Socio-Technical Interplay in a Two-Sided Market: The Case of Learning Platforms

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Abstract The rise of the platform era changes the way interactions are structured and enables transactions at a distance. The platform phenomena also enables co-creation of content, shifting the way services are delivered across diverse boundaries. This is especially apparent in workplaces, where the developments change roles, relationships and conditions for teaching and learning, creating the possibility of a two-sided market. From a socio-technical and socio-cultural learning perspective, this study primarily aims for a better understanding of platforms in higher educational settings. Using a learning platform as an illustrative case, we argue for platform context transactions that are not monetary transactions. The main contribution of the paper is to offer a discussion where we problematize the transactional concept in two-sided markets. The findings shed new light on emerging challenges and tensions in the interplay between the constant change of technology and what it means to work in such change. This has implications for both teaching and learning and offers insights that can be valuable for understanding the shift to online learning during the recent pandemic of covid-19.

Keywords Two-sided market · Platforms · Learning platform · Transactions · Higher education · Socio-technical interplay · Online learning · Covid-19

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1 Introduction

The rise of the platform era is changing the way services are delivered as platforms enable different types of transactions at a distance. The development is rapid and multidimensional, raising various socio-technical questions around issues about trust, ethics, responsibility and privacy that are influenced by transactions enabled by platforms [1]. Studies on workplace technology have historically focused on specific systems and tools provided by the organization, in contrast to private use based on individual choice [2, 3]. Now, the emergence of platforms and ubiquitous technologies are blurring the boundaries between professional and personal use; shifting the focus in the field of IS and related disciplines from organizational, individual or group interactions with single technologies to platforms and artifact ecologies [4–8]. This shift brings diverse challenges and an immense cultural shift that affects various contexts in society. Higher education that enables teachers and students to switch between the classroom and meet through learning platforms is one such context. The context of higher education is changing rapidly, a change which has been especially apperent during the recent pandemic of covid-19.

The socio-technical systems work of Mumford and of Checkland, adopted in UK and Scandinavia [9–11], created an opening for qualitative and critical perspectives in IS research early on [12]. Over the past years, there has been renewed attention to the relationship between the social and the technical, in the light of the ongoing transformation of work and society, and the increased interest in platforms and artifact ecologies. The socio-technical approach, especially the Scandinavian school, is still thriving within modern IS research and, as we argue in this paper, is highly relevant for understanding two-sided markets in learning environments. Conceptualizations of digital infrastructures and platforms in prior literature have emphasized the socio-technical aspects [1, 13], however much of the research on two-sided markets and platforms address large-scale platforms and merely sees the transactional concept as an economical transaction. More insight is needed on socio-technical aspects of how small-scale platforms can be configured within local contexts in order to enable other types of transactions [1, 14, 15]. In this study, we use a learning platform as an illustrative case in order to argue for platform context transactions that are not monetary, which outlines a gap in the literature, addressed as the primary aim of this study. Even though most universities use learning platforms, they are not necessarily supportive of neither the features needed by the students nor the teachers, which brings us to the secondary aim of shedding light on the needs within a learning platform context. This dual aim is addressed herein as little is known about what is needed for learning to be exchanged online on the one hand, and offline on the other hand and how the socio-technical interplay between the classroom and the learning platform is actualized.

The two-sided market perspective is, until this point, applied to economic exchange, whereas we, in this paper, argue for other aspects being exchanged in a two-sided market. Consequently, we argue that *learning* can be such an exchange in a two-sided platform. To elaborate on the context of learning platforms, we see

that students in higher education have access to high-quality lectures and expertise from top universities and institutions which include subjects their teachers may not be knowledgeable in. Massive online open courses (MOOCs) and other forms of distance learning compete with traditional campus-based education. It raises questions about how education today can be complemented by MOOCs and the freely accessible learning materials flourishing on the Internet. Similarly, parts of higher education are increasingly digitalized, especially due to changed work situations in the lock-downs following the pandemic, and the shift between online and offline needs to be examined carefully. In traditional higher education, the one does not outweigh the other; instead it is an interplay between the classroom interactions and the learning platform, an interplay that is not always seamlessly fitted.

The main contribution of this paper is to offer a discussion where we problematize the transactional concept in two-sided markets. We also provide a discussion, from a teacher perspective, on how they see their role in engaging students in *learning to learn* and the socio-technical interplay of shifting between classroom and platform interactions. Our research is guided by socio-technical and socio-cultural perspectives, using concepts from the platform literature and two-sided markets, illustrated with examples from interviews with university teachers and the authors' own teaching experiences.

The remaining part of the paper is structured as follows: The following section provides an overview of related literature, where the concept of performance and two-sided markets are elaborated on. In this section, we also present central theoretical concepts guiding this research. Section three presents the results of the learning exchange in the platform, followed by the final section, where learning platforms as two-sided markets are discussed and reflected on from a socio-technical perspective.

2 Related Work and Theoretical Background

Lifelong learning is a concept used to illustrate the will to create the motivation for students to learn in school (in this case, higher education), and to apply the technique through the working life and in that way, continue to learn. More precisely, this means that the tools and methods for learning that take place in higher education can also be developed through future work [16–21]. However, there is a lack of success in creating commitment and interaction in learning platforms where students and teachers learn together. The students expect teachers to "deliver" the knowledge to them, which often takes form through discussions about formalities around the examination and dissatisfaction with the assessment. In some cases, this may trigger or intensify lacking incentives to pursue one's own learning, and the students fail to understand how digital tools and methods for learning can be used as a facilitator of (a) learning here and now, and (b) for lifelong learning, even after their education is completed, and when working life has begun. Diminishing the boundaries between formal learning and increasing an understanding of lifelong learning improves the

likelihood that the student will use the tools learned during education as a lifelong learning tool [22].

Since the introduction of Learning Management Systems (LMS) during the late 1990s, many studies have examined the success factors of using LMS, including various technical and non-technical factors [cf 23, 24]. In IS research, much focus has been on areas such as knowledge management systems and support for knowledge sharing, whereas surrounding communities of IS, for instance, CSCW and HCI have commonly been concerned with evaluations of learning in terms of user behavior, often from cognitive perspectives, with the purpose to inform the design of information systems, such as LMS's. Likewise, in knowledge management studies, learning is often not articulated; instead, the focus is placed on outcomes or effects of learning (efficiency, competitive advantages, cost reductions, etc.) rather than learning per se [20, 25–27].

There are other aspects and tensions of meeting through digital technology that is worth unfolding when talking about the socio-technical arrangement of introducing and using a learning platform where teaching and learning are exchanged. Sennett [28] states that modern society is attempting to destroy the evils of routine by favoring the flexibility of organizations and for workers. Moving the increasing workload of teaching and learning into learning platforms, enables flexibility that is both liberating and constraining. Accordingly, for flexibility to work in modern society, humans would need to have the skillset of trees and to be able to bend and yield but then go back to their original form [28]. However, flexibility also entails providing students with an environment to learn at all hours, which brings us back to the value exchange in such a platform, on the one hand, for the teachers, and on the other hand, for the students. Shifting between the classroom context and the learning platform is not straightforward.

Thus, to survive in a flexible learning environment, there is a growing need for personal preservation and individual sustainability. Knowing how far the teachers can push the students, and knowing how to facilitate a flexible learning community, is something trees seem much better at than humans. This study explores the teachers' role as facilitators and therefore examines the teachers' side of the platform context by focusing on university students' learning from a teacher's perspective. We propose a socio-technical *tool* (i.e. digital teaching and learning material with the focus on facilitating learning between the two) which enables a deeper understanding on how, and for what purposes digital platforms can be used, and how and in what way educational methods can be used and mixed to facilitate the learning exchange. For this, we use the socio-technical approach to information systems, where both social and technical aspects are taken into consideration alongside socio-cultural learning perspectives as a framework.

2.1 A Socio-Technical Perspective

To understand performance in two-sided markets and how the learning exchange happens as a socio-technical process, we will first elaborate on the socio-technical literature in IS research. The socio-technical approach is based on the relationship between the social and technical systems. The social system consists of professionals and their practices, cultures and roles, while the technical system consists of the technologies that support the work processes of the social system. The socio-technical approach is well known in the Scandinavian school of information systems, where early systems development was affected almost equally by social, political, technological and economic factors, with the organization seen as comprised of both social and technical element. Seminal work such as Mumford's sociological studies on socio-technical systems in the UK in the mid-sixties [e.g. 29], influenced Checkland [9], who in turn, influenced Scandinavian research as a response to union concerns aiming for workplace democracy. The ideas of Mumford and Checkland interacted with the political forces in play to form the Scandinavian systems development tradition [e.g. 30, 31].

Historically, the socio-technical approach aimed to overcome the opposition between technological and social determinism. It has in turn been criticized for either favoring the technical or the social [32–34], and for being an instrumental, normative tradition, and the practical impact of the practices involved in socio-technical research has been questioned [e.g. 35–37]. In recent years, the focus of the research done from a socio-technical perspective has shifted. In the early years, the research focused on altering the practices to fit the technical system, whereas today the focus is more on socio-technical design where both the practices involved and the digital artifacts are viewed in an interplay in which both need to be carefully designed and adapted [38]. An inherent ontological distinction between technology and the social has however, been preserved even in recent socio-technical studies, which validate "the viability of a socio-technical approach" [39, p. 385].

Within the socio-technical tradition, there is also a "socio-technical toolbox" [40] consisting of analytical tools that can be used by practitioners and scholars to learn IS as a practice and as a discipline. The toolbox helps to analyze, conceptualize, and understand complex transformation processes within contemporary workplaces. Bednar and Sadok [41] divide the toolbox into eight categories: "change analysis, system structure definition, system purpose, system perspectives, system priorities, desirable system, system action and system for evaluation and engagement" [41, p. 5]. The toolbox is designed to support learning about business system design and has been compared to action research in which practitioners are heavily involved in activities in the workplace to learn and understand the complexity of change in organizations. An important purpose of using the toolbox is to be aware of one's own contextual understanding and simultaneously understand others' by engaging in activities that can enable actors to make sense of the differences. From a socio-technical perspective, a digital tool can be conceptualized as a tool for creating knowledge; for instance, a tool for teachers to enable lifelong learning for students. As

described by Treem and Leonardi [42] visibility, persistence over time, and edibility are characteristic affordances of such tools.

A socio-technical approach aligns with a socio-cultural learning perspective discussed below, as both evolved in response to positivist and simplified views of causality (e.g., learning as transfer of knowledge or technology as cause of change). Instead, these perspectives address the emergent dynamics of people interacting with others—including technologies—in a situated context. Thus, suitable to study technology use in complex social practices such as higher education and online learning and teaching.

2.2 A Socio-cultural Perspective

Koschmann [43] elaborates on learning from a socio-cultural perspective and claims that learning takes place in context and that knowledge develops in the interaction with other people. Research and practice interests relate to the use of technology for collaboration and problem-based learning (rather than instructional efficacy, competence or transfer) and a corresponding focus on process rather than outcomes. Similarly, Brown and Adler [44] explain the concept of "social learning" as learning where the understanding of the content and context is socially constructed through conversations about the content and interactions with others about problems or actions. The focus is on how learning occurs rather than on what is learned. Learning is not seen as a characteristic of individuals but of a relationship between those who teach and the world around it. There is a similarity between Brown and Adler's description of social learning and Carmean and Haefner's [45] principles for deeper learning which argue that learning is a result of a meaningful understanding of material and content. This deeper learning occurs when learning is social, active, contextual, engaging and student-owned. Research has shown that to understand, analyze, apply and save information to long-term memory; the learner (e.g. the student) must actively engage in the material. Bates [46] uses experiential learning as an umbrella concept, referring to "learning by doing", as a teaching approach where learning takes place within real contexts.

A transmissive learning perspective is, in contrast to the social learning approach, based on psychological, cognitive, and behavioristic theories, where learning is viewed as something individual, cognitive processes that can be transferred between individuals. Bates [46], emphasizes the importance of mixing different perspectives on learning so that different skills are favored, such as conceptual, practical, personal, and social. For example, students need to learn facts, principles, standard procedures and the like before they can start a well-founded discussion on the subject or before they can begin to solve problems. As such, teachers can apply both transmissive and socio-cultural approaches in their teaching. Traditional classroom lectures and students' own readings are examples of transmissive teaching methods, whereas

seminars, workshops and supervision often involve activities of social interaction and thus social learning.

Although our approach to learning is based on a socio-cultural perspective, we see the importance of using transmissive based methods to strengthen a breadth of skills. It is important to see the learning on a course or program from a holistic perspective, where certain perspectives on learning are emphasized in certain parts and some in others. We believe that there is a need for new ways of thinking of learning platforms that provide learning opportunities for individuals to learn how to learn, while at the same time learning how to use the technology, both as students and in professional life.

3 Method

As described in the previous section, we have a socio-technical view, meaning that it is in the interaction between the digital and the technical—in practice—where learning takes place. In addition, our view on learning is based on a constructivist, socio-cultural perspective where the context and the social interaction between people are essential. What triggered our interest in this particular problem is that the reason behind specific methods for teaching in higher education is not always transparent to our students. With teaching methods, we refer to how the teaching is designed based on a view of learning, choice of supportive material, place (physical or online) and how these link to the subject [46]. As teachers, we are often not transparent with our pedagogical motives for the teaching methods and the tools we choose to use, and we often take for granted that the concepts we use are sufficiently accepted for everyone to understand. To elaborate, when we as teachers refer to a seminar, the students do not always understand without guidance what a seminar or a workshop is, what is expected of them as participants, how to prepare if it is mandatory and if so, what participation means.

For that reason, we have developed a tool for teachers to promote a learning spirit that stimulates engagement, interaction, and lifelong learning through the learning platform. This tool is a learning tool, intended to serve as a common learning area, to develop knowledge about, and to create a consensus around, the types of teaching methods used. It is primarily aimed to function as a basis for discussion and learning internally in the teacher's team, but can also be used as a learning object for the students, and an object for teachers to refer to when they talk about different types of teaching with the students. The intention is that the tool or learning object functions as a "buffet" of ideas about learning and technology and how they interact with the subject [TPACK, e.g. 47], which can be put together as one wants based on the circumstances of the teaching. The idea is that it is in fact a dynamic tool that is developed together with all teachers involved over time. The learning tool is created and accessible in the learning platform, Canvas, for all teachers to explore and is presented as a course (see Fig. 1).
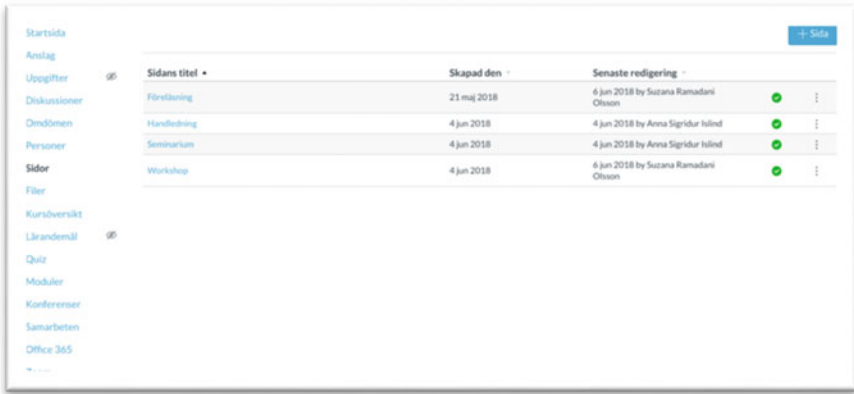
Fig. 1 An overview of the learning tool, embedded within a course in canvas

In this study, we used a qualitative approach and the empirical data consists of semi-structured interviews with 12 university teachers in Informatics at bachelor and masters' levels. The aim was to shed light on their view on how to facilitate learning based on their experience of using different types of teaching methods, as well as learning platforms. The participants were selected using snowball sampling [48]. Nine of the interviewed teachers were male, three were female, and the age ranged from 33 to 64. The interviews were analyzed through content analysis and are elaborated on below.

4 Results

The results are presented as socio-technical snapshots, exemplified with illustrative quotes from the interviews, describing four types of teaching methods frequently used: lectures, seminars, workshops, and supervision. We explain on what pedagogical basis they rest, which digital elements we recommend in connection to the different methods (which was tested through the tool we developed), and how the methods and digital tools can be combined in different ways so that they together contribute to learning.

4.1 Lectures

A traditional lecture where the teacher has the command and instructs the students from a top-down perspective can be understood as a transmissive view of learning where goals and knowledge come from *outside*, in this case, from teacher to student

in the form of lecture and instruction [46]. The transmissive view of learning as something internal that can be "transferred" from teacher to student is not the view of learning that primarily governs the teaching today. Nevertheless, it is important to take that perspective and historical view on lectures as a phenomenon into account. While lectures are an important part of higher education, our empirical data shows that moving away from long lectures where the students have a passive role for too long is central.

One teacher that we interviewed reflects on the purpose of lectures. The reflection lands in lectures as an activity for information dissemination aimed to provide all students with the same base of information and that this information can be: "*something that can be recalled, and built on, in following activities on the course*". Three of the teachers like the idea of the 'flipped classroom' where information is published on the learning platform for students to take part in online before meeting with the teacher and other students offline. Through the interviews, there is a distinction between information and communication where 'information' is dedicated to the lecture and 'communication' to other types of teaching methods such as seminars, online discussions, workshops and supervision: "*I try to separate it more like 'ordinary information' about how to do something or you describe something, it can be videos, it can be texts, reading instructions for books. And then you have a part when you 'communicate' in different ways, interact […] That is why I like the idea of flipped classroom because you can reuse the information, the part of teaching that is the same for all students, and spend more time [to] get to know the student and adjust the information in the best way.*"

There is also a discussion present in eight of the interviews regarding the concept of 'lecture' as a teaching method that is often used for recorded presentations that the teachers publish on the learning platform. One teacher emphasizes the importance of distinguishing between recorded presentations which are in the form of a monolog and a recording "*when you put a camera in the room where there is an interaction between the teacher and the audience*", which are something different than lectures as social activities. It gives the wrong impression to talk about lectures in the offline context, as one teacher explains, referring to the difference between recorded lectures as the creation of course material and video presentations of specific topics, which means to "*leave the lecture form and move on to the presentation form.*" Another teacher is skeptical of recorded material for a different reason. That teacher thinks that it is risky to use the word *recorded lecture* for what that teacher sees as a video presentation because the campus lecture involves so much more than a recorded material does: *Recording the lectures gives some students a false sense of being able to skip the lecture […] but when they listen to a recorded lecture, they are missing the context around it, so then they might get more confused than knowledgeable.*

Two methods that can be used to engage students during lectures are *response tools* (e.g. a quiz or mentometer) and *active learning*. These are based on presenting the problem area, using some response tool to collect the students' answers to the question posed; and then ask the students to work in pairs with the same issue, discuss the area, reconcile and improve and finally redo the test. The session should be concluded with a discussion about the answers. The time for these exercises

should be short, only a few minutes. In this way, response tools can be a support for, for example, exploring where the students are in relation to the goals they are expected to achieve at the end of the course or education, but that the technology is too much in focus. Response tools and lectures can thus be combined in different ways, depending on the purpose.

As expressed by one of the teachers: "*an experienced teacher notices when the audience's attention is lost, for example, by observing in what way the students use the laptop while the teacher is talking.*" By enabling questions to be asked, the teacher can also choose to deepen some aspects of what is taught when he/she realize that the students do not understand, i.e. engage them in active learning. One teacher emphasizes the importance of being able to move between the different teaching methods and to be perceptive to the particular needs of a unique group and individual students. To dynamically "*switch between different types of teaching*" is a required skill, s/he claims.

4.2   Seminars

A seminar in a higher education context is a meeting either face-to-face or online where students and teachers participate actively. The teachers' role is to be responsible for the implementation of the seminar by acting as a moderator and educator to get everyone to participate and that participation should lead to in-depth knowledge. Unlike the lecture, the seminar is an opportunity for reflection, ventilation of knowledge, and co-creation of new knowledge [46]. One way is to let students conduct seminars independently, to solve problems and use knowledge from previous learning opportunities and make a synthesis that they report back in class, receive criticism, comments, and guidance on how the work can be improved. Another form is that the teacher provides questions to be discussed in the group together with the teacher, to deepen previous knowledge or understanding of specific literature. A third way is to form small groups or conversations with individual students. The students present their work, and the teacher asks in-depth questions. The advantage of small groups or one-on-one meetings is that they can be adapted to the person's ability, knowledge, and personality.

The teachers problematized the size of the groups entering higher education today as an increasingly pressing issue where teachers do not enough time with each of the students: "*You may notice that there are some students who dominate the seminars, who take all questions and then the rest is very quiet, and then you also know these particular students might be silent in a large group but are perhaps better suited for talking in very small groups or individually.*" Also, some students are better at expressing themselves in text, making the online seminar more fitting for those. Motivation is an important factor in learning, which was also apparent through the interviews. The smaller the groups, the more intimate and specialized conversations can be formed. It is, therefore, necessary to find ways that fit these conditions in increasingly large groups. Although online discussions are seen as gateways to serve

more students in a shorter time, creating online seminar discussions proves more difficult than on campus: "*The discussions were completely dead in Canvas [the learning platform]. But then a Discord was started and the students started talking there instead. They had seminars without us. It [Discord] is a good tool and forum that is more informative, but it is not an official tool for us. What I have done is that I have appointed some "spies" [some of the students] who report what is happening on Discord. We have to pick up feelings of dissatisfaction [with the course] that we otherwise have no idea about.*"

Digital seminars in the form of threaded online forums are a way to visualize a conversation in a way that makes it easy for the participants in the conversation to follow the conversation by inserting posts with each other in the order they are made. The main idea with the seminars is to offer a diversity that allows the students to talk both in text and in speech, meet on campus and online. It is not always the same students who are most active in the digital forums and face-to-face seminars: "*…also a way to give students who may not talk in class, the opportunity to speak.*" Another valuable aspect of the online seminar brought up in the interviews is that it gives the students a massive written dialogue to use as reading material for further tasks or examination: "*they can copy formulations and reuse materials they have used in the seminar, which can both enhance learning but also entail plagiarism issues if they use material from others.*" As discussed in one of the interviews, plagiarism of discussions is often not seen as an issue by the students but can, in some cases, become a problem. Disadvantages with the online seminar are that it is more challenging to keep track of the group and make sure that everyone is talking. It is quite stressful to move between the groups, and because reading posts demand a lot of attention, the people behind the posts become less visible. In all interviews, there are both pros and cons to online versus offline and the integration of both and evaluating each situation is seen as the way forward. The option of the online seminar was therefore incorporated with a recommendation to use it in an offline context to enrich that setting and create a socio-technical learning experience.

4.3 Workshops

Some of the teachers frequently use workshops as a teaching method. That entails applying "learning by doing" through workshops based on a mix of case methodology and project-based learning. One describes it as "*especially great in subjects where it is difficult to crystallize exactly right from wrong, where there are grey zones, and where different solutions can be identified as possible solutions to the problem.*" Workshops are often being held in full class to jointly review the themes for the workshop, with the purpose of applying the techniques and methods later. Contrary to the intention of the workshop, a teacher points out that: "*experiences from these workshops are that students did not take an active part and contribute to the work. Commonly there are only a few students who talk; the rest of the class is entirely passive.*" The new design discussed in the form of the workshop is to divide the

class into smaller groups and use a tool that facilitates a digital message board, for example, the Padlet. All groups document their thoughts and results simultaneously online, which means that they can see how other groups think about an idea or a problem. This was developed as a part of the learning tool and incorporated into the offline workshop in order to better enrichen the workshop as a socio-technical teaching method.

The workshop format allows students to participate in and shape the course, both implicitly and explicitly, but it also allows the teacher, as one participant commented, to be sensitive and adjust the different forms of teaching depending on what might suit this group: "*How that combination of information and discussion, how it looks, it depends on topic and it depends on the group. Sometimes I may have said six weeks before I meet the students that we will have a seminar but then when the course has started and you get to know each other, I'm like - let's have a workshop instead.[…] I know many people who like the course to be fixed and ready from the beginning but I like when my courses are more dynamic and when I involve the students.*"

Active learning as a teaching method can help increase variation in teaching, which in turn can contribute to the students' in-depth learning. By using different digital tools, a collaboration between the students can be facilitated, and the creation of the collective knowledge, which takes place in the interaction with others, is promoted. The digital tool is here a tool for creating knowledge and for teachers to be able to adapt their participation to the different groups. The challenge, as expressed by some of the teachers, was not that the interest in getting involved is low. Instead, the groups are too big for the students to feel safe to participate in the activities, and that the teaching methods not invite the student to take place and be involved: "*By working in small groups, it is easier to involve all the participants in the group to take place, to cooperate with each other*". The participants raised the issue of smaller groups taking more time which led to the discussion of an online workshop tool, which could enable some participants to partake online, and others offline. However, this particular part was what most participants were skeptical about (mixing online offline in a workshop format). They agreed on that helping the students understand what workshops entailed before they entered would help tremendously. That led to the development of informational support included in the learning tool that would help students learn about workshops, on beforehand, with the hope of making them more efficient.

4.4 Supervision

Supervision can be conducted in different ways and arise from different purposes. Supervision can be asynchronous or synchronous and can take place both in a physical meeting offline as well as online. It can be done individually and in groups, depending on the purpose. Individual supervision tends to be more focused on the student's success, while group supervision usually becomes more general [46]. The primary

purpose of supervision is to help the students move forward in their knowledge process.

When discussing supervision and how learning occurs, one teacher highlights: "*supervision, just as a lecture, is a highly social activity.*" This teacher makes a distinction between the teaching material (e.g. slides, books and papers discussed in supervision) and the social aspects of meeting face-to-face: "*Well the material is supposed to create the foundation, the structure, arouse thoughts and then I [the teacher] should be able to concretize, exemplify and elaborate on that. And not least, what is the biggest thing about supervision, it is the contact with the person there. Because both the supervision is not one-way communication, it is interactive, yeah, it is an interactive process.*"

Supervision may include digital components that support the process. One simple example is conducting supervision through forums that are used as part of online courses in different programs. Forums often function as a tool for getting messages to more than one at the same time, like a bulletin board. That means that it enables: "*a possibility to digitalize an analog work process that previously took place in the classroom.*" A sub-purpose of a forum can be to archive what previous students have done, which can contribute to the learning of the new students. Two teachers in the interviews highlight that supervision can be done via text, for example, in the form of comments on students writing supported by different types of digital services. For instance, via Google Docs, which is a digital text editing service. The same applies to PowerPoint slides, which can also be edited and shared with classmates and teachers for input through supervision. Another way to conduct supervision is via Zoom, Skype, and Adobe Connect. There, the supervision becomes synchronous, and the students meet the teacher in a virtual room through video and audio-based tools. However, in the interviews, it was apparent that during one-on-one supervision, the teachers preferred to see the student, and they also preferred offline context for that type of supervision. However, the teachers were positive towards mixing, depending on the need at the time. As one teacher said: "*Switching between the digital and the social, that is where the magic happens. To be able to make sense of what happens on [the discussion forum] or during supervision, you need the context of what happens in the classroom or during a face-to-face meeting, to get a deeper understanding of it all.*"

Consequently, supervision can include course-specific components, such as programming or academic writing, which can be seen as an object to interact around during supervision but whether it occurs online or offline is negotiable. What all guidance has in common, regardless of form and content, is the desire to help the student further in the knowledge process, a drive that became very clear during the interviews. What was also seen from the interviews is that in order to get asynchronous supervision in digital forums, teachers need to adapt their communication method and tonality. Forums can be used as a communication tool and act as peer-to-peer support students between. What can be more difficult to achieve is an equal dialogue between students and teachers, where tonality and communication patterns can be of greater importance. It can often be perceived as the teacher interrupts and provide answers during such setup and thus, the discussion stops. Although these types of solutions are traditional video-meeting tools, they can be used in different ways, and

the teaching practice can be adapted accordingly. In line with that, the learning tool included zoom as an option to conduct supervision in cases where digitally mediated supervision was seen fit.

5 Discussion

The types of teaching methods: lectures, seminars, workshops, and supervision can be understood as activities constituted by a variety of socio-technical interactions. The goal of these interactions is to enable learning. Through the literature on two-sided markets, transactions are seen as an exchange, which entails monetary value. However, supported by the findings of this paper, we argue that in a learning platform, there is the value exchange of learning which can be seen as a transaction in a two-sided market. The two sides of the market are the teachers and the students, and the market is the learning platform with a range of support included in the platform. In the following section we (1) elaborate on the notion of learning as a transaction between the two actors 'teachers' and 'students' and (2) use a socio-technical alongside a socio-cultural learning perspective to shed light on how the transactions occur in practice, hence how social and technical elements of the transactions are used and combined by teachers and students. We end with a reflection on the competences and strategies needed to utilize technology in a way that helps the participants (teachers and students) enhance learning.

5.1 *Learning as a Transaction in a Two-Sided Market*

In this paper, we illustrate an understanding of the socio-technical interplay between the learning platform and the learning in the classroom. As a part of that, we want to shed light on performance in relation to digital platforms. McKenzie [49] identifies three types of performance in contemporary culture—organizational performance, technological performance and cultural performance—and talks about the social dimension of technology and how projected technologies are more social than technological. Introducing technology as a facilitator for learning (and understanding the socio-technical process of doing so) involves different types of performance. From a teacher's point of view, the development and design of how the learning is facilitated through a learning platform have to do with organizational performance. However, as our results show, technology use requires technological performance both from the teachers' and from the students' side. It is well known from IS discussions that technology cannot be placed in a setting without consequences. It triggers cultural changes, meaning that this way of teaching and learning also touches upon cultural performances. The cultural changes happen both for the teachers and for the students, as visible through the findings of this paper, where the teachers draw from

their experience of shifting between online and offline and the cultural aspects of each.

Seeing a learning management system or a learning platform as a two-sided market, even though it does not entail a business transaction, might be seen as somewhat controversial. Traditionally, a two-sided market facilitates exchange between consumers that have not been in transactions before and enables interaction because the interaction takes place by way of the platform [1, 50]. The lens of the two-sided market has been growing since the early 2000s and has been referred to as two-sided markets, multi-sided markets, and multi-sided platforms in the literature [50, 51]. Here we do not refer to a market as a market where economic exchange takes place but as an exchange of specific service. We see learning (where there are teachers on the one side and students on the other side) as an exchange of knowledge and see that as a transaction in a two-sided market.

By viewing learning as a transaction in a two-sided market, we make the epistemological assumption that learning is a social activity and a relationship between teachers and students, facilitated by digital tools. To unpack this relationship and the role of the actors and the technology, we argue that a socio-technical lens is useful. It helps us to distinguish between social and technical elements in the different types of teaching meanwhile supporting us with an understanding of the relevance of both for learning. The four types of teaching methods: lectures, seminars, workshops, and supervision, can be viewed as assemblages of social and technical elements. The included elements are not fixed or predefined, but we argue that both social and technological elements do need to be present and they need to interplay for learning to be enhanced. Our findings illustrate how the different types of teaching and learning transactions involve different levels of interaction. In the following, we exemplify and discuss the socio-technical character of these interactions.

5.2 Strategies for Flexibility and the Importance of Context

Although learning platforms used for teaching and learning in higher education are relatively easy to use, it requires competence to use them in a way that can potentially support the learning process, instead of hindering it [46]. This has become increasingly apperent during the shift to online learning during the pandemic of covid-19. In this paper, we have identified and described various socio-technical aspects of relevance for teaching and learning. In the following, we reflect on the findings in the two distinct themes of context and flexibility. A summary of the types of teaching, corresponding digital tools, and socio-technical interactions identified in the material is provided in Table 1.

Taking the context seriously. As for the context in which the teaching is conducted, it is important to note that future students will be raised with digital technology for fun and leisure, but they do not per se know how to use it in an effective and professional manner to support their learning. The use of digital tools in private differ from

Table 1 Summary of types of teaching, digital tools, and socio-technical themes

Teaching method	Types of technologies	Socio-technical themes
Lectures: *transmissive learning, active learning*	Quiz, mentometers, response tools	Adaptation of technology to support the purpose one is looking for [37]
Lectures: *transmissive learning, active learning*	Quiz, mentometers, response tools	Adaptation of technology to support the purpose one is looking for [37]
Seminars: *Social learning, moderation, questions, investigative tasks*	Online Collaborative Learning (OCL), threaded forums	Use of technology for collaboration and problem-based learning and instruction as enacted practice [43]
Workshops: *Experiential learning, referring to "learning by doing."*	Digital message board	Use of technology that affords visibility, persistence over time and edibility [42]

competent actions in a professional context. Although there is an increasing focus on digital competence, it will take time before knowledge and methods for digital competence are achieved at all levels. How future students can work with digital technology for learning will probably vary widely between groups and individuals. The pedagogic challenge that comes with the use of various tools, which the future student feels comfortable with, can also be an asset. As teachers, we may be allowed to let go of the control of deciding on the tools and instead deciding on the teaching content. This may, however, disadvantage students who are less well versed in professional digital behavior. A key challenge is to not leave the student with this task since the role of the teacher includes support in navigating the digital tools and the task's learning objectives. A way to deal with these challenges is to evaluate which tools the students use and how they learn with them, to take advantage of their knowledge and make the teaching more relevant.

With the knowledge of the experiences the new students have of how to deal with problems and learn (e.g. moving image instead of text, fast communication, one-time learning, flexibility, other views of authorities, etc.), we believe the teaching needs to be adapted accordingly. For example, it needs to add value to the students, that is something other than a lecture on YouTube. We believe that this added value is about working in practice with problems and issues in workshops and seminars. It can be challenging to do online in an established learning environment like the university. We also think the teaching role is about seeing the students, thus creating a relationship with them so that the teacher can catch those who do not hang around and stimulate those who are at the forefront a little extra. A personal relationship with the teacher gives the student added value to come to school and confidence in the teaching. The actual packaging of knowledge and learning becomes essential so that education can contribute with unique benefits that are difficult to achieve on your own or outside the university.

Flexibility and individualization. Flexibility to adapt to the knowledge and engagement level of the students is a vital skill as a teacher. That can be done by sensing the mode of the students in the classroom and how they engage with the subject being taught. Being flexible is a more difficult task online when the teacher cannot pick up subtle social expressions from the students. Because the tools we use are also used privately, the new technology comes with expectations from the students on what it can be used for. We can see increased individualization and expectation of flexibility and that one wants to do as one wants rather than follow a collective mass. This expectation can be used positively to work with inclusion, for example, students with special needs. It will then be important to focus on what competencies we want students to achieve. In the system development program, we have recently worked on this flexibility and individualization challenge as we have a student who is blind. We have been reviewing how we write the course objectives in relation to what we want to assess. We have discovered that we sometimes write in the syllabus how we will assess a specific course target and we sometimes write in which way, i.e. we specify a specific digital tool one must use in the examination. When a blind student becomes our student, it challenges our view of the form of examination, and we need to think about alternative methods for assessment and what skills we should assess, rather than on the type of technology we use. The tools we deal with on our "buffet", however, are primarily aimed at supporting the teaching practice, rather than supporting the students' competence in absorbing practical knowledge, which is part of taking the degree on our programs. However, all the tools, in the form of use we advocate, have a dual-use because the student is an end-user, as well as the teacher. In the use of digital tools and design of courses, it is important to keep in mind that the students are influenced by our way of using digital tools, although teaching practice is also an important aspect. Adapting the use of these tools to the situation fits in with Suchman and Trigg's [52] argument that the most successful digital tools are those which "co-evolve with practice."

Hence, by viewing the different types of teaching through a socio-technical lens, we see how social interaction and technology in the classroom can interplay to improve learning. The teacher-student relationship is of mutual character. The teacher depends on being close to the students to sense their presence or absence, and the students need nearness to the teacher and other students to engage in course activities. A recorded campus lecture, for instance, is difficult for a student to make sense of without attending fully, as questions, jokes, facial and bodily expressions are lost in the recording.

To sum up, the pedagogical conviction can be described as a constructivist approach where a socio-cultural perspective is crucial. Underpinning this is the assumption that learning occurs in social contexts and that it is impossible not to learn. Our findings illustrate some of the ways digital tools can be used to support this type of learning. For example, using quizzes during lectures, using threaded forums online to practice online conversations, and using digital message boards to collaborate and share knowledge between groups during a workshop. We argue that more flexible approaches to learning and teaching are crucial to prepare students for the digital workplace of the future. Modern work has long been characterized

by flexibility and pressure to perform [28, 49], accentuated by the digitalization of professions [53] and the expansion of platforms into everyday life [54]. Furthermore, it is evident that IS has broadened beyond IT and computerization and is increasingly relevant and integrated into almost all aspects of workplaces and society. Finally, our findings highlight the importance of increased transparency for students to utilize the given learning opportunities. From the two-sided market perspective, this benefit both the teachers and the students, as students that are prepared will likely be able to focus on the course-related topics, problems, and questions rather than on formalities and requirements for examinations. From a socio-technical and socio-cultural perspective, we believe that if we succeed in getting the students to understand that the teaching moments are interwoven with the subject and aiming for lifelong learning (not just taking place in a formal context on a course), we can motivate students to get involved and come to campus and participate actively to a greater extent.

6   Conclusion

In this paper, we have addressed the need to develop a better understanding of why and for what purposes digital tools and educational methods are used in higher education, and how they can contribute to lifelong learning. For this purpose, we developed a learning object—a learning tool—consisting of ideas about pedagogy, technology, tools, and how they interact with the subject being taught. The socio-technical and socio-cultural perspectives as a framework for understanding technology and learning in practice helped to shed light on some of the challenges and tensions associated with teaching and using learning platforms and the digital tools embedded in these systems.

In conclusion, a digital tool to support teaching should not be seen as static, but as a dynamic and continuously changing tool, characterized by the interplay between the change of technology and in teaching methods. From a socio-cultural perspective on teaching and learning, the socio-technical interplay involves valuable transactions of learning between two sides of a platform—between students and teachers. It is of vital relevance for teachers, and professionals in general, to see this transaction and put it in foreground when negotiating technological and social aspects of teaching and learning.

References

1. Islind, A. S. (2018). *Platformization: Co-designing digital platforms in practice.* University West.
2. Baskerville, R. (2011). Individual information systems as a research arena. *European Journal of Information Systems, 20,* 251–254.

3. Bødker, S., Lyle, P., & Saad-Sulonen, J. (2017). Untangling the mess of technological artifacts: investigating community artifact ecologies. In *Proceedings of the 8th International Conference on Communities and Technologies* (pp. 246–255). ACM.

4. de Reuver, M., Sørensen, C., & Basole, R. C. (2018). The digital platform: A research agenda. *Journal of Information Technology, 33,* 124–135.

5. Wiberg, M., Ishii, H., Dourish, P., Vallgårda, A., Kerridge, T., et al. (2013). Materiality matters—Experience materials. *Interactions, 20,* 54–57.

6. Islind, A. S., Lindroth, T., Lundin, J., & Steineck, G. (2019). Co-designing a digital platform with boundary objects: Bringing together heterogeneous users in healthcare. *Health and Technology, 9,* 425–438.

7. Norström, L., Arghavan Shahlaei, C., Johansson, L.-O., Islind, A. S., & Lundh Snis, U. (2019). New logics of ethics in the age of digital platforms: Design fictions of autonomous cars. In *Proceedings of the 17th European Conference on Computer-Supported Cooperative Work-Demos and Posters*. European Society for Socially Embedded Technologies (EUSSET).

8. Islind, A. S., Lindroth, T., Snis, U. L., & Sørensen, C. (2016). Co-creation and fine-tuning of boundary resources in small-scale platformization. In Scandinavian conference on information systems (pp. 149–162). Berlin: Springer.

9. Checkland, P. (1981). *Systems thinking, systems practice.* Chichester: Wiley.

10. Mumford, E. (2006). The story of socio-technical design: Reflections on its successes, failures and potential. *Information Systems Journal, 16,* 317–342.

11. Mumford, E., Hirschheim, R., Fitzgerald, G., & Wood-Harper, A. (1985). *Research methods in information systems.* North-Holland Publishing Co.

12. Wynn, E., & Vallo Hult, H. (2019). Qualitative and critical research in information systems and human-computer interaction: Divergent and convergent paths. *Foundations and Trends® in Information Systems, 3,* 1–227.

13. Hanseth, O., & Lyytinen, K. (2010). Design theory for dynamic complexity in information infrastructures: The case of building internet. *Journal of Information Technology, 25,* 1–19.

14. Islind, A. S., Snis, U. L., Lindroth, T., Lundin, J., Cerna, K., & Steineck, G. (2019). The virtual clinic: Two-sided affordances in consultation practice. *Computer Supported Cooperative Work (CSCW), 28,* 435–468.

15. Islind, A. S., & Lundh Snis, U. (2018). From co-design to co-care: Designing a collaborative practice in care. *Systems, Signs and Actions, 11,* 1–24.

16. Billett, S. (2014). Mimetic learning in and for work. In *Mimetic Learning at Work* (pp. 1–21). Berlin: Springer.

17. Islind, A. S., & Lundh Snis, U. (2017). Learning in home care: A digital artifact as a designated boundary object-in-use. *Journal of Workplace Learning, 29,* 577–587.

18. Norström, L., Islind, A.S., & Vallo Hult, H. (2017). Balancing the social media seesaw in public sector: A sociomaterial perspective. In *RIS Selected Papers of the Information Systems Research Seminar in Scandinavia.* Tapir Akademisk Forlag

19. Vallo Hult, H., Hansson, A., Svensson, L., & Gellerstedt, M. (2019). Flipped healthcare for better or worse. *Health Informatics Journal, 25,* 587–597.

20. Vallo Hult, H., Islind, A. S., & Norström, L. (2018). Tuning professionalism in the public sector. In *AIS SIGPRAG pre-ICIS workshop on "Practice-based Design and Innovation of Digital Artifacts"*. San Franciso, CA, USA.

21. Islind, A. S. (2014). The "PantryApp": Design experiences from a user-focused innovation project about mobile services for senior citizens. In International working conference on transfer and diffusion of IT (pp. 359–362). Berlin: Springer.

22. Gellerstedt, M., Johansson, K., & Winman, T. (2015). Work integrated learning: A marriage between academia and working life. *Journal of Systemics, Cybernetics and Informatics, 13,* 38–46.

23. Al-Busaidi, K. A. (2012). Learners' perspective on critical factors to LMS success in blended learning: An empirical investigation. *CAIS, 30,* 11–34.

24. Amrou, S., Semmann, M., & Böhmann, T. (2013). Managing for transfer of training: Directions for the evolution of learning management systems. Chicago, Illinois, USA: AMCIS.

25. Vallo Hult, H., Islind, A. S., Johansson, L.-O., & Lundh Snis, U. (2017). Towards learning with digital artifacts. In *IFIP WG 8.6 Working Conference on the Diffusion and Adoption of Information Technology,* Guimares, Portugal. IFIP.
26. Islind, A. S., Lundh Snis, U., & Pries-Heje, J. (2017). Learning at the digital boundaries. In *IFIP WG 8.6 Working Conference on the Diffusion and Adoption of Information Technology*, Guimares, Portugal (pp. 1–4). IFIP.
27. Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly, 25,* 107–136.
28. Sennett, R. (1998). *The corrosion of character: The personal consequences of work in the new capitalism.* New York: W.W. Norton.
29. Mumford, E., & Henshall, D. (1978). *Participative approach to computer systems design: A case study of the introduction of a new computer system.* Halsted Press.
30. Bjorn-Andersen, N., & Eason, K. (1980). Myths and realities of information systems contributing to organizational rationality. *Human Choice and Computers, 2,* 97–109.
31. Hedberg, B. (1978). *Using computerized information system to design better organizations and jobs.* Swedish Center for Working Life.
32. Cecez-Kecmanovic, D., Galliers, R. D., Henfridsson, O., Newell, S., & Vidgen, R. (2014). The sociomaterialty of information systems: Current status, future directions. *MIS Quarterly, 38,* 809–830.
33. Leonardi, P. M., Nardi, B. A., & Kallinikos, J. (2012). *Materiality and organizing : Social interaction in a technological world*. Oxford: Oxford University Press.
34. Orlikowski, W. J. (2009). The sociomateriality of organisational life: Considering technology in management research. *Cambridge Journal of Economics, 34,* 125–141.
35. Bjerknes, G., & Bratteteig, T. (1995). User participation and democracy: A discussion of Scandinavian research on system development. *Scandinavian Journal of Information Systems, 7,* 1.
36. Kyng, M. (1994). Collective resources meets puritanism. *Scandinavian Journal of Information Systems, 6,* 5.
37. Leonardi, P. (2012). Materiality, sociomateriality, and socio-technical systems: What do these terms mean? How are they different? Do we need them? In P. Leonardi, B. Nardi, & J. Kallinikos (Eds.), *Materiality and organizing: Social interaction in a technological world* (pp. 25–48). Oxford: Oxford University Press.
38. Leonardi, P. M., & Barley, S. R. (2010). What's under construction here? Social action, materiality, and power in constructivist studies of technology and organizing. *The Academy of Management Annals, 4,* 1–51.
39. Robey, D., Anderson, C., & Raymond, B. (2013). Information technology, materiality, and organizational change: A professional Odyssey. *Journal of the Association of Information Systems, 14,* 379–398.
40. Bednar, P., Sadok, M., & Shiderova, V. (2014). *Socio-technical toolbox for business analysis in practice* (pp. 219–227). Springer International Publishing.
41. Bednar, P., & Sadok, M. (2016). *Bridging the gap between theory and practice: Socio-technical toolbox* (pp. 51–62). Springer International Publishing.
42. Treem, J. W., & Leonardi, P. M. (2013). Social media use in organizations: Exploring the affordances of visibility, editability, persistence, and association. *Annals of the International Communication Association, 36,* 143–189.
43. Koschmann, T. D. (1996). *CSCL: Theory and practice of an emerging paradigm.* Hillsdale, NJ, US: Lawrence Erlbaum.
44. Brown, J. S., & Adler, R. P. (2008). Minds on fire: Open education, the long tail, and learning 2.0. *Educause Review, 43.*
45. Carmean, C., & Haefner, J. (2002). Mind over matter: Transforming course management systems into effective learning environments. *EDUCAUSE Review, 37,* 26.
46. Bates, A. W. (2015). *Teaching in a digital age.* Vancouver BC: Tony Bates Associates Ltd.
47. Willermark, S. (2018). Digital Didaktisk Design: Att utveckla undervisning i och för en digitaliserad skola.[Digital didactical design: To develop teaching in and for a digitalised school]. Dissertation. Trollhättan: University West.

48. Bryman, A. (2016). *Social research methods.* Oxford: Oxford university press.
49. McKenzie, J. (2001). *Perform or else from discipline to performance.* London: Routledge.
50. Gawer, A. (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. *Research Policy, 43,* 1239–1249.
51. Rochet, J. C., & Tirole, J. (2006). Two-sided markets: A progress report. *The RAND Journal of Economics, 37,* 645–667.
52. Suchman, L. A., & Trigg, R. H. (1992). Understanding practice: Video as a medium for reflection and design. Design at work (pp. 65–90). L. Erlbaum Associates Inc.
53. Susskind, R. E., & Susskind, D. (2015). *The future of the professions: How technology will transform the work of human experts.* USA: Oxford University Press.
54. Hult, H. V., Islind, A. S., Master Östlund, C., Holmgren, D., & Wekell, P. (2020). Sociotechnical Co-design with General Pediatricians: Ripple Effects through Collaboration in Action.