

The complexity of educational design research

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Abstract To enhance the relevancy of educational research findings, a research approach known as design research has gained influence. This approach is described as complex, but no satisfying explanation of this complexity has been provided. In this paper we question *why design research is complex by nature*. Following a longitudinal case conducted by the third author, we argue that design research in educational sciences (EDR) necessitates balancing three different motives and accordingly, three epistemic practices: (1) educational research, (2) educational design, and (3) educational change. An analysis of challenges in the case study shows the difficulty for the EDR researcher to understand and disentangle underlying motives during the research process, but also the difficulty of dealing with different, easily conflicting research positions, resources, quality rules, time frames, audiences, and products. The identification and description of three epistemic practices offers a framework with which difficulties of EDR can be understood and anticipated.

Keywords Design research · Methodology · Complexity · Epistemic practices · Activity theory

Educational research has been criticized for its lack of impact on practice. According to the National Research Council of America (2002, as cited in Broekkamp and Van Hout-Wolters 2007) there is a ‘sharp divide between educational research and the practice of education in schools and other settings’. Some have argued that this is due to a lack of communication of the results of research (e.g., Tenkasi and Hay 2004), others argue that it is caused by a primary concern with theory-oriented research that can be seen within most of research methodology in the social sciences up till the last decade (Verschuren and Hartog 2005).

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As a possible solution to bridge the gap between educational research and practice, a new methodological approach was introduced focusing on so-called ‘design experiments’ (Brown 1992) and ‘design science’ (Collins 1992). Since then, this approach has received growing attention (Sandoval and Bell 2004). Other names have been introduced such as design experimentation, design-oriented research and design-based research (Design-Based Research Collective 2003). One of the main motives for initiating design research in educational sciences stems from the desire to increase the relevance of research for educational policy and practice (Gravemeijer and van Eerde 2009). As Engeström (2007) noted, design research in educational sciences has shifted the focus of attention from isolated individuals to entire learning environments or learning ecologies. Along with this shift, researchers have started to realize pedagogical interventions in educational practices in order to study in situ the workings of particular theories. Collins et al. (2004) mention that design research meets the needs of educational research to address theoretical questions about learning in context, that is, to study learning phenomena in the real world and go beyond narrow measures of learning.

Despite being a promising method by increasing the relevancy of research outcomes, design research has its own idiosyncrasies, much of which still need to be uncovered. Collins et al. (2004) point to the difficulties arising from the resistance of real-world situations to experimental control, the large amounts of data arising from a need to combine ethnographic and quantitative analysis and comparing across designs. Engeström (2007) has recently criticized discourse on design research that, according to him, tacitly assumes that ‘researchers make the grand design, teachers implement it (and contribute to its modification), and students learn better as a result’ (p. 369). Though several design studies are indeed presented in such a top-down and linear view (clear and distinctive roles, the researcher determining the ‘end points’ for the design experiment), we believe that a lot of design researchers in praxis act differently. In most reports of design studies, researchers refer to their exploration of contextual contingencies of the field and to their efforts towards agency and ownership by the professionals who are directly involved in educational change (e.g., Cobb et al. 2003). These efforts move beyond the classical research tradition that assumes laws of linearity in research and objectivity of the researcher.

However, it has been pointed out that design research is an inherently complex research approach (Collins et al. 2004). The Design-Based Research Collective (2003) stressed that the design researcher faces an important tension: the coupling of empirical research to design, and complications which arise from sustained intervention in messy situations. In a similar vein, Engeström (2007) describes interventions as ‘contested terrains, full of resistance, reinterpretation and surprises from the actors’ (p. 369).

In this paper we question *why design research in educational sciences is complex by nature*. Understanding the complexity of educational design research (referred to as EDR in the remaining of this article) is a first step in arriving at appropriate methodologies. The answer we provide to the question in this article consists of three claims. First, we argue that there are three different motives embedded in design research, namely: conducting research, creating a usable design, and establishing sustainable change in the field. Second, we argue that these motives represent three different epistemic cultures, that is, three different cultural traditions regarding what are appropriate ways of reasoning and what results are to be produced. Third, we argue that the three culturally informed motives partly contradict, leading to challenges for the design researcher in ongoing decisions.

As departure for our claims, we present a longitudinal case of EDR conducted by the third author of this article, who we refer to as Ilya. As it concerns a 6 year long PhD study, it reflects an elaborate longitudinal learning process about the complexity of

educational design research. We believe this case to be prototypical, as many educational design researchers recognize the complexity of the research process. We will draw on interview data and reflective notes in which the educational design researcher elaborates on her educational design research, as well as on some typical artefacts which have been developed and used.

In what follows we will first introduce the research of Ilya and describe several recurring challenges that were faced during the research process. Following, we discuss how Ilya pursues three motives *simultaneously*, describing how these rely on different epistemic cultures that tacitly inform the local and ongoing decisions that are made. We offer a systemic characterization of the different epistemic cultures using the activity system model as analytic model (Engeström 2000). Doing so, we are able to lay out the inherent complexity of design research. We will further suggest that the only way to perpetuate this type of research in an enriched way is to be aware of and transparent about a multi-perspective approach.

1 The design study conducted by Ilya

Ilya started her PhD study in 2003 and her thesis was published in 2010 (Zitter 2010). With a background in ICT and user system interaction, she already had extensive experience as consultant ICT and organizational change. At the same time she was rather new to conducting research. Following her research process throughout 6 years shows a learning process common to every PhD student (e.g., ‘based on what I know now I would have done things differently’). Our interest is not in describing or understanding this learning process per se. Rather, the learning process of Ilya offers a window to the complexity of the nature of educational design research.

Ilya’s PhD study aimed at improving competence based, ICT supported learning environments in higher professional education by means of ICT. The motive for this research was, in her wording, not to ‘gain knowledge for the sake of knowledge’, but ‘to solve real problems’ that were faced in higher professional education. Higher professional education in the Netherlands still experienced a lot of problems with the competence based curricula they had established recently. Both students and teachers experienced different difficulties, and the intention of Ilya was to explore how to optimize current initiatives in competence based education. In doing so, she aimed at deriving solutions that were both scientifically grounded and practically relevant. Her PhD study consisted of three successive design cases in different educational settings, mainly situated in a Dutch University of Applied Sciences with about 35,000 students in total. The design cases concerned three student courses: one eight-week course for 32 students in the Health Care Faculty in collaboration with an accelerated medical program of an Academic Teaching Hospital, two subsequent years of an, eight-week course in the Faculty of Communication and Journalism for respectively 125 and 175 students and one course with a duration of half a year for 26 students in the Faculty of Natural Sciences and Technology. Ilya and her colleagues reported on the findings of the three studies in various publications (Zitter et al. 2009, 2010, 2011).

1.1 Recurring challenges

Ilya faced several recurring challenges during the research process, relating to respectively establishing authority, managing time and sequentiality, participating and observing, reconstructing the conceptual development and addressing audiences. In the following we describe

each of these challenges, which, as we will describe later, reflect how she pursues three different motives.

1.1.1 *Establishing authority*

A first challenge that Ilya faced in her research process was gaining a certain authority within the field of study. Especially in the first case that she investigated, she felt she did not have the position to make suggestions for improving education. In one note about the first phase of her research she formulated this issue as follows:

First of all, I was simply added to the team, so I also lacked sufficient status to give such advice to begin with. Hence, when I did give advice, I had to wait and see if my recommendations would be incorporated or not. So to some extent this particular design process took its turn without me.

With ‘sufficient status’ she referred to having the possibility to influence the field, being someone who is approached for specific questions and to whom one listens to. She stated that she could easily provide suggestions, but making these suggestions really matter to the people you address is something else.

Comparing the first and her two later design studies, she learned that a crucial aspect in achieving such a position is the introduction and beginning involvement in the field of study. In the first case she was part of a larger team of educational advisors who seemed to have more seniority in the field of study, which was the health care domain. This was partly due to her being in the ‘formal’ position of a PhD student, despite having years of experience as an ICT and organizational change consultant. She also noticed that the most respected educational consultants had already spent a longer time in the educational contexts in question, in which they managed to build up relations and experience in the field. She realized then that gaining authority is a process that requires time and participation in the field. With this in mind, she managed to achieve a sense of authority both in the second and third case, by investing more time and simply by ‘being there’ and starting to make herself useful in daily practice whenever questions or problems arose. She described this process as follows:

I had decided based on my first case study that a better approach was to start with observing. In the first case I started designing immediately, or I should say the improving and researching. I tried to do that all at once. I noticed that was not as effective as I had hoped, so I told them I would first come to observe in this context. But active, in the sense that they would involve me at all times, and that I was allowed to join in everywhere. That I would sit in at all teachers’ meetings, and that I’d have access to all documents. All those sort of things. So, I only wanted to *not* be active during the teaching itself. There I would be a kind of fly-on-the-wall, observing the teaching. But, next to that, I’d be available for discussions. That is in fact how I presented myself there. I just walked around, into teachers’ offices to ask all sorts of things. In that way, I got to know everyone and they got to know me. That’s when they started to ask questions.

In addition to such an informal part in which one creates relationships with those people who will be directly involved in educational changes, she realized that gaining authority also requires a formal recognition and acknowledgement by the managers of the organizational units in which the studies took place. All in all, she sought authority at three levels: the level of institutional policy makers, management and teachers (including coordinators).

The second case study mentioned above was a spin-off of an informal talk with a teacher/coordinator she knew from an internal organizational platform concerned with educational

innovation. When the teacher/coordinator described the courses in his department, Ilya became interested and asked whether she could come and visit his department. From there on she started with visiting and talking with different teachers and coordinators about the way their course was set up, collaboratively reflecting upon how it could be improved. This way of getting involved in the educational context to be studied allowed her to depart from a good relationship and shared interest with the teachers and coordinators, assuring their willingness and input in cooperating in the design study. However, in order have a complete sense of authority, she asked her own director to mention her research in his meetings with the faculty director. Doing so, the faculty director was aware of the research being conducted. After this, she experienced that her research study was recognized as being potentially worthwhile to support.

1.1.2 Managing time and sequentiality

A second challenge Ilya faced recurrently was deciding about the timing and sequentiality of her research actions. For one, she found it difficult to align her research actions with the actions of the teachers and coordinators with whom she worked. One explicit example of this challenge can be found in the first case study. She approached the first case according to what she perceived as a common order of steps in doing design research. First, she started with gaining scientific insights. She did so by systematically scrutinizing the literature, selecting a certain theoretical model and by conducting a Delphi study in which experts were questioned about how this model could inform educational practice. This should have formed the basis for formulating design principles, which she aimed to evaluate by implementing these in educational practice. In the meantime, she kept visiting the meetings with the teachers and coordinators involved and informed them about the research process. However, about half-way in the process of the Delphi study, she was confronted with a more or less final draft of the educational design that was developed by the teachers and coordinators themselves. This design did not closely relate to the theory she departed from or the design principles that she was about to develop. Whereas her intention was to come to a theoretically well grounded set of design principles to move education practice ‘in the desired direction’, she encountered the value in educational practices to have things prepared on time, and to prepare this in line with *what they perceived* as the main targets. Ilya deduced that the main theoretical concepts embedded in the design project and her design approach (e.g., concepts of ICT-supported multi-professional learning) did not seem as relevant to the teachers and coordinators.

Like in the first case I really tried to execute the Delphi study first, which gave rise to *research* results. Or, one could do a literature search, and that literature search...well, all those elements would end up in the curriculum design, making it grounded [i.e., scientifically]. Then you’d measure the effect of that design and so on. I let go of that. [...] It was too much; no one in the educational setting was holding their breath for that.

On the basis of this experience, she concluded that it was not the best approach to systematically work from theory and derive ideal targets with which you start informing and designing educational practice. She concluded, in a similar vein to gaining authority, that she should not work as an expert in isolation preparing ‘the ideal design that is scientifically grounded and based on theory’, but instead, start from connecting with the teachers and coordinators in the context of their daily practice and their interests.

Following up her intention to start from daily practice in the second and third case study, she found that the sequentiality in her design studies came to be dependent on the

particular culture of the department in which she conducted research. In the second case, desired changes in the education sort of evolved over time Ilya, whereas in the third case, the educational design followed from a more predefined and linear process of designing, implementing and evaluating. Both approaches fitted the interactional culture of the faculty. She described this as follows:

Sanne (interviewer): Well, did you use the same approach as in your second case?

Ilya: They were a bit more organized at the Faculty of Natural Sciences and Technology. They have the explicit project approach of “first design the curriculum, then implement it”, whereas the other faculty...there everything just intermingledThere, I’d sit for a day and I learn from someone: “oh, we are about to discuss this and this”. And I’d quickly sit in to join in on that discussion. Whereas in this context the meetings were planned. There was an planning and a project manager, who’d invited me for all meetings and I would sit in on those. So, I was involved in the complete preparation from the start.

The timing and sequentiality was not only an issue with respect to the research steps *within* each case, but also an issue that she faced in the process of selecting and ordering the three cases. From the perspective of the iterative character of design research, Ilya’s deliberate intention was to use the results of the first case as input for the second case, hence, conducting the case studies one after the other. However, she describes how this linear process was partly artificial, since it forced her to finish the case study already after one round of design, whereas she would have preferred to go back to the course at hand the next academic year to see whether the educational changes had remained or could be further improved. However, this latter was not possible, given the time that was available for conducting each case study.

Ilya: This was the second. And the third was about to start in September. So I could squeeze in another one between September and January...which meant searching for another case based on pragmatic arguments.

Sanne: What are these pragmatic arguments?

Ilya: That the timing is right. As it could not interfere with the other case study, because I wanted to go back to that context at any rate.

Follow-ups in each case simply extended the formal time frame of Ilya’s research project. Consequently, she was forced to make a compromise in the amount of time and iterations in the different case studies.

1.1.3 Participating and observing

During the final writing stage of her PhD project, additional challenges emerged. One concerned the determination of what was considered to be ‘data’. Her descriptions of the field work reveal that Ilya had spent large amounts of time visiting and observing the sites. Guba (1981) argued how such a process of prolonged engagement and persistent observation allows the teachers to get adjusted to the researcher, and is a way for the researcher to recognize the central issues at stake. At the same time, one can argue that the more time is spent in various situations in the field, the more complex it becomes to determine your role and the effects of your presence.

Asking her about how she engaged in the field and gathered data, it becomes clear that Ilya explicitly distinguished between ‘formal’ versus ‘informal’ contact with the teachers and coordinators involved. For her, formal contact consisted of interaction that was organized and

planned, such as the meetings in which the teachers and coordinators discussed and reflected on the enacted educational design, as well as the consequent education and interaction between teachers and students. She perceived these instances as ‘design in action’. Whenever this was the case, she took the role of silent observer, with the intent not to disrupt the process of decision making and the way in which education was enacted. It was also these occasions that she recorded the interactions and treated it as her data.

Given the type of research, however, she also wanted to engage in the field as participant designer. She framed this role as a process of informal interaction, often taking place in the form of spontaneous talks with the teachers and coordinators as a result of a question or problem that popped up, or in the form of talks taking place in the corridor or coffee-room. These interactions were not seen as data and considered to be a process taking place ‘off the record’.

Yes, but this is something I have always found extremely difficult, because at some point I was also preoccupied with whether I should not gather data while in the social room ...but I always thought...Listen, when the voice recorder is on, I am the researcher and they should just do what they have to do. When the voice recorder is off, then we are just among ourselves, and I then just can say what I have to say. I always tried being very polite and I never judged anyone, but I simply did give my opinion.

The reason for her to focus on the interactions in organized settings was that Ilya was mostly concerned with final decisions on the educational design, as well as the enactment of this education design. In the end, her aim was to evaluate the proposed educational design in order to further improve it where necessary.

Sanne: Why did you do that, record the organized meetings, and not say anything there?

Ilya: That was informative about how the educational design was being executed. And if they agreed with it or not. If I was in such a meeting...wow, those teachers didn’t hold back. If 16 teachers complain about something in the educational design, I know enough. I may have my reasons for why it is all very good, but if 16 teachers say it does not work that way, I know enough. Whereas if I hear 16 teachers say: “did you have such a great meeting as well?” and everyone starts off excited about the meeting, saying the students did this and this, when the teachers are very excited, then I would really radiate. [...] Because teachers are the ones that make the students work, because students are very receptive to that. And although students do a lot by on their own account, if the teacher thinks it’s useless, the students will never use it.

Though she managed to maintain such a clear distinction in her various roles and in defining her data, she found it difficult to evaluate whether this could be considered an appropriate methodology.

Ilya: Sometimes, I’d do some very practical things. [...]. As I am simply there and I do have the time. It is strange though, because I’d expected to be there as a highly proper researcher, but that is not what happened.

Sanne: What do you mean, a proper researcher?

Ilya: Well, I’d read... that participating was off limits. That is something I found really complex. Something I completely didn’t understand. I did not get how one could.... Because I did not get how I could...well, my background is user system interaction and our roots lie in ethnography. A bit more like....really participating and being there. That you should feel it and be there to achieve the good ...to get the knowledge that’s useful in designing. Because without it, effective design is never possible.

Sanne: How did you cope with this idea?

Ilya: Well, I sort of just ignored it. But then I'd present at a conference. And people would flip out! They'd thoroughly disagree with what I was doing. Luckily I met other minded researchers, but I also noticed that they have a more proper approach.

Sanne: More proper in what way?

Ilya: They explicated which role they had, to name one. For example [name researcher], she collected data on every interaction she had during the design process. I never did that. I always thought "okay, at a certain moment...just like a designer, you're simply designing and you can do what you want". When someone uses it, then it is no longer up to the designer to say: "you should do this or that". That's up to the users or participants, the design should stand alone. [...] That's the integrity to which I always adhered: as long as you're designing, the product is still in progress, it's allowed. But afterwards, when it's in action, when the participants themselves...then you observe. [...] You stop talking, because you can't explain the design. People should be able to understand and use it as it is. And sometimes watching what they'd do to your design, makes you bite your tongue, because they turn the whole thing around. But it's their moment. [...] At that point, I can assume the traditional researcher role and observe. Preferably from close by, without being in the way. Because I will not disturb them in using the design, the collaborative design.

Asking her why about her solution, she contends that it is the way she was trained as a designer. She contends that only observing during the design process would be illogical in the 'world of design'.

1.1.4 Reconstructing the conceptual development

A fourth challenge, also emerging during the final stage of writing, is writing down the integrated story of her research, explaining the way she connected the experiences in the educational field to the scientific literature. In Ilya's reflections we can see how the experiences in the educational field and the developing insights from the scientific literature and community are mutually enriching. For example, at a certain point she started using the concepts of 'learning task' and of 'boundary objects' based on her readings in scientific literature and discussions with colleagues. These concepts helped her to look at educational practice and distinguish phenomena and objects as the central units of analysis she aimed to manipulate in her design. As such, scientific models and concepts functioned as a lens to determine what is valuable to focus on in educational practices. Vice versa, engaging in the field lead to particular ideas and questions that motivated and directed her search in scientific literature, thus educational practices also enriched her conceptual focus. She points to the latter process in the following excerpt.

Ilya: when you design, it's intended for a certain context. So, you keep the context in mind and you try to adhere to it, to what's happening, to what you see, what you observe. And you continuously try to ask participants evaluative questions. I use the literature in the same way. When I had an idea, I'd immediately look up if someone else wrote about it with similar or different ideas.

Sanne: So, based on an idea from the field?

Ilya: Yes, I'd see if there was someone else who had thought about it in the same way. Or if someone radically disagreed. So I immediately tried to look for: have other people thought of this or can I find a formal model to formalize the idea somewhat more.

Sanne: what do you mean with formalize?

Ilya: conceptualize, sorry. [...]

Ilya: Yeah, I mean, take a chair. I sort of know how I chair looks like, but it helps to know which parts should be included at any rate in order to be able to design. Particularly when I want to improve the design. Then I want to know which parts belong to it and which do not, and which are susceptible to external influences and which are not. But what makes it hard, is that educational research literature does not look like that. [...] I could not find anything about it, because that is not the language of research. This left me utterly confused for quite some time.

Throughout her research trajectory she moved back and forth between the scientific community and the educational practices that formed the field of her investigations. Despite this ongoing movement and mutual enrichments between science and the field, she maintains to perceive her study as having walked two separate paths simultaneously. One path concerned participating at the site by means of joining meetings, having talks with teachers, reviewing curriculum material, observing education and so on, whereas the other path concerned reviewing a lot of scientific literature, visiting conferences and talking to research colleagues. Whereas the first path is located in the landscape of educational practices striving for ‘real changes’, the other path is located in a scientific landscape composed of concepts, models and developing an argumentative reasoning, hence reflecting a different discourse.

in the meantime I read everything I could find. I have never read as much as then. Everything really. To keep cross referencing with the field. I have experience with that, I believe in that. If I assess its use with coordinators, students, different teachers, different participants, external consultants, and they report back, then I know what is good and what is not. But I thought, I also represent research there, so I should also monitor the literature continuously, to monitor what people say about this type of learning from a more theoretical perspective.

The tension between these two different paths and related discourses arise most strongly when she has to write down her research process and results.

Sanne: How did you seek integration between all the things you heard and saw in practice and the literature you’d read?

Ilya: That’s difficult for me, as is apparent now. Because it actually requires a complete and integrated story, whereas in reality there are two separated streams.

Here she considers it difficult to retrospectively explain to others the ‘integrated story’.

1.1.5 Addressing audiences

A fifth challenge that can be identified in Ilya’s reflections is the issue of whom she wanted to address in answering her research questions. It seemed that Ilya found herself in a threefold position regarding her main audience. This becomes most clearly visible in her various efforts to report the results of her studies. Asking her about a model she developed in the first case, she says the following:

Sanne: You just mentioned a model? [...] What happened with it?

Ilya: Well, I used it to finalize that entire Delphi study without question and neatly published about it on various conferences, among which a really renown international medical conference. At that time, the intention still was to write an article about it. But I was completely fed up with it. I never did write it, as no one had ever used the results in educational practice. They have only been presented neatly as being results of the project [for an external agency], except for the fact that they did not make it to the actual design. Yes, then for me they are not of any interest.

Her description of this reporting stage clearly shows some frustration. Using words like ‘neatly’ and ‘renowned’ she implicates how she tries to live up to certain expectations of her as a researcher. However, she also indicates those scientific results that did not make it to the design, are not of interest to her. In a later fragment she explains how she did not only write scientific articles and present at conferences, but also provided several workshops for educational advisors in which she presented and discussed the “actual designs” she had been developing. When being explicitly asked about whom she considers to be her audience, she mentions how she ideally addresses not just researchers, but also educational advisors and teachers/coordinators.

I’ve always had the illusion that my audience is the teacher. But I don’t think that’s entirely correct. When I finish my articles, there will be a large gap between them and the mainstream teacher. Yet I hope at least educational advisors....And I hope that I can transform them [i.e. the articles] into products that are appropriate for teachers.

Her intention to address the teachers and their educational practices also comes to the fore in her efforts in what she calls “formal educational evaluation” and in making “real documents”:

Sanne: When you say “formally evaluated the learning environment”, what do you mean by formal?

Ilya: Well, it results in a document, that is accepted within the organization and that they acquire ownership about it. Put their logo on it and a series number. You also have documents...I also gave all sorts of emails and papers to everyone, but that are not documents that really matter. This is a document that is still being used.

Sanne: So, you mean that it has a different effect, a different status?

Ilya: Status yes, you really go all out for the management and someone in a formal role. Instead of “well, here is tip for you, see if you can use it”, really saying “Dear sirs and madams, in your role as coordinator and in my role as researcher and representative of my agency, I have an evaluation report for you, based on the following things...”. And you discuss it in a formal meeting. At the same time, we also gave workshops about it in various settings.

Ilya’s concern is to assure that the resulting educational design will be used in future practice, ideally by teachers and coordinators, but otherwise by educational advisors. Her approach in this is making a concrete product, and as such ‘reify’ (Wenger 1998) the design in a material form.

2 Three motives, three epistemic cultures

To understand complexity of educational design research, we need to understand what underlies the various challenges faced by Ilya. A first step is to understand the different motives underlying her PhD study. Her descriptions reflect three different motives. First, Ilya voices a *research* motive by stressing her efforts to (a) ground her educational designs in theory, in scientific concepts and in preparatory empirical studies (e.g., Delphi study), (b) be a silent observer when ‘design was in action’, (c) follow a sequential and constructive empirical process in which she finished one case study before moving to the next, and (d) write publications and present at conferences. Second, Ilya voices a *design* motive in describing her efforts to develop thorough and useful educational designs by (a) having the context in mind, (b) trying to do iterations in and between cases for further improvement of design, (c) working towards

a final, usable design product. Third, Ilya voices a *change* motive in describing her efforts to (a) solve ‘real problems’ and establish change in educational practices, (b) be engaged (prolonged) in the field and having informal talks with diverse people, (c) collaborating with teachers and coordinators on educational designs, (d) writing reports acknowledged by the educational institute about findings and final products.

Though one may interpret these motives as personal aims of Ilya, we claim that they represent three different epistemic cultures that typically intersect in educational design research. Epistemic cultures are culturally and historically developed practices with a specific attitude toward knowledge and knowledge claims (Knorr-Cetina 1999). We will now describe each of these epistemic cultures in more detail using cultural historical activity theory (CHAT) as analytic lens (Engeström 2001). As discussed by Roth and Lee (2007), CHAT represents a theoretical tradition that can be traced back to the works of Vygotsky (1934/1986, 1978) and his contemporaries. Central to the theory is the idea that individual goal-directed actions can only be understood by considering the larger collective system of activity from which this action derives its meaning. This activity system represents a specific community of people that all share a certain object that motivates their actions, artifacts (both conceptual and material tools) that mediate these actions, and rules and a division of labour to structure and organize the collective activity. Applying this idea to Ilya’s case, we want to focus on the three epistemic cultures that render Ilya’s actions meaningful.

2.1 Educational research

Educational research is, just like any scientific enterprise, about coming to know more about the world. However, typical for educational research is that not only the nature but also the object of activity is about how people know and learn. Accordingly, the outcomes produced by research are ideas and insights, theories and models with which to describe the way in which people learn and the way in which this learning can be organized by education or facilitated otherwise. The focus of research is typically captured by in a specific question or problem (Oost 1999). Especially given the high specialization in scientific interests, research seems to be mostly an individual and conceptual endeavour. However, philosophical and sociological studies of science have shown how science is an inherently social activity (Kuhn 1962; Star 1989; Latour and Woolgar 1979). It is social in the sense that researchers often address a particular scientific community in what and how they conduct research. Researchers are expected to build forward on existing knowledge in a certain domain, and by doing so use agreed upon concepts and categorical platforms as linguistic markers to describe phenomena at hand (Säljö 2002). Also in methodology, researchers build forward on accepted tools and procedures. This enhances the use of standardized techniques and instruments for data gathering and data analysis, often made available to the community by means of methodological handbooks (for example, ‘Handbook of Qualitative Research’ by Denzin and Lincoln 2005).

Typical in scientific practices is also the critical stance of the researcher and the research community towards the methodology that precedes the knowledge claims. Generally, one can see how methodological procedures need to be transparent (visible and comprehensible) and acceptable (e.g., following quality criteria such as reliability and validity) according to the scientific community (Akkerman et al. 2008). Living up to these standards requires the researcher to work in a systematic way. In the materialization of research in the form of articles and presentations, researchers often (re)construct a systematic way of working, implying that there is first a theory and a research question, then a process of study, and then a process of concluding findings and implications.

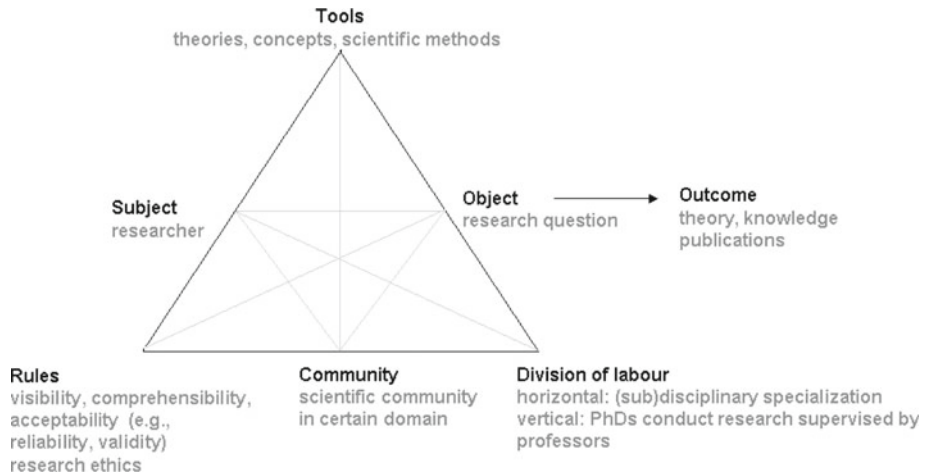


Fig. 1 Research activity

Though doing research is situated in, mediated by and addressed to a social scientific community, the individual researcher still needs to make their own interpretations of scientific tools and rules. Roth and Lee (2004) showed in anthropological research among scientists how scientific tools are only meaningful to the researcher to the extent in which he or she is familiar with the contextual constituents under which these tools were constructed. In her study of different research units, Knorr-Cetina (1981) found that rules of official science are transformed by local interpretations regarding questions, instrumentation, duration of experiments and regarding other rules. The researcher is expected to justify to his or her own community of knowing as to what and how research is conducted, providing arguments based on collectively accepted theoretical and empirical sources. The system of collective activity informing researchers' actions can generally be pictured as in Fig. 1.

2.2 Educational design

Typical of educational design is that its motive centralizes around finding a solution to a problem, or improving an existing solution. The design process is one of development towards that. The outcomes of the design activity can vary from optimal or alternative solutions to a set of design principles or guidelines with which an optimal solution can be reached (Van den Akker 1999). Looking at the sort of practical outcomes and the notion of usability, design activity intends to produce tools to enable change in practice.

Scientific or practical theories but also explorations in the problem field may help the designer to understand the problem and think about the direction the solution should take. Other tools can also be invoked, as creativity and innovation are strongly encouraged. Designers often work in teams to benefit from complementary expertise, by including, for instance, a technician and an architect, and do justice to the different stakes that are involved, for instance by including future users. Accordingly, the division of labor can vary in the different stages of the design process.

Educational design processes represent iterative processes, using a cyclic approach of design, evaluation and revision (Collins 1992). It is for this reason that educational design processes are often characterized as zigzag or even chaotic (Kirschner et al. 2002). Next to creativity, a shared rule underlying educational design practice is the need attune solutions to

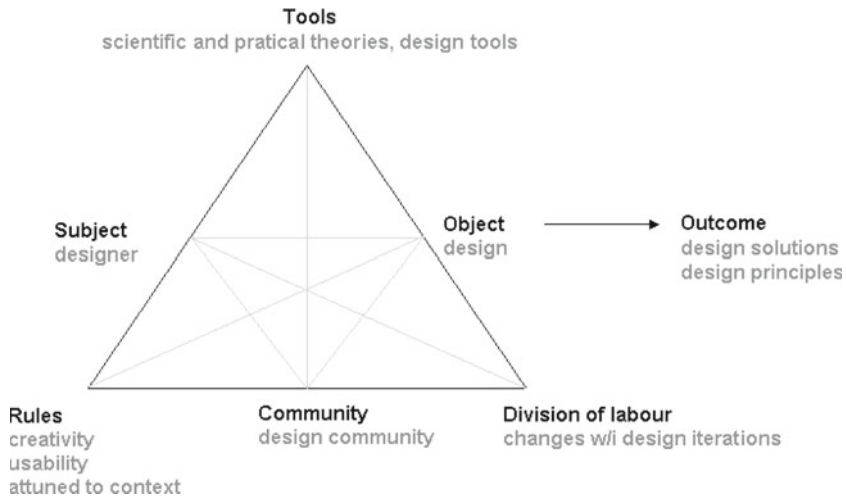


Fig. 2 Design activity

the context for which you design, meaning that specific conditions apply and specific interpretations of problems (Kirschner et al. 2002). This implies that optimal solutions should not only be creative but also usable. Design activity can generally be pictured as in Fig. 2.

2.3 Educational change

Educational change is about the process of change in the broadest sense, ranging from the redesign of a single lesson to school innovation and even large organizational innovation. As change itself is what is the focus, agents in educational change explore how change comes about and how it is experienced by those changing and being changed (Almekinders et al. 2009). The change activity focuses on local problems and aims to arrive at sustainable, long term solutions for those problems. Tools that change agents invoke range from design products and solutions to down-to-earth resources as time and money. As change processes are meant to have consequences for people in a certain practice, the actions of change agents are often also political in nature. A change agent needs to develop an understanding of informal cultures, alliances, coalitions, and conflicts in the local community, and be aware of the (political) motivations behind a proposed change and possible resistance against the intended changes (Kezar 2001). Finally, a change agent has to find a way to account for perspectives of different stakeholders. In doing this, he or she needs to gain both informal or horizontal as well as formal or vertical authority.

As change tends to follow a natural process in a specific community, it is often gradual, non-linear, long-term, unpredictable, and unintended (Kezar 2001). This differs from both research and design activity, which tend to reflect more goal-driven and predefined processes. Figure 3 gives a general picture of educational change as activity system.

3 Standing at the intersection of educational research, design and change

The complexity of EDR resides in the fact that it includes actions that cannot be understood by only one of the epistemic cultures described above. The question is *how* the three

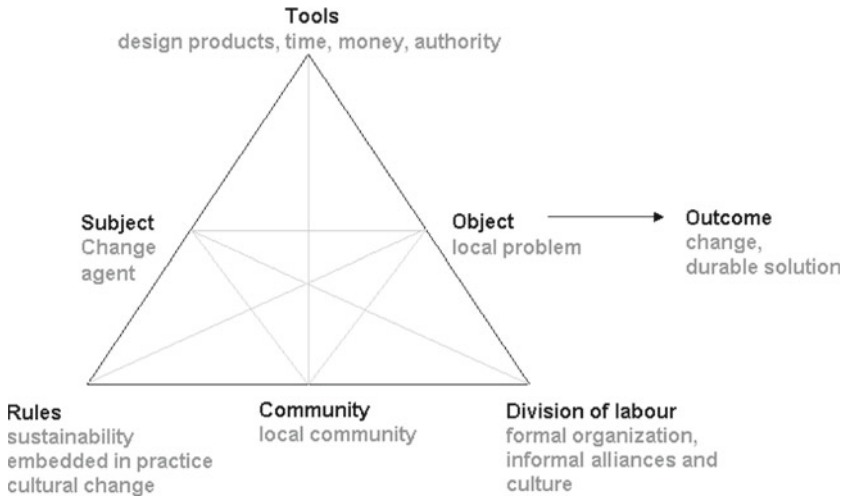


Fig. 3 Change activity

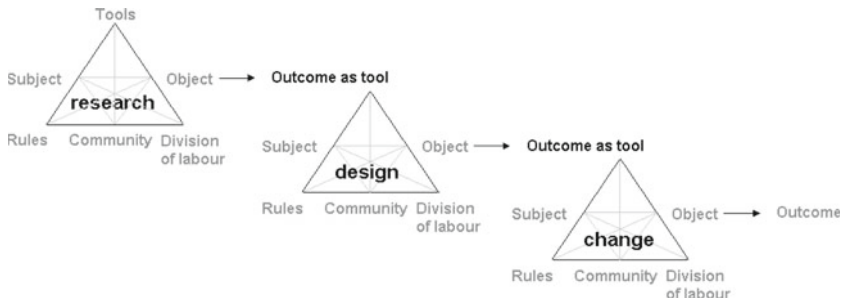


Fig. 4 Linear progression educational research, design and change

epistemic cultures intersect in what an educational design researcher is doing. When conceived of as separate systems of activity, it seems that educational research, design and change are primarily enriching one another; educational theories or concepts produced by research can be functional tools for developing educational designs, design products can function as tools for establishing educational change, and in turn, the change processes and outcomes function as the object of analysis in educational research. It is this mutual enrichment that motivated scholars to employ EDR approaches (Cobb et al. 2009). However, what is implicitly and falsely assumed is that the activities of educational research, design and change follow a constructive and complementary cycle of linear progression. When translating this in an activity theoretical model, such an assumed linear progression could be pictured as in Fig. 4.

On the basis of concrete experiences in EDR such as in the case of Ilya, and similar feelings of complexity by others (Joseph 2004; Yamagata-Lynch 2007) we want to argue that educational research, design and change do not follow one after the other but are concurrently informing and contextualizing the actions of EDR researchers. This creates a situation in which the EDR researcher has triple motives and has to live up to the standards and norms of three different epistemic cultures at the same time. Rendering this in activity theoretical

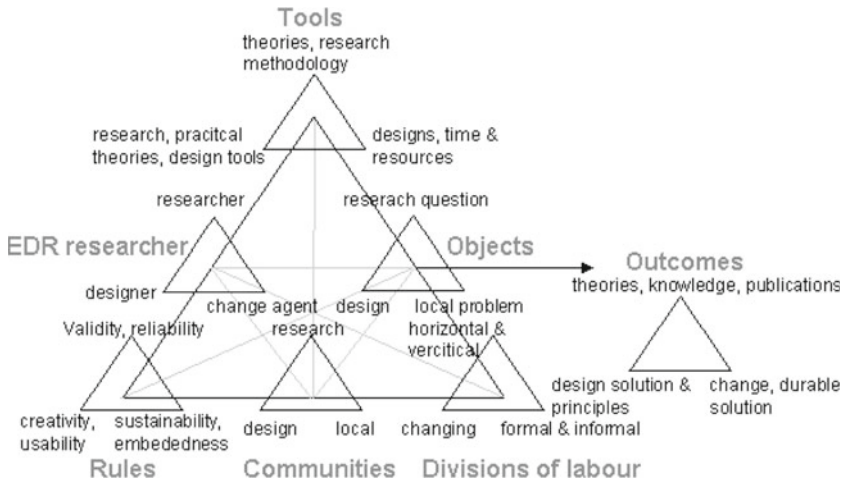


Fig. 5 Concurrent activity of educational research, design and change

terms, it implies that contradictions do not just exist between the nodes of the (elements of) different activity models, but also *within* them. In such cases, [Halloran \(2000\)](#) argues that visually separating concurrent activities might not do the experienced complexity justice. He advances an alternative way of representing the simultaneous experience in what he calls an Activity Space, where the concurrent activities are portrayed as one. In line with this reasoning, we model the complexity experienced by the EDR researcher in Fig. 5.

The simultaneity of three epistemic cultures in EDR research brings two sorts of difficulties for the researcher. A first more general difficulty is to understand the EDR process, disentangling during and afterwards with what goals, what tools and with what quality rules in mind certain decisions are made. A second difficulty running through this is the sometimes conflicting nature of the three epistemic cultures. Let us go back to the challenges faced by Ilya to illustrate both these difficulties.

Ilya’s struggle of *gaining authority* in the local educational field reflects both a design and change motive, since she wanted to implement her design and by doing so make a difference in educational practice. Ilya realized that her position as external researcher somehow stood in her way, as she was perceived as an outsider. This position did not give enough ground for actions. She found that she had to spend time with teachers and participate in the educational field for informal acknowledgement as well as create a formal or vertical acceptance of her participation by the institutional policy makers and management. This process of gaining authority created for her what could be seen as a subject position in the local educational community from which to act, but partly undermined her initial distant position as researcher observing the local educational community from the side.

In Ilya’s challenge to *manage time and sequentiality* within and between her case studies we can see that there is a tension between on the one hand actions to ground the design in expert opinions and scientific literature (aligning educational design and research) and on the other hand actions to make sure that a design is suited for the local educational context and finalized when teachers and coordinators need it (aligning educational design and change). These different goals contradicted one another in quality rules but also in timeframe; grounding design in research required her to take time, be reflective, and follow a systematic process of study within and throughout the cases. However, actual use of design products to establish educational change required timely actions and collaboration with teachers to ensure

acceptance and usability. As fruitful as daily educational practices can be, one can see that there can be sudden/spontaneous acceptances and possibilities to implement ideas (e.g., a willingness of a teacher to implement a particular design principle to enhance authentic education), but, as fruitful, these initiatives can disappear due to changing circumstances (e.g., busy schedules of teachers).

In Ilya's challenge of *participation versus observation*, we can read a tension between design and research motive, quite literally by adopting two different positions. Following a design tradition, Ilya strived to interact informally and acted as participant designer, fostering close collaboration with teachers and coordinators during the process of designing. In so doing, she was initially concerned more with the design products rather than the design process. Following an educational research tradition and her understanding of important quality rules however, she aimed to maintain distance and act as silent observer. She chose to take on this different subject position during those instances in which the educational designs were being used by teachers, or in her phrasing 'when the design was in action'. Retrospectively, she finds it difficult to determine her data. Does or does it not include the design process? Considering the research tradition, she argues that it would have been better to track more closely the more informal design process that lead to the educational designs. At the same time however, her reason not to do so was that a recording of spontaneous talks could have easily harmed the informality and the process of gaining trust and authority (see first challenge).

Ilya's challenge regarding *the reconstruction of the conceptual development* reflects her feeling of having walked two paths, one focused on change and presence in the educational community, and one focused on research and employing a scientific discourse. She points out how participation in the educational community was enriching for determining a scientific focus and vice versa, she finds it is hard to be aware of and write down afterwards an integrated story of when precisely ideas have emerged and how they were developed. This latter seems to suggest in itself a research motive to write down an unambiguous and linear process of scientific progression.

Ilya's doubts about *addressing audiences* in the final stage of writing shows how she tries to respond to 1) the research community by "neatly" writing publications and present at renowned conferences, 2) to the educational designers by giving workshops in which she presents and discusses her design models, but also to 3) the educational community of teachers and coordinators making designs explicit, writing evaluation reports towards formal acceptance by educational managers. This implies that the three different communities speak different discourses and require various efforts of the researcher for dissemination and valorization of EDR results.

4 Conclusion and discussion

We have made a three-fold claim. First, by describing exemplary challenges of an EDR researcher, we have illustrated the way in which EDR encompasses three different motives simultaneously, namely: conducting educational research, developing educational design, and establishing desired change in an educational community. Second, we argued that these motives are embedded in three different epistemic cultures, that is, three different cultural traditions regarding what are appropriate ways of reasoning and what outcomes are to be produced.

This understanding of EDR offers an alternative explanation of its complexity. Some scholars have addressed the complexity of design research in the same terms as the divide

it aims to overcome: the challenge of continuously creating linkages between theory and practice (e.g., [Tenkasi and Hay 2004](#)). Theory then is often associated with formal bodies of knowledge as expressed in books, articles, expert opinion, and research principles, whereas practice is associated with the field setting that is object of study, including its contextual contingencies, conventions, norms, routines, rules, and established procedures. We think this way of addressing the complexity of EDR does not do it justice, if only because educational science is a dynamic practice in itself, and because practices in the field of investigation (e.g., within educational institutions) are certainly not theory-less. On the contrary, as our descriptions of the three cultures intersecting in EDR point out, each culture rests on different instruments, discourses, rules, divisions of labor, and accordingly carries out its own *episteme*.

Lastly, we have modeled EDR in terms of an endeavor that takes place at the intersection of three different epistemic cultures simultaneously. We advocated that this can be enriching in the sense that outcomes of the one system can function as tools in terms of the other (e.g., conceptualizations as outcome of research can function as guiding tools in making design principles). Yet, the tensions faced by Ilya also illustrate how conflicts in motives can emerge and how these are often intuitively managed during ongoing actions. We propose that more transparency in decision making processes in EDR is needed, and hoped to have offered an initial framework with which to grasp and anticipate the complex dynamics of EDR. Transparency is desirable not only for maintaining and improving methodological rigor (which clearly is a research motive), but also to enhance researchers' sense of agency and deliberate shifts in subject positions in the process.

In this paper we have attempted to understand EDR by providing only generic descriptions of intersecting cultures. Naturally, different approaches can be found within the field of EDR. According to [Engeström and Sannino \(2010\)](#), educational design research can be characterized as more of a 'variable approach', or a 'formative approach'. Whereas the variable approach adheres more to the common quality rules of educational research and design (aiming at systematic and predefined research processes) the formative approach adheres more to educational design and change (aiming at innovative and sustainable changes and ownership in the field). Though different approaches may indicate a different priority of motives, we contend that all EDR trajectories, to at least some extent, deals with the three motives of research, design and change and according epistemic practices.

Central in this paper has been the perspective of the EDR researcher, thereby not considering other actors adhering to one or more of the epistemic cultures (e.g., the teachers). We have related the actions of the researcher to three epistemic practices, using cultural historical activity theory as analytic framework in an eclectic way. A relevant next step in contextualizing and comprehending EDR research would be to study the interactions and collaborations between the EDR researcher and significant others in the different communities, respectively the scientific community, the educational design community and the educational community. This affords a better understanding of how others perceive and react to the different positions and decisions of the EDR researcher.

References

- Akkerman, S., Admiraal, W., Brekelmans, M., Oost, H.: Auditing quality of research in social sciences. *Qual. Quant.* **42**, 257–274 (2008)
- Almekinders, C.J.M., Beukema, L., Tromp, C.: *Research in Action: Theories and Practices for Innovation and Social Change*. Wageningen Academic Publishers, Wageningen (2009)

- Broekkamp, B., Van Hout-Wolters, B.: The gap between educational research and practice: a literature review, symposium, and questionnaire. *Educ. Res. Eval.* **13**, 203–220 (2007)
- Brown, A.: Design experiments: theoretical and methodological challenges in creating complex interventions in classroom settings. *J. Learn. Sci.* **2**, 141–178 (1992)
- Cobb, P., Confrey, J., de Sessa, A., Lehrer, R., Schauble, L.: Design experiments in educational research. *Educ. Res.* **32**, 9–13 (2003)
- Cobb, P., Zhao, Q., Dean, Ch.: Conducting design experiments to support teachers' learning: a reflection from the field. *J. Learn. Sci.* **18**, 165–199 (2009)
- Collins, A.: Toward a design science of education. In: Scanlon, E., O'Shea, T. (eds.) *New Directions in Educational Technology*, pp. 15–22. Springer, Berlin (1992)
- Collins, A., Joseph, D., Bielaczyc, K.: Design research: theoretical and methodological issues. *J. Learn. Sci.* **13**, 15–42 (2004)
- Denzin, N.K., Lincoln, Y.S.: Introduction: the discipline and practice of qualitative research. In: Denzin, N.K., Lincoln, Y.S. (eds.) *The Sage Handbook of Qualitative Research*, pp. 1–32. Sage, Thousand Oaks (2005)
- Design-Based Research Collective: Design-based research: an emerging paradigm for educational inquiry. *Educ. Res.* **32**, 5–8 (2003)
- Engeström, Y.: From individual action to collective activity and back: developmental work research as an interventionist methodology. In: Luff P. Hindmarsh J., Heath, C. (eds.) *Workplace Studies*, Cambridge University Press, Cambridge (2000)
- Engeström, Y.: Expansive learning at work. Toward an activity theoretical reconceptualization. *J. Educ. Work* **14**, 133–156 (2001)
- Engeström, Y.: Putting Vygotsky to work: the change laboratory as an application of double stimulation. In: Daniels H., Cole M., Wertsch J.V. (eds.) *The Cambridge Companion to Vygotsky*. pp. 363–382. Cambridge University Press, Cambridge (2007)
- Engeström, Y., Sannino, A.: Studies of expansive learning: foundations, findings and future challenges. *Educ. Res. Rev.* **5**, 1–24 (2010)
- Gravemeijer, K., van Eerde, D.: Design research as a means for building a knowledge base for teachers and teaching in mathematics education. *Elem. Sch. J.* **109**, 510–524 (2009)
- Halloran, J.: The activity space: analyzing intentionality in open cooperative work. Unpublished Doctoral Thesis, University of Sussex (2000)
- Joseph, D.: The practice of design-based research: uncovering the interplay between design, research, and the real-world context. *Educ. Psychol.* **39**, 235–242 (2004)
- Kezar, A.J.: Understanding and facilitating organizational change in the 21st century: recent research and conceptualizations. In: Kezar, A.J. (Series ed.) *ASHE-ERIC Higher Education Report*, vol. 28(4). Jossey-Bass, San Francisco (2001)
- Kirschner, P., Carr, C., Van Merriënboer, J., Sloep, P.: How expert designers design. *Perform. Improv. Q.* **15**(4), 86–104 (2002)
- Knorr-Cetina, K.D.: *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science*. (Pergammon Press, Oxford 1981)
- Knorr-Cetina, K.D.: *Epistemic Cultures. How the Sciences Make Knowledge*. Harvard University Press, Cambridge (1999)
- Kuhn, T.S.: *The Structure of Scientific Revolutions*. University of Chicago Press, Chicago (1962)
- Latour, B., Woolgar, S.: *Laboratory Life: The Social Construction of Scientific Facts*. Sage Publishers, London (1979)
- National Research Council: *Scientific Research in Education*. (National Academy Press, Washington, DC 2002)
- Oost, H.: De kwaliteit van probleemstellingen in dissertaties [The quality of problem statements in dissertations]. Unpublished Doctoral Dissertation, Utrecht University, Utrecht, The Netherlands: IVLOS Reeks (1999)
- Roth, W.M., Lee, S.: Science education as/for participation in the community. *Sci. Edu.* **88**, 263–291 (2004)
- Roth, W.M., Lee, Y.L.: "Vygostky's neglected legacy": cultural historical activity theory. *Rev. Educ. Res.* **77**, 186–232 (2007)
- Säljö, R.: My brain's running slow today. The preference for "things ontologies" in research and everyday discourse on human thinking. *Stud. Philos. Educ.* **21**, 389–405 (2002)
- Sandoval, W.A., Bell, P.: Design based research methods for studying learning in context: introduction. *Educ. Psychol.* **39**, 199–201 (2004)
- Star, S.L.: The structure of ill-structured solutions: boundary objects and heterogeneous distributed problem solving. *Distrib. Artif. Intell.* **2**, 37–54 (1989)
- Tenkasi, R.V., Hay, G.W.: Actionable knowledge and scholar-practitioners: a process model of theory-practice linkages. *Syst. Pract. Action Res.* **17**, 177–206 (2004)

- Vanden Akker, J.: Principles and methods of development research. In: van den Akker, J., Nieveen, N., Branch, R.M., Gustafson, K.L., Plomp, T. (eds.) *Design Methodology and Developmental Research in Education and Training*, pp. 1–14. Kluwer, The Netherlands (1999)
- Verschuren, P., Hartog, R.: Evaluation in design-oriented research. *Qual. Quant.* **39**, 733–762 (2005)
- Vygotsky, L.S.: *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press, Cambridge (1978)
- Vygotsky, L.S.: *Thought and Language* (A. Kozulin, Ed., Trans.). MIT Press, Cambridge (1986) (Original work published 1934)
- Wenger, E.: *Communities of Practice. Learning, Meaning and Identity*. Cambridge University Press, Learning (1998)
- Yamagata-Lynch, L.C.: Confronting analytical dilemmas for understanding complex human interactions in design-based research from a cultural-historical activity theory (CHAT) framework. *J. Learn. Sci.* **16**, 451–484 (2007)
- Zitter, I.: *Designing for learning. Studying learning environments in higher professional education from a design perspective*. Unpublished doctoral dissertation, Utrecht University, The Netherlands (2010)
- Zitter, I., Kinkhorst, G., Simons, P.R.J., Ten Cate, Th.J.: In search of common ground: A task conceptualization to facilitate the design of (e) learning environments with design patterns. *Comput. Hum. Behav.* **25**, 999–1009 (2009)
- Zitter, I., De Bruijn, E., Simons, P. R. J., Ten Cate, Th.J.: The role of professional objects in technology-enhanced learning environments in higher education. *Interact. Learn. Environ.* (2010). doi:[10.1080/10494821003790863](https://doi.org/10.1080/10494821003790863)
- Zitter, I., De Bruijn, E., Simons, P.R.J., Ten Cate, Th.J.: Adding a design perspective to study learning environments in higher education: three case studies. *High. Educ.* **61**, 371–386 (2011)