



# Enhancing teacher collaboration in higher education: the potential of activity-oriented design for professional development

Magda Pischetola<sup>1</sup> · Jeppe Kilberg Møller<sup>2</sup> · Lone Malmborg<sup>3</sup>

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## Abstract

Professional development programs for teachers in higher education are often characterized by top-down approaches, which fail to make appreciable differences in teaching practices. This study uses a qualitative approach to explore activity-oriented design (AOD) as an instrument for collaborative learning in higher education teacher professional development. We examine Teknosofikum, an ongoing project developed in Denmark along three iterations, involving a total of 64 course participants (42 in the hybrid format; 22 online). The study applies the methodology of design-based research: data was collected via 15 semi-structured group interviews, online forums, and field notes/recordings from online meetings and onsite workshops. Data analysis follows the methodology of grounded theory and evidence is given significance inductively, based on contextual data. Four activities were selected to assess the potential of AOD methods in enhancing teacher collaboration, with different aims reflection, discussion, theory-practice alignment, and participation. Our analysis revolved around three main categories: trust, deep interaction, and shared beliefs/values. The results show how collaborative group work activities have improved trust and knowledge-sharing among participants and have contributed to creating a safe learning environment. The paper concludes that AOD methods could better assist educational designers in promoting professional development courses that aim at enhancing teacher collaboration in higher education.

**Keywords** Activity-oriented design · Higher education · Teacher professional development · Collaborative learning

## 1 Introduction

Teacher professional development<sup>1</sup> involves “activities that develop teachers’ skills, knowledge, expertise and other characteristics as a teacher” (OECD, 2009: 49). It is intended to improve the quality of education and extend teachers’ commitments as “change agents” (Day, 1999). Nevertheless, initiatives aiming at developing in-service teachers’ professional skills are often characterized by top-down approaches (Riedner & Pischetola, 2021), which fail to address the real needs of participants (Dilshad et al., 2019; Roseler & Dentzau, 2013) and to make appreciable differences (Dysart & Weckerle, 2015). Research has shown that professional development programs also fail to actively acknowledge teachers’ self-efficacy (Pischetola, 2020) and self-concepts (Wang et al., 2004), both of which are crucial for producing significant change in teaching practices.

A growing body of research is pointing to the need for collaborative approaches in education (Cumbo & Selwyn, 2022; van der Rijst et al., 2022) and the importance of giving value to socially constructed learning processes in the classroom ecosystem (Pischetola & Miranda, 2020). Recent studies have shown that collaborative knowledge-building practices can have meaningful, lasting impacts (Bødker & Kyng, 2018; Stahl, 2006a) and can elicit collectively generated shifts in practices (Brodie, 2021; Hairon et al., 2017). Most of these studies, however, focus on primary and secondary education (Tuhkala, 2021); considerably less research has examined the professional development of higher education teachers (Avalos, 2011; Svendsen, 2020).

As White et al. (2016) argue, a transition in teaching formats in higher education requires teachers’ involvement and reasoning about each component of their practice. Thus, a professional development program should seek to promote teachers’ agency in making professional decisions about what they need to learn and how they might challenge themselves to acquire new skills (Brodie, 2021). More qualitative approaches are needed in the assessment of academic professional development, to better explore how programs focusing on forging relationships and building trust can have lasting impacts (Pleschová et al., 2021; van der Rijst et al., 2022).

In this paper, we aim to address this research gap by presenting a case of collaborative knowledge-building practices in a professional development program for higher education teachers in Denmark. The program adopts a framework of activity-oriented design (AOD; Durand & Poizat, 2015; Li et al., 2015), which has its roots in activity theory (Engeström et al., 1999; Leont’ev, 1981; Vygotsky, 1978) and computer-supported collaborative work (Nardi, 1996). AOD methods allow for the involvement of participants in creating productive learning spaces, artifacts, and collaborative learning environments (Carvalho & Yeoman, 2017; Yeoman & Wilson, 2019), by engaging simultaneously with theory and practice in learning situations (Durand & Poizat, 2015; Goodyear et al., 2021). AOD is also a key instrument in supporting higher education curriculum reform (Li et al., 2015), as it enables participants to connect learning theories and teaching practices (Anderson & Shattuck, 2012; Christiansson et al., 2018).

<sup>1</sup> In the relevant literature, it is also known as continuing education, continuous professional development, in-service teacher education, or lifelong professional learning.

The program presented in this paper is the outcome of Teknosofikum, an ongoing (2020–2023) project funded by the Danish Ministry of Higher Education and Science and developed collaboratively by four institutions. The aim of the project is to expand professional skills related to technology education, based on an understanding of technology as an agent in teaching and learning practices (Dakers, 2006; Pischetola, 2021).

The project is conceived as design-based research, which in turn is characterized as an interdisciplinary approach conducted in real-world settings (Reimann, 2011; Wang & Hannafin, 2005) through iterative analyses that support educational designers in implementing innovative proposals (Cobb & Gravemeijer, 2008). In the case of Teknosofikum, the innovative proposal concerns the use of AOD both in the organization of the online learning environment and in onsite workshop activities, with the aim of empowering higher education teachers in the pedagogical use of technologies, thus mitigating many of the difficulties they might encounter in planning meaningful activities. In the first three iterations of the project, 64 participants completed the course, 42 of which attending it in the hybrid format and 22 in the online format.

The following research questions guided our study:

- How can the professional development of higher education teachers be conceived as collaborative knowledge-building?
- How can activity-oriented design methods contribute to collaborative knowledge building in a professional development program for higher education teachers?

## 1.1 Activity-oriented design

Activity theory has contributed greatly to the field of computer-supported collaborative learning since the 1990s (Gifford-Enyedy, 1999; Nardi, 1996). At the core of this theory is the idea that culturally defined activities are internalized through social interaction, in the process of learning. That idea inspired the creation of a model of design for computer-supported learning environments, called activity-centered design (Gay & Hembrooke, 2004). In this model, social interaction is conceived as generating both cultural tools and cognitive processes, and learning is understood as a culturally mediated practice. Activities through which an individual learns can be defined by a hierarchical order, from organizations, to actions, to specific operations (Nardi, 1996).

In accordance with this idea, computational activities can also be organized and classified in the same way that human activities are (Christensen & Bardram, 2002). For example, a computer-mediated environment organized through an activity-centered design approach will feature a focus on interactions and interdependencies among teachers, students, tasks, and mediating materials (Gifford-Enyedy, 1999). It will also be structured around human activity (Baldwin et al., 2020).

More recently, the literature has introduced a new framing of this model, namely AOD, which uses activity theory as a paradigm for computer-supported collaborative learning. Here, activity is understood not only as an internalization process of learning, but also as a mechanism for making knowledge actionable (Markauskaite

& Goodyear, 2017) by translating learning to practice. In fact, engaging with AOD mechanisms supports the translation of conceptual frameworks into concrete actions (White et al., 2016).

AOD is based on the idea that learning is not only culturally and historically situated (Engeström et al., 1999; Vygotsky, 1978), but also driven by different epistemologies (Goodyear et al., 2021). Therefore, it acknowledges that working collaboratively might be challenging, especially in community-based participatory designs (Grönvall et al., 2016) and in interdisciplinary projects (Santaolalla et al., 2020), where conflicting values and points of view may arise. This is precisely why this model is relevant for teachers' professional development, where different theories and beliefs need to be articulated in order to seek convergence and shared epistemic grounds (Fischer et al., 2021).

With regard to approaches grounded on activity theory, several scholars have underlined the importance of producing design principles that can adjust interventions to their situated contexts, thus optimizing outcomes. For the purposes of this paper, we refer to the formulation of Yeoman and Carvalho (2019) on the need to use principles and theories as tools. According to the authors, the theoretical framework of the activity supports “designable components” (Carvalho & Yeoman, 2017: 193) that will be used to define the material structure of learning activities.

## 1.2 Teacher collaboration

The educational sector is increasingly confronted with the need to develop collaborative skills and collaborative work environments (Riedner & Pischetola, 2021). As Vangrieken et al. (2015, p. 18) point out, “proficient collaboration” among teachers is required, not only to achieve high performance in teaching, but also to enhance collaboration among students.

In higher education, AOD allows learning to be shaped as a collaborative process among teachers. In fact, in educational settings following this model, constant dialogue is maintained between the course design teams and the participants (Greenhow & Belbas, 2007), who themselves undertake the role of designers (Konnerup et al., 2018).

Research suggests that the quality of collaborative processes in professional communities depends on several aspects. First, trust among the participants is crucial (Brodie, 2021; Schechter, 2012), all the more so within computer-supported learning environments, as online settings happen to limit trustful collaboration and knowledge-sharing (Booth, 2012; Gerdes, 2010).

Second, the frequency and depth of interactions are key factors for improving collaborative knowledge-building practices (Dollinger et al., 2018). Collaborative learning among teachers can be induced, for example, by sharing experiences, observing each other's practices, or by discussing and reflecting together (Plauborg, 2009).

Third, teacher collaboration is not simply exchanging information to achieve a better result. Working in a collaborative way implies interdependence and shared responsibility towards a common goal (Romeu et al., 2016). Deep-level collaboration inevitably requires touching upon beliefs and values, which in some cases can be perceived as threatening, as disagreement often generates conflict. However, striving for

dialogue and towards cohesion has proven a key factor for the growth of teacher collaboration practices (Vangrieken et al., 2015). In this sense, AOD methods are useful when moving from specific tasks toward exchanges about differing values (Goodyear et al., 2021) and contributing to the collective knowledge of a group (Romeu et al., 2016).

This paper explores the potential of AOD in higher education teachers' professional development, where the emergence of collaborative practices and trustful relationships can have a positive and lasting impact (van der Rijst et al., 2022). We anticipate that the findings of our research could better assist educational designers in promoting professional development courses that aim at enhancing teacher collaboration in higher education.

### 1.3 The Teknosofikum project

Teknosofikum is a three-year project (2020–2023) funded by the Danish Ministry of Higher Education and Science. Its goal is to prepare higher education teachers for the professional opportunities and challenges entailed by digital technologies. The expected outcome is a 20–37-hour modular hybrid learning course. Four partner institutions—the IT University of Copenhagen, the Royal Danish Academy - Architecture, Design, Conservation, the University of Copenhagen's Faculty of Law, and Design School Kolding—are collaborating on the learning design, content development, and implementation of Teknosofikum, in five iterations. A total of 500 in-service teachers from all over Denmark are expected to attend the course over the duration of the project.

The overarching goal of Teknosofikum is to motivate and inspire higher education teachers to incorporate technology into their teaching practices in meaningful ways, through different digital tools/platforms, and with an understanding of the mutual influence between technologies and society (Hasse, 2017). This includes an interdisciplinary perspective at the crossroads between Law, Computer Science, and Design, with activities geared toward the acquisition of new information, reflection upon critical issues, and implementation of new ideas and concepts in teaching.

Teknosofikum is also intended to actively treat teachers as agents of their own professional development (Brodie, 2021). Thus, course participants are free to choose among two formats: an online course in the virtual learning environment (20 h) or a hybrid course with two additional onsite workshops (37 h). Figure 1 below shows the two learning paths for the respective courses.

In the virtual learning environment, the course participants are offered roughly 30 topics, divided between two categories of content: technology and education. Participants define their own professional needs and choose a suggested amount of five topics for each category. Each topic is accompanied by an activity that explores collaborative knowledge-building.

Furthermore, at the final workshop/online meeting, participants prepare teaching plans based on the ideas they were inspired with in collaborative activities during the process.

Drawing on the aforementioned concept of teacher collaboration, Teknosofikum's educational design team has identified three key goals to be achieved through



**Fig. 1** Visual representation of the two learning paths of Teknosofikum

the activity-oriented design of the course: trust, deep interaction, and discussion of beliefs/values. In light of these core goals, activities have been designed to be carried out in small groups of four or five participants from different institutions. In fact, the literature on technology, interaction, and cognition has given particular emphasis to the role of small working groups, reading circles, and informal professional discussions for the genesis of insights and new ideas (Greenhow & Belbas, 2007; Stahl, 2006b). The participants form groups at the first onsite workshop/online meeting.

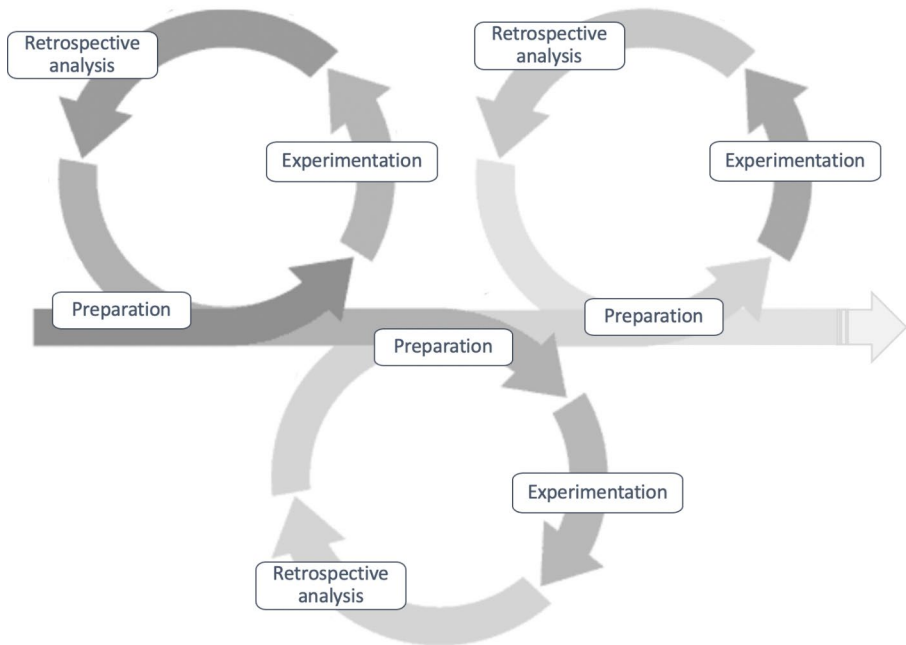
## 2 Research methods

The study presented in this paper examines the use of AOD methods in collaborative knowledge-building within a professional development program for higher education teachers in Denmark. The methodology used for the study is design-based research, an approach that is considered systematic but flexible (Sandanayake et al., 2021), as well as effective in bridging the gap between research and practice (Barab & Squire, 2004). As Reimann (2011) explains, design-based research is an investigation of educational interactions, provoked by a set of tasks, materials, and tools that characterize a whole learning environment. Common characteristics of design-based studies are their relatively extended duration (weeks or months – in our case years) and the close involvement of a team of educational designers in the research design.

Anderson and Shattuck (2012) summarize the aspects that make design-based research interesting for educational settings as follows: being situated in a real context; focusing on design/testing of a meaningful intervention; using mixed research methods; involving multiple iterations; promoting collaborative partnerships between researchers and practitioners.

Cobb & Gravemeijer (2008) define three phases in the design-based research process:

- Phase 1: Preparation.
- Phase 2: Experimentation.
- Phase 3: Retrospective analysis.



**Fig. 2** Visual representation of the design-based research methodology

The first phase is the most delicate, as it calls for epistemological alignment and a shared understanding of purposes. Once these are clarified and a common vocabulary is created among the designers, it is necessary to envision a theory of learning and an expected learning trajectory. The phase of experimentation will inform the researchers about the need to adjust future learning designs. Finally, in the retrospective analysis, tools and methods are assessed in terms of their suitability, given the initial theories, so as to inform redesign (preparation) in the next iteration (see Fig. 2 below).

## 2.1 Participants

The three first iterations of Teknosofikum involved a total of 64 teachers from the four different partner institutions. Of those teachers, 42 attended the course in the two different formats, as follows:

- May 2021 (first iteration): 7 online participants.
- October 2021 (second iteration): 22 hybrid participants.
- March 2022 (third iteration): 20 hybrid participants; 15 online.

The participants were recruited by each institution in different ways, through newsletters, public calls at faculty meetings, top-down requirements from heads of departments, and in some cases through local in-service teacher development programs for

junior teachers. Participants were evenly divided among teachers occupying junior positions (one PhD fellow, nine postdoctoral fellows, four teaching assistants, and 14 assistant professors) and senior positions (15 associate professors and three professors with special responsibilities). In addition, 18 part-time lecturers were recruited for the third iteration.

## 2.2 Data collection and analysis

The instruments used for data collection were 15 semi-structured group interviews, online forums in the virtual learning platform, and notes/posters resulting from four selected collaborative activities conducted during synchronous online meetings and onsite workshops. The details of each activity are presented in the *Experimentation phase* subsection below.

In one activity (#3), the participants were required to fill an online survey about their teaching perspectives (Pratt et al., 2001). The instrument was considered a conversational tool, to spark discussion among the participants, and not used for data collection itself. Other online surveys were used also during online meetings and onsite workshops, to give feedback to researchers and educational designers about the most valued aspects of the proposed AOD activities.

Five semi-structured group interviews were undertaken online at the end of each iteration with the aim to collect the participants' feedback on all the aspects of the course (learning path, topics available on the virtual learning platform, overall assessment of the learning process, activities, and most valuable outcomes). The interviews were recorded, transcribed, and analyzed with the use of the software NVivo 12. The online forums were downloaded in PDF format and imported into NVivo 12 as well. Three researchers were involved in the process of reading the collected material multiple times, to gain familiarity with its content. A descriptive open coding method was employed to categorize the findings with a keyword or a short sentence. Finally, the field notes from online and onsite meetings were used to support the process of recoding around the key features of teacher collaboration. This triangulation strategy is common in qualitative data collection and analysis, to improve the trustworthiness of the research (Oliver-Hoyo & Allen, 2006). Based on the literature on AOD methods, we organized data into three categories: trust, deep interaction, and discussion of teachers' beliefs/values.

It is important to emphasize that, in design-based research, there is no strict separation between theory development and theory application, as "data acquisition and analysis have to be (close to) continuous in order to drive forward multiple cycles of testing and design optimization" (Reimann, 2011, p. 39). This is why the data analysis of design studies resembles the methodology of the grounded theory (Glaser & Strauss, 1967), where evidence is given significance inductively, based on the analysis of contextual data (De Villiers, 2005). Similarly, the design-based research process allows for a constant dialogue between theoretical frameworks and their tested applications. Following the design-based research process, we used the results to redesign the course and the virtual learning environment at each iteration. In this way, theory and practice advanced concurrently, so as to solve real problems in real contexts.



### 3 Results

In what follows, we briefly describe our uses of AOD methods during the preparation and experimentation phases of each iteration. Then, in the retrospective analysis, we analyze qualitatively the collaborative processes generated by these activities, drawing on the collected data.

#### 3.1 Preparation phase

In the preparation phase, AOD methods served different purposes at each iteration of the project. The first two iterations of Teknosofikum (May 2021 and October 2021) focused on the conceptualization of technology education for higher education teachers, in order to organize the virtual learning platform's contents by relevance. The third iteration (March 2022) focused on interdisciplinary dialogue among the participants, for increasingly in-depth explorations of the collaborative processes of knowledge-building in professional communities.

At each iteration, the preparation phase had the purpose of (re-)designing the course, based both on the proposals from the design team and on the feedback from the course participants. As a result, the virtual learning environment changed significantly over the three iterations, from a content organization concerned with *topics* (iteration #1), to a content organization focusing on *disciplines*, based on the expertise of the participating partner institutions (iteration #2), to an organization addressing *knowledge areas* (iteration #3). Figures 3 and 4, and 5 below present the respective entrance page for course participants at each iteration.

#### 3.2 Experimentation phase

At each iteration, the experimentation phase allowed us to test the concepts defined during the preparation phase. The first iteration took place in May 2021, with seven participants in the online format only, due to Covid-19 restrictions. The second iteration took place in October 2021, with 22 participants in the hybrid format only, in order to test the design of the onsite workshops. In the third iteration in March 2022, both formats were implemented, with 15 and 20 participants, respectively. AOD methods were constantly applied in both the virtual learning environment and the onsite workshops. A summary of the activities is presented in Table 1 below, and a detailed explanation of each activity follows.

For the sake of clarity, we will divide descriptions of the activities into online and onsite.

#### 3.3 Online activities

In the virtual learning environment, the course participants worked individually in asynchronous mode. Along the three iterations, the activities grew in intensity and complexity. In the first iteration, they included only debates in forums, which occurred after watching a video, reading a paper, or listening to a podcast about a specific topic. In the second iteration, aside from debates in forums, the activities

# Welcome to Teknosofikum

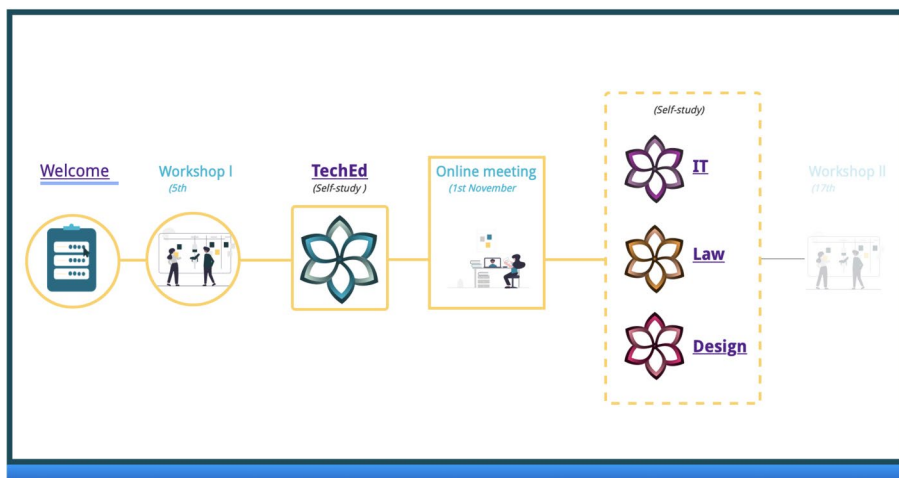
The course is framed around **six topics**, which can be explored in a **personalized order**. Each topic presents a different format (lecture, debate, interactive video) which we will ask you to evaluate in the end of the course. Related to each topic, **you will be asked to perform a few activities**, such as reading, searching the web, and post in the forums.



**Fig. 3** Learning environment iteration #1. Content organized on *topics*

# Welcome to Teknosofikum

This is your interactive dashboard where you can access the different modules (*TechED, Design, Law and IT*). The yellow line indicates where you are in the process and the modules will unlock after attending the different workshops and meetings.

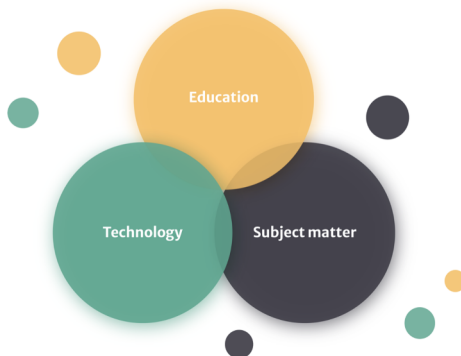
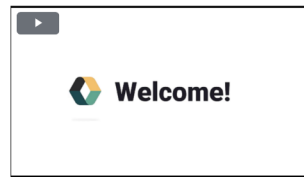


**Fig. 4** Learning environment iteration #2. Content organized on *disciplines* (IT, Law, Design)

# Welcome to Teknosofikum

This is your interactive dashboard where you can access the different modules of Teknosofikum, divided in two categories that compose our TechEd proposal for teacher professional development:

1. [Technology](#)
2. [Education](#)



## What is TechEd?

The purpose of technology education is not only to make the most creative use of technology, but also to be aware of the critical and ethical issues related to it. This is why we prefer the term TechEd to the more commonly used EdTech. In short, TechEd focuses on the human factor while EdTech puts an emphasis on the tools, or educational technologies, as they are known.

Know more:

<https://teknosofikum.dk/about.html>

**Fig. 5** Learning environment iteration #3. Content organized on *knowledge areas* (Technology & Education)

also included media content production. The course participants were asked to produce a small video, a podcast, or a mind-map about a subject they were teaching or had taught in the past. In the last iteration, in addition to these activities, the course participants were also asked to reflect in a more in-depth manner on their teaching practices and to fill out a “How might I...” sheet with new teaching ideas to be discussed in groups during the workshop 2 or online round-up meeting.

The synchronous activities included a midway online meeting for all course participants, divided into small working groups, and online kick-off/round-up meetings for the online format (implemented in the third iteration).

The midway online meeting was introduced in the second iteration of the course, in order to gather feedback from the course participants about the content and the format of the virtual learning environment. Based on positive evaluations by the design team, in the third iteration, this meeting was introduced as part of the learning path for both formats and was used to support course participants in their self-study. The main purpose of this meeting is to motivate the groups to work collaboratively, despite the fact that course participants belong to different higher education institutions in Denmark.

The online kick-off and round-up meetings have radically changed their formats from merely informative encounters between the design team and the course participants (iteration #1) to sessions involving more substantial collaborative work and group discussions (iteration #3). The activities of both meetings were designed based on the onsite workshops’ activities and were adapted for a one-hour online meeting.

**Table 1** Activities of experimentation phase at each iteration

Activity-oriented design			
	<b>Iteration #1</b> <i>online only; 7 participants</i>	<b>Iteration #2</b> <i>hybrid only; 22 participants</i>	<b>Iteration #3</b> <i>15 online participants; 20 hybrid participants</i>
Virtual learning environment ( <i>asynchronous/ individual study</i> )	Debates in forums	Debates in forums Media content production	Debates in forums Media content production “How might I...” sheet completion
Midway online meeting ( <i>synchronous/ group work</i> )	<i>Activity not held at this iteration</i>	Discussion of content Feedback on format	Discussion of content Knowledge-sharing Planning for next phase (“How might I...”)
Online kick-off and round-up meetings ( <i>group work</i> ) <i>Two one-hour online meetings</i>	<u>Online 1:</u> Brief presentation of the virtual learning platform <u>Online 2:</u> Discussion about content Feedback about format	<i>Activity not held at this iteration</i>	<u>Online 1:</u> Teaching perspectives Technology implosion <u>Online 2:</u> Mapping teaching ideas Design your teaching experiment Share your experiments
Onsite workshops ( <i>group work</i> ) <i>Two days from 10:00 until 3:30pm</i>	<i>Activity not held at this iteration</i>	<u>Workshop 1:</u> Teaching perspectives Technology implosion <u>Workshop 2:</u> Personas Cards-game Sketch prototyping	<u>Workshop 1:</u> Teaching perspectives Technology implosion <u>Workshop 2:</u> Mapping teaching ideas Group reformulation Design your teaching experiment Share your experiments

### 3.4 Onsite activities

The two onsite workshops were where the collaborative potential of AOD was most prominently tested. Teknosofikum’s first workshop ever was held in October 2021

**Table 2** Description of the four selected activities examined in this study

<b>Activity #1</b>	<b>Reflections in forum (online asynchronous)</b> After each topic accessed in the learning environment, course participants are asked to post their reflections in the forum and to share their professional knowledge about a specific technology trend and/or teaching practice.
<b>Activity #2</b>	<b>Discussion about content (online synchronous)</b> At the online midway and round-up meetings, course participants share their opinions about the most relevant topics encountered and the most interesting activities that produced knowledge-building.
<b>Activity #3</b>	<b>Teaching perspectives (onsite—workshop 1)</b> The course participants are introduced to learning theories and their relation to practice. They complete a survey about their own teaching perspective(s) and then, in groups, discuss some of their teaching beliefs/values/actions.
<b>Activity #4</b>	<b>Redesign of virtual learning platform (onsite—workshop 2)</b> The participants are asked to give suggestions for the future shape of the course, by discussing the topics presented throughout the course and diving into the specific components (what should be kept, eliminated, reformulated?).

(iteration #2) and was organized around two group activities: teaching perspectives and technology implosion. In the first of these, course participants shared their thoughts, beliefs, and experiences relating to teaching. In the second activity, each participant picked a technology (e.g., wi-fi router, self-driving car) and shared their knowledge/ignorance about it. Both activities concluded with plenary sessions in which each participant would present their reflections. This workshop's format was maintained in iteration #3, as it proved to be very productive. The format of the second workshop, in contrast, changed radically from iteration #2 to iteration #3, from a design-centered format aiming at refining the content organization in the platform to a more teacher-centered format focused on transforming teaching practices. This was due to the differing purposes of the iterations, given that the third iteration was closest to the final Teknosofikum course.

### 3.5 Selected collaborative activities

We now present the four online/onsite activities designed to trigger collaborative knowledge-building practices among course participants (see Table 2 below).

### 3.6 Retrospective analysis

Data from the online forums, online meetings, and onsite workshop materials are examined in relation to each activity. Data is organized around three key features of teacher collaboration in professional communities, as highlighted by the literature:

- 1) Trust.

**Re: Activity - Professional shifts in higher education**

by [REDACTED] · Tuesday, 2 November 2021, 9:34 PM

I remember the first time I use Mentimeter in class: I was so glad to get students' answer so quickly after asking a question. Also almost all students answer, so it was no more the situation where the usual one or two students answer only.

[Permalink](#) [Show parent](#) [Edit](#) [Split](#) [Delete](#) [Reply](#)
**Re: Technological Attentionality - Professional shifts**

by [REDACTED] · Friday, 1 April 2022, 8:31 AM

During the pandemic, I had online supervision. I divided them into groups of four. This created a space where they felt safe showing their projects and giving feedback. It was very positive. On the other hand, online teaching often becomes a bit one-sided. Black screens and very little response to questions. So online teaching is good for something, but maybe not everything.

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**Re: Technological Attentionality - Professional shifts**

by [REDACTED] · Friday, 8 April 2022, 10:10 AM

Tech are certainly changing our social relations these years. In the wake of the pandemic, many staff meetings are now turning into hybrid meetings, and I am still unsure how I feel about this development. Something bothers me, but why? What does bother me, is when I have to teach in this hybrid manner... I find it very difficult and unsatisfying to divide my attention between people who are there in the flesh and those just listening most of the time – perhaps even without a video feed. As a teacher I am very dependent on being able to respond to those small clues that our gestures and facial expression give away about the learning situation...I would hate to lose this in my practice...so I am not too happy about the outlook of teaching practice in HEIs becoming more and more decoupled from physical presence of students/teachers. A lot of energy, engagement, and learning will get lost...the types of learning that we can achieve will change with this development. As a society we need to be mindful of this...when, and when not, to use digital/hybrid formats is interesting from a didactical POV. As educational professionals we need to engage with such questions and lead upwards in our organizations to challenge the ever-growing dominance of market logics in our industry. Such logics need to be kept in check to not erode meaningful human relations and interactions, which I find crucial to much learning – at least when it comes to teaching topics that revolve around social themes and learning through sharing of experiences, reflections and perhaps values. Sometimes learning calls for psychological safety in the learning community, which is difficult to facilitate in a strictly online taught course, I think. How to support such psychological safety online is a great question to reflect on...the use of a physical kick-off workshops (such as in this TechEd course) takes us some of the way...

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**Fig. 6** Activity in forum on the topic “Technological attentionality.”

- 2) Deep interaction.
- 3) Shared beliefs/values.

## 4 Results

### 4.1 Activity #1—Reflections in forums

As it would be too extensive to present all the topics discussed in the forums, we have selected a few participants' exchanges as examples of asynchronous debates centered on proposed topics. The interesting aspect of the forums is that course participants can build on discussions from previous iterations of the course, as all posts continue to be preserved by the design team (Fig. 6).

### 4.2 Activity #2—Discussions about content

In what follows, we provide a few excerpts from the online meetings with small groups (3–6) of course participants. Given the space limitations, we have selected the most representative quotations from each iteration, which express opinions that were also conveyed by other participants. (Codes and numbers are used to preserve anonymity.)

#### Iteration #1

*I really liked this kind of an evaluation of your teaching. There was this discussion on what your roles are as a university professor. Are you a teacher, a facilitator, an instructor, or all of these? Are you some? Are you none? Reflect-*

*ing back to your question, I think that what we need [in Teknosofikum] is to think: how can we make the teachers better? I think it's to offer different kinds of scenarios. (L1, round-up meeting)*

*What I would really, really like would be sharing examples of how other teachers did what was inventive, with diverse methods, how they were thinking outside the box, and how they did it, because I get really inspired from other people's examples of teaching. [...] So, facilitating group discussions that start with an example or good ideas or something would really help me, instead of another webinar and sitting on planning webinars on my own. I would like more interaction with people to discuss things further. I've been on my own for a year now [...] I'm screen tired. (D3, round-up meeting)*

## Iteration #2

*I'm still kind of confused by the content. I don't know if I understand what I should get out of this. [...] Is this for students or for educators? Is this for technology being used by students as part of education? Is this for educators using technology in support of their educational practices? (CS8, midway meeting)*

*You know, what is technology? It's very different when you're talking about design technology, than it is when discussing the software platform. Is it actually learning how to code? How do you do that? How do we teach students how to code interactively online or whatever? (D5, midway meeting)*

*I really liked those active learning tools, especially. I think that helped me a lot in moving forward with my education. And I also liked the podcast/video exercise. [...] It wasn't many students that gave me feedback. But some of them said that it really worked well. [...] I would have not considered making a video if it hadn't been a task in the exercise, but I think I would consider doing it in my next courses as well. (D11, midway meeting)*

## Iteration #3

*The topic of critical literacy in computing was by far the most interesting. I was eager to know more. Is there going to be a part 2? (CS15, midway meeting)*

*I only took Tech topics so far, and they all confirmed what I know already. Especially regarding conspiracy theories, my concerns were confirmed. However, as for the Blockchain topic, I was surprised about how non-critical that part is! It did not mention the environmental challenges at all, bitcoin, and stuff. I think in Teknosofikum there's the idea that we need to be critical towards technology, right? (SS1, midway meeting)*

*We had great group communication when we met, but it has been more difficult since then. Life is very busy, but this meeting helps me get back to it. (D12, midway meeting)*

*It's always nice to meet colleagues who are teaching, we always have interesting and engaging exchanges from it! (L14, workshop 1)*

### 4.3 Activity #3—Teaching perspectives

In the first iteration, teaching perspectives were not discussed in group work. Reflecting on them was proposed as an individual activity in the asynchronous mode, through the forums. This changed in subsequent iterations of Teknosofikum, and a stronger focus has been put on this activity, first in onsite workshops (iteration #2) and later also in the online kick-off (iteration #3). Each course participant was asked to complete an online survey, which would generate an individualized profile related to their own teaching perspective(s). A topic was also created by the design team in the virtual learning platform, with a video explaining five teaching perspectives and the corresponding learning theories.

#### Iteration #1

*These teaching perspectives are totally new to me [...] I could have answered the test based on a different course and gotten different results; therefore, I don't find it conclusive. My teaching is generally based on both teaching and supervision, which demand different approaches. As a teacher, I am keener to share my knowledge, and as a supervisor, I mostly enable the student to find his/her way and solutions. (L2, forum)*

*While there is the issue of big classrooms making it hard to nurture learning and self confidence in analysis, it is very much the idea guiding teaching at my university, I think. Social reform [one of the teaching perspectives], however, is much less clearly institutionalized. I think that my kinds of social reform—critique and justice around gender and sexuality—are not on the map. Hence, every engagement I do to push students towards these critiques feels like they are on my own account...meaning that if I fail in any way, like if students are unhappy with it, it is unclear to me what sort of [institutional] backup I will get. (CS1, forum)*

*We all come from various kinds of education, so I think it'd be useful to also hear the students. It could be a way of seeing yourself from the perspective of the student. This feedback would help you a lot. [...] And if the theme is, e.g., assessment, it doesn't matter if it's Medicine students or Design students, then you have a theme that is the same for all of us, where we could sit down and have a discussion and check examples. (L4, round-up meeting)*

#### Iteration #2

*In the group discussion, we realized that we have perspectives that are very alike! I would expect that we'd be more different from each other. This discussion was like a mirror. It helped us look both at the individual actions and at what we aim for, in our teaching. It was really interesting to learn about the others, a mirror for all of us. Thank you for choosing this way; it's very concrete. It gives us personal agency and interdisciplinary dialogue. (CS7, onsite workshop 1)*

*It was quite difficult to understand the categories. They are too open-ended and miss out on a more direct discussion of what is our role as teachers. Aside*



**Table 3** Participants' questions on teaching perspectives, workshop 1, anonymously posted on Mentimeter. At the end of the workshop, each participant was also asked to fill out a survey regarding their takeaways. A total of 13 participants gave their feedback on the teaching perspectives activities (see Table 4 below)

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Questions emerging from group discussions on teaching perspectives

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*How much are these five perspectives dependent on discipline (i.e., teaching domain)? For example, is the experience perspective more important in art teaching than the transmission perspective? How about teaching technology?*

*I want to have the students reflect, but the students are scared, do not have the basic knowledge, or do not dare to not have the right answer.*

*What is to be done when teachers are happy with the creative and empowering learning process and outcome—and the student, after the course, says they did not understand what the purpose was?*

*It's problematic when you have 100 students and want to give feedback...but don't have enough time.*

*What is effective teaching?*

*What is good teaching?*

*When do we do "transmission" teaching?*

*How can one bridge the space between theory and practice?*

*What is the distinction between course learning objectives vs. teaching perspectives?*

*How do the different teaching perspectives or teaching styles influence teaching activities—for example, can you do peer-to-peer teaching for all five?*

*Doesn't good/effective/useful teaching involve all five perspectives?*

*It was very interesting to learn that—across very different institutions—we face quite similar issues of how to deal with designing and executing education/courses aiming for empowerment, when students are so focused on getting things "right."*

*How does one use technology to facilitate constructive peer feedback/learning?*

*How does the context influence the teaching perspectives—for instance, the difference between classroom teaching and lectures with 300 students?*

*Do you think that that technology has changed the way students see themselves and, by extension, their view of their education?*

*I would like to see more emphasis given to the importance of paying attention to responsive processes learning.*

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*from this, we had a similar experience to the other groups'. It was surprising to recognise our similarities. [...] We also talked about the need to reflect more on teaching from the point of view of our corporate identity [our field and institution]. (D8, onsite workshop 1)*

*We had several doubts: Are we discussing learning in general or learning in higher education? Is this about theory or are we to think about concrete actions? Some questions were ambiguous, and we thought that the teaching perspectives should not be framed as a "checklist." It should be considered, for example, that the course manager also has expectations about our teaching. So, how much can we really act upon our beliefs? (L8, onsite workshop 1)*

### .Iteration #3

For the onsite workshop, the design team had planned an exercise for gathering feedback on the teaching perspectives exercise. After a 45-minute group discussion following the results of the initial online survey, course participants were asked to prepare some questions to submit to other participants in a plenary discussion. They did so through a new online survey, which yielded the following results (see Table 3):

The online participants also commented spontaneously on the teaching perspectives exercise a few times during the midway meetings and in the forum. They

**Table 4** Participants' takeaways activity on teaching perspectives, workshop 1, anonymous survey. The same feedback was requested from online participants at the kick-off meeting, with the following results (Table 5)

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Takeaways from teaching perspectives activity (workshop)

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*I have become aware of new teaching perspectives.*

*This was interesting. I look forward to digging into it more. We had some very good discussions.*

*This was a good overview.*

*Networking with people was useful.*

*I appreciated getting new ideas to implement digitization with a critical perspective in teaching.*

*I became more clear about my own preferences.*

*The activity confirmed my approach.*

*It was helpful to learn of the experiences and teaching perspectives from other disciplines.*

*I am now more aware of when I apply certain ways of teaching, and I could perhaps even inform the students about why they are taught in specific ways in specific contexts.*

*The activity showed the complexity in diverse perceptions of what teaching is and how we teach as individuals.*

*I learned that I both value and enact a lot of empowerment in my teaching, which I think is very much suited for the course in mind.*

*It is general and broad. Some new perspectives were provided in the teaching and group works.*

*The activity provided a nice overview but was far from reality (in practice, it is more mixed).*

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**Table 5** Participants' takeaways from the teaching perspectives activity, kick-off meeting, anonymously posted on Mentimeter

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Takeaways from teaching perspectives activity (online)

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*This was interesting. I would have loved having more time to discuss the content.*

*This was very interesting—great to know.*

*Food for thought on how we adapt the different teaching styles to context and students' personalities.*

*OK, I am looking forward to getting new inspiration.*

*I appreciated the content on the relationship between intentions, actions, etc.*

*There might be discrepancies between intention and action; the reality of the classroom can be a factor.*

*There was an interesting debate on individual profiles and takes on professional identity.*

*It was nice to hear how others interpreted their results.*

*I found it noteworthy that my beliefs and my intentions scored higher than my actions!*

---

referred both to the exercise (survey and discussion) they had participated in during the kick-off meeting, to breakout rooms, and to a summarizing video they could watch in the virtual learning environment (Fig. 7).

*The five teaching perspectives are very cool—eye-openers. I understood also why I do what I do, and it's very empowering. I am sending students to the industry and to learn from each other, and there's a lot of complexity. Part of my course is lecture. (CS16, midway meeting)*

**Re: The 5 Teaching Perspectives**

by [redacted] - Thursday, 7 April 2022, 6:33 PM

My teaching probably consists of all 5 strategies. From the survey, I can see that I ideally wishes to teach with the strategies that act, reflect and are relational. In reality, I could benefit from involving more hands on and empowerment.

The subject of design can not be learned at all without either the empowerment, relational or experience strategies. I base my teaching on the projects we have been involved in in the Laboratory for Social Design. And we ask the students to go out and feel the world, form relationships with users and experiment together.

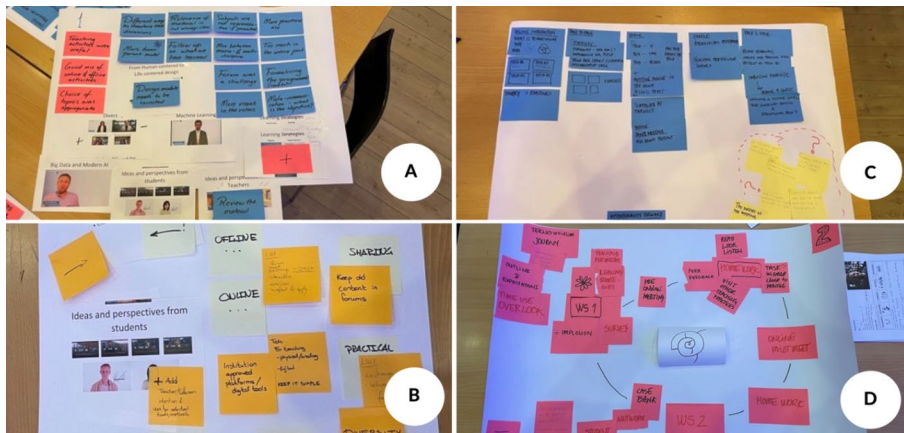
[Permalink](#) [Show parent](#) [Edit](#) [Split](#) [Delete](#) [Reply](#)
**Re: The 5 Teaching Perspectives**

by [redacted] - Monday, 25 April 2022, 12:20 PM

Seems like I'm pretty even on all five perspectives. That makes sense, as I find them all valuable in different ways.

[Permalink](#) [Show parent](#) [Edit](#) [Split](#) [Delete](#) [Reply](#)

**Fig. 7** Participants' posts about teaching perspectives in the forum



**Fig. 8** Posters constructed by participants in Re-design activity, during onsite workshop 2, iteration #2

*I think that the very best educators [for teacher professional development] are those who really know what they are talking about. Smart methods cannot replace expertise but can help the learning process. (CS19, midway meeting)*

#### 4.4 Activity #4—Redesign of the virtual learning platform

In the process of Teknosofikum's reconceptualization and redesign, some common critiques emerged from contrasts between participants' expectations and their experiences during the course, both in iteration #1 and in iteration #2. All groups stressed the need for more communication and clearer information about the learning path and the required time investment—in short, the user journey. Bearing these issues in mind, participants reflected upon the course's topics and proposed new design elements for the subsequent iteration (see Fig. 8).

Groups A and B focused particularly on the format of contents, suggesting that some of the videos should be replaced by podcasts or papers. In these redesign proposals, attention was drawn to micro elements of the course, rather than the overall structure and purposes. On the other hand, groups D and C were more innovative

in their proposed overviews of the course, advocating a spiral model and a flipped model, respectively. In the following, a few excerpts from their video-recorded feedback convey the arguments for these choices.

#### Group D—spiral model

*This [points at the center of the image] should be a circular thing, not a linear thing, so that you could actually come back again and keep on improving. That's why we have this spiral model in the middle. [...] We really liked the overall framework; it is like a gift to us. Of course, in the beginning you don't get it in depth, so there's something about revisiting the topics in this...well, we called it a journey. (D6, workshop 2)*

*We had some very practical new ideas about visiting each other at different institutions, having a look at the "operation room," and getting feedback about teaching. We talked about the fact that most people are too polite to be honest, and it could be really interesting to have someone by your side to tell you, "This is really boring," or, "This is really powerful"—honest opinions. That would also allow us to build some deeper relationships. [...] Or we could have a common case, that we implement at different institutions and then compare with each other. We included in our model a case bank, which would be extremely relevant for all the colleagues here. With it, we could do something at the student level, or better, at the teacher-student level. (CS7, workshop 2)*

*It is so much easier now to call any of you, because we have been in the same room and have shared this experience before going online, so you are not total strangers. This aspect is very important, as networking is also relevant for us academics. It's so seldom that people are actually really honest and say what they think works and what they think does not work. So, being able to facilitate this safe space of shared practice—I don't know what to call it—where it feels "all right," that would really be teaching me something. (D6, workshop 2)*

*You see that there is a "back" line that indicates iterations. As we were saying, it could be stretched out to "lifelong." When the idea is to develop critical reflections about teaching, this is nothing that we do like this [snaps fingers]. Instead, we could all relax if we visited a different colleague at different institutions every term and give feedback to each other about teaching, so that we really improve all the time. That makes it really concrete to us, close to our practice. (CS7, workshop 2)*

#### .Group C—flipped model

*I think it is essential to have some time to work with each other in an unstructured way. [...] Fundamentally, what we propose is a kind of flipped procedure, which starts by creating personas and discussing how our field engages with technology, sharing with each other how we construct technology, not as teachers, but from the point of view of our disciplines, the fields that we're acting in. To give each other this vocabulary about what technology is, how we understand technology to be [...], providing some examples, and having some collaborative discussions about how tech affects the field. And then, we would*

*meet online and take a more pedagogical approach of how to teach using technology, maybe taking the approach of how things are changing ... this might be one way to move forward. Then, when we meet again, we could refine our personas, update our teaching styles, and reflect on technology education and how we could incorporate technology in multiple dimensions. (D7, workshop 2)*

*Once you presented the circular idea [looks at the members of group D], that would also benefit our model, where we thought that teachers from Law, Design, and Computer Science could collaborate on designing a case for the three areas. That could be done by revisiting the contents at different moments. Or this could be done by having all the participants from the same field, e.g., Design, working together on a case. (L8, workshop 2)*

*We also pointed out some takeaways. I feel that my attention has really been raised during the course. I am much more aware of the issues that concern technology in education, and I will live with that. (D7, workshop 2)*

To sum up, three core principles appear to be relevant to the reframing of Teknosofikum: the modularity of contents, peer collaboration, and the variety of formats. For the purposes of this study, we will analyze how teacher collaboration appears as a transversal aspect in these results.

## 5 Discussion

We begin this section by addressing the second and more specific research question that guided this study:

- How can activity-oriented design methods contribute to collaborative knowledge building in a professional development program for higher education teachers?

Our results reflect the increasing complexity of the Teknosofikum course and concept over their development in the three iterations, with a total of 64 participants completing the course.

Overall, a first result that emerges from our data analysis is that AOD has contributed to differentiating the tasks that course participants were asked to perform, with the purpose of achieving different aims: reflection (activity #1), discussion (activity #2), theory-practice alignment (activity #3), and participation (activity #4). Among these goals, the latter was mostly directed at the improvement of the course for subsequent iterations of the project, while the other three defined achievements of both individual participants and groups.

### 1) Individual achievements.

Among the individual achievements, the participants mentioned that reflections on topics in the learning platform are useful (activity #1), but *practice-based* reflections (activity #3) are even more meaningful, as they can be “very concrete” and may promote “personal agency.” Based on a similar line of reasoning, the contents that par-

ticipants found most relevant to their own development as higher education teachers were those that provided them with examples of activities, tools, and strategies they could use in their teaching. As one participant put it, what she found in Teknosofikum was inspiring ideas “for new ways to do stuff.”

Some common critiques have also emerged from the participants’ experiences during the course. They have stressed the need for more communication and clearer information about the required time investment—that is, the user journey—and they have expressed some doubts about the design of some activities. Regarding activity #3, for example, one participant said, “It is general and broad,” while another described it as a “nice overview ... but was far from reality.” Doubts were also expressed about the core concept discussed in the activity on teaching perspectives: “What is effective teaching?”, “Are we discussing learning in general or learning in higher education?”, “Is this about theory or are we to think about concrete actions?”

It is worth emphasizing that, even in these critiques, it is possible to discern a high degree of reflection that benefits teachers in terms of professional development. However, the findings that mostly relate to our focus of analysis are the ones that concern collective achievements during the Teknosofikum course.

## 2) Group achievements.

Group work and collaborative practices have proven to be the most meaningful, as regards teachers’ professional development. Data analysis shows that all three key features found in the literature on collaborative knowledge-building practices are present in the reports on the four selected activities, both online and onsite. We examine these features in detail below.

- Trust.

When asked to share their opinions on the Teknosofikum format (activities #2 and #4), the participants did not express any special interest in specific educational tools or platforms, or in guidelines for using technologies in teaching. Rather, they stressed the power of peer exchange, unstructured discussions, and mutual feedback regarding teaching formats and strategies.

What they mentioned as “really powerful” in the project is the “shared experience” and “shared practice” of “being in the same room,” thus moving from being “total strangers” to creating networks of peers. In the words of one participant, Teknosofikum has created a “safe space” where “it feels all right” to give each other honest feedback. This result corroborates the importance of collaboration and teamwork in multidisciplinary fields (Romeu et al., 2016) and shows the potential of working actively around a common task. This result also supports the idea that, in a course for higher education teacher development, what is most effective and meaningful is an approach that emphasizes integrated knowledge, where disciplinary perspectives come into play and where networking is part of growing as a professional.

- Deep interaction.

The focus on group activities allowed participants to address complex questions (e.g., “What should technology education address?”) using a practice-based approach. This fostered intensive and deep interactions among the course participants, who particularly appreciated the collaborative activities centered on specific tasks. In the onsite workshop, for example, activity #4 required the use of posters, where different opinions and debates had to be summarized using keywords. From a bottom-up perspective, the participants needed to redesign the course for the next iteration, and they had the chance to explore what they knew about technology education and what they thought about it. Two groups out of four concluded that, for higher education teachers’ professional development, technology education is a “lifelong process,” which cannot be completed in a 37-hour course but can at most be initiated by it. They designed a model of exchange that enabled their newfound networks to survive after Teknosofikum, in order to “build some deeper relationships.” In addition, many participants asked the design team to provide them with access to the virtual learning environment after the course, so they would be able to check the materials again, for further ideas for teaching.

- Discussing beliefs/values.

Participants described sharing their teaching beliefs and values with peers (activity #3) as “an eye-opener,” a “bridge between theory and practice,” and a “mirror,” as they discovered similarities in terms of practices and challenges with colleagues from other institutions. Most participants did not know that their teaching practices were driven by distinctive epistemic beliefs, and they had fun discovering the discrepancies between what they think is important and what they do to achieve their purposes as teachers. Working in a collaborative and cross-disciplinary way therefore provided opportunities for articulating their thoughts and learning about themselves. These results show how the involvement of participants in creating a productive collaborative environment can engage them both with theory and practice (Goodyear et al., 2021). In this sense, AOD methods have proven effective in achieving a reflection about epistemic and pedagogical grounds of participants’ teaching practices (Pischetola, 2020).

## 6 Conclusion

The purpose of this design-based research study was to qualitatively assess the potential of AOD methods for higher education teacher collaboration in the context of a program for professional development. Our results demonstrated that AOD can be very useful for creating an environment of active learning, participation, and collaboration centered on specific activities that higher education teachers might consider relevant for their own teaching. Moreover, the research sheds light on how teacher professional development itself can be conceived as a space for collaborative learning, per the first research question guiding this study.

Based on the data analysis and the results presented in the previous section, we can identify at least two elements that characterize a program of teacher education as one

that might enhance collaborative knowledge-building. First, collaborative activities are much more likely to be productive when a safe learning space for participating teachers is generated, whether online or onsite. In our study, the four selected activities allowed for an exploration of situated and self-aware learning (Goodyear et al., 2021), as each teacher applied their ability to think consciously about educational design (Scott & Lock, 2021) and technology adoption (Pischetola, 2021). The safe space—as mentioned by one interviewee—consisted of an environment of informal discussion and feedback, where participants felt free to share their experiences. This result confirms that “academic development impact cannot, and should not, be solely restricted to quantifiable data” (van der Rijst et al., 2022, p. 2), but it should include social relations and sharing practices as important outcomes. Following design-based research, “safe learning space” can become a powerful design concept in the implementation of teacher professional development programs.

Second, in line with previous research (Cumbo & Selwyn, 2022; Santaolalla et al., 2020), this study has demonstrated the potential of collaborative practices in creating cross-disciplinary networks of academics who will continue to share ideas, practices, and teaching experiments. In fact, participants expressed the wish to continue to communicate and give each other feedback after the course, in order to further develop their teaching practices and experiment with new tools and strategies. In this result, we recognize the potential of collaborative practices for transforming learning into action (Markauskaite & Goodyear, 2017), which is especially important for the effective use of technologies in teaching (Riedner & Pischetola, 2021). Due to the qualitative nature of our study and the small sample size, this result cannot be generalized. Nevertheless, this finding offers an insight of aspects that higher education teachers value in a professional development program. It also offers valuable lessons regarding the format of the activities that could be implemented to improve teachers’ awareness about their own beliefs and ideals guiding their actions.

As our results illustrate, one crucial step toward increasing teachers’ levels of motivation consisted in investing in the quality of interactions that characterized the group work in Teknosofikum. In all the proposed activities, course participants shared personal experiences, discussed personal values and beliefs, and reflected together on the direction of in-depth exchanges. In this process, they also recognized many of their similarities, despite belonging to distinct disciplinary fields and institutions and coming from different backgrounds. They sometimes mentioned their surprise at finding such a fertile base of shared feelings and experiences, given the fact that they had not met before. Therefore, “network” is the second element emerging from our study that has both theoretical and practical implications. In fact, this aspect confirms the concept of learning as being culturally and historically situated (Engeström et al., 1999), but it also gives value to encountering different values and epistemologies (Goodyear et al., 2021). In practical terms, creating and engaging with a network of shared and collaborative practices is fundamental to innovation in the professional development of higher education teachers. As Dollinger et al. (2018) have pointed out, the quality and depth of interactions are key elements for meaningful collaborative knowledge-building.

A final point emerging from this study concerns the importance of designing professional development courses that consider teachers themselves as designers



(Hjalmarson & Diefes-Dux, 2008; Yoon et al., 2006). At this respect, it is worth emphasizing that the Teknosofikum course design changed radically over the three iterations (Pischetola et al., 2022), in response to critiques, requests, and suggestions offered by the course participants. The iterative virtual learning platform redesign facilitated refinements of the AOD methods, inclining participants to become more interactive as the course progressed, which in turn resulted in increased benefits from mutual feedback.

Involving teachers in the redesign of the course is also a way to foster their self-efficacy (Wang et al., 2004) and agency in making decisions (Brodie, 2021) on what a professional development program should offer. This supports the conceptualization of teacher professional development as a process that aims at extending teachers' commitments as "change agents" (Day, 1999), where agency is not merely an individual achievement, but rather a dialogic process between the individual and the educational ecosystem (Miranda & Pischetola, 2020). In this sense, AOD and collaborative knowledge-building practices can be useful to frame meaningful proposals for professional development in higher education.

## 7 Limitations and recommendations

Several limitations underlie our study. Firstly, the sample studied is small ( $N=64$ ), which constitutes a limitation on the generalizability of our results. Due to this small sample size, it is reasonable to estimate that the participants' responses might not reflect proportionally the whole teacher body at the four participant institutions. Two further iterations of Teknosofikum will be conducted in 2023 and will include increasingly larger participant groups, as well as extend the project to other higher education institutions in Denmark. Therefore, it will be instructive to observe the AOD methods in those iterations and to compare their results with the previous data analysis. In the long-term, if Teknosofikum will be established as a course that all Danish higher education institutions offer to their teachers, it will also be possible to undergo quantitative and more generalizable analysis.

Another limitation affecting the generalizability of our findings is the relatively narrow disciplinary origins of course participants, being recruited exclusively from the fields of Design, Computer Science, and Law. Moreover, three out of four partner institutions are relatively small, in terms of the number of faculty members, while the fourth (the University of Copenhagen's Faculty of Law) is approximately four times the size of any of the other three. The number of course participants was calibrated proportionally in the project design. Nevertheless, this element could have a relation to the culture of origin at each institution, in the sense of being more or less focused on collaborative knowledge-building practices. In the next two iterations, the course will be open to participants from Social Sciences and the Humanities. With teachers from other fields, the results might be significantly different.

Thirdly, our analysis did not take into account the seniority of the course participants and its relation to collaborative practices. Further research should investigate the relationship(s) between these aspects—disciplinary fields, institutional culture

and size, and seniority of the participants—and the motivations of higher education teachers pertaining to participation in collaborative group work.

Finally, a limitation that our study shares with all design-based research is the fact that learning is studied in a *designed* environment and considered as an experiment guided by theoretical constructs – namely AOD in our study. Despite design-based research having internal coherence in terms of methodology, there is no general agreement among researchers about how to ensure validity in a designed context (Jan et al., 2010). We reckon that to strengthen the validity of our study, it would be needed to unpack the design process of the project in its different iterations. This was not examined here for space limitations. However, the design principles of Teknosofikum have been partially covered in the work by Pischetola et al. (2022) and will be the core topic of another forthcoming article.

Future studies applying the methodology of design-based research in educational settings might consider focusing on the relationship between the design principles of a course and its outcomes in terms of teacher collaboration. Promising lines for research include both quantitative and qualitative approaches examining the impacts of activity-oriented design within professional development in higher education, with emphasis on social relations, shared practices, and network formation among teachers. Another important aspect to be deepened is the potential of activities that aim at teachers' reflections on their own beliefs, as well as the theoretical and epistemic grounding of each component of their practice.

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**Data availability** The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Conflict of interest** The authors declare no conflicts of interest.

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## Authors and Affiliations

Magda Pischetola<sup>1</sup> · Jeppe Kilberg Møller<sup>2</sup> · Lone Malmborg<sup>3</sup>

✉ Magda Pischetola  
m.pischetola@hum.ku.dk

Jeppe Kilberg Møller  
jeppem@itu.dk

Lone Malmborg  
malmborg@itu.dk

- <sup>1</sup> Department of Communication, University of Copenhagen, Copenhagen, Denmark
- <sup>2</sup> Center for Computing Education Research, IT University of Copenhagen, Copenhagen, Denmark
- <sup>3</sup> Department of Digital Design, IT University of Copenhagen, Copenhagen, Denmark