi-Strauss (1969) brought the tropes into anthropology and related the tropes to both immateriality and materiality through the concept of the embodied logic of the concrete. Roland Barthes related the tropes to the analysis of still images (1964/1977) and James Monaco brought the tropes, especially the metonymy, into film theory (1977).

Interaction design theory

In order to identify aspects of designs for learning practice, which may constitute elements of a methodology for design practice we draw on interaction design theory. Following Löwgren and Stolterman (2007), who understand interaction design as an action-oriented and context-related theory and practice, we understand designs for learning as an action-oriented and context-related practice. The teacher's design-work resembles the interaction designer's development of *operative images*, or externalisations of the design vision, which are articulated through sketches and metaphors (Löwgren & Stolterman, 2007 p. 19). According to Löwgren and Stolterman, the operative image, as it gradually becomes more detailed, also becomes operational and transforms into design specifications and eventually the final design. Taking this stance to design implies that design specifications scaffold both the development of and a meaningful experience of the design when used. That is, the specifications address the situated experience, agency and mutual learning. For this purpose, usability and user-experience become relevant. Not as measures, but as dynamic indicators that support *thoughtful design*, the reflective evaluation of the emerging design as process, mutual learning and final design, because thoughtful evaluation and decision making has to relate to an articulated and situated something. In the concretisation of usability and user-experience, we draw on Sharp, Rogers and Preece (2007) who offer pragmatic and operational descriptions, which we transform to suit the purpose of designs for learning.

We also draw on interaction design theory because this domain has adopted metaphor and metonymy in ways, which we find transferrable to designs for learning. Since the beginning of graphic user interface (GUI) design, visual metaphors have been used extensively to convey the designed and embedded ideas of digital systems and their offers for interaction to the users (Kress, 2010; Löwgren & Stolterman, 2007). One example is the classic desktop metaphor (source) that conveys to the user options for interaction and agency (target) as if they were performed at a physical desk. The metaphor also serves other purposes during interaction design processes. Kensing and Madsen (1991) recommended the use of metaphors as thinking tools in the process of developing visions. Kress (2010, p. 30) stressed the visual aspects of the metaphor and stated, *"All signs are metaphors"*. Löwgren & Stolterman (2007, p. 75) suggested that metaphors may constitute a technique to maintain a divergent thinking and avoid *"design fixation"*. Metonymy has taken on another presence in interaction design. According to Bertelsen, Breinbjerg and Pold (2007) metonymy has not been subject to much attention and they *"propose metonymy as a vehicle for users' appropriation of software"* (Ibid. p. 234). Bertelsen, Breinbjerg and Pold

argue that the metonymy helps users to break out of the boundaries set by a metaphor, as metaphors refer to known sources using the word processor as example. When meeting the word processer, the user understands the embedded idea through the typewriter metaphor. However, in order to unfold the full potential of the word processor the user has to go beyond the metaphor. Here, a metonymy (source) can address aspects of the potential (target). Likewise, Noble, Biddle and Tempero (2002) see the metonymy as useful during the design process when realizing a design vision. Here, the imagined cause, effect, or attribute (source) refer to the yet not existing final design (target).

As a methodology-based practice, designing for students as learning designers involves a pedagogy and learning dimension along with a design dimension. In the following sections, we first address the pedagogy and learning dimension and then the design dimension of designing for students as learning designers.

Designing for Students as Learning Designers: The Pedagogy Dimension

The teacher's PRE phase is aimed at the framework-as-product and frames both teacher and student agency. The framework-as-product is shared with colleagues, students and parents via the schools' digital platforms. In relation to students' agency, the framework-as-product formulates subject-related or transdisciplinary learning objectives and content based on the teacher's professional knowledge and experience and related to the specific school-level, school context and culture. In addition to the objectives, content, organisation and planning, the framework includes choices about learning resources and evaluation; plans, concepts and the expected arena for teaching and learning; modalities, learning and production resources and product forms and presentation. Within the framework, the students may design and produce a variety of subject related digital products such as games, websites, digital video, quizzes, complex multimodal learning objects, digital books, robots, simple PowerPoint presentations etc. However, because the framework constitutes an arena in which action and processes are expected to take place, the framework-as-product's design must meet certain specifications to constitute a field of possibilities in which students become constituted as learning designers. The framework-as-product must scaffold the following.

- The students' PRE phase: Invite students to imagine the digital production, to set goals, to plan content and workflow and to orchestrate their individual learning processes.
- The students' PRODUCTION phase: Invite students to explore the subject matter, to experiment and inquire, to evaluate consecutive temporary stabilizations of the digital production against the stabilized objectives and to reflect and modify their practice accordingly.
- The students' POST phase: Invite students to evaluate the quality of their work in relation to the design process, the product and the subject-related learning outcome. The POST phase may also address feed forward in relation to future individual learning efforts.

In practice, the teacher's framework-as-product provides the initial stabilization of intentions and structuring without which it is impossible for the teacher to recognize the emerging divergences between the students' expected and actual practices and react accordingly (Christensen & Kreiner, 1991). Thus, the teacher's PRACTICE-IN-CLASS phase becomes contextualized, dynamic, process-oriented designs for learning. In relation to the teacher's agency during this phase, the framework-as-product must meet specifications that aim to produce an arena for the teacher's expected dynamic process management of the students' learning, thinking and agency as learning designers. This includes designing the expected scaffolding of the students' dynamic process (blue in **Figure 1**), including how and when to present aspects of the subject matter; how to introduce the digital production project; how to engage and involve students; how to convey objectives; and when and how to evaluate temporary, stabilized versions of the digital production (process-evaluation). However, the framework must also include the specifications for the teacher's expected process management of the overall process (orange in **Figure 1**) in order that the teacher be able to make informed changes in the original framework during actual teaching and learning processes (Sørensen & Levinsen, 2014). Process management addresses the WHEN and WHY of shifting between teacher roles (instructor, knowledge provider and facilitator); the WHEN and HOW of performing quality assurance, including teacher-initiated process-evaluations; and the HOW of performing final evaluations in the students' POST phase. Process management also addresses planning timeslots during which the teacher observes students' practice, asks open, dialogue-supporting questions to detect students' rationales for what they are doing, and reflects on emerging divergences between the expected and actual performances and outcomes and reacting accordingly.

In the framework-as-process, key practices for teachers include initiating open, reflection-supporting dialogue with students and using the following principles: reducing teacher-centred time; providing just-in-time delivery of subject-related information and instruction to students; and the principle that students will ask a child before a grownup. In addition, to make informed choices about how and whether to intervene, teachers must identify whether students' performed practices represent idleness or approaches that differ from the expected but still are productive in the context (Sørensen & Levinsen, 2014; Levinsen, 2017).

Designing for Students as Learning Designers: The Design Dimension

The previous section presented some important pedagogic specifications that a design for learning must meet in order to frame students as learning designers. Following Löwgren and Stolterman (2007), we understand designs for learning as an action-oriented and context-related theory and practice. Additionally, we see similarities between the teacher as learning designer and the thoughtful interaction designer. Thus, the above-mentioned specifications address the expected framing of the agency of both the teachers (orange in **Figure 1**) and the students (blue in **Figure 1**) within the designs for learning. However, the

teacher must also consider how to represent, or following Löwgren & Stolterman (2007), *articulate* these specifications as design elements that the students can easily decode and in which the immediate, unavoidable divergence between the expected and actual performance does not become too large.

Following this, and according to Sharp, Rogers and Preece (2007) the design of representational forms address usability and user-experience requirements that the design must meet. Sharp et al. suggested that designing for user experience means providing designs that are helpful, motivating, rewarding, supportive of quality, enjoyable and informative. These requirement have to be transformed and adapted to suit a design situation, where a teacher designs an arena and a framework that empowers students to act as learning designers. The teacher's design is considered

- Helpful and informative, when the students are guided towards empowerment.
- Motivating, when the students draw on their own capacities and experience inner motivation.
- Rewarding and enjoyable, when the students experience that learning the subject matter is worth the effort.
- Supportive of quality, when the students gradually acquire competences that allow them to self-evaluate and to participate in discussions and reflections on the quality of their work.

Being a thoughtful learning designer then implies that the teacher reflects on what it actually means to strive to design for a positive students' learner experience under the constraints and options provided by the expected actual learning situation. It also implies that the teacher thinks of what kind of indicators or signs to look for to remain informed and capable to reflect, act, and design or redesign based on the actual learning situation as it emerges. Sharp et al. suggest six pragmatic, operational usability goals: effectivity, efficiency, utility, learnability, memorability and safety, which we have transformed and adapted into design requirements in our context.

- In terms of effectiveness, the designs for learning are supposed to guide the students towards empowerment. Empowerment in this context is a process of change. In our research we have found signs that articulate this change, such as types of student questions that move from "help us", "what should we do now?" to reflective inquiries regarding the subject matter; the students ability to deal with complexities; the length of time where the students focus on their work.
- Efficiency and learnability. Efficiency is usually about saving time. Designing for students as learning designers is not about saving time. It is about re-allocating time from the teacher centred use of time, e.g. introductions and disciplinary activities to the student centred (and empowering) activities. Efficiency is therefore paired with learnability, as a sound balance between teacher and student centred activities implies that the students do not have to spend long time (efficiency) listening to the teacher's introductions in order to grasp the idea (learnability).
- Utility is the question whether the product provides the right kind of functionality. Transformed to designs for leaning this means that the students have access to relevant resources in the learning context.
- Memorability refers to how easy it is to remember the use of a product. Transformed to designs for learning this means that the framework supports the students' memory of the embedded didactic idea. The signs to look for are whether the students remember from time to time, what they are doing, why they are doing it and how to go about doing it. Low memorability means that the teacher has to recall the basics, thus positioning the students as reactive rather than empowered.
- Safety is about protection from dangerous or undesirable conditions. In relation to designs for learning, students may be exposed to various internet hazards such as bullying, abuse and fake information. At present, protection is addressed from two positions, either prohibition or *bildung* (general education). We argue for *bildung* and for providing the students with knowledge and means for self-protection as part of any designs for learning.

Designing for the teacher's agency

For the teacher to meet the requirements regarding framing the process management of students' PRACTICE-IN-CLASS, the metaphor trope becomes a useful design option.

One useful metaphor in designing for students as learning designers is teacher-as-project-manager, because project management offers concrete examples of how to manage processes and act in fluid environments (framework-as-process) that often appear abstract from the teacher's point of view. When acting as teacher-as-project-manager, the teacher acts like (but not identical to) a project manager who is managing a research-and-design team (the students) that is exploring a subject and related objectives through a design process (the digital design process) aimed at 'professional' dissemination (the digital product). Thus, using metaphors may help to identify methods for handling the expected versus actual emergence of the entity-process paradox as flux. Using metaphors may also help to transfer and adapt project- and process-management elements into the pedagogic framework in accordance with requirements. Following this line of thought, the teacher's design and orchestration of key activities in time may rely on design thinking and may imitate various design models, depending on the actual need. At present, one popular design model used in Danish primary school for this purpose is the *Design thinking model* (EMU, 2018). This linear model (**Figure 2a**) holds five successive phases: Empathize (explore the challenge and formulate the problem); Define (qualify the problem formulation through further exploration and feedback); Ideate (develop several ideas); Prototype (physical representation and feedback); Test (test and revise). Unlike the original waterfall model, iteration is only present in the test phase. Another model that is frequently used is the *Design to improve life-compas* (Design to improve life education 2018) which represents a circular iteration through four phases: Prepare; Understand; Design; Finish for each

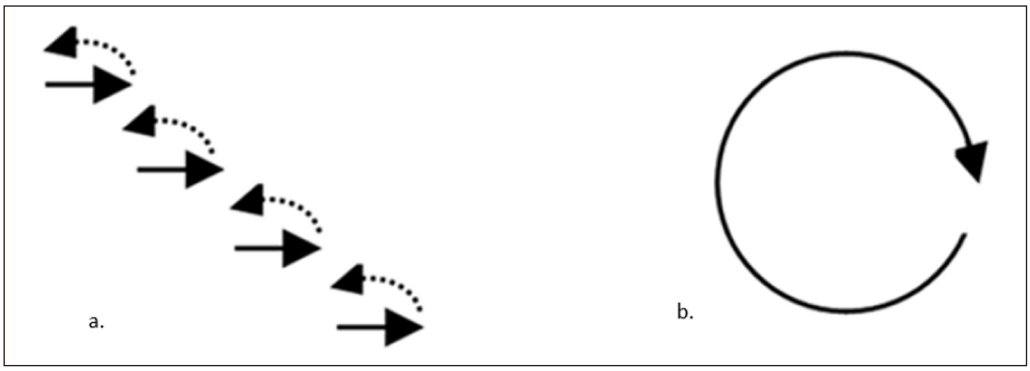

Figure 2: Shows the structure of the *Design thinking model* **(a)** and the circular *Design for life-model* **(b)**.

stage of the design process from idea, sketching, prototyping to realization (**Figure 2b**).

The point is that the teacher's framework is modelled using design models as metaphors for the structure of the learning process. This may help the teacher to decide on deadlines for deliveries (temporary stabilizations) and to align process-evaluations to the stages of progress towards the final stabilization within the chosen design model, as different temporary stabilizations demand different approaches. Temporary stabilizations may be ideas, conceptualizations, sketches, various stages of prototyping and the final product (Sharp, Rogers & Preece, 2007). Using design models as metaphors may also help the teacher and students to let go of the often-seen fixation on the final design product at the expense of the process and temporary stabilizations and to recognize the importance of temporary stabilizations to producing relevant feedback, feed forward and learning. As we have discussed elsewhere the teacher-as-project-manager in fluid environments (Levinsen, 2013) and the use of design models as metaphors for adapted frameworks (Tosca & Sørensen, 2017), in the following, we will concentrate on the design dimension in relation to the students' agency (shown in blue in **Figure 1**).

Designing for the students' agency – initial framing

The purpose of designing for the students' agency is to provide scaffolding for the expected empowerment of students as learning designers. According to Latour (1992), via design, it is possible to distribute tasks to material and immaterial artefacts. In the concept of the Students as Learning Designers, the task is scaffolding and the artefact or stabilized entity is the framework-as-product, into which the teacher's intentions are coded in order to frame the expected patterns of agency. These codes equal Norman's affordance concept, which '... refers to the perceived and the actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used' (Norman, 1988, p. 9). We understand that the actual affordances, as produced by the designer, represent or code intentions and expectations. In other words, they invite certain patterns of agency rather than others. Actual affordances are stabilizations that belong to design-as-product. In addition, we understand the perceived affordances as temporary stabilizations that belong to the design-as-process when the design interacts with users. The designer must aim to provide strong clues that suggest a range of possibilities to the user, even though, as mentioned previously, the realisation of a design cannot be determined or controlled. As both Wenger (1998) and Dourish (2006) claimed, learning and agency cannot be designed, only designed *for*. Given this, the questions include the following: What kind of scaffolding practices are to be represented as designed affordances in a design for learning, in order to invite students to act as learning designers? How can teachers as learning designers meet the above-mentioned requirements of usability and user experience?

In our research, we found that the main drivers of students' engagement (empowerment, motivation and stamina) align with the requirements for usability and user experience. Thus, students' engagement and empowerment are driven in an arena where informally acquired ICT literacy and play competencies become legitimate in the school context (Sørensen, Audon & Levinsen, 2010; Sefton-Green, 2006; Skovbjerg, 2018). In addition, we have identified a series of competences acquired through play that are relevant to transfer, as they align with the competences needed by students acting as learning designers (**Figure 3**).

The teacher's framework must afford the students' transfer of these informal ways of knowing and doing things (Sørensen & Levinsen, 2018) in accordance with the requirements. Metaphors support usability and user experience, as they build on recognition of similarities between domains, which in our case include the transfer of ways of doing things. In other words, the students are inspired to think, for example, '*This can be done just like we did ... when we played...'*. Consequently, designed affordances for transfer can be represented as metaphors drawn from various forms of play, including role-playing and construction games. In this way, experiences from outside school form the source domain that represents and concretize the more abstract target domain inside school.

Students' motivation and self-determination

We found that the drivers in terms of students' motivation and stamina during digital production processes were their feeling of being free to make their own choices, take ownership and construct ideas or design visions of what their digital product might become (Sørensen, 2002; Sørensen, Audon, & Levinsen, 2010). We found that children especially value the following.

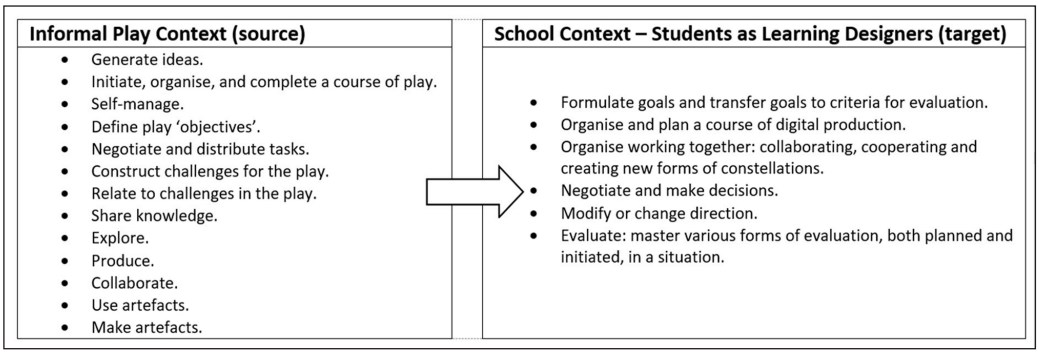

Figure 3: Informal competences compared to school competences. Based on Sørensen, Audon, and Levinsen (2010).

- Agency – to do things themselves and to be in control
- Challenges – to be faced with problems to be solved
- Making (reification) – to create, produce and experiment
- Sociality – to communicate and socialize in communities
- Performance – to gain recognition and enjoy respect
- Self-interpretation – to explore and try out their identity, including gender
- Enjoyment – to engage in emotionally and bodily pleasurable situations

These values correspond with Deci and Ryan's acknowledged Theory of Self-Determination (2012) and mean that the framework must specify how to afford the students' imagination and creativity. Designing for visions of something not yet there, builds on students' ability to imagine, and therefore the metonymy becomes relevant as the metonymy can be used to spark the students' imagination by addressing the target (the emergent digital production) in terms of source elements (selected examples, clips or details). Based on the inspiration from the metonymy, the student's digital production of learning objects may, as mentioned above, turn in many directions. They design and produce subject related games, websites, digital video, quizzes, complex multimodal learning objects, digital books, robots, simple PowerPoint presentations etc. If for example the production is a computer game, the students may imagine the target thus: *'If we make something like [the suggested source detail] … then, if we make a level in the game at which … and we have a monster … then, we could …[the imagined design target]'*. Consequently, designed affordances for inviting imagination can be represented by metonymy. However, metonymy and metaphor become intertwined in the teacher's design-as-process. The metonymy inspires the WHAT; the metaphor inspires the HOW; and the subject matter itself delivers the WHY and the content.

Returning to the original model (**Figure 1**), this means that the design dimension contributes to solving some of the pedagogic design questions, including, the following: How to introduce the project to the students? How to engage and involve students? Presenting the project in terms of metaphors invites transfer of the students' play competences and multimodal and digital literacy to become the drivers of engagement and empowerment. Presenting the production in terms of metonymy invites the students' interest, imagination, creativity and knowledge to become the drivers of motivation, stamina and empowerment. Of course, both metaphor and metonymy must take into account the students' level and the learning objectives regarding the academic content.

Designing for the students' agency – framing the flux

Once the students begin to work in their PRE phase, the teacher's framework-as-product transforms into framework-as-process. This means that the students need dynamic scaffolding to supplement the initial scaffolding in order to maintain status as empowered the designs for learning in process. In addition, the scaffolding directs the quality of the process toward meeting the learning objectives and toward developing and qualifying the students' informal competences.

In our research, we found that key elements of dynamically scaffolding the ongoing mutual constitution of design-as-process and framework-as-process are process-evaluations and the students' ownership of the learning objectives (Sørensen & Levinsen, 2014; Sørensen & Levinsen, 2014a). We found that students often did not take ownership of learning objectives when the teacher presented them in teacher language. This was also the case if the teacher tried to translate teacher language into student language. In both cases, the objectives remained in the teacher's domain, and we found that the students had difficulty figuring out what to do and remembering it. Often the teacher-formulated objectives did not work as affordances in the learning design, and instead of being empowered, the students remained reactive and frequently asked, *'What are we supposed to do?'* or *'Can you help us?'*. Likewise, the teacher remained instructive and disciplinary, telling the students what to do and correcting errors. In our latest projects, we experimented by collaborating with the teachers on dialogue-oriented approaches in which the students participated in formulating the objectives in their own language. These objectives took on multiple forms and functions (Laet & Mol, 2000). They became affordances that helped the students to remember and supported them in figuring out what to do. They also became design requirements that the students used as criteria for evaluating the quality of their work during the PRE, PRODUCTON and POST phases. Below, we demonstrate how the teacher can design for empowerment and scaffolding-as-process using class dialogue. The sample dialogue is based on metaphor, metonymy and explorative inquiry that invites the class no matter age to draw on its informal competences,

knowledge, imagination and creativity, thus taking on responsibility within the teacher's framework.

The first grade remediates known fairy tales into multimodal representations with fifth grade as their target group. The subject is Danish as a native language. The general and subject-specific objectives are 1) learning to negotiate content and means of expression in groups, 2) playing and experimenting with language, genre, multimodality and digital production (Danish Ministry of Education, 2009). The teacher asks, *'Can you help me to list some fairy tales?'* The class suggests several examples including horror stories, which do not belong to the genre. This leads to improvised questions from the teacher: *'Are there some of these that are not fairy tales? How do we tell the difference?'* The class suggests that fairy tales are old and horror stories are new because they contain things from the present that do not occur in fairy tales. When asked, *'What do fairy tales have in common?'*, the class suggests that they often begin with *Once upon a time* and ends with *They lived happily ever after*. There is usually a princess, a hero, a witch and a dragon. The hero has to fight evil to win the princess. The hero, who is always a man, has a helper who can be a person, an animal or a thing that can talk and take action. At this point, the teacher delivers a short (just-in-time) introduction to narrative structure that is based on the metaphor *the storytelling bridge*, and the teacher includes and structures some of the class's suggestions. The bridge is divided into scenes: beginning, end and 'something in the middle' (the hero's challenge). Then the teacher asks, *'If fifth grade is to understand our productions, what will that take?'* The students identify the following as important: *'Others can tell who is who; others can see how they feel; others can see where they are; and others can understand what's going on'*. On one hand, these suggestions represent children's language of the genre categories: characters, emotions, place, narrative structure and logic. On the other hand, they represent design requirements for the digital production. In the final round before the students begin to work on their own, the teacher asks about the requirements (without mentioning the word): *'How do we make sure that others can see and understand …?'* This inquiry begins with metonymy and invites the students to draw on what they know within the domain (source) about storytelling and multimodal means of expression in order to imagine elements of the future product (target). The students suggest solutions that align with affordances in terms of props, use of camera and sound and staging dialogue and scenes. The teacher asks, *'What else could you do to find out?'* Students suggest solutions that align with testing, including showing things to others and learn from how they react and what they think.

Scaffolding as process – transforming the objectives into affordances

We found that inviting the students to co-construct the requirements transformed the original formal objectives into affordances that functioned as scaffolding-as-process, which helped the students to remember what they were doing and why and to maintain and modify their collaborative process and develop their emerging design. The objectives also transformed into evaluation criteria that emerged in multiple representations that were used throughout the students' PRODUCTION phase. By turning requirements into questions, the students provided themselves with a lens through which to evaluate the quality of their design at various stages of temporary stabilization. Early in the process, when sketching storyboards and scenes, they asked themselves, *'Can others tell who is who and where they are?'* After materializing something, or during the teacher-initiated process-evaluations, they would ask peers, *'Can you tell who is who and where they are?'* Then, the peers would reflect and provide feedback based on the same criteria, suggesting feed forward, including *'If you take a close-up of Hans holding the stick … Then we understand what's going on.'* In the POST phase, the final evaluation took place, with fifth grade as the target group. The class had prepared a set of summative questions based on the evaluation criteria. They were afraid that the fifth graders would avoid providing genuine feedback in order not to hurt the younger students' feelings. They showed their production and asked the fifth graders if they could recognize the fairytale and retell the story as presented. They also selected problematic passages and asked what was going on and which characters were in it. Again, this provided useful insights and learning. In the POST-phase evaluation, the teacher let the students conduct as much of the process themselves as possible without interference. However, it is always the teacher's responsibility to intervene if necessary and to conduct the final summary of what has been learned.

Conclusions

In this paper, we outlined the concept of Students as Learning Designers in order to look more deeply into the methodology embedded in the teachers' practice of designing for students as learning designers. Using the lens of metaphor and metonymy and interaction design theory, we reflected a decade of our empirical research-and-development studies. In doing so, we dealt with the entity-process paradox, which in the domain of design applies to the distinction between and intertwining of *design-as-product* and *design-as-process*. In accordance with interaction design, we suggested affordances that apply to the teacher's design practice regarding design as both product and process.

We found that the initial affordances that are constructed based on metaphors and incorporated into the teacher's framework-as-product support both usability and user experience, as they draw on the students' recognition of similarities between domains. Guiding the students' image of the working process toward the domain of play empowers the students to transfer their informal knowledge into the school context from the beginning. Likewise, metonymy draws on the students' informal digital and multimodal literacy. Thus, guiding the students' image of their design product toward examples within the domain of multimodal productions invites the students' creativity and intrinsic motivation to work toward the imagined goal. Within the framework, the students imagine different design options such as games, robots, websites, online books, quizzes, digital video and PowerPoint presentation.

Regarding the teacher's practice-in-class, we found that teachers and students' co-creation of learning objectives provided strong dynamic affordances. Therefore, we suggest that the teacher's design effort regarding dynamic affordances be directed toward designing a framework for in-class dialogue. The co-created objectives, which were formulated in student language, took on multiple appearances for the students, including design requirements for the multimodal digital production, criteria for both self-evaluation and peer evaluation of the quality of the process and the emerging production and criteria for summative final peer evaluation. Thus, these objectives, which we call *goal-criteria* (Sørensen & Levinsen, 2015), became dynamic affordances that helped the students to figure out and remember what to do.

This methodological approach to learning and designs for learning may appear complex. However, in our research, our experience has been that teachers working in teams and focussing on designing frameworks for students as learning designers gradually adapt their practices to the method and begin to iteratively explore, reflect on and share their experiences as thoughtful learning designers.

Competing Interests

The authors have no competing interests to declare.

References

Barad, K. (2003). Posthumanist performativity: Toward an understanding of how matter comes to matter. *Signs*, *28*(3), 801–831. DOI: https://doi.org/10.1086/345321

Barthes, R. (1977/1964). "Rhetoric of the Image." In: *His Image-Music-Text: Essays. Selected and Translated by Stephen Heath*, 32–51. London: Fontana, 1977. (Originally published in 1964).

Bertelsen, O. W., Breinbjerg, M., & **Pold, S.** (2007). Instrumentness for Creativity Mediation, Materiality & Metonymy. *C&C '07 Proceedings of the 6th ACM SIGCHI conference on Creativity & cognition*, 233–242. DOI: https://doi.org/10.1145/1254960.1254992

Callon, M. (1992). The Dynamics of Techno-Economic Networks. Coombs, R., Saviotti, P., & Walsh, V. (Eds.), *Technological Change And Company Strategy: Economic and Social Perspectives*. London, San Diego: Harcourt Brace Jovaovich.

Castells, M. (2000). *End of millenium. Information age: Economy, Society and Culture*. MA, USA: Wiley-Blackwell.

Christensen, S., & **Kreiner, K.** (1991). *Projektledelse I løst koblede systemer: Ledelse og læring I en ufuldkommen verden*. København: Jurist- og Økonomforbundets Forlag.

Dale, E. L. (1997). *Pedagogik og professionalitet*. Oslo: Ad Notam Gyldendal A/S.

Dale, E. L. (2000). Professionalisering og læring i organisationer. I: P. Andersen og P Frederiksen (red.): *Innovation, competence, læring*. Frederiksberg: Dafolo.

Danish Ministry of education. (2009). *Fælles mål 2009 – dansk*. Faghægte 1. København: Undervisningsministeriet.

de Laet, M., & **Mol, M.** (2000). The Zimbabwe Bush Pump: Mechanics of a Fluid Technology. *Social Studies of Science*, *30*(2), 225–263. DOI: https://doi.org/10.1177/030631200030002002

de Saussure, F. (1977/1916). *Course in general linguistics*. (Translated by W. Baskin). Glasgow: Fontana/Collins. Originally published in 1916.

Deci, E. L., & **Ryan, R. M.** (2012). Motivation, personality, and development within embedded social contexts: An overview of self-determination theory. In: Ryan, R. M. (Ed.), *Oxford handbook of human motivation*, 85–107. Oxford, UK: Oxford University Press. DOI: https://doi.org/10.1093/oxfordhb/9780195399820.013.0006

Design to Improve life education. (2018). http://designtoimprovelifeeducation.dk/da/content/design-improve-life-kompasset accessed 21 September 2018.

Dourish, P. (2006). Re-space-ing place: "place" and "space" ten years on. *CSCW '06 Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work*, 299–308. NY: ACM. DOI: https://doi.org/10.1145/1180875.1180921

EMU. (2018). https://www.emu.dk/modul/design-thinking-i-projektopgaven accessed 21 September 2018.

Illeris, K. (2006). *Læring*. Roskilde Universitets Forlag.

Jakobson, R., & **Halle, M.** (1956). *The Fundamentals of Language*. The Hauge: Mouton.

Kensing, F., & **Madsen, K. H.** (1991). Generating visions: Future workshops and metaphorical design. In: Greenbaum, J., & Kyng, M. (Eds.), *Design at Work: Cooperative Design of Computer Systems*, 155–168. Hillsdale, NJ: Lawrence Erlbaum.

Koschmann, T. D. (1994). Toward a Theory of Computer Support for Collaborative Learning. *The Journal of the Learning Science*, *3*(3), 219–225. DOI: https://doi.org/10.1207/s15327809jls0303_1

Kress, G. (2010). *Multimodality – A social semiotic approach to contemporary communication*. London and New York: Routledge.

Lakoff, G., & **Johnson, M.** (2003). *Metaphors we live by*. London: The university of Chicago press. DOI: https://doi.org/10.7208/chicago/9780226470993.001.0001

Latour, B. (1992). Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts. Bijker, W. E., & Law, J. (Eds.), *Shaping. Technology/Building Society. Studies in Sociotecnical Change*, 225–258. Cambridge Mass.: MIT Press.

Levinsen, K. (2013). Didaktisk design i netværksskolen – at sætte rammer for hverdagens praksis. Garde-Tschertok, D., & Gottlieb, A. (Eds.), *Netværksskolen*. København: Akademisk Forlag.

Levinsen, K. (2017). Didaktisk forstyrrelse – erfaringer fra et samarbejde mellem forsker og praktikere. *Paideia*, *13*, 17–26.

Lévi-Strauss, C. (1969). *The Raw and the Cooked*. London: Cape.

Löwgren, J., & **Stolterman, E.** (2007). *Thoughtful interaction design: A design perspective on information technology*. The MIT Press. DOI: https://doi.org/10.7551/mitpress/6814.001.0001

Monaco, J. (1977). *How to Read a Film*. Oxford University Press: New York.

Noble, J., Biddle, R., & **Tempero, E.** (2002). Metaphor and Metonymy in Object-Oriented Design Patterns. *Australian Computer Science Communications*, *24*(1), 187–195.

Norman, D. (1988, 2001). *The Design of Everyday Things*. New York: Basic Books.

OECD. (2008). *21st Century Skills: How ca you prepare students for the new Global Economy?* https://www.oecd.org/site/educeri21st/40756908.pdf accessed 10 Jan. 2018.

Orlikowski, W. J., & **Scott, S. V.** (2008). 10 sociomateriality: challenging the separation of technology, work and organization. *Academy of Management Annals*, *2*(1), 433–474. DOI: https://doi.org/10.5465/19416520802211644

Rogers, Y., Sharp, H., & **Preece, J.** (2007). *Interaction Design: Beyond Human – Computer Interaction*. 2rd edition. Chichester, United Kingdom: John Wiley & Sons Ltd.

Schoeneborn, D., Vásquez, C., & **Cornelissen, J.** (2016). Imagining organization through metaphor and metonymy: Unpacking the process-entity paradox. *Human relations*, *69*(9), 915–944. DOI: https://doi.org/10.1177/0018726715612899

Sefton-Green, J. (2006). *Literature review in informal learning with technology outside school: A report for nesta futurelab*. Bristol: NESTA Futurelab.

Skovbjerg, H. M. (2018). *About Play*. Aarhus: Aarhus Universitetsforlag.

Sørensen, B. H. (2002). Børnene nye læringsfærdigheder – didaktiske perspektiver. Sørensen, B. H., Jessen, C., & Olesen, B. R. (Eds.), *Børn på nettet. Kommunikation og læring*. København: Gads Forlag.

Sørensen, B. H., Audon, L., & **Levinsen, K.** (2010). *Skole 2.0*. Aarhus: Klim.

Sørensen, B. H., & **Levinsen, K.** (2014). *Didaktisk design – digitale læreprocesser*. København: Akademisk Forlag.

Sørensen, B. H., & **Levinsen, K.** (2014a). Digital Production and Students as Learning Designers. *Designs for Learning*, *7*(1), 54–73. DOI: https://doi.org/10.2478/dfl-2014-0011

Sørensen, B. H., & **Levinsen, K.** (2015). Evaluation as a Powerful Practice in Digital Learning Processes. *Electronic Journal of E-Learning*, *13*(4), 290–300.

Sørensen, B. H., & **Levinsen, K.** (2018). *Den hybride skole*. Aarhus: Klim. To be published in ultimo 2018.

Tosca, S., & **Sørensen, B. H.** (2017). Spændingfeltet mellem proces og produkt. Sørensen, B. H., Levinsen, K., & Skovbjerg, H. M. (Eds.), *Digital produktion – deltagelse og læring*, 27–44. København: Dafolo.

Wenger, E. (1998). *Communities of Practice – Learning, Meaning, and Identity*. Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511803932

How to cite this article: Levinsen, K. T., & Sørensen, B. H. (2019). Teachers' Designs for Learning Practices when Designing for Students as Learning Designers. *Designs for Learning*, 11(1), 30–39. DOI: https://doi.org/10.16993/dfl.111

Submitted: 02 May 2018 **Accepted:** 08 January 2019 **Published:** 05 April 2019

Designs for Learning, is a peer-reviewed open access journal published by Stockholm University Press.

OPEN ACCESS