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Teaching and Learning in an Institutional Massive Open Online Course: Implications for Agency in Online Pedagogy

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Acknowledgements

The point of departure for this thesis was the assertion that instructor and student agency are developed and enacted in making contributions to joint meaning-making activities. Agency is a socially learned, developed, and enacted capacity of instructors and students, and collaborative teaching and learning activities are the most productive resources for developing and enacting agency, as participants learn to mobilise digital technologies in developing their agency in learning. This thesis is a strong illustration of this claim, as it builds upon extensive reflection on scientific ideas, resources, traditions, and enriching interactions with diverse individuals and research communities. Without these, both the process and final outcomes would have been different. I acknowledge and express my gratitude to all those who contributed to this research process in various ways and at different points in time.

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Abstract

Aim and research questions:

The aim of this thesis was to examine joint teaching and learning activities, focusing on the role of digital technologies in mediating students' engagement in collective meaning-making processes. The goal was to understand how instructors' and students' agency are developed and enacted in both synchronous (online meetings) and asynchronous (discussion forums) contexts in an institutional massive open online course (MOOC). Three research questions were investigated*:*

i. How does instructor agency come into play when facilitating students' online collaborative learning activities?
ii. How does student agency unfold, and how is it mediated by technologies when students engage in online collaborative learning activities?
iii. How do instructor and student agency co-evolve, and why do they become so prominent in joint teaching and learning activities in online learning environments?

Analytical perspective:

The theoretical perspective and analytical framework of this thesis draw on the cultural-historical theory, incorporating key constructs such as Vygotsky's zone of proximal development (ZPD), Galperin's pedagogical phases, and Stetsenko's notion of collaborative practices. In this framework, agency is viewed as a socially mediated capacity to learn to engage actively in collaborative meaning-making activities. This agency is nurtured and expanded through processes of collaborative meaning-making. Specifically, the thesis delves into three main areas of enquiry: (i) how the dialectical interrelationship between instructors engaging in facilitating and guiding students' learning and students' active engagement in learning evolves in online collaborative meetings (synchronous); (ii) how the relationship between instructors' professional agency in facilitating students' learning and agency in learning in course discussion forums (asynchronous) unfolds; and (iii) how the interrelationship between peer engagement unfolds and is mediated by digital technology (resources) in online collaborative (synchronous) meetings.

Methodological take:

Methodologically, this thesis uses a qualitative research enquiry. Three studies have been conducted to examine (i) how instructors' facilitation in online collaborative meetings is influenced by students' agency in learning, (ii) how instructors employ epistemic intervention strategies, and how these choices influence and are influenced by student agency in discussion forums, and (iii) how digital technology supports students' engagement in online collaborative learning. Primary data sources are video recordings of instructor-student and student-student interactions, as well as discussion forum posts, supplemented by MOOC post-course questionnaires.

Contributions:

This thesis makes important contributions to revealing the processes of developing and enacting agency in and through online collaborative meaning-making activities. First, it reveals that agency comes into play when instructors and students collaboratively engage in developing an understanding of target concepts. Second, it employs cultural-historical theory

to analyse joint meaning-making activities in online collaborative learning environments. This approach is innovative and shows the potential usefulness of the cultural-historical perspective in the analysis of online learning. Third, it offers a pedagogical framework called the OECT framework to organise and promote collaborative teaching and learning activities that nurture agency in online teaching and learning.

Main findings and conclusions:
The main findings are that collaborative meaning-making activities are unique resources for developing agency and that the mobilisation of digital resources expands the possibilities for this development. These contributions have implications for designing online teaching and learning environments where both instructors and students develop and enact their agency in advancing conceptual understanding.

Table of Contents

List of Figures and Tables

List of Abbreviations

ICTPED	Pedagogical Information Communication Technology
CHT	Cultural-Historical Theory
cMOOC	Connectivist MOOC
CoI	Community of Inquiry
DPIA	Data Protection Impact Assessment
EISs	Epistemic Intervention Strategies
ENA	Epistemic Network Analysis
GDPR	General Data Protection Regulation
IA	Interaction Analysis
MOOC	Massive Open Online Course
OECT	Orientation, Engagement, Contribution and Transformation
OSCL	Online Synchronous Collaborative Learning
SIKT	Norwegian Agency for Shared Services in Education and Research
SPOCs	Small Private Online Courses
TA	Thematic Analysis
TAS	Transformative Activist Stance
TD	Transactional Distance
xMOOC	Extended or lecture-based MOOC
ZPD	Zone of Proximal Development

Part I: Extended Abstract

Chapter 1: Introduction

Several years ago, I conducted a study for my master's thesis that examined the pedagogical practices in the first international massive open online course (MOOC) offered by the University of Oslo in 2015 on the FutureLearn platform (Singh, 2016). The findings revealed that simply having well-organised learning content does not guarantee student engagement. Whilst tools and communication spaces, such as discussion forums, were necessary, their availability did not necessarily result in productive learning. This was evident in the significant decrease in forum activity, with over 3,700 comments in the first week dwindling to approximately 500 by the final week of the six-week course. Ultimately, only 100 out of the initial 7,000 registrants remained active. Students cited various reasons for dropping out, including a lack of support from peers and disengagement from the instructor, as well as challenges in understanding lecture videos, some of which were perceived as biased. Conversely, engaged students emphasised the importance of feedback from teaching assistants and peers, indicating that the exchange of ideas and participation in discussions enhanced their involvement in collective meaning-making activities. Although the high dropout rate led me to question the sustainability of MOOCs in higher education, my greater concern is relying too heavily on students to independently drive their own learning. This approach overlooks the fact that learning is primarily a social activity in which both instructors and students contribute to the meaning-making process.

In addition to discussion forums, which served as the main space for interactive and collaborative learning activities among participants, the course also offered two live online learning sessions for students to engage in face-to-face discussions with course participants (facilitators and students). Students reported that these live learning sessions were useful for their learning; however, the analysis of these sessions was beyond the scope of my master's thesis. Since then, I have been particularly interested in exploring how participants engage with each other to develop their understanding of learning tasks. How do their roles and positions (e.g. presenter, commentator, listener) unfold? How do these positions influence the contributions of other participants in the collaborative meaning-making process? Do participants change their positions as they progress in collaborative learning activities? If so, what factors contribute to these changes? How does the joint meaning-making process evolve over time? Investigating these questions is essential for gaining a deeper understanding of how agency is developed and enacted in joint teaching and learning activities. Agency refers to the ability of participants to learn to actively engage in collaborative activities, contributing to the creation of shared meanings and thus improving problem-solving capabilities. The process of learning to engage in these collaborative activities entails taking initiative in voluntarily presenting and explaining ideas, advocating for and defending perspectives, critically evaluating these viewpoints, and revising them based on empirical evidence and rational thinking. This process is crucial in developing and enhancing conceptual understanding. Consequently, agency in teaching and learning is developed, enacted, and expanded in and through collaborative activities (Stetsenko, 2017). In the context of teaching and learning, knowledge is defined as 'a set of activities, and activities can be developed, enacted and re-enacted… when engaged in real-life problem solving'; it is not something that is accumulated and stored (Arievitch, 2017, p. 142). Agency, therefore, refers to the capacity to learn to engage in meaningful learning activities and enhance the ability to develop and expand these activities to advance the conceptual

understanding of target concepts. Digital resources (something that students share on the screen while engaging in online joint teaching and learning sessions) can mediate students' agency in learning, as students mobilise these resources to present their ideas and approaches to solving problems and raising questions. Digital environments and tools may assist instructors and students in repositioning themselves as active agents in epistemic practices and enhancing their capacity to learn to engage in meaningful activities (Engeness, 2020, 2021b). Therefore, I argue that instructor-student and student-student interactions aimed at developing and advancing conceptual understanding are the most productive resources for developing agency in online education, especially MOOCs.

According to Matusov et al. (2016), society is currently undergoing a shift from a post-industrial era to a post-knowledge era, placing greater emphasis on design and authorship rather than solely acquiring knowledge. This transition necessitates an educational approach that promotes agency, emphasising co-participation, co-creation, uniqueness, and problem-solving abilities. The authors refer to this approach as 'authorial agency', which recognises individuals as active contributors to their own meaning and culture through social dialogue, fostering the role of participants as both creators and producers. Such agency plays a formative role in instigating transformation in self and world making, with the actors involved championing social change, justice, and equality (Stetsenko, 2017, 2020). Consequently, several scholars underscore the significance of agency in 21st-century education. Such education requires communication, dialogue, collaboration, and creativity to enrich meaning-making processes and address the overarching socio-economic challenges present in today's societies (Glăveanu, 2015; Goller & Paloniemi, 2017; Harasim, 2017; Matusov et al., 2016; Stetsenko, 2017). This agency becomes particularly crucial in online learning environments, where participants are often geographically dispersed and unfamiliar with one another. MOOCs basically promote ‘teacherless courses’, where intelligent networks make key decisions for students (Harasim, 2017). Instructor-student and student-student interactions and collaboration in teaching and learning remain underdeveloped and under-focused in the pedagogical designs and practices of MOOCs (Julia et al., 2021; Margaryan et al., 2015). In such contexts, particularly in MOOCs, students are frequently positioned as consumers of knowledge, rather than as producers or knowledge constructors. This not only results in a high dropout rate in online courses but also limits the possibilities of building knowledge collectively and developing participants' (instructors and students) agency in meaning-making activities, which further underscores the importance of fostering participants' authorial agency in MOOC learning environments.

The aim of this thesis was to examine joint teaching and learning activities, specifically focusing on the role of digital technologies in mediating student engagement in collective meaning-making. The goal is to understand how the agency of both instructors and students is developed and enacted in these joint activities. Therefore, it is of paramount importance to closely observe and examine rich discussions and interactions between course participants. This will provide deeper insight into how their agency evolves in joint meaning-making activities and how digital resources, like the draft of the examination assignment, are used to foster agency in online learning.

I conducted two qualitative case studies to examine how instructors facilitate students' learning in synchronous (online meetings) and asynchronous (discussion forums) contexts in the ICTPED MOOC: Pedagogical Information Communication Technology Massive

Open Online Course 2020 and students' synchronous collaborative learning activities in the ICTPED MOOC 2021. The first case study, which delved into synchronous and asynchronous teaching and learning contexts, was comprised of two studies (Articles 1 & 2). The second case study focused on students' engagement in collaborative learning and how digital technologies mediate their joint meaning-making activities; this is covered in one study (Article 3). Both case studies were aimed at analysing how participants' agency unfolds and is shaped by the contributions of co-participants in joint meaning-making activities. The subsequent table offers an overview of the thesis, while the following section provides the context for the case studies.

Table 1

Overview of the Thesis

Teaching and Learning in an Institutional MOOC: Implications for Agency in Online Pedagogy		
Case study 1		***Case study 2***
Article 1	**Article 2**	**Article 3**
Instructors' facilitation of students' learning in online collaborative teaching and learning sessions	Instructors' epistemic intervention strategies in MOOC discussion forums	Digital technology and students' engagement in online collaborative learning

1.1 Context of the study: ICTPED MOOC

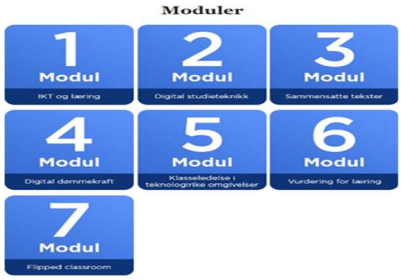
In response to the rise of MOOCs, professors at the Norwegian University of Science and Technology launched a MOOC titled, ‘Technology and Societal Change’ in 2013 via Canvas. Concurrently, Norway's Ministry of Education and Research initiated an enquiry into the role of MOOCs in education. An expert committee confirmed their potential for flexible learning and digital skill development (Kjeldstad et al., 2014). Recommendations were made for governmental funding to integrate MOOCs into Norway's educational system, marking a formal, nationally mediated development path focused on professional communities such as teachers (Tømte et al., 2017). Most Norwegian MOOCs are accredited and offered by higher education institutions.

The ICTPED MOOC, established in 2016, is one of the longest-standing institutional MOOCs in Norway. Another notable MOOC in the country is the Information Communication and Technology MOOC (ICT MOOC), which was initiated in 2014. Both MOOCs are offered by Østfold University College as part of a formal educational programme to develop in-service and pre-service teachers' digital skills and professional digital competence. Offered annually via Canvas, the ICT MOOC and ICTPED MOOC are aimed at enhancing teachers' digital skills in Norway. These asynchronous online courses are open to anyone with upper-secondary education. Unlike conventional MOOCs, such as those offered by big MOOC providers (Coursera, edX, FutureLearn), ICTPED MOOC offers more flexible learning opportunities to students. Students' learning activities and problems are rigorously followed and supported by course instructors through discussion forums and individual and collaborative online guidance meetings on Zoom, Teams, and other platforms. This could be one reason for the pass rate of more than 70% every year, as opposed to that of conventional MOOCs, which is lower than 10% on average (Mehrabi et al., 2022). Most students and instructors remain active on Canvas discussion forums and

Facebook discussion groups, which are the main spaces and tools for communication, information, and collaboration between instructors and students. Students are also offered online voluntary learning meetings with instructors and fellow students in the institutional MOOCs. I collected data from two modules of the course (Module 3: Multimodal Text and Module 7: Flipped Classroom), as students must complete individual assignments in these two modules. Much discussion in online discussion forums and meetings centres on developing a conceptual understanding of various concepts (e.g. multimodal text) related to the assignments and finding more creative solutions for them. The following figure provides an overview of how ICTPED MOOC is arranged modularly.

Figure 1

Overview of the ICTPED MOOC Modules



(Note: This figure was taken from the ICTPED MOOC 2022)

1.2 Why is agency important in online education?

Online learning environments often result in instructors and students being physically and socially distant, potentially leading to decreased interaction, diminished sense of belonging, and a consequent 'transactional distance', as termed by Moore (1993). This distance is more pedagogical than geographical, causing many students to over-rely on their autonomy, which can be problematic because many fail to self-direct their learning. The high dropout rate from MOOCs suggests that most students fail to take charge of their learning by enacting their autonomy (Fuchs, 2017). What MOOC providers have failed to acknowledge is the fact that autonomy is a learned capacity; thus, it is developed in and through social interaction. The capacity to function autonomously primarily originates from social activities (Díaz et al., 1990). Therefore, learner autonomy is viewed as 'socially situated agency' (Toohey, 2007, p. 232). Not all students are able to exercise autonomy and hence need pedagogical support (Ding & Shen, 2022). I argue that collaboration involving interactions between students and instructors provides the most effective pedagogical support. This is because epistemic practices, such as proposing, communicating, evaluating, and legitimising knowledge claims, are best accomplished through social interactions (Kelly & Licona, 2018). Performing these epistemic activities collaboratively is integral to the evolution, development, and enhancement of participants' agency in teaching and learning, and in ultimately developing them as critical learners and thinkers. Moreover, by engaging in collaborative practices, students develop and expand their conceptual understanding. This, in turn, leads to transformation, which can be described as enhanced capability to critically understand problems and creatively solve them across various socio-cultural contexts.

Conceptual understanding is fundamental to transformation in knowledge building and innovation. Concept formation (i.e. meaning-making) is a complex social and creative activity mediated by tools and signs (e.g. language) (Vygotsky, 2012; Engeness, 2018). However, it is generally agreed in the literature that MOOCs do not promote interactive and collaborative pedagogical activities systematically (Gamage et al., 2020; Harasim, 2017; Kotzee & Palermos, 2021; Margaryan et al., 2015). The increased student dropout rates in conventional MOOCs (Borrella et al., 2022) show that the availability of tools or spaces for communication, interaction, and collaboration in itself does not guarantee participants' engagement in collaborative teaching and learning (Parks-Stamm et al., 2017). This suggests that participants are required to be active in navigating, recognising, and mobilising resources to develop their agency in learning. The same holds true for course instructors to enact their professional agency, that is, the capacity to make principled choices in when, how, and why to engage with students to assist them in solving their problems (Maclellan, 2017), and in facilitating student learning.

However, students as active agents for their learning have been missing in online student collaboration (Sjølie et al., 2022), let alone how their agency evolves when they engage with course instructors and fellow students to develop and advance conceptual understanding. How agency emerges in online learning activities has never been adequately studied (Ligorio et al., 2017), nor is there any discourse regarding how digital resources assist in developing instructor agency in teaching and student agency in learning. Therefore, the aim of this thesis was to examine how collaborative teaching and learning activities contribute to developing and enacting participants' agency in online education.

1.3 Instructor and student agency in MOOC pedagogical practices

On the basis of knowledge claims and pedagogical approaches, MOOCs can be classified into two distinct categories (Bozkurt & Keefer, 2018; Mohamed & Hammond, 2018): connectivist or cMOOCs, which came into existence in 2008, and extended or lecture-based xMOOCs (Downes, 2012). xMOOCs, characterised by lecture-based courses and standardised assessments, are examples of such practices. In xMOOCs, instructors engage in chunking, organising, and delivering learning content and tasks for students. On the other hand, instructors in cMOOCs or connectivist MOOCs aim to provide a learning environment in which students can create their own learning content by creating and establishing learning networks. They believe that, more than instructors do, technology should or can assist learning. Thus, online teaching and learning practices are couched into two main pedagogical approaches: xMOOCs promote teacher-driven processes, whereas cMOOCs promote student-driven processes. The former does not enable student agency because students are put into a position of content acquisition, whereas the latter downgrades teacher agency as teachers are considered the guide on the side of collective meaning-making activities. These two positions and pedagogical practices perpetuate traditional conceptions of teaching and learning in online education, emphasising either student or teacher agency, which must be re-evaluated (Roth & Radford, 2011). The reason lies in the understanding that human agency is enacted, realised, developed, and expanded in and through collaborative practices (Stetsenko, 2017). Broadly speaking, collaborative practices are dialectically evolving cultural-historical practices that involve cultural tools and the identities of actors engaged in those practices. In the teaching and learning context, collaborative practices involve instructor-student and student-student interactions. Thus,

social and collaborative activities are the most fundamental resources for developing and enacting agency in teaching and learning. Empirical research on connectivist MOOCs frequently equates student agency with autonomy, defined as the capacity to navigate learning networks independently (Downes, 2012; Fuchs, 2017). While MOOCs offer tools such as blogs and forums for this purpose (Milligan et al., 2013), such a definition overlooks a more nuanced, cultural-historical understanding of agency. In this view, autonomy is a dynamic evolving capacity in and through social interaction that can change when faced with new challenges (Arievitch, 2017; Galperin et al., 2023). Thus, the quality of interaction is vital for agency development. The current pedagogical practices in MOOCs often inadequately support these interactive aspects. Although some research suggests that well-designed pedagogical supports can enhance critical thinking and agency (Bali, 2014; Montgomery et al., 2015), MOOC design neglects to focus adequately on social and collaborative learning (Julia et al., 2021; Margaryan et al., 2015; Toven-Lindsey et al., 2015). This deficiency in pedagogical structure hinders the ability of instructors and students to fully develop and enact their agency in meaningful activities (Harasim, 2017; Littlejohn & Hood, 2018), consequently constraining intellectual advancement.

1.4 Technology and agency in online teaching and learning

Technology refers to a wide range of material (laptops and computer laboratories) and immaterial electronic systems of communication (social media, conferencing platforms, PowerPoints, etc.). Recently, ChatGPT has appeared as a more potent artificial intelligence system of communication with generative capacity. These technologies provide affordances to share resources, communicate, collaborate, engage in productive discussion, build learning groups and communities, co-construct knowledge, visualise ideas, and promote self-learning processes (Jeong & Hmelo-Silver, 2016; Jitpaisarnwattana et al., 2022; Ng, 2015). Indeed, MOOCs as online courses are enabled by the affordances of technology. Online conferencing technologies such as Microsoft Teams and Whereabouts (in which collaborative teaching and learning sessions occurred in this study), offer affordances for sharing digital resources through their in-built functions. Likewise, course discussion forums provide affordances for greater flexibility in teaching and learning activities. However, I argue that the affordances of technologies themselves exert little or no influence on participants' agency. The affordances of any environment or technology are contingent upon the participants' ability to actively explore, identify mediational resources, and mobilise them to enhance their conceptual understanding. This perspective suggests that the affordances of any environment or technology are discovered and constructed through engagement in joint meaning-making activities. Such a viewpoint on affordance aligns with the cultural-historical theory, as participants' active engagement with the environment transforms it into a social context for intellectual development (Vygotsky, 1998). Gibson's ecological stance on affordances emphasises participants' active roles in perceiving action possibilities presented by the environment (Heras-Escribano, 2019).

This thesis focused on how digital technologies mobilised in collaborative learning activities assist participants in developing and enacting their agency in joint meaning-making activities. Thus, in this thesis, digital technology refers to any digital resources such as PowerPoint slides and Word documents, or anything that students share on their screens during learning activities. In theory, any learning environment provides affordances and constraints for action possibilities, but digital learning environments provide unique

affordances for teaching and learning, as participants can share their materialised ideas and discuss, record, and modify them synchronously and asynchronously. This mobilisation of resources helps participants develop and enact their agency, as they learn to question, clarify, and validate ideas by using digital resources. Any resource or tool that participants utilise in learning to engage, interact, and collaborate in developing a conceptual understanding is considered mediation in the cultural-historical theory, which may have infinite developmental potentials (Vygotsky, 1997). Thus, the potential of digital resources to develop and expand participants' agency evolves in and through joint interaction as participants learn to use and mobilise resources to deepen their understanding. Vygotsky and Vygotskian scholars emphasise agentive engagement in joint teaching and learning activities (Arievitch, 2017; Engeness, 2021a; Stetsenko, 2017) to nurture learners' potential and engender transformation in teaching and learning.

Existing pedagogical practices in MOOCs focus on content design, organisation, and delivery (Anderson & Dron, 2011; Yuan & Powell, 2013). They neglect robust pedagogical support for social engagement, dialogue, and collaboration, echoing traditional cognitivist-behavioural teaching approaches (Bayne & Ross, 2014; Gamage et al., 2020; Harasim, 2017; Rhoads, 2015). The lack of opportunities and support for engaging in interaction and collaboration with others limits the very foundations of developing and enacting agency (Stetsenko, 2017). To date, to my knowledge, no empirical studies have accounted for the joint processes of developing and enacting agency in online teaching and learning activities or revealed the dynamically emerging interrelationship between instructor and student agency, both in synchronous and asynchronous collaborative teaching and learning activities. The aim of this thesis was to contribute to this little-known area of research in MOOC teaching and learning by building upon the following three concepts, and the interrelationship between the concepts was examined from the perspectives of the cultural-historical theory by adopting a qualitative case study research design.

Joint engagement

Joint engagement is a process of engaging with either instructors or peers to develop a conceptual understanding and solve problems through mutual assistance. An online space as a virtual place and tool for joint engagement is required to present, discuss, and debate ideas. Both online conferencing platforms (e.g. Teams) and discussion forums may promote joint engagement. In this thesis, joint, collaborative, and collective engagements are used synonymously.

Digital technology

Digital technology encompasses two distinct but interconnected aspects. Initially, it creates premises for online teaching and learning, through tools like learning management systems (e.g., Canvas), discussion forums, and live meeting platforms (e.g. Teams). Thus, it serves both as a space and a tool for collective engagement in learning. It also refers to any software such as PowerPoint and OneNote that allow the creation and sharing of materialised ideas, which are referred to as digital artefacts or resources in this study. Nevertheless, the use and mobilisation of digital technologies depend on participants' goals and intentions.

Agency

This concept encompasses instructor and student agency in online teaching and learning. Instructor agency is defined as the instructor's capacity to make pedagogical decisions

regarding when, how, and why to engage with students to facilitate their learning (Maclellan, 2017). Student agency is defined as the capacity to learn how to engage in joint teaching and learning activities to develop a conceptual understanding (Engeness, 2021a). The capacity to facilitate and learn together develops in and through joint practices that involve interactions among participants. It is the instructors' and students' proactive action and consciousness towards their teaching and learning goals.

1.5 Theoretical and empirical bases

This thesis is grounded in the cultural-historical theory, positing that learning and conceptual understanding develop in and through social engagement and collaboration guided by human actors (teachers and peers) and mediated by non-human tools (e.g. computers) (Galperin et al., 2023; Stetsenko, 2017; Vygotsky, 2012). It argues that agency in teaching and learning is developed and enacted in and through collaborative practices (see Chapter 2). The role of digital technologies in mediating students' agency in learning evolves in and through collaboration.

Empirically, this study was set in a Norwegian MOOC and relies on three key data sources: online interactions between instructors and students (Article 1), forum posts and post-course surveys (Article 2), and peer interactions (Article 3). It employed qualitative methods such as interaction and thematic analysis (TA) to investigate how collaborative meaning activities mediated by digital technology contribute to the development of agency in teaching and learning, both in synchronous and asynchronous learning environments. Epistemic network analysis (ENA) was used to visualise instructors' intervention strategies in discussion forums (Article 2), while post-course surveys were used as supplementary data (Articles 1 & 2). Further details on data and their usage are discussed in the next section.

1.6 Overarching aims and research questions

The overarching aim of this thesis was to examine the processes of engaging in joint teaching and learning activities, focusing particularly on the role of digital technologies as mediators of student engagement in collaborative meaning-making processes. This research sought to understand how instructor and student agency evolve and manifest in and through joint meaning-making activities in the ICTPED MOOC. To achieve these aims, I set up three research questions.

RQ1: How does instructor agency come into play when facilitating students' online collaborative learning activities?
This research question was aimed at examining how instructors' facilitative activities unfold and are influenced by students' agentic engagement in online collaborative teaching and learning between students and course instructors. Article 1 delves into how instructors and students engage collectively in online live meeting sessions (synchronous learning), while Article 2 examines how instructors intervene to facilitate students' learning in discussion forums (asynchronous learning). Through both articles, I reveal and establish the interrelationship between instructors' professional agency and students' agency in joint teaching and learning activities.

Q2: How does student agency unfold, and how is it mediated by technologies when students engage in online collaborative learning activities?
This research question was aimed at examining how small groups of students engaged in online collaborative learning activities in the MOOC and how those activities influence student agency in learning. It also evaluated how digital resources (e.g. OneNote and PowerPoint) support students' engagement and agency in collaborative learning activities. This research question is the focal point of Article 3.

RQ3: How do instructor and student agency co-evolve, and why do they become prominent in joint teaching and learning activities in the online learning environment?
This question was aimed at analysing the emergent, reciprocally influential relationship between instructor and student agency in joint meaning-making activities. Thus, a framework based on the synthesis of the findings from the three studies included in this dissertation is introduced to elucidate the intricacies and dynamics of this relationship.

1.7 Contributions of this thesis

The central contribution of this thesis lies in its illumination of the processes of developing and enacting agency in online joint teaching and learning activities, spanning both synchronous and asynchronous collaborative environments (Articles 1, 2, & 3). By synthesising the findings from three empirical studies, the thesis introduces a pedagogical framework named OECT, which stands for orientation, engagement, contribution, and transformation. This framework represents the most significant *empirical* and *theoretical* contribution of this thesis. It aims to guide practitioners in facilitating collective teaching and learning activities in which agency is nurtured and expanded. These activities include orientation, engagement, and contribution, which collectively foster transformation in learning. The OECT framework is elaborated in detail in Chapter 6. As *methodological contributions*, the study accounts for processes mutually evolving and influencing collaborative teaching and learning activities in which agency is developed and enacted (see Chapter 4).

1.8 Outline of the thesis

This thesis is divided into two main parts: an extended abstract (Part I) and the articles (Part II). Chapter 1 introduces the study's focus, context, rationale, aim, and research questions, as well as pedagogical practices in MOOCs. It provides a brief overview of the theoretical and empirical foundations and contributions of this thesis. Additionally, it outlines the primary concepts and aims of the thesis. Chapter 2 articulates the theoretical perspectives and analytical frameworks. Chapter 3 delves into the literature review and identifies research gaps, while Chapter 4 details the methodological approach, research quality, and ethical considerations. Chapter 5 summarises three studies included in this thesis. Finally, Chapter 6 discusses the OECT framework in relation to the overarching research questions. This chapter also outlines the empirical, methodological, and theoretical contributions of the thesis, along with its limitations and implications for future research in online education.

Chapter 2: Theoretical Framework

This chapter discusses the theoretical perspectives emerging from Vygotsky's (2012) cultural-historical perspectives on teaching and learning and the processes of developing a conceptual understanding. The core theoretical premise is that teaching and learning are socially mediated meaningful activities, and knowledge as a systematic activity and thinking is both the process and product of mutual collaboration among participants. Agency as a socioculturally mediated capacity is developed and enacted in and through collaborative practices, developing participants' zone of proximal development (ZPD). I delve into Galperin's pedagogical theory (Galperin et al., 2023), which builds on and expands Vygotsky's perspective and offers a way to implement the cultural-historical approach in educational settings to enhance student learning. I also discuss Stetsenko's (2017) ideas on how collaborative practices that form the foundation of ZPD involve agency in teaching and learning. Finally, I outline and explain the analytical framework and summarise how these perspectives have influenced the context of this research.

2.1 Vygotsky's (1896–1934) c ontributions to the cultural-historical perspective of teaching and learning

For Vygotsky, the social environment is the primary source of human learning and development (Vygotsky, 1998). It is not a combination of factors but an infinite 'source of development' (Vygotsky, 1998, p. 299). The source becomes a resource for learning and conceptual development, as participants actively orient to make sense of their learning tasks by mobilising resources available in the environment, which is commonly understood as mediation. For example, course instructors, peers, and learning materials can be considered resources for meaning-making and intellectual development in online learning environments. Participants' positioning, activities, and experiences make the social environment a 'social situation of development' (Vygotsky, 1998, p. 198), which means that developing a conceptual understanding involves participants' active engagement in mobilising mediational resources available in their environment. Thus, participants' active engagement in social environments creates and re-creates the social situation of intellectual development, sustaining dynamically evolving interrelationships between participants and environments. The host of emotions and dramatic movements evolving during the process of engagement and interaction with the social environment shape an individual's learning and development (Vygotsky, 1994). Vygotsky focused on analysing the role and influence of the social environment on the learning and psychological development of students, suggesting that the way one engages with and experiences the social environment shapes their learning and intellectual development. As Vygotsky eloquently put it, 'Every inventor, even a genius, is always the outgrowth of his time and environment. His creativity stems from those needs that were created before him, and rests upon those possibilities that, again, exists outside of him' (Vygotsky, 1930, in van der Veer & Valsiner, 1991, p. xi). Therefore, what matters most is the participants' active engagement in the social environment that influences their entire course of learning and conceptual development. MOOCs may offer opportunities to engage in learning individually and collectively in online learning environments, but the qualities of teaching and learning are influenced by collective engagement in MOOCs. In my understanding, Vygotsky emphasised mediational resources for engagement with the social environment, the relationships formed while engaging with

it, and the outcomes of those relationships. Participants interact with the social environment through mediational resources, which include human beings, cultural-psychological tools (e.g. language), and material tools (e.g. computers) (Vygotsky, 2012). They learn to engage in social activities in and through these mediational resources in online teaching and learning.

I find Vygotsky's emphasis on human agency, as human mediators facilitate and guide how tools can be appropriated in and through social interaction and collaboration (Kozulin, 1998; Vygotsky, 2012), known as explicit mediation (Wertsch, 1985).Of course, other tools such as computers or language may offer explicit mediation of actions if they are included in the orienting systems of teaching and learning (Galperin et al., 2023). Still, it is human actors who decide how tools can be mobilised and even created while learning together. Furthermore, implicit mediation is difficult to detect because it does not include explicit material tools or social communication, but inner speech (self-conversation) mediates human consciousness (Daniels, 2015; Wertsch, 1985). Explicit and implicit mediations are a core part of teaching and learning processes that involve course instructors, students, and learning tasks. The task of learning, motive (internal motivation), tools (computer), and signs (internalised tools) mediate our learning and meaning-making processes (Engeness & Zavershneva, 2021). In short, we learn to act in the surrounding world through and with mediational resources; thus, our agency evolves in and through mediational resources, which Wertsch et al. (1993) called 'mediated agency' (p. 341). The core to the mediated agency is mediated teaching and learning activities, as instructors and students become conscious of the tools to be used and learn how to mobilise tools to engage meaningfully in learning activities (Engeness, 2021a). Therefore, the concept of mediation is one of Vygotsky's crucial contributions (Daniels, 2015; Engeness, 2021a; Wertsch, 1985).

The mediational processes between social activities and individual learning involve what Edwards (2005) called ‘relational agency’, which is the capacity to recognise and engage with fellow participants as resources to solve complex problems. Relational agency develops through collective activities aimed at solving problems by leveraging participants' experiences and expertise and propelling them forward in epistemic activities (Edwards, 2017). This agency is connected to the ZPD, where students develop problem-solving skills by interacting with others. Thus, the ZPD is termed the relational zone of collective knowledge construction (Goldstein, 1999). In addition, the relational zone formed in social interaction nurtures a dialectical relationship between external (social) and internal (individual) activities (Bidell, 1988). The dialectical relationship is situated and emerges through a cycle of uniting contradictory ideas to understand reality in all its complexity of interrelationships (Bidell, 1988). This relationship is agentively developed by the actors involved in activities (Arievitch, 2017) and transformed in and through collaborative practices (Stetsenko, 2017).

In my understanding, mediational processes establish a dialectical relationship between the social environment and individual actors involved in these activities. Central to this relationship is human agency, defined as the ability to engage in meaningful joint activities by using mediational resources for problem formulation and resolution. According to Vygotsky, this capacity exceeds mere relationality, including a transformative aspect. Humans not only adapt to existing structures but also transform them through collaborative efforts (Stetsenko, 2017). The transformation, conceived as changes in existing thinking and

practices and enhanced problem-solving capacity, involves mobilisation and construction of conceptual (ideas and lived experiences) and material tools (e.g. technology) by which human beings develop and enact agency (Stetsenko, 2017). From the cultural-historical perspective, human agency is viewed as a mediated, relational, and transformative capacity developed in and through joint activities to understand and solve problems (Edwards, 2010; Engeness, 2021a; Stetsenko, 2017). However, the transformative potential of Vygotsky's project remains unexplored (Stetsenko, 2017).

Consequently, this dialectical relationship between social and individual factors, facilitated by mediational resources, nurtures and advances participants' capacity to reason and think critically, thereby developing reasoning, systematic thinking, and consciousness, which Vygotsky (2012) called higher psychological functions (HPFs). These HPFs are cultivated in and through collaborative interactions with instructors or more knowledgeable individuals and involve the use of mediational resources (Engeness & Zavershneva, 2021; Vygotsky, 2012). Vygotsky explicitly stated that HPFs, comprising of voluntary attention, critical thinking, rational thought, volitional action, creativity, and goal-directed thinking, originate through social '*collective activity*' (Vygotsky, 1987, p. 259). Human consciousness, understood as systematic knowledge, evolves from the formation of HPFs, which themselves evolve in and through collective activities (Robbins, 2001; Vygotsky, 2012). Therefore, Vygotsky emphasises the importance of *active participation in social activities* with *mediational resources* that primarily influence the development of *human psychological functions* (Engeness & Zavershneva, 2021).

2.2 Agency and ZPD

On the basis of the argument presented in the previous section, agency can be considered a core aspect of the concept of ZPD, which was explained by Vygotsky as a theoretical tool to explain the process and outcome of collaboration between teachers and students (Davydov, 1998). By engaging in collaborative teaching and learning activities, students contribute (receiving and offering meaningful contributions) to their own and others' conceptual understanding. This mutual process of assisting each other forms the bedrock of the ZPD and involves both educators and students and the social milieu they cultivate (Davydov, 1998). In such a context, Vygotsky (2012) suggested that *teaching and learning plays a leading role in developing conceptual understanding*. Such forward-thinking processes lie in the ZPD (Davydov, 1998; Galperin et al., 2023), which is created when 'students' experientially rich spontaneous concepts meet the teachers' systematically organized academic concepts' (Vygotsky, 2012, p. xviii). This indicates the importance of interaction and collaboration between course instructors and students in creating the ZPD, and human agency evolves in and through interaction and collaboration. Learning and knowing involve not just accumulating already mastered skills but also co-creating possibilities such as the capacity to learn and solve problems creatively. Galperin's pedagogical theory foregrounds a dialectical approach to bringing about 'quantitative (e.g. acquisition of new skills) and qualitative changes (e.g. establishing the relationship between skills across contexts and practices to enhance the capacity to be in control of one's own learning) in the psychological functions of the learner' (Engeness, 2021a, p. 110). I contend that such transformative changes necessitate instructors and students to interact and collaborate, through which they plan, execute, and evaluate activities. Therefore, students' agency in learning and teachers'

agency in guiding students' learning emerge in and through interactions and collaboration that foster the ZPD.

Active engagement in joint meaning-making activities is crucial for realising ZPD as a potentially emerging problem-understanding and problem-solving capacity. Creating the ZPD, in turn, enhances agency, as participants actively position themselves in collective meaning-making activities. Online platforms can serve as socio-pedagogical spaces where both instructors and students develop and enact their agency. This enactment allows instructors to tailor their guidance based on observed student struggles, thereby facilitating learning. Students also assess the instructors' effectiveness in this setting. Enacting agency also implies that instructors realise their capacity to facilitate and guide students' learning and that students realise their capacity to engage in learning. Such realisation becomes more visible in collaborative teaching and learning, as instructors can see and infer what students struggle with and why, and then they enact their professional agency (i.e. professional repertoire of knowledge and skills) to assist students in making sense of problems and developing a conceptual understanding. Agency is central to actualising the ZDP, which in turn leads to developing more agency (more capacity to know and learn more critically). Consequently, agency and ZPD are interlinked and mutually reinforced. Galperin's pedagogical theory aptly explains this reciprocity, which I will further discuss in the subsequent section.

2.3 Contributions of Galperin (1902–1988) to Vygotsky's legacy: Revealing the processes and product of the ZPD

In the previous section, I argued that the processes of collaboration that involve developing agency as core driving forces for meaning-making create the ZPD. In this section, I discuss how these processes of collaboration develop and what outcomes they encompass. I contend that Galperin's theory offers powerful explanations for creating the ZPD in and through the agentive engagement of instructors and students in joint teaching and learning processes. Galperin's pedagogy theory provides a systematic approach to connecting the process of transforming external social activities into internal mental activities, which Vygotsky has not expounded on in detail (Arievitch, 2017; Arievitch & Haenen, 2005; Engeness, 2021a; Haenen, 2001). Exploring the original scholarly works of Galperin, Engeness (2021a) delved deeper into Galperin's pedagogical theory. According to Galperin, six pedagogical phases are involved in systematically developing a conceptual understanding and students' capacity to learn: (i) motivation, (ii) orientation, (iii) materialised action, (iv) communicated thinking, (v) dialogical thinking, and (vi) acting mentally. Galperin argued that motivation not only refers to a source of energy that drives observable behaviour. It is an ‘orienting aspect, a guiding aspect’ (p. 44) that involves identifying the target object of the action (e.g. the learning goal) and selecting valuable tools to perform this action sustainably. Motivation is a delicate aspect of teaching and learning that often remains implicit or invisible, referring to a passion for learning that is internally driven rather than externally driven by rewards or winning a competition. Therefore, it is a complex aspect of learning involving external and inner factors. In a nutshell, it is concerned with forming a learner's attitude and relation to the learning outcomes to be achieved (Engeness & Lund, 2020).

Orientation refers to revealing a system of actions to be taken for learning. Action implies guiding steps (orienting) that involve a series of activities (executive). While planning

actions to be taken for learning, 'images of surrounding reality and images of ideal actions' (Engeness, 2021a, p. vi), which constitute the main component of orienting activity, are created. In doing so, learners may establish an interconnected relationship between the actions and the target concept to be developed. Galperin argued that ideal actions or mental images are derived from material actions. Therefore, the actions to be taken should be grounded in rationality (justifying why some material resources are used) (Engeness & Lund, 2020). Galperin identified three types of orientation in learning: incomplete, complete but teacher constructed, and complete but learner constructed. In *incomplete orientation*, learners discover mediational tools and essential characteristics of a concept through trial and error, which leads to slow learning with many mistakes. The *complete but teacher-constructed orientation* involves the teacher providing all the necessary information for solving a specific problem, allowing for quick learning with minimal errors but limited transferability to other situations. The *complete but learner-constructed orientation* involves learners taking the lead in outlining how they want to go about learning, following a teacher-given approach to identifying the essential features of a concept, allowing for quick and accurate learning with enhanced capacity to transfer skills to other learning situations (Engeness, 2021a; Engeness & Lund, 2020). These orientation phases may determine the kind of pedagogical support to be offered to students to develop their understanding of a learning concept. Assessing whether students can orient their learning independently has implications for student agency in learning and instructor agency in teaching. Students are empowered by the approach that enhances their understanding of how to engage in specific learning activities and fosters understanding about what it means to learn. Through the third type of orientation, students as agents become increasingly aware of unfamiliar and shifting meanings in diverse contexts and the transformation process of the activities. Based on Galperin's perspective on orientation, we can reason that agency appears to be the capacity that is developed and enacted in learning. Therefore, *orientation* is crucial in understanding and influencing how the agency of instructors and students can unfold in joint teaching and learning.

After developing a plan of orienting actions, students and teachers may engage in *materialised action*, which involves the explicit use of material objects (e.g. a book and map) or materialised ideas (Word documents, PowerPoint slides, and animations) to drive teaching and learning processes. The materialised objects encapsulate the essential features of the target concepts and invoke interactions among participants, fostering the development of their conceptual understanding. Materialised objects might become tools for enacting and developing agency, as students may learn to engage in joint learning processes by using them (Stetsenko, 2017). After developing an image (meaning) of learning tasks, students engage with instructors and fellow students in clarifying, explaining, and assessing ideas without recourse to materialised objects in the phase of *communicated thinking.* With the support of the mental image or meaning that students have created in the phase of communicated thinking, students perform an action by talking to self, which is called *dialogical thinking*. This can be called internal dialogue or self-conversation, in which an individual engages in reflecting on the final understanding of the ideas, which Vygotsky (2012) called ‘private speech’ and plays a crucial role in organising and structuring HPFs. However, students may engage in dialogical thinking while communicating ideas, as it is closely related to interactions with materialised objects. The dialogical thinking phase begins with communicated thinking (Engeness, 2021a). In short, it involves the self-reflexivity of learning that gives *rise to consciousness* (Leont'ev, 1974). Finally, this entire

process leads to the formation of a new autonomous-like individual system of mental actions called *acting mentally*. Arievitch (2017) refers to it as an enhanced capability to solve problematic situations. By going through this process, students' external social actions are transformed into a mental phenomenon, forming a chain of adequate thinking.

2.4 Stetsenko's contributions: Interrelationship between human agency and collaborative practices

In the previous section, I discussed how the dialectical processes of collaborative teaching and learning that lead to the creation of the ZPD are formed from the perspective of Galperin's theory. In this section, drawing on Stetsenko's (2017) transformative activist stance (TAS) perspective, I illustrate how the mutually influencing interrelationship between collaborative practices and human agency unfolds. Stetsenko (2017) argued that the transformative dimension of Vygotsky's project remains unexplored, as the existing socio-cultural perspectives drawing on relational onto-epistemology focused on participation and adaptation to the status quo. Stetsenko introduced the TAS as a framework to interpret and develop Vygotsky's philosophical concepts. The TAS delves deeper into Vygotsky's lineage to Marxist dialectical thinking on human learning and development, which emphasises the primary role of human agency in creating and transforming human history and the world. Human agency is not something 'inherent in the nature of self-contained individuals'; it is '*a situated and collectively formed ability of human beings*, as quo agents of social practices and history' that challenges existing practices and seeks alternatives to foster human development (Stetsenko, 2017, p. 84). Conceptualising agency in this way challenges purely individualist and mentalist readings of agency. Bandura's conceptualisation of autonomous agency (self-directed capacity) and mechanical agency (capacity to respond to stimuli) reflect a completely individualist and mentalist conceptualisation of agency (Bandura, 1989). On the contrary, his third conceptualisation of emergent interactive agency emphasises the roles of the environment in making conscious intentions but links agency only to the individual's mental capacity for self-control. Agency arises from individuals' engagement in their social words (Ahearn, 2001; Mercer, 2011). Individual agency involves the acts of 'taking stances, making choices, enacting responsibility and answerability' (Stetsenko, 2017, p. 188) within the context of collaborative practices. Collective agency evolves when individual actors contribute to collaborative practices from their unique experiences and perspectives. Broadly speaking, these dimensions of agency unfold in and through cultural-historically evolving collaborative practices. However, in the context of teaching and learning, they come into play when instructors and students interact and collaborate to make sense of learning tasks and problems and attempt to solve them.

Stetsenko (2017) introduces the concept of ‘the collectividual,’ a dynamically evolving realm where social and individual activities intersect. She posits that individuals are inextricably tied to their communities through common goals and mutual obligations. Through this dialectical process, social practices not only shape the individual but also are shaped by them. Reality is always subject to changes and reconstructions 'through dialectics and movements of social, communal practices embodied in human acts of being, knowing, and doing' (Stetsenko, 2017, p. 171). Therefore, our active engagement in collective practices forms 'the grounding for development and learning' and knowledge construction through 'an active process of co-construction, co-creation, and discovery' (Stetsenko, 2017,

p. 326). From a dialectical perspective, mistakes, failures, and contradictions constitute essential moments of learning and knowledge building (Dafermos, 2018), foregrounding at least two contradictory perspectives (Baxter, 2004) to develop and enact agency. In this way, individual and collective dimensions of agency unfold and are developed through the quality of the contributions (activities) made by actors involved in making differences in the world of social practices in and through collaboration. Collaborative practices offer mediation and tools for enacting and developing agency. Our ZPD evolves at the intersection of individual and collective agency, unfolding in and through collaborative practices to realise our goals. Therefore, collaborative practices are the onto-epistemologically central, mutually co-constitutive process of social practices involving individual and collective agency.

I have used Stetsenko's conceptualisation of agency as a phenomenon that evolves in and through collective activities aimed at solving learning tasks. Instructors and students in MOOCs may engage in collective teaching and learning activities in different spaces (online meetings [Articles 1 & 3] and discussion forums [Article 2]). These two spaces provide different types of affordances for developing and enacting agency. For example, in live learning sessions, the participants engage actively in presenting, clarifying, assessing, and reflecting on ideas and approaches to solving the examination assignment (Articles 1 & 3). This process of teaching and learning involves dilemmas and contradictions, as participants have different ideas and approaches to understanding learning tasks and solving problems. Dilemmas and contradictions demand dialogue/interaction and collaboration among participants in and through which agency is developed and enacted, leading to transformation (i.e. challenging preconceived notions, developing new ideas and practices, and enhancing the capacity to learn). Teaching and learning are not about imparting and acquiring information; it is a collective process of exploring and realising our intellectual possibilities. I contend that collaboration among participants creates what Brandom (1995) called the 'space of reasons' (p. 895), which is similar to Bakhtin's 'space of authoring' (Holland et al., 2001, p. 169). Space is required for meaning-making, an intersubjective activity where shared understanding arises through interaction with others (Rommetveit, 2014). Technologies can create learning spaces for collective practices (Damşa et al., 2019), thereby fostering shared epistemic agency, defined as the ability to collaborate in creating shared knowledge objects (Damşa et al., 2010). Meaning-making is 'like an electric spark that occurs when two different terminals are hooked together' (Voloshinov, 1986, p. 103). Therefore, interaction and collaboration are of paramount importance for developing and enacting agency. They are even more important in online education, where social and collaborative teaching and learning activities remain under-prioritised (Harasim, 2017; Julia et al., 2021; Losh, 2017).

A sense of belonging and community is developed through mutual dialogue and interaction. Undermining social and collaborative activities thus undermines the very sources of developing and enacting agency. I argue that from the dialectical perspective, the duality of active and passive complementing agency unfolds as a unified process of collective meaning-making activities. Being passive does not mean non-participation but being attentive, receptive, and reflective to others' viewpoints so that one can understand and contribute to collective meaning-making activities. The agency-passivity dialectic emerges in dialogue and collaboration, as participants sometimes lead their activities and are sometimes driven by them (Roth et al., 2013). Furthermore, tools such as learning tasks and

conceptual models required to develop and enact agency are mobilised, developed, and become meaningful in collaboration. To put it succinctly, collaborative activities afford tools for enacting agency, and such tools are also developed through collaboration. In this way, agency lies at the heart of collective problem-posing and problem-solving activities. Conceptualising agency as an emergent phenomenon in and through which collective agency evolves may also address the critiques that CHT emphasises teacher agency rather than student agency (Roth & Radford, 2011), as teachers are often considered competent or knowledgeable others.

However, how agency evolves is seldom reported in the literature, as existing studies focused on labelling behavioural activities such as raising a question and posting a comment as students' agentic expressions. There is a tendency to assume that agency is the autonomous capacity that students use to learn independently in an online learning environment. For Vygotsky, autonomy or self-regulation is an HPF, which is primarily developed in and through social interactions. Thus, learner autonomy can be called a socially developed agency. The same holds true for instructor agency.

2.5 Analytical framework to examine the processes of collaborative teaching and learning

The contributions of the aforementioned cultural-historical scholars indicate the dialectical interrelationship between collaboration and agency in bringing about qualitative changes in meaning-making activities. I employed Stetsenko's TAS perspective to reveal the interrelationship between collaborative activities and agency and Galperin's pedagogical theory to examine the processes of engaging in online collaborative teaching and learning activities. The analytical framework is used to examine how online collaborative teaching and learning activities were initiated, what was shared, how interaction unfolded, and how target concepts were concluded.

2.5.1 Interrelationship between collaborative teaching and learning and agency

Human agency evolves through social collaborative activities aimed at developing a conceptual understanding of target concepts and solving problems creatively. This evolution of agency necessitates mediation and the use of tools. For instance, during joint teaching and learning activities, instructors or knowledgeable individuals facilitate learning by clarifying concepts and providing supporting evidence for arguments. Moreover, such activities may involve the mobilisation of explicit material tools or materialised objects (e.g. OneNote documents and PowerPoints) to aid instructors and students in comprehending the presented material, questioning ideas, fostering interaction, and ultimately actively participating in collaborative meaning-making processes. Collaborative teaching and learning activities offer students opportunities and resources to initiate and drive productive learning processes, allowing them to find their own voices and roles and gain traction within shared practices. For instructors, engaging passionately in joint teaching and learning enhances their professional capacity and identity, enabling them to become competent facilitators. Similarly, for students, it is the very source and means of becoming competent learners. To make sense of challenging issues and foster a shared understanding, deeper interaction and dialogue between instructors and students and between students and students are necessary. Therefore, collaborative teaching and learning activities are crucial sources for developing and enacting agency.

2.5.2 Examining joint processes of teaching and learning

Galperin emphasises orienting activities and performing them as crucial aspects of teaching and learning (Galperin et al, 2023). He considers orienting activities as managing tools, whereas performing activities are working tools through which external/social activities are transformed into internal/mental activities. The transformation of learning activities is described by the students' enhanced capacity to solve problems that evolve in and through students' engagement in the joint activities. This transformation developing dialectically goes through six overlapping pedagogical phases: (a) motivation, (b) orientation, (c) materialised action, (d) communicated thinking, (e) dialogical thinking, and (f) acting mentally (Engeness, 2021a; Galperin et al., 2023). I argue that students' and instructors' agency in collaborative teaching and learning evolves in performing the above-mentioned pedagogical phases, especially orientation, materialised action, communicated thinking, dialogical thinking, and acting mentally. I call these pedagogical phases epistemic activities, as they are performed to develop a conceptual understanding to enhance autonomy in solving problems. Motivated students become aware of their goals and learning problems to be solved (the examination assignment). They take initiation for learning: they position themselves actively in the learning process, present their ideas and the problems they encountered in developing a conceptual understanding, and seek assistance from instructors and fellow students. This is what I call agentic orientation in learning. The same is true for course instructors who allow students to take the lead in learning, make sense of their problems, assess and validate their ideas and approaches to solving problems, and provide guidance for improvement by engaging with students. By mobilising materialised tools (PowerPoint slides and conceptual models), students learn to present their ideas systematically, which assists co-participants in making sense of what is being presented. In this way, in the phase of materialised action, materialised resources shared among participants function as tools for developing agency as they support students in learning to present, question, and clarify ideas. Presenting, questioning, and clarifying ideas fosters participants' active engagement in joint interaction, deepening meaning-making activities.

When students develop a conceptual understanding of target concepts in the learning task to be learned, they do not necessarily rely on materialised tools to perform teaching and learning tasks. They can learn to engage in learning by talking, and instructors learn to facilitate without mobilising materialised tools, which is called communicated thinking. This means materialised activities start gaining the characteristics of ideal theoretical activity, but they are still explicit in the form of talking and can be observed in small-group discussions. The agency emerges as a developing and expanding capacity in the phase of communicated thinking as group members engage in questioning what each of them so far has understood about the concept under discussion. The students and instructors start reflecting upon what they understand and what issues need further discussion, which is called dialogical thinking, indicating that social meaning-making activities are being transformed into mental activities. Reflecting on what one understands, what is yet to be understood is participants' agentic capacity, which continues to appear in the phase of acting mentally. In this way, Galperin's pedagogical phases describing how the transformation of social activities evolves into mental activities are used as descriptive-analytical resources for understanding how instructor and student agency evolves in joint teaching and learning activities in a MOOC learning environment.

Chapter 3: Reviewing the Relevant Literature

This chapter critically reviews the relevant literature regarding the affordances that technologies provide to enable and promote collaborative teaching and learning activities in MOOCs, as well as how these activities are performed. The latter section focuses on the processes of engaging in collaborative teaching and learning activities, as agency is developed and enacted in such practices. As research studies that have investigated these processes in MOOCs are not necessarily abundant, I draw on studies that have examined collaborative learning in online education within the context of higher education. Before I discuss the review of relevant literature, I briefly explain the processes and reasons for selecting literature for the review.

3.1 Procedures for searching and reasons for selecting the literature

Initially, key search terms were formulated, including 'collaborative teaching and learning in MOOCs', 'collaborative engagement in MOOC teaching', 'agency in MOOCs', 'teacher and student agency in online education', 'digital technologies and collaborative learning', and 'processes of collaborative teaching'. Given that substantive MOOC research became prominent after 2012, I focused on studies from 2015 to July 2023. I utilised three electronic databases: Oria from the University of Oslo, ERIC, and Education Resources. However, the search was intricate, necessitating the frequent use of Google and Google Scholar when relevant articles appeared within chosen studies. Thus, the literature search resembled a snowballing method, often involving delving into references from initially consulted resources (Greenhalgh & Peacock, 2005).

MOOC literature commonly examines teaching and learning aspects separately (Deng et al., 2019), often relying on quantitative methods such as surveys and social network analyses. Current qualitative research often explores instructors' and students' perspectives using surveys, interviews, and log files (Deng & Benckendorff, 2017). Contributions in discussion forums, which are the primary spaces and tools of interaction and collaboration, often veer towards mere information sharing, sidelining the promotion of critical thinking (Bali, 2014; Bonafini et al., 2017). A significant void exists in addressing teaching and learning as a collective meaning-making process, specifically examining instructor-student and student-student interactions, within MOOC pedagogical frameworks and practices (Julia et al., 2021; Margaryan et al., 2015). Recent research studies in online education underscore the value of bichronous (synchronous and asynchronous) communication to augment students' engagement and elevate the quality of pedagogical supports (Martin et al., 2023; Martin et al., 2020). However, a considerable portion of these studies fall short of offering a solid theoretical foundation (Deng et al., 2019), a cornerstone for sculpting pedagogical direction and practices. These studies suggest promoting and supporting instructor-student and student-student interactions for deepening meaning-making activities in MOOCs. Instructors also need to be pedagogically strategic in facilitating and supporting students' learning activities, as their excessive interventions (e.g. directly answering students' questions) may not promote students' learning (Blum-Smith et al., 2021) and capacity to solve problems collaboratively in discussion forums (Ntourmas et al., 2022). I maintain that a qualitative research approach focusing on the examination of instructor-student and student-student interactions is the most appropriate approach to investigating how

participants' agency evolves in joint meaning-making activities. Therefore, I prioritised literature based on qualitative, theoretically backed empirical studies centred on the processes of engaging in joint teaching and learning in MOOCs. The review began by exploring the role of technology in collaborative teaching and learning, then delves into pedagogical approaches and practices, and finally, focuses on the processes for collective teaching and learning. The chapter concludes with a summary and the position upheld in this study.

3.2 Affordances of technologies for social and collaborative teaching and learning in MOOCs

This section briefly discusses the definitions and affordances of technology in supporting collaborative learning in MOOCs synchronously and asynchronously. Defining technology is intricate, given its ever-evolving nature and differing interpretations across contexts. The term can encompass everything from a basic tool like a pen to sophisticated electronic communication systems with generative capacities, such as ChatGPT. Today, items such as pens or blackboards are viewed as pre-digital technologies, while artificial intelligence tools such as ChatGPT are deemed digital technologies due to their capabilities in digital communication, information production, manipulation, and storage (Selwyn, 2022). MOOC platforms themselves are technologies, as they allow participants to communicate ideas, share files, and keep a record of them.

Mitcham (1994) provided a relevant philosophical perspective to understand technology as a four-dimensional activity: objects, activities, knowledge, and volition. Objects include everything from static structures such as computer laboratories to dynamic machines and computers, forming networks and processes. Activities refer to the creation and utilisation of technological objects, such as designing or using a computer for teaching. Knowledge encompasses the understanding needed to create and utilise technologies, while volition examines the mutual relationship between human activities and technological development. Mitcham noted that technology as an activity represents a significant juncture where knowledge and volition converge to either produce or utilise artefacts. As such, technologies are not merely tools to perform something, but 'processes and practices of doing, understanding and developing knowledge' (Selwyn, 2022, p. 201) in an ethically sound manner. This view echoes Vygotsky's ideas on using tools to foster higher psychological functions, which connects technology with human learning and psychological development, similarly to Mitcham's concept of technological volition that emphasises that human need and intention shape technologies, which in turn shape human behaviours (McLain et al., 2019). MOOCs can be seen as a product of human desire (technological volition) to transform the traditional landscape of teaching and learning, offering a more flexible, open education to all learners who wish to engage as lifelong learners at their own pace and place. They are evolving into learning ecosystems that develop and expand through continuous interaction between participants and their environments (Campos et al., 2022). MOOC ecosystems can offer several affordances such as video resources which may functions as tools for students to position themselves as active agents in epistemic activities (Engeness, 2021b).

The term 'affordance' is often used in education to discuss the potential of technologies for learning, but its meaning varies (Bower, 2017). Originally proposed by Gibson (1978) and

later expanded by Norman (1999) in the context of designing artefacts such as calculators, affordance refers to the action possibilities an environment offers to actors. Exploring those possibilities requires actors' active engagement with the environment. The perception of affordance, which involves gaining ecological information about what is meaningful to actors in an environment, is crucial. To perceive an affordance indicates the prospective (goal-oriented) actions of actors, emphasising their active roles in exploration. It is understood as the 'agential capacity' of actors to discern information about their surroundings (Heras-Escribano, 2019). Such perception makes an environment meaningful, fostering a dynamically evolving and shaping interrelationship between actors and their surroundings (Heras-Escribano, 2019). To sustain this mutual development and shaping, actors' agency is essential. Agency is defined as the capacity of actors to control their behaviours, which are developed via continuous interactions with their environments (Heras-Escribano, 2019). This ecological approach to affordance highlights the actors' proactive roles in exploration, development, and the maintenance of these mutual relationships. This perspective on affordance is especially relevant in the MOOC context. MOOCs are not just courses; they form a learning ecosystem for both individual (Fournier et al., 2019) and collective learning (Garreta-Domingo et al., 2018).

MOOCs provide varied resources for both individual and collaborative teaching and learning. Through forums, live sessions, blogs, and social networking tools (e.g. Facebook), MOOCs foster social learning activities (Saadatmand et al., 2017). Integrating other tools such as Blackboard and Google Docs enables students to engage in interaction and active learning through questioning, sharing, decision-making, and reflection (Al-Samarraie & Saeed, 2018). Such tools enable teaching and learning to be more distributed and multi-spaced (Bloch, 2021), enhancing students' problem-solving ability through interaction with co-participants (Koehler & Vilarinho-Pereira, 2023). Therefore, scholars argue that MOOCs can promote collective intellectual (co-)development through collective knowledge sharing and reflection (Cress et al., 2016; Fischer, 2018; Garreta-Domingo et al., 2018; Margaryan et al., 2015). While the affordances of technologies for collective meaning-making are well established (Conole, 2015; Jeong et al., 2017), there is limited insight into their actual use for collective meaning-making activities in MOOCs, especially in the ICTPED MOOC context. I contend that these affordances arise through collective teaching and learning, shaping agency and conceptual comprehension. However, recent findings suggest that MOOCs offer limited interaction opportunities between instructors and students (Chong et al., 2022). Thus, I place more emphasis on reviewing the literature that scrutinises the processes of performing joint teaching and learning activities in the following sections.

3.3 Pedagogical approaches and practices in MOOCs

This section offers a concise overview of prevailing pedagogical strategies, particularly within cMOOCs and xMOOCs, and the emerging approaches that seek to merge the best of both. MOOCs, which are online courses accessible to all, are bifurcated into two types based on their knowledge claims and pedagogical approaches: connectivist cMOOCs and lecture-based xMOOCs (Bozkurt & Keefer, 2018; Mohamed & Hammond, 2018). MOOCs, rooted in a connectivist approach, champion learner autonomy and advocate for flexible, decentralised, and collaborative learning (Siemens, 2017). Within this model, learners develop knowledge through online social interactions, with instructors serving as facilitators (Blum-Smith et al., 2021; Lazarus & Suryasen, 2022). Conversely, xMOOCs present a more

centralised and linear approach to learning. Here, learners engage with pre-set activities autonomously, and instructors predominantly disseminate knowledge (Bozkurt & Keefer, 2018; Estrada-Molina & Fuentes-Cancell, 2022). Pedagogically, while cMOOCs mirror Sfard's (1998) participation metaphor, xMOOCs align with the acquisition metaphor (Singh & Mørch, 2018). However, both types have garnered criticism for their portrayal of instructors within the MOOC spectrum, either as central authorities or mere collaborators (Ross et al., 2014). These MOOCs assume a student's capacity for independent learning, which suggests that technology is a supportive tool. However, despite their purported connectivist stance, research indicates that cMOOCs rarely offer significant collaborative opportunities beyond the given materials (Margaryan et al., 2015). Present-day MOOCs, leaning towards the xMOOC style, integrate varied communication methods and adopt diverse pedagogical stances (Bayne & Ross, 2014; Bozkurt & Keefer, 2018). Consequently, the demarcation between cMOOCs and xMOOCs has been blurred, especially as xMOOC platforms increasingly prioritise interaction and collaboration (Kovanović et al., 2018). Thus, such simplistic categorisations have been contested for inadequately capturing the diverse MOOC designs and emerging pedagogies (Bayne & Ross, 2014; Rhoads, 2015).

Higher education institutions now integrate MOOCs into their curricula, blending online and in-person collaborative activities (Wollscheid et al., 2020). These iterations are known as small private online courses (SPOCs) (Fox, 2013), often fostering a blend of individual and group learning (Wollscheid et al., 2020). Unlike SPOCs, restricted to specific institution members, the ICTPED MOOC is open to students beyond Østfold University College, encompassing Norway and its neighbours. Emulating the xMOOC design, this course is entirely online. The subsequent sections will delve into the literature centred on collaborative teaching in xMOOCs. Given the scarcity of qualitative studies on joint meaning-making in xMOOCs, research exploring collaborative online learning environments will be incorporated into this review.

Toven-Lindsey et al. (2015) conducted a qualitative examination of the pedagogical practices in 24 MOOCs by observing instructional activities. Their focus was on the epistemological and social dimensions of teaching, and they based their study on the framework developed by Arbaugh and Benbunan-Fich (2006). This framework explores instruction by intersecting continua from objectivist individual learning (where a single objective reality needs to be assimilated) to constructivist group learning (where reality is socially created). According to Arbaugh and Benbunan-Fich (2006), active collaborative teaching methods offer notable benefits by emphasising learner interaction and positioning students at the centre of knowledge construction. Utilising theories such as cognitive constructivism and social constructivism, the researchers discovered that MOOCs tend to support objectivist individual teaching rather than group-oriented, interactive learning. Most discussion forums were found to explain only assignments and concepts, lacking meaningful collaboration. The authors concluded that a shift from traditional teaching models is needed to promote more active and transformative learning through collaboration and interaction in MOOCs. Other studies emphasise the need for authentic problem-centric learning and instructor engagement to foster active learning and collective meaning-making activities, which are under prioritised in MOOCs (Hew, 2016; Verstegen et al., 2018).

Julia et al. (2021) conducted a qualitative analysis of 50 MOOCs on Coursera, focusing on scalable interaction and formative feedback. They used the scalability framework by Kasch

et al. (2017) to evaluate the design quality of MOOCs in terms of scale, cost, and quality. The framework highlights the importance of educational design format, including student-instructor interaction (quality of teacher feedback), student-student interaction (quality of peer feedback), and student-content feedback (quality of automated feedback). The study found that many MOOCs provided superficial formative feedback and lacked meaningful collaborative learning activities. However, some MOOCs had high instructional design quality with valuable interaction and feedback. This finding contradicts a previous quantitative study (Margaryan et al., 2015) that reported low design quality in terms of social collaboration in 76 MOOCs. Instructors tended to have a more independent role, focusing on course development and pre-planning activities. However, different theoretical perspectives can influence perceptions of quality and how it is maintained.

Recently, Rivera et al. (2023) conducted a qualitative study to explore the course specifications, pedagogical instructions, and guidance in the discussion forums of 4 edX MOOCs. The aim was to understand how these elements support students in engaging in meaningful social learning. The study was framed using social constructivism, incorporating Vygotsky's ideas and Garrison's community of inquiry framework. Both theories emphasise that social processes enhance understanding and facilitate knowledge construction. The study revealed that meaningful interactions, such as information sharing, collaboration, critical reflection, and transactivity, contribute to knowledge enhancement. However, the authors found that MOOC forums primarily focus on cognitive processes, such as describing facts and sharing experiences, while neglecting to support social processes like questioning shared information. This design approach may prioritise individual knowledge construction over social learning. Rivera et al. (2023) also noted that previous studies have mainly examined MOOC pedagogy and quality through self-reported assessments and instructional design principles, largely overlooking the specific learning design of discussion forums, particularly in terms of socio-cognitive support and guidance. The provided guidance typically focuses on technical assistance for using forum features, lacking essential directions for meaningful interactions and meaning-making. The findings suggest that MOOC instructors often design discussion forums primarily to engage learners at a cognitive level, with social processes playing a less significant role.

3.4 Processes of engaging in collaborative learning in online education and MOOCs

This section reviews the literature on the execution of social and collaborative teaching and learning activities. Scholars in the European context have introduced the concept of social or sMOOCs to enhance participation, interaction, and collaboration, aiming to foster social learning and knowledge building by integrating technologies like Facebook, Twitter, and blogs (Frau-Meigs et al., 2021). Though this concept predates MOOCs, empirical studies stress the necessity of interaction for meaningful learning and problem-solving (Evans & Jakupec, 2022; Falloon, 2011). Lack of interaction may increase ‘transactional distance’ (TD) (Moore, 1993), a barrier that hinders meaning-making processes. Various forms of TD can occur, including cultural and psychological (Bozkurt et al., 2020). However, structured approaches such as xMOOCs may not promote sufficient interaction (Gamage et al., 2020). Limiting opportunities for dialogue or interaction in learning limits the possibilities of developing and expanding agency (Losh, 2017; Morrison-Love, 2017). The community of inquiry (CoI) framework, which is prominent in online education, explores how text-based

interaction between participants enhances students' learning (Amemado & Manca, 2017). Drawing on Dewey's idea of transactions, CoI asserts that technology can create a shared learning space, but critical thinking and knowledge construction require interaction and collaboration (Garrison, 2015).

Garrison (2016) developed a practical inquiry model in higher education comprising four phases: triggering event, exploration, integration, and resolution. It begins with engaging in activities or problems, followed by group exploration, critical discourses for meaning construction (integration), and problem resolution, although the last phase may be challenging to achieve. The literature emphasises teacher presence in the CoI framework, such as forum posting, to support social and cognitive presence (meaning-making) (Shea et al., 2022). However, instructors' contributions, including facilitating, challenging ideas, summarising discussions, and suggesting solutions, were minimal in MOOC discussion forums (Goshtasbpour et al., 2020). Therefore, learning activities hardly produce fruitful resolutions of learning problems (Kaul et al., 2018). These studies recommend focusing on teaching presence and learner presence to encourage meaningful student interactions and warn against overlooking teacher-student relationships. To deepen meaning-making, some researchers suggest expanding the CoI framework by incorporating synchronous collaborative teaching and learning activities (Timonen & Ruokamo, 2021). A lack of professional expertise among teaching assistants in fostering collaboration (Ntourmas et al., 2022) and the ongoing neglect of teacher presence (Aitken & Hayes, 2021; Baran et al., 2013) can adversely impact participants' agency in teaching and learning in MOOCs.

Sobko et al. (2019) conducted a qualitative study to determine what collaborative learning looks like and what makes it possible for students within the context of an online course offered by a public university in the United States. The participants were undergraduate students. They collected data from 10 discussion groups (using Zoom and whiteboards) involving 31 students and analysed a discussion of one group of three students through inductive thematic analysis (TA). Follow-up interactions with the group were also analysed. This study is vital for understanding what collaborative learning in an online environment involves and how it can be executed. Furthermore, the study is based on robust theoretical perspectives. The socio-cultural theory, influenced by Bakhtin (1986) and Latour's (2005) actor network theory, has been utilised to conceptualise and analyse online collaborative learning. For Bakhtin, meaning-making involves continuous dialogue or a series of linguistic/semiotic exchanges among participants, creating a chain of communication. Sobko et al. argued that the integration of digital tools (e.g. Zoom) can enrich but also complicate this chain of communication. Online environments may be entirely different and unfamiliar to many participants; adapting to a community with unique belief systems, values, and communication styles requires conscious effort to assimilate unfamiliar ways of thinking while becoming acquainted with others' perspectives. Similarly, Latour emphasises a network of interrelations between human and non-human actants, with learning outcomes arising from the interactions of various actants. For Latour, agency, as the capacity to act and produce effects, is shared among human and non-human actors. Unlike Latour, for Bakhtin, agency seems exclusively human and unfolds in the interrelationship of self-other. On the basis of these perspectives, collaborative learning is seen as a complex network of interactions involving both human and non-human actants, fostering convergence through synchronous and asynchronous communications that facilitate shifts in knowledge and thinking. The study reports that most studies have relied on self-report data (surveys) to

investigate online collaborative learning, and the affordances of collaboration are often taken for granted. Across the literature, the roles of digital tools or technologies in mediating learning online remain unexplored. Therefore, they emphasise the need to delineate, explore, and question these affordances through direct observations, which are rare in the existing literature. Furthermore, much of the literature on collaboration and online learning addresses learning outcomes broadly, but the micro shifts (e.g. developing new perspectives, questioning assumptions, interrogating concepts, and connecting to real-world experiences) that enable learning outcomes are often overlooked.

The findings of this study indicate that micro shifts, facilitated by networks of dynamic actants emerging through collaboration, may foster changes in thinking, which leads to ideological growth. The affordance of digital tools (referring to SuiteC, which consists of tools that support collaboration, sharing of ideas, and making connections) plays a crucial role in these shifts, as students were able to remix, create, and represent content on screens according to their new perspectives. The study results also suggest that synchronous communication via Zoom functions as a mediator for student-instructor interactions, fostering micro shifts. Thoughtful assignments and creative tasks with guiding questions can generate dialogue. However, for students' agency to come into play, follow-up unstructured time is needed to steer discussions in productive directions, creating an open space that nurtures the emergence of genuine insights. Thus, synchronous virtual spaces may be more conducive to student agency.

Altowairiki (2021) conducted a qualitative study to investigate the experiences of instructors and students with online collaboration in two graduate courses at a Canadian university. Guided by Vygotsky's social constructivism perspective, the study considered online collaboration as a multifaceted process needing thoughtful planning, facilitation, and evaluation. Through semi-structured interviews with five students and two instructors, and online observations of synchronous and asynchronous interactions between two instructors and eight students, the study identified five themes concerning collaborative learning processes. These themes included setting the stage for collaboration, which encompasses providing clear expectations, detailed collaboration descriptions, assisting students in using technological tools, and facilitating interactions. Building a safe community involves outlining proper etiquette and holding synchronous sessions to create a sense of belonging. Modelling desired learning expectations involves activities such as sharing resources, posting and responding to questions, and stimulating deeper discussions. Guiding the collaboration process entails giving formative feedback, resolving conflicts, and acknowledging students' contributions, while assessing collaboration processes and outcomes involves utilising both formative and summative assessments to aid students' participation. The study highlights that the prevailing research primarily focuses on the results of collaborative learning, overlooking the understanding of how it is actually executed. It also emphasises that online students come with diverse expectations and experiences, and that instructors hold key roles in preparing, supporting, and steering the collaborative learning process to meet the desired goals.

Haugland et al. (2022) conducted a qualitative study, using six focus group discussions and 13 individual interviews, to examine student collaboration in an online master's course at a Norwegian University. The study participants fulfilled the formal course requirements. A qualitative content analysis was performed on the data, resembling a TA, although the exact

method was not explicitly stated. The study's interpretation leans towards a social constructivist approach, drawing on frameworks such as situated learning (Lave & Wenger, 1991) and others focusing on collaboration and cooperation (Johnson et al., 2014). These are believed to be grounded in Vygotsky's perspectives, although he is not directly referenced. The study's findings reflect the notion of learning as a dynamic social process where interactions lead to knowledge development, akin to Vygotsky's ideas. The literature review within the study underlined that in-depth learning is often achieved through peer discussion and reflection. Three distinct working processes in online small group collaboration were revealed: joint responsibility with flexible organisation, individual responsibility with flexible organisation, and individual responsibility with unorganised collaboration.

In the joint responsibility and flexible organisation model, all group members developed an understanding of their assignments, with shared responsibility leading to deeper learning. Through this process, students acted more like a team, sharing responsibilities, engaging in group discussions, and providing feedback. By contrast, groups with individual responsibility and flexible organisation merely cooperated rather than collaborated, dividing assignments into sub-tasks and assigning individual responsibilities. There was no attempt to develop a shared understanding of the topic. The third category, individual responsibility with unorganised groups, resulted in only a few students taking responsibility for learning, with others failing to participate in collaboration. The study found that none of the groups altered their strategies during the learning processes, even if they found them inadequate for effective collaboration. This insight emphasises that online group collaboration may differ and that collaboration may not result in shared understanding without proper pedagogical support. The study concludes that merely working in a group does not amount to collaborative learning. Instead, it requires active contributions from individual members to develop a shared understanding.

3.5 Summary of the research and position held in the study

The reviewed research studies suggest that MOOCs may form an ecosystem that supports both individual and collective learning, but the focus is geared more towards individualistic learning rather than robust collaborative teaching and learning activities. Whilst MOOCs offer various teaching and learning practices, they often fall short of fully leveraging modern technology for interactive and collaborative learning. Currently, pedagogical frameworks primarily emphasise improving the design quality of MOOCs, focusing on scalable communication and formative feedback. This scope is narrow and insufficient; it relegates collaborative learning to mere participation in discussion forums, which primarily focus on information sharing and acquisition rather than developing critical thinking and exploring problems collaboratively. The affordances of modern technologies for enhancing synchronous and asynchronous interaction remain underexplored due to inadequate methodological focus and sound theoretical underpinnings of MOOC pedagogical design activities.

A tacit assumption underlies the roles of instructors and students, portraying instructors as having agency (making pedagogical decisions and implementing them), whilst students are deemed autonomous agents (responsible for self-regulating and independently directing their learning). Whilst this assumption holds partial validity, agency evolves iteratively within practices, and adult participants may have already developed a multitude of

knowledge. However, learners exhibit diverse levels of autonomy, with some possessing the capability to steer their learning independently whilst others need pedagogical support. The lack of autonomy in learning and robust pedagogical scaffolding to nurture students' autonomy in learning is often reported as the main reason contributing to high student attrition rates in MOOCs. Autonomy is a socio-culturally learned capacity that is subject to change and transformation upon encountering novel problems and perspectives. Agency evolves in and through presenting, clarifying, questioning, defending, and assessing ideas and perspectives and reflecting on one's understanding of learning tasks, and collaborative teaching and learning activities are the most productive resources for developing these micro-epistemic activities. Such micro-epistemic activities thrive best within small group collaborations and systematic pedagogical supports that unfold in interaction and dialogue. In interaction and collaboration, instructors and students become co-learners and co-teachers simultaneously. Nevertheless, social collaborative teaching and learning remain voluntary and are poorly integrated into current pedagogical practices. The unidirectional dissemination of learning content and tasks in MOOCs undermines the potential for collaborative teaching and learning.

In addition, research on MOOCs often lacks a strong theoretical grounding. Even when rooted in progressive theories such as connectivism, MOOCs fail to incorporate these principles effectively into their design and practices. As a result, they often subscribe to behaviourist-cognitive pedagogies, prioritising structured content over collaborative learning experiences. Although MOOCs are celebrated for their flexibility, allowing learners to customise their educational journey, this tends to overshadow the fact that profound learning arises from social and collaborative activities.

To capture the essence of agency in online educational settings, the thesis posits that one must move beyond merely accounting for individual activities, such as forum posts, to study the dynamic processes that contribute to collective meaning-making. While digital technologies have the potential to mediate learning, their effectiveness hinges on active interaction and collaboration among participants. This perspective aligns with the cultural-historical theory of teaching and learning and challenges the conventional notion of instructors and students as separate entities, advocating instead for their unified roles as co-contributors to collective meaning-making activities.

Moreover, the literature on MOOCs is predominantly quantitative, focusing on participant engagement without deeply exploring the collaborative meaning-making processes between instructors and students. This presents a crucial research gap that this thesis aims to fill. Qualitative research methods can elucidate how the agency of both instructors and students is developed and enacted in collaborative learning environments. This thesis argues for a shift in focus towards engagement in joint meaning-making activities within MOOCs. The prevalent methodological approaches cannot capture the complexities of human agency and call for more nuanced qualitative studies. By doing so, the study aims to fill a significant research gap. It advocates the investigation of processes in and through which instructors and students collaboratively contribute to collective meaning-making activities, suggesting that such activities are formative for the development of agency in teaching and learning. By exposing these critical issues and gaps, this thesis underscores the need for a shift in MOOC pedagogy and research, advocating for a more collaborative and participatory approach to online education.

Chapter 4: Research Methodology

This chapter presents the research design, methodological approach, and empirical contexts of all three empirical studies included in this thesis. Conceiving teaching and learning as a collaborative process for developing a conceptual understanding and problem-solving capability, in and through which both instructor and student agency evolve, necessitates methodologies that permit thorough investigation and provide substantial input interpretation. Consequently, I have selected a qualitative research methodology that allows for an in-depth examination and understanding of the phenomenon (Creswell & Poth, 2016; Merriam, 2009). This approach provides flexibility to address emerging issues (Maxwell, 2013; Merriam & Tisdell, 2016). The study employed a qualitative case study methodology, founded on the belief that social actors create understanding and meaning through collaboration and interactions (Creswell & Poth, 2016; Merriam & Tisdell, 2016; Stake, 2006). Its aim was to examine joint teaching and learning activities to understand how instructor and student agency are developed and enacted, in and through the collaborative meaning-making process, and how technologies support students in developing their agency in collaborative learning. I consider that the cases of online instructor-student and student-student interactions, both in synchronous and asynchronous contexts, are of special interest because they provide a unique opportunity to observe and examine how the agency of the instructor and student unfold in and through interactions. The rationale behind the analytical procedure used in this thesis is explained in connection with the qualitative research methodology. In addition, the quality of the research was addressed by discussing the validity and reliability of the chosen methods of analysis, as well as the ethical considerations for conducting research in the MOOC teaching and learning environment.

4.1 Two-phase sequential case study design

Sequential research design based on the timing, weighting, and ordering of data and their analysis is common in mixed-method traditions (Creswell & Creswell, 2017), which can be applied in a qualitative case study (Nair et al., 2023; Thomas, 2021). I view a case study as 'both a process of inquiry about the case and the product of that inquiry' (Stake, 2006, p. 8) that captures the particularity and complexity of a 'quintain—something that we want to understand more thoroughly' (Stake, 2006, p. vi). For instance, I examined instructor-student and student-student interaction to analyse how agency in teaching and learning is developed and learned. The qualitatively oriented case study further allowed for a bidirectional dialogic approach to inductive and deductive reasoning at various stages of the research process (Rule & John, 2015). A pertinent example is the development of themes in Article 2; their creation was influenced by the analytical framework I adopted. Therefore, a case study is well suited for 'getting a rich picture and gaining analytical insights from it' (Thomas, 2021, p. 21).

The aim of this case study was to examine joint teaching and learning activities to illustrate how the agency of instructors and students evolved in and through online collaborative teaching and learning activities in the ICTPED MOOC. This design is based on the timing for data collection, data resource weightage, and analytical strategies. The primary data, collected in two sequential phases, are qualitative in nature, comprising video recordings of online teaching-learning sessions and discussion forum posts, and were assessed using

qualitative strategies. Quantitative data from post-course surveys served as supplementary resources, shedding light on students' perceptions of the ICTPED MOOC, particularly regarding collaborative learning experiences.

In Phase 1, data were gathered from the 2020 ICTPED MOOC for Study 1 (Article 1) to scrutinise how instructors facilitated student learning in synchronous settings (live online teaching sessions) and how these facilitation activities were influenced by students' agentic engagement. Subsequently, data for Study 2 (Article 2) were collected from the same course, focusing on how instructors supported student learning in asynchronous settings (Facebook group and Canvas course forum). In both Phase 1 instances, the intention was to develop a deeper understanding of how the agency of instructors and students was developed and enacted in and through joint teaching and learning activities in two different contexts.

As no students consented to share data on their online collaborative learning from the ICTPED MOOC 2020, data were instead collected from the ICTPED MOOC 2021, termed Phase 2 of data collection. In this phase, data were gathered for Study 3 (Article 3) to explore how students mediated one another's learning in online synchronous settings (live online collaborative sessions) and how digital technologies (e.g. OneNote document) aided their participation in such activities. The aim was to understand how digital technology enhanced students' engagement and, subsequently, their agency in joint learning processes. The following table provides a summary of the data corpus.

Table 2

Overview of the Case Study

	Types of data	**Status**	**Description**	**Study**
Phase 1 ICTPED MOOC 2020 Module 3: Multimodal Text	Video recordings of instructor-student online meetings	Core data	Meetings (n=8) Length = 360 minutes Students (n=17) Instructors (n=2)	**Study 1 (Article 1)**
	Reflection videos	Supplementary data	n=2 Length = 20 minutes	
	Post-course survey	Supplementary data	n=1	
	Dialogical posts from a Canvas discussion forum and the Facebook discussion group	Core data	n=178 dialogical posts (Facebook) n=79 dialogical posts (Canvas) n=192 students n=6 instructors	**Study 2 (Article 2)**
	Post course survey	Supplementary data	n=7 post-course survey questions	
Phase 2 ICTPED MOOC 2021 Module 7: Flipped Classroom	Video recordings of student-student online meetings	Core data	Meetings (n=7) Length = 274 minutes n=23 students	**Study 3 (Article 3)**

4.2 Phase 1: Instructors' facilitation of students' learning

4.2.1 Study 1: Instructors' facilitation of students' learning in online guidance meetings (Article 1)

Purpose: To examine how instructors facilitated students' learning in online synchronous teaching and learning sessions and how students' agentic engagement influenced instructors' guidance.

Empirical context: The online synchronous teaching and learning sessions were arranged on the Whereby conferencing platform (https://whereby.com/) and were voluntary. Students were informed about the sessions in Module 3: Multimodal Text, which included an obligatory examination assignment. The assignment required students to create a multimodal text that could be practically used in real lessons at school, as well as a reflection video about the entire process of creating the assignment. The assignment was comprehensive and required students to apply both theoretical knowledge and practical skills (details about the assignment are presented in Article 1). Out of the 365 registered students in the course, only 45 students consented to join the sessions, and only 17 managed to participate in them. Eight meetings were organised with varying numbers of participants. Four meetings were facilitated by an experienced instructor, while the remaining meetings were facilitated by a novice instructor. The meeting setup is shown in the following figure.

Figure 2

An Example of Online Guidance Meeting Setup

Data collection: Data was collected in February 2020. The meetings were observed and recorded using Canvas Studio, a video platform integrated into the Canvas learning management system. I did not participate in teaching and learning activities, but I video recorded the meetings and took notes on how interactions unfolded. Therefore, my role was that of an observer as a participant (Merriam, 2009), which allowed me to observe and record the meetings without participating in the discussion. Additionally, students' reflection videos on their examination assignment creation process were used as supplementary materials to gain insight into whether the ideas discussed in the selected meetings were applied in the creation of the assignment. A post-course survey was also used to gain insight into students' perceptions of online teaching and learning meetings.

4.2.2 Study 2: Instructors' facilitation of students' learning in asynchronous teaching and learning contexts (Article2)

Purpose: To examine how instructors' professional agency unfolded in intervening to address students' learning in discussion forums and how instructors' intervention strategies were affected by students' engagement in learning.

Empirical context: The main context of this case study was an asynchronous learning environment (e.g. Facebook group and Canvas discussion forum of the course). Altogether, 299 participants, including six course facilitators and the researcher, joined the Facebook discussion forum of ICTPED MOOC 2020. Canvas had many different forums, but a discussion forum from Module 3 was selected because it had comparatively more dialogical posts. The main reason behind this was that the students had to complete the examination assignment in Module 3, which might have triggered more discussions in the forum. Teaching and learning activities in discussion forums unfolded asynchronously. Instructors and students had flexibility in terms of postings and revising them in discussion forums.

Data collection: Data were collected from a Facebook group and a Canvas discussion forum from June to August 2020. From the Facebook group, 218 posts were initially identified, but only 178 posts that promoted discussion among instructors and students were selected for analysis. Such posts were called dialogical posts, as instructors' epistemic intervention strategies (EISs) evolved through these posts. A thread post had a maximum of 37 dialogical exchanges and a minimum of one exchange in the Facebook group. Moreover, 79 dialogical posts were identified in a Module 3 discussion forum. The data were manually extracted and organised on Excel spreadsheets for thematic (Braun & Clarke, 2019) and epistemic network analyses (Shaffer et al., 2009). I described my role as a complete observer (Merriam, 2009), as I collected the discussion forum data after the course was over and made no contact with the students. The data protection impact assessment (DPIA) protocol approved by the Østfold University College was followed to ensure anonymity, confidentiality, and untraceability of data sources.

Post-course survey data were also used to gain insight into students' perceptions and about giving and receiving learning support on the discussion forums. The survey was designed and administered by course instructors and obtained from the course instructors. Seven of 33 questions were selected from the survey. The main reason for selecting these questions was that they mainly focused on exploring students' perceptions of online social and collaborative learning opportunities (detailed in Article 2).

4.3 Phase 2: Digital technology and online collaborative learning

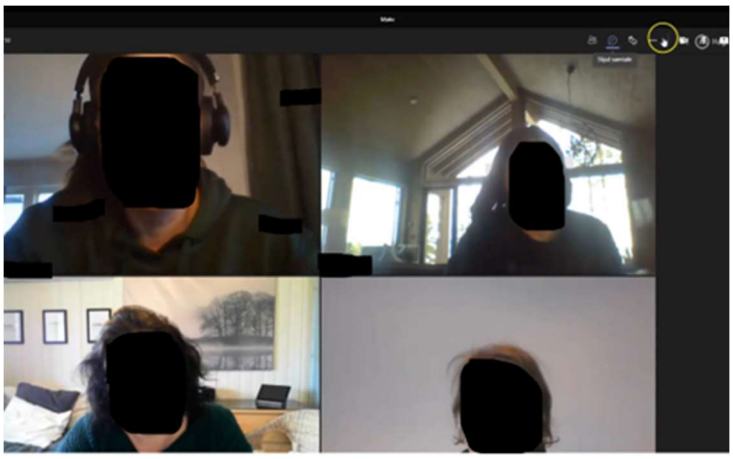
4.3.1 Study 3: Digital technologies and student engagement in online collaborative learning (Article 3)

Purpose: To examine how students mediated each other's learning and how digital technologies (e.g. OneNote document) facilitated students' engagement in online collaborative learning in ICTPED MOOC 2021.

Empirical context: The main context of this case study was also online synchronous collaborative meetings between students. The meetings were organised by the students themselves, mainly on the Microsoft Teams platform. As in Study 1, brief information, along with a letter of informed consent, about how to form a small group using Google Doc was embedded in Module 7: Flipped Classroom of the course. The students had an obligatory individual examination assignment in the module. Consequently, the purpose of online collaborative learning between students was to help them engage in developing a conceptual understanding of target concepts in the assignment. Therefore, all 297 students registered for the course were informed and encouraged to participate in voluntary online collaborative learning meetings with their peers. Of the total 297 students, 73 consented to participate and share the data of their collaborative learning meetings with the researcher. Only 23 students formed groups and engaged in online collaborative learning meetings. It is possible that students' low participation in online collaborative learning, including case study 1, was because the participation was voluntary, and some students might have engaged in collaborative learning without informing the instructors/researcher. Many students drop out of traditional MOOCs owing to a lack of interaction and collaboration among participants (Gamage et al., 2020; Singh & Mørch, 2018). The meeting setup is shown in the following figure.

Figure 3

Example of an Online Collaborative Learning Meeting Setup



Data collection: Data collection was conducted during April and May 2021. Informed consent was obtained from the students. Out of a total of seven meetings, I was invited to five meetings to observe and record them. In two meetings, I was not invited, but the students consented to share the recordings of their meetings with me. I included only the recordings of the meetings in which I was present as an observer participant. Video recordings of online collaborative learning were the main data source in this study. Details of the data are presented in Article 3.

4.4 Data corpus and justification of methods

The data corpus collected for the case studies mainly includes observation data, supplemented by survey data. Online synchronous interactions were recorded digitally, and

discussion forum posts were manually extracted. The aim of the observation of online student-instructor and student-student interactions was to gain insight into how instructor and student agency evolved collaboratively in synchronous and asynchronous collaborative teaching and learning contexts. Iterative observations of video recordings and selection of transcriptions based on initial conjectures were made about the social interaction (DeLiema et al., 2021). This approach helped me avoid what Blikstad-Balas calls (2017) 'magnification' (p. 6) issues that occur when we amplify activities or events that are not representative of overall patterns of activities or events. Thus, the analysis of the video recording served as 'a microscope' for an in-depth study of how teaching and learning activities unfolded in online live sessions (Knoblauch & Schnettler, 2012, p. 335). Discussion forum posts also represent naturally occurring discourse/conversations among participants in online learning environments as they take initiative to raise questions and engage with them. These digital data serve as a context for the social worlds of teaching and learning (Beneito-Montagut, 2011). My focus centred on synchronous (live sessions) and asynchronous (forums) activities.

Article 1 reports how the qualitative method was used to examine the interrelationship between instructor facilitation and students' agentic engagement in joint teaching and learning processes. Qualitative analysis is considered the most suitable method to investigate how the complex phenomenon evolved in and through joint processes (Creswell & Poth, 2016). Therefore, video recordings of online live student-instructor interactions were selected as the primary data sources. Article 2 reports on the interrelationship between instructors' intervention strategies and students' agency in learning course discussion forums. Such interrelation can be more subtly captured by combining qualitative and network analysis approaches. Therefore, combining a TA (Braun & Clarke, 2019) and an epistemic network analysis (Shaffer et al., 2009) of discussion forum dialogical posts provided me with a more microscopic approach to investigating discussion forum teaching and learning activities qualitatively and quantitatively. Surveys were utilised as supplementary sources of data to provide an understanding of the ways in which students perceived various methods of receiving and providing learning assistance in the course.

Finally, Article 3 examines how students support one another in online collaboration and the interrelationship between students' engagement in collaborative learning and the role of digital technologies (resources). The qualitative approach is the most suitable for examining how such an interrelationship develops during the processes of collaborative learning. Therefore, video recordings of online live student-student interactions were selected as the main data sources.

4.5 Analytical approach and processes

This section outlines the key assumptions and analytical strategies that guided the analyses in the three empirical studies, which are grounded in cultural-historical theory. While I describe the procedures for interaction analysis, TA, and epistemic network analyses, I place greater emphasis on interaction analysis, as it was the primary data analysis method in two of the studies (Articles 1 & 3).

4.5.1 Interaction analysis

The interaction analysis (IA) method was used to analyse the video recordings. The foundational assumption of IA is that learning is a joint activity achieved through collective engagement (Hall & Stevens, 2015). In this context, the processes of joint teaching and learning activities can be traced through student-instructor and student-student interactions, where talk is considered to represent the process of collaborative meaning-making (Linell, 2009; Mercer, 2002). This conceptualisation should be treated as a reflection of how instructors facilitate students' learning and how students learn collaboratively. Therefore, attention should be given to the processes of how students and instructors engage in social interactions and mobilise digital technologies that contribute to invoking student engagement in the joint meaning-making process. This assumption invites an analytical focus on the sequences of interactions between students and instructors, resulting in the development of a shared perspective of learning tasks.

The second assumption, rooted in Vygotsky's (2012) cultural-historical perspectives on learning and development, posits that teaching and learning are collective activities mediated by various resources. In this view, learning originates primarily from social activities and unfolds within socially mediated environments, a concept referred to as the external plane in Vygotskian analysis. In the process of transferring from the external to the internal plane (i.e. the internalisation of the ideas being worked with), the activity undergoes certain transformations, which, according to Galperin et al. (2023), can be observed in four main forms: orientation, materialised action, communicated thinking, and dialogical thinking. These transitions towards internalisation reflect the process of developing and advancing a conceptual understanding by the learner. Therefore, examining how learning happens in each of these forms can aid in understanding how conceptual understandings in social learning activities are transferred and transformed into the internal plane of the learners. These forms of transformation were employed in the analysis as a framework to understand how and why students and instructors engaged in different phases of the teaching and learning activities.

Analytical strategies for IA

Data analysis was an iterative process in which emergent findings informed the next steps. The analysis of video recordings of student-instructor and student-student interactions examined how facilitating and learning activities evolved during the process of joint meaning-making and how digital technologies facilitate students' engagement in collaborative learning. The focus on the joint processes of teaching and learning is adequately captured by the IA (Hall & Stevens, 2015; Jordan & Henderson, 1995). The unit of analysis in the interaction was turn-taking and sequences unfolding during the joint processes of meaning-making; thus, the analytical focus was joint meaning-making processes. I chose episodes from the interaction trajectories judged sufficient to answer my research questions. The finer details of a linguistic analysis of interactions (e.g. intonation and discourse markers) were not included.

The data were initially transcribed by professionals specialised in data transcription. Subsequently, I reworked the transcriptions to align with my analytical framework. In two of my articles (Articles 1 & 3), I stated that I followed the Jefferson’s transcription

conventions (Jefferson, 2004) to transcribe the data. However, whilst writing this thesis, I realised that I was actually closely aligned with Mercer's (1995) strategies for IA. Mercer argued for presenting data transcriptions in non-technical ways to enhance their understandability for broader audiences beyond the community familiar with technical transcription methods, as stated by Jefferson (2004). Therefore, I have included only essential information: utterances removed from the original interaction [...], incomplete information …, unclear sections (), and other information that I believe to be absolutely essential in the given context. This process facilitated a thorough re-examination of video recordings, contributing to an increased awareness of the specific interaction episodes that were most conducive to an in-depth analysis of how joint meaning-making processes mediated by digital technologies unfolded.

Each video recording was treated as a meaning-making event (Erickson, 2012), comprising many episodes of learning. An episode consists of a sequence of learning activities initiated by a single presenter and subsequently discussed, debated, and concluded within collaborative learning trajectories. One meeting involved four students, and each student had approximately 11 minutes to present and discuss their ideas or problems in a 45-minute session. Ideally, one meeting consisted of four episodes of learning in a joint interaction. However, the number of students participating in each meeting varied from one to four. Some meetings lasted longer than 45 minutes. Each episode consisted of orienting, presenting, discussing, and reflecting on the presented task, which I referred to as sub-episodes. Therefore, a meaning-making event is made up of many episodes of learning, depending on the number of participants and their contributions to enrich the meaning-making event. For example, when one participant presents and clarifies his/her ideas, other participants involved in the meaning-making events contribute to developing and expanding the presenting participants' ideas by asking questions and sharing their understanding of the presented ideas. This process may continue to expand unless participants develop some shared understanding of the tasks. In this study, I refer to these sub-episodes as micro meaning-making activities.

I also focused on how digital resources or artefacts (e.g. OneNote document, Article 3) were utilised in the learning process. Therefore, I selected episodes that clearly demonstrated how digital resources were utilised and mediated students' engagement in joint learning without disrupting the sequential nature of the shared learning trajectory. Taking these criteria into consideration, I chose two video recordings that represented student-instructor interactions and one video recording that represented student-student interactions. The two selected video recordings of the student-instructor interactions also showcased the facilitation of activities by both an experienced and a novice instructor (Article 1). In this way, extracts representing sub-episodes were chosen for interaction analysis. The following figure illustrates the process of reviewing and selecting sub-episodes. Consequently, a 'so-called story' (Derry et al., 2010) emerged from the analysed extracts, which influenced the final selection of extracts chosen to represent the patterns of student-instructors and student-student interactions in the articles. Therefore, I argue that the selected extracts in Articles 1 and 3 exemplify a narrative structure of the story that the study aimed to convey.

Figure 4

Processes of Selecting Episodes and Extracts for the IA

E= episode, SE= sub-episode

The interactions in the selected extracts were analysed sequentially, meaning that each utterance was analysed in relation to both the preceding and subsequent ones in the ongoing interaction. The primary units of analysis were turns and sequences of the student-instructor and student-student interactions, rather than isolated utterances. The analytical descriptions focused on the participants' interactional achievements. Therefore, the approach focused on how meaning-making involved the unfolding of utterances in joint teaching and learning (Linell, 2009; Mercer, 2010). This detailed process of analysing interaction sequences allows for an analysis of 'what is going on for the participants in interaction' in terms of meaning-making processes (Hall & Stevens, 2015, p. 79). The description of the setting preceded each interaction sequence, providing situational details for the chosen extracts.

The IA was performed in three steps (Marková, 1990; Linell, 1998). First, turn-takings and sequences in the selected extracts from the student-instructor and student-student interactions were described using numbered lines. Then, the selected extracts were interpreted. Second, the description of the extracts was interpreted from the perspective of the research questions. Finally, emergent findings were outlined and explained using the adopted analytical lens.

4.5.2 Thematic analysis

Following the guidelines outlined by Braun and Clarke (2012), I conducted the thematic analysis (TA) of discussion forum posts. It is the most commonly used analytical strategy in qualitative research (Braun & Clarke, 2019). The rationale behind choosing this approach was that it enabled me, as a researcher, to engage in an inductive process of generating themes out of data, which is cyclic, organic, and creative (Braun & Clarke, 2012). The TA can also be conducted deductively (Byrne, 2022). The themes were constructed through six phases. First, the discussion forum posts of the ICTPED MOOC 2020 were manually extracted on Excel spreadsheets. Manual data collection, though time-consuming, is an effective approach to collecting data from discussion forums (Braun et al., 2017). Each thread post and subsequent post that followed the thread post were numbered. As the thread posts that invited participants' comments and questions promoted dialogue and discussion on the discussion forums, they were termed dialogical posts. For example, the first selected thread post was named dialogical exchange one (DX1), and this naming convention was consistently applied to all other thread posts as well. All original posts were in Norwegian and were translated into English. The translations and familiarisation process were more intense, and I consulted course instructors on many occasions to understand many posts containing complex idiomatic expressions.

Then, I selected only posts involving discourse among instructors and students because the instructors' intervention strategies emerged from the exchanges between the participants. Second, I developed two broader themes through the inductive process of data familiarisation: (i) mode of intervention (how instructors communicated to support students' learning) and (ii) teamwork (how instructors employed a joint approach to addressing students' learning needs). Using the two broader themes as central organising concepts (Braun & Clarke, 2019), I coded the dialogical posts in terms of mode and team approach to intervention. For example, the occurrences of intervention using written texts, self-created videos, and instructors not engaging with peer discussion were used to detail the underlying commonality in data items regarding the subject of the research (Braun & Clarke, 2012). Then, I further developed these themes during the recursive processes of reading and re-reading the data set. Fourth, five themes were developed: textual intervention, video or textual video intervention based on modes, referral, remote interaction, and peer interventions based on teamwork. I also listed the instructors' main activities corresponding to the generated themes. For example, for referral intervention, instructors joined their fellow instructors in replying to students' questions. Fifth, I defined and exemplified themes, which are 'embedded in the scholarly field' (Braun & Clarke, 2012, p. 69), that is, influenced by the theoretical perspective outlined in Chapter 3. Finally, I prepared a full theme template (presented in Article 2) and developed it into a research paper with my co-author. The six phases of TA are outlined in the following table.

Table 3

Process of Thematic Analysis

	Step	Activities
1.	Gaining familiarity with the data	Reading, rereading, note-taking, and translating discussion threads Consulting with course instructors to understand confusing posts
2.	Generating themes	Listing and coding discussion thread posts Giving a code to each discussion thread post and each discussion post that follows Combining thread and discussion post codes
3.	Searching for themes	Re-reading the discussion lines and discussion threads to find new themes Comparing themes
4.	Reviewing themes	Listing themes Combining or collapsing themes
5.	Defining and naming themes	Naming, defining, and exemplifying themes Categorising themes based on modality of interventions and teamwork
6.	Reporting themes	Preparing a theme template and publishing a research paper

4.5.2 Epistemic network analysis

ENA is based on the theory of epistemic frames (Shaffer, 2017), which stipulates that human activities are situated in communities of practice and involve knowledge-based (epistemic) conversations. Learning is embedded in these interactions; thus, learning is an interpersonal process in which learners are engaged with peers or instructors. Such embedded and situated learning activities are compatible with a socio-cultural approach, as outlined in Chapter 2, which, as Shaffer (2017) reported, can also be quantified and visually represented. Instructors' and students' discussion forum activities were taken as what Gee (2014) calls discourse, which involves reading, writing/posting, interaction, believing, valuing, and feeling (using various objects, symbols, images, tools, and technologies). My intention in using an ENA was to visualise the patterns and centrality of instructors' feedback-giving activities in the discussion forums (Canvas and Facebook), using the themes generated from the TA and comparing the weighted values of the relations of the themes for each instructor. I used it as a supplementary analytical method for TA to visualise the EISs and account for their recurrent patterns and centrality (i.e. what strategy is more prominent in the various groups).

4.6 Research credibility, validity, generalisation, and research ethics

In this section, I discuss how I maintained research credibility and dealt with ethical issues. Research credibility pertains to whether methodological processes of reporting findings of an investigation are transparent, valid, confirmable, and reliable (Denzin & Lincoln, 2018). The quality of qualitative case studies depends 'less on the concepts of *sample, validity,* and *reliability*, but more on the *conception*, *construction,* and *conduct of the study*' (Thomas, 2021, p. 82), which are illustrated in the subsequent sections.

Reliability: In qualitative research, reliability deals with whether research findings are consistent with data collection or methodological procedures (Merriam & Tisdell, 2016; Stake, 2005). In other words, whether the process of 'generating understanding' (Stenbacka, 2001, p. 551) is both transparent and reliable, a concept (Maxwell, 2002) called *descriptive validity*. Consequently, reliability is closely tied to validity (Maxwell, 2002). I have taken several steps to ensure the reliability of the studies in this thesis.

First, video recordings enhance reliability, as they capture social activities in real-time (Heath et al., 2010; Jordan & Henderson, 1995), allowing for repeated review to verify the accuracy of selected extracts. Such opportunities ensure that 'questions of what is actually on the tape versus what observers think they saw can be resolved by recourse to the tape as the final authority' (Jordan & Henderson, 1995, p. 45). Second, I followed standard procedures of selecting video recordings for the IA outlined by (Erickson, 2012). This allowed for systematic and repeated viewings of selected episodes, enabling me to closely follow the participants' actions and interactions. Third, the data were transcribed and presented in a consistent, non-technical manner, fostering greater understanding and trustworthiness of the research processes. Lastly, the three-step process of conducting interaction analysis (Linell, 1998, 2009) ensured the transparency of making analytical judgements and outlining emergent findings.

Regarding qualitative TA, reliability lies in the creative, reflective, and subjective processes of storytelling rather than discovering an external truth (Braun & Clarke, 2019). The procedures I employed to develop themes were made more explicit (see Table 2), and these themes were formulated inductively, considering the interactions within the discussion forums. The incorporation of ENA enhanced the transparency of these procedures, enabling the quantification of each theme's occurrence and revealing interrelated patterns among them. I argue that this unique blend of TA and ENA bolsters both the reliability and validity of theme development and the identification of their interrelationships.

Validity: In qualitative research, validity concerns the extent to which the findings drawn from presented data are credible (Merriam & Tisdell, 2016) and thus involves the process of description, conclusion, explanation, interpretation, and making claims transparent (Maxwell, 2013). Hence, a transparent and detailed explanation of how the study was conducted, how data were analysed, and how inferences are justified is vital to ensure the study's integrity. The study utilised IA as a rigorous method for capturing, recording, and analysing co-occurring teaching and learning activities. This approach enables readers to trace the analytical steps taken, thereby substantiating the study's validity. Furthermore, the combination of TA and ENA enhances transparency in visualising patterns of interrelationship and articulating claims about instructors' intervention strategies in

discussion forums. This methodological synergy bolsters the validity of these claims and the study. Moreover, multiple data sources, including video recordings and discussion forum posts, enhance internal validity, reinforcing the credibility of the research findings (Merriam & Tisdell, 2016). Such an array of data allows for substantiated claims about the evolution of participants' agency across different settings, further bolstering the study's validity.

Peer review is another strategy for ensuring that the findings of studies are valid. I presented and discussed the data and findings of three different articles with my supervisors and research group colleagues and presented them at course seminars and conferences. The feedback received, particularly concerning the data analytical framework and emerging themes, was considered to ensure that the inferences were both adequate and valid. Furthermore, my prolonged engagement with the video recordings and discussion forum posts throughout the study increased the validity of the observation data (Maxwell, 2013).

Generalisability: In qualitative case studies, generalisability, also known as transferability, resides in the capacity to reveal underlying processes, illuminate complex relationships, and contribute to theory building through detailed, context-specific knowledge (Merriam, 2009; Thomas, 2021). The proposed framework, termed the OECT framework, synthesises the findings of three empirical studies and can be applied to assess how participants develop and enhance their agency in social and collaborative teaching and learning within online higher education settings. According to Thomas (2021), generalising means '*finding patterns* or *distilling* or *finding links between them*' (p. 244), and the OECT framework can thus be applied to observe and promote how agency in engaging to make contributions to the collective process of developing a conceptual understanding in different contexts. Consequently, the quality of the analyses, rather than the quantity of the data, takes precedence in investigating the processes involved in developing and enacting agency to advance higher-order thinking. I contend that the selected data corpus is sufficient to account for this process.

4.6 Ethical considerations

I was more like a guest 'in the private space' of research participants (Stake, 2005, p. 459), in which ethical issues were 'often less visible and more subtle' than in quantitative research (Lipson, 1994, p. 333). Moreover, ethical issues in qualitative enquiry continue to arise during the process of conducting research activities (Creswell & Poth, 2016; Merriam, 2009). At times, I felt that conducting qualitative research online about an online course posed additional ethical dilemmas and challenges, as I tended to read every comment shared by participants. Moreover, instructors' and students' discussion forum posts and video lectures are considered personal data according to the general data protection regulation (GDPR). Is it ethical to know the data that one is unsure about their inclusion in the study? Therefore, I attempted to maintain an ethically sound code of conduct during the whole process of conducting this study, as suggested by scholars (Merriam & Tisdell, 2016; Stake, 2006). I took some additional steps to carefully address ethical issues to make this study ethically sound and transparent.

Since communicating the purpose of why the researcher is present and wants to engage with participants is one of the first important steps in dealing with ethical issues (Merriam & Tisdell, 2016), I initially made the purpose of my presence in the course explicit by creating

and sharing a short introductory video with the course instructors. This step is particularly crucial in an online environment, where researchers and participants may be unfamiliar with each other. By explicitly conveying the rationale behind the researcher's presence, it is possible to foster a sense of trust within an open online environment. Furthermore, this proactive approach can prove instrumental in mitigating issues of intrusiveness, thereby ensuring a more respectful and ethical engagement with research participants. I contend that building trust by adequately informing research participants who the researcher is, what the researcher intends to do with the participants' data, and why it is crucial in contacting research participants and collecting data. In phase 1, only one group of students shared a recording of their learning sessions, asking for feedback, although they did not invite me to participate in their collaborative learning sessions. I think this happened partly because of the lack of communication and rapport with the course students. Therefore, I had to collect data from phase 2, where I actively communicated and motivated students by highlighting the shared benefits of engaging in collaborative learning and offered a gift card for the best-performing team. My role was that of an 'observer as participant' (Merriam, 2009, p. 144) in online meetings where both instructors and students gave me their informed consent to observe, record, and store their activities, while it was that of a 'complete observer' (Merriam, 2009, p. 145) in discussion forums. I observed students' discussion forum activities and manually extracted them after the course was over for this study. Therefore, it was neither possible to contact students nor gain informed consent from them. Obtaining voluntary informed consent from course participants is considered an important strategy for ensuring ethically responsible practice (Elgesem, 2015). In collaboration with my main supervisor, I created an online letter of informed consent and embedded it in the course with the help of course instructors prior to observing participants' online meetings. I obtained prior written informed consent from the participants who invited me to online teaching and learning sessions to observe and record their learning sessions for data. I also obtained their oral consent before the sessions began. However, complexity arose in taking down discussion forum posts of the course, as I collected data after the course was over. It was almost impossible to contact the participants and obtain informed consent. Willis (2017) also reported that informed consent in online contexts might be unobtainable. He proposed two ways of waiving informed consent in online research: if data remain in the public domain (e.g. Facebook, Twitter) and if data are treated as textual or documentary. However, the question arose whether the online course activities are public domain or private domain. Some authors have argued that online spaces such as forums can be seen as public spaces to waive informed consent for processing data (Sugiura et al., 2017). Scholars have also argued that as long as the researcher can justify the necessity and public good of the research, online data can be used without informed consent (Ingierd & Fossheim, 2015). I reported this complexity to the Norwegian Agency for Shared Services in Education and Research (SIKT) and followed their suggestions. However, complying with SIKT guidelines was insufficient, as anonymisation, as stipulated in the General Data Protection Regulation (GDPR), does not protect participants against data traceability or interoperability. Therefore, I signed the DPIA protocol with ØUC to ensure that no person can be identified and traced by the discussion forum posts cited in the study (Article 2). Finally, the DPIA turned out to be an important tool to deal with the ethical dilemmas that emerged during the analysis of the discussion forum data.

Chapter 5: Summary of the Articles

In this chapter, I will provide a concise summary of the three articles, including their respective objectives, research enquiries, theoretical foundations, methodologies, results, and their contributions to accomplishing the overarching aim of this thesis. Subsequently, I will succinctly summarise the three articles, highlighting the proposal of an analytical framework derived from the synthesis of findings across these articles. The primary aims of the articles were to investigate the following three research queries within the context of this thesis.

RQ1: How does instructor agency come into play when facilitating students' online collaborative learning activities?

RQ2: How does student agency unfold, and how is it mediated by technologies when students engage in online collaborative learning activities?

RQ3: How do instructor and student agency co-evolve, and why do they become prominent in joint teaching and learning activities in the online learning environment?

5.1 Summary of Article 1

Singh, A. B., & Engeness, I. (2021). Examining instructors' roles in facilitating students' learning process in pedagogical information and communication technology massive open online course. *Cultural-Historical Psychology, 17*(2), 76–89. https://doi.org/10.17759/chp.2021170208

This article focuses on how instructors facilitate students' learning and how their facilitating and guiding roles are influenced by students' agentic engagement in learning in online collaborative teaching and learning meetings. MOOC instructors rarely engage with students in synchronous collaborative learning activities (Chen et al., 2019), and research studies have highlighted the need to promote collaborative teaching and learning activities to foster meaning-making activities (Foroughi, 2016; Watkins et al., 2020). Collaborative teaching and learning activities are not only sources for meaning-making but also the core resources for developing and enacting agency in teaching and learning. Instructors' roles in facilitating and guiding students' learning evolve in and through collaborative teaching and learning activities, and are influenced by students' agentic engagement in learning.

The aim of this study was to address the first and third research questions of this thesis, which focused on the interrelationship between instructor and student agency in developing and advancing a conceptual understanding of target concepts related to learning tasks (e.g. the examination assignment) in both synchronous and asynchronous teaching and learning contexts in the ICTPED MOOC. This article zooms in on instructors' facilitating and guiding activities in synchronous teaching and learning contexts. The cultural-historical theory, especially Galperin's pedagogical theory, is used as an analytical resource, which suggests that teaching and learning involve planning, performing, and reflecting over jointly created orienting activities to gradually transform socially constructed meaningful activities into individual mental activity. Galperin outlined six dialectically evolving pedagogical phases: (i) motivation, (ii) orientation, (iii) materialised action, (vi) communicated thinking, (v) dialogical thinking, and (vi) acting mentally. These pedagogical phases are used as

analytical resources to examine what roles instructors perform at different times in the learning process in online meetings and how students' engagement influences them in learning.

The primary data sources were video recordings of online meetings, supplemented by two students' reflection videos and post-course survey data used to gain insights into their experiences. They were used in phase 1, which focused on revealing the interrelationship between instructors' facilitating and guiding roles and students' engagement in synchronous and asynchronous teaching and learning contexts. The interactions between instructors and students were analysed by interaction analysis (Jordan & Henderson, 1995) using Galperin's pedagogical theory as an analytical resource.

The analysis revealed four pedagogical functions performed by instructors: (i) setting up the learning process, (ii) reifying students' ideas, (iii) assisting students in developing their conceptual understanding, and (iv) summarising and structuring students' understanding of the target concepts. These functions are contingent on students' engagement in the learning process. The more actively students contribute to the learning process by presenting ideas, raising questions, and articulating problematic issues, the more actively instructors facilitate and guide students' learning by clarifying and validating students' ideas. This study shows that instructors with online teaching experiences tend to negotiate the background setting process of teaching and learning by explaining how they want the students to engage in learning processes, whereas the novices rely on students' initiations. This mutual process of deepening meaning-making is augmented by materialised ideas, that is, the draft examination assignments, as instructors raise questions about how ideas are organised and what pedagogical values they offer in real teaching and learning practices, and students explicate their ideas and approaches to creating the assignment. The use of materialised ideas, such as sharing PowerPoint slides, invokes instructors' and students' active engagement and interaction in collective meaning-making processes. The findings suggest that the dialectical interplay between instructor and student agency emerges as an essential characteristic of online collaborative teaching and learning, where instructors' orienting, executive, and assessing functions of student learning shape students' agentic engagement. Galperin's theory proved useful in analysing how joint teaching and learning activities unfold and the development of students' conceptual understanding. The article also reports that students were satisfied with online collaborative teaching and learning meetings, which contributes to deepening their understanding of the examination assignment. The analysis of students' reflection videos indicated that the students applied the concepts discussed in the meetings to create examination assignments. Thus, this study highlights the importance of the joint engagement of instructors and students in deepening meaning-making activities in and through which they develop and enact their agency.

Overall, the study contributes to understanding the mutually influencing interrelationship between instructor and student agency in developing and advancing the conceptual understanding of target concepts related to learning tasks in and through four mutually evolving pedagogical activities: orienting, reifying ideas, assessing ideas, and summarising and structuring target concepts.

5.2 Summary of Article 2

Singh, A. B., & Mørch, A. (2024). Instructors' epistemic intervention strategies in MOOC discussion forums. *Journal of Educators Online*, *21*(1). https://doi.org/10.9743/JEO.2024.21.1.5

This study examined how instructors' professional agency came into play in employing epistemic intervention strategies (EISs) to support students' learning in course discussion forums (asynchronous contexts) and how the employment of EISs influenced student agency in learning in the forums. Discussion forums are the main spaces and tools for joint engagement in collective meaning-making activities. Developing critical thinking evolves in and through interaction with others (Galikyan et al., 2021; Shea et al., 2022). However, the availability of discussion forums is not sufficient to nurture them into spaces of learning and meaning-making. Instructors' well-thought pedagogical support (Bozkurt & Keefer, 2018) and students' engagement in learning (Galikyan et al., 2021) are required, but employment of well-thought pedagogical support is barely available in MOOCs, resulting in massive students' dropout from the courses (Gamage et al., 2020; Margaryan et al., 2015). This study focused on how instructors' EISs affect students' learning and how students' agency shapes instructors' agency in facilitating and guiding students' learning in asynchronous teaching and learning environments to address the first and second research questions of this thesis. The cultural-historical theory, especially the concept of ZPD, is used to conceptualise discussion forums as socio-pedagogical spaces for meaning-making and developing a conceptual understanding. To do so, instructors and students actively engage in facilitating and learning activities because the ZPD is created in and through dialogue and collaboration (Vygotsky, 2012).

Thematic and epistemic network analyses were used to analyse 178 dialogical posts in the Facebook group and 79 posts in a Canvas discussion forum. The TA was used to explore instructors' EISs from discussion forum exchanges between instructors and students (called dialogical posts), and an epistemic network analysis was used as a supplementary analytical method to visualise the patterns and centrality of instructors' EISs in the discussion forums. The post-course questionnaire was the supplementary data used to gain students' perspectives on different social and collaborative learning in the MOOC. The data were collected in the frame of Phase 1.

The findings revealed that the instructors employed five EISs: (i) textual, (ii) video or textual-video tutorials, (iii) referral, (iv) peer, and (v) remote interaction. Most students were generally satisfied with these strategies. The employment of these EISs was predominantly influenced by students' active engagement in the learning process and the complexity of their queries. As an illustration, instructors proactively addressed students' questions and comments about the course content and examination assignments using textual or textual-video tutorials. They employed remote interaction interventions to respond to complex queries that combined various texts or uploaded videos. When students required more personalised feedback, the instructors leveraged the video intervention. However, if students engaged in sharing their experiences and reflections on problem-solving, the instructors refrained from intervening in their learning process. Instead, they encouraged peer-to-peer interaction in the Facebook group discussions. Conversely, peer interaction was shorter in the Canvas discussion forum, as instructors frequently replied to students' questions.

It was observed that instructors' direct replies might limit the room for interpretation and discussion, thereby limiting students' agency in learning. The study highlights that instructors' direct approach to answer students' questions, without allowing them to explore answers to their questions by drawing on different perspectives, constrains students' agency in learning. The inherent design of the Canvas learning management system partially restricts student agency compared to the Facebook group discussion interface, which actively fosters engagement by persistently updating its members about online activities through real-time notifications. Hence, instructors are required to be more judicious about pedagogical choices while intervening in students' learning activities in course discussion forums. The evolution of EISs during collective teaching and learning facilitates interaction and collaboration among participants, thus expanding their knowledge and learning, which is referred to as the participants' ZPD. The ZPD is developed and nurtured in and through joint engagement in meaningful teaching and learning activities.

This article contributes to revealing the emerging interrelationship between instructors' agency in intervening to address students' problems and student agency in learning. The more students become active in raising questions and articulating their needs, the more active instructors become in enacting their professional agency in facilitating student learning. While enacting professional agency, instructors develop and expand their professional agency in online pedagogical practices as they learn how to address students' unique questions and problems.

5.3 Summary of Article 3

Singh, A. B. (2023). Digital technology and student engagement in online synchronous collaborative learning sessions. *Culture and Education*. Manuscript under review.

This study examines how students engage in learning in online synchronous collaborative learning sessions (OSCL) within a massive open online course (MOOC). The study specifically focuses on the role of digital technologies in facilitating students' agency in collaborative meaning-making activities during these sessions. In this context, digital technologies refer to platforms such as Microsoft products (Teams, PowerPoint, OneNote) as well as the digital artefacts or resources (e.g., OneNote documents, PowerPoint presentations) created by students using Microsoft products. The online platforms such as Teams foster collaboration, allowing students to share and discuss their individually created digital artefacts. However, MOOCs generally offer limited interactive learning opportunities, with most interactions occurring within discussion forums (Chong et al., 2022). These forum activities often entail minimal engagement in higher-level learning, such as critical thinking (Beer, 2019). On the other hand, OSCL sessions have the potential to enhance collaborative meaning-making activities. Nonetheless, these potentials have not been thoroughly examined in the context of MOOCs, nor have the ways in which digital technologies mediate students' agency in learning. This study aims to address the second and third research questions within the overall thesis.

To examine how students collaboratively engage in developing a conceptual understanding of various concepts and when solving problems (examination assignments), the study adopts

the cultural-historical theory (Vygotsky, 2012), specifically Galperin's pedagogical theory (Engeness, 2021a). According to Galperin, developing and advancing conceptual understanding involves six pedagogical phases: motivation, orientation, materialised action, communicated thinking, dialogical thinking, and acting mentally. Agentic students who are aware of their learning goals and the problems they need to solve can engage in small group learning activities. Mediation as a process of transferring and transforming external activities (social interaction) into internal activities (meaning) that involves mobilising digital artefacts unfolds as students' progress in joint meaning-making activities. Galperin's theory provides a useful framework for examining the interplay between peer collaboration and the digital resources in OSCL sessions to enhance students' agency in learning. Video recordings from OSCL sessions between students served as the main sources of data in Phase 2. This phase centred on examining the ways in which peer mediation and the utilisation of technology contributed to student engagement in OSCL activities. The analysis of the recordings was conducted using an interaction analysis framework established by Jordan and Henderson (1995), and the findings were interpreted through the lens of the cultural-historical theory.

The analysis revealed that the students engaged in four main activities during online OSCL: (i) establishing social connection and presence, (ii) reflecting on previous learning activities, (iii) sharing digital artefacts, and (iv) reflecting on shared understanding. These activities emerged as students worked on creatively solving the examination assignment. The initial learning process consisted of two primary activities: establishing social connection and presence and reflecting on previous learning activities. This suggests that being socially connected is important for meaningful learning, and that developing a sense of social connection involves mutual learning. Students with knowledge and skills in addressing technical issues helped other students establish a sense of connection on the screen. They actively assisted their peers by using the affordances of digital technologies, such as cursor pointing, to establish and maintain social connection and presence in OSCL environments. Once students were comfortable with the technologies and being seen by their peers, they reflected on their previous learning activities and their progress with their individual examination assignments. This reflective activity is crucial, as it shapes subsequent activities and affects the quality of meaning-making. Reflecting on previous learning activities creates an environment that fosters students' zones of proximal development, as they observe each other's levels of understanding and identify areas for further discussion. Based on their previous learning experiences and the progress of their individual examination assignments, students voluntarily chose their roles and actively shared their digital artefacts (such as drafts of the examination assignment) to discuss and improve their understanding. Those who struggled with developing their ideas and approaches to solving the assignment became presenters of digital artefacts, while those who were close to finishing the assignment became feedback providers, facilitators, and guides for collaborative learning. However, these positions were not fixed and changed as students developed their agency in the collaborative learning process. During the activity of reflecting on shared understanding of the Flipped Classroom concept, students' roles evolved to include providing feedback and critically assessing presented ideas and approaches. This suggests that initial roles and positions can evolve as students develop their agency in collaborative meaning-making. Digital artefacts played a crucial role in transforming students' positions and fostering conceptual understanding of the target concepts.

Overall, this study illuminates the processes through which a small group of students can develop their agency in joint meaning-making activities and the ways in which digital resources can facilitate the development and enactment of agency to enhance conceptual understanding. Students who are agentically oriented and cognisant of their learning tasks and the problems to be addressed can effectively contribute to shared meaning-making activities by mobilising digital resources.

In summary, the findings from the three studies show that instructor and student agency are developed and enacted through joint teaching and learning activities to develop and advance the conceptual understanding of target concepts in learning tasks. Collaborative teaching and learning activities are the main resources for developing and enacting agency in online synchronous and asynchronous teaching contexts. Digital resources are useful for developing agency in teaching and learning if participants actively mobilise them during engagement in meaning-making activities. A dialectical relationship appears to exist between instructor and student agency in online teaching and learning activities. This means that the more active the students become in taking the initiative in learning processes by positioning what and how they would like to present, discuss, and seek assistance, the more actively engaged the instructors are in making sense of students' problems and devising strategies to address their problems and guide their learning.

A similar process emerged in collaborative learning between peers; the more students actively present their ideas and approaches to solving the problems, the more actively co-participants engage in making sense of ideas and assessing them. Digital resources facilitate and enhance this process of joint meaning-making. Based on the syntheses of the findings, developing and advancing conceptual understanding involves four dialectically evolving pedagogical activities: orientation, engagement, contribution, and transformation (OECT for short). Agency evolves through performing these activities collectively. I propose a framework for joint teaching and learning processes for online education that involves these interdependent pedagogical phases. I call them epistemic activities, as we learn by going through these activities. The purpose of proposing it is to help practitioners and practice-oriented researchers understand the importance of collaborative teaching and learning activities as core resources for developing and enacting agency in online education. Furthermore, to effectively apply the CHT in online education, it is necessary to expand and reposition it within the context of online education. In this setting, instructors and students should be viewed as active contributors in joint meaning-making activities, rather than merely as providers and consumers of knowledge. These joint meaning-making activities involve the use of mediational resources and tools that are crucial for developing, realising, enacting, and expanding agency in learning (Engeness, 2021b; Stetsenko, 2017). Mediational resources in teaching and learning are individually constructed or materialised ideas about learning tasks. The proposed framework is discussed in detail in Chapter 6.

Chapter 6: Discussion of the Findings and Conclusions

In the preceding chapter, I briefly presented a framework by synthesising findings from three articles that aimed to elucidate how joint teaching and learning activities can evolve into pivotal resources for developing and enacting agency in online education. In this chapter, the proposed framework will be explained in connection with the research questions posed in this study. Furthermore, the theoretical, empirical, and methodological contributions, practical implications, and limitations of this thesis will be delineated.

This thesis aimed to examine joint teaching and learning activities by focusing on the role of digital technologies in enhancing student engagement in collaborative learning. It sought to understand how instructor and student agency evolve in both synchronous and asynchronous contexts. To accomplish this, the thesis poses three key research questions. These questions examined instructors' and students' engagement in these processes and how technology mediates this engagement, ultimately analysing the interplay between participants' agentic engagement and the role of technologies in fostering agency in online education.

By synthesising the findings from three research articles, a pedagogical framework is proposed for practitioners and applied researchers. This framework offers insights into how collaborative activities become productive resources for developing agency in online teaching and learning. The framework comprises four dynamically evolving phases: orientation, engagement, contributions, and transformation (abbreviated as OECT), which are termed as micro-pedagogical activities. Here, instructor and student agency are shaped by collaborative practices that allow the use of mediational resources and tools to develop and enact agency in teaching and learning (Engeness, 2021a; Stetsenko, 2017). These mediational resources can also be generated through collective meaning-making processes. The framework is discussed in the subsequent section.

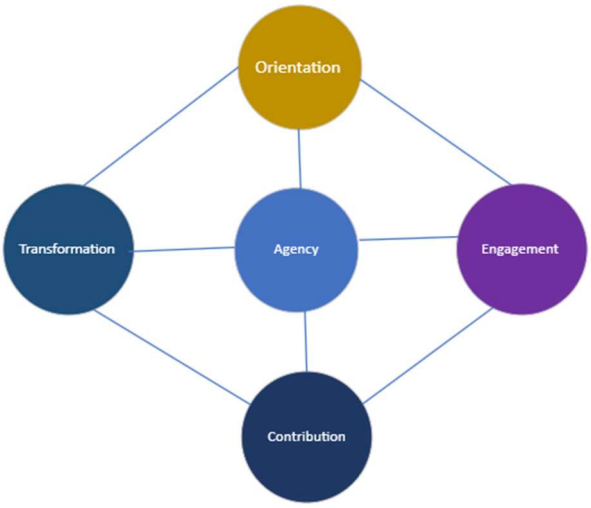
6.1 OECT framework for developing and enacting agency in teaching and learning practices

The OECT framework is comprised of four dynamically interconnected and continually evolving epistemic activities: orientation, engagement, contributions, and transformation. Progressing from one activity to the next is not merely a mechanistic transition but rather a dialectical process involving participants' active contributions to meaning-making activities. For instance, a participant contributes to collective meaning-making activities by sharing materialised ideas (e.g. a draft of an assignment) and articulating the embryonic ideas they endeavour to cultivate. In response, co-participants nurture this process, offering their insights and proffering pertinent queries, thereby instigating a meaning-making process. Consequently, the shift from one activity to another is intricately multifaceted. The deployment of digital technology, or more specifically, digital resources, augments this transition by mediating participants' immersive engagement in joint learning. The participants' agency evolves in performing these activities collaboratively. Developing agency also implies enacting agency in teaching and learning, as instructors learn to facilitate more effectively, and students learn to engage more meaningfully in learning activities and thus enhance their capacity to understand and solve problems creatively in and

through interaction and collaboration. The OECT framework has both *theoretical* and *empirical* dimensions, which I will expound on in the subsequent sections.

Figure 5

Framework for Joint Meaning Making in Online Teaching and Learning



Orientation

Orientation is a critical element in engaging in joint meaning-making processes. It involves setting the stage for engaging in joint teaching and learning by revealing available resources and outlining activities to perform. For Galperin (Engeness, 2021a), students can engage in three types of orientation: incomplete, complete teacher constructed, and complete student constructed. In an *incomplete orientation*, students identify mediational tools and characteristics of target concepts through trial-and-error approaches. Most of the students' discussion forum activities, including posting questions and comments, can be regarded as part of an incomplete orientation. This is because these activities primarily focus on solving problems rather than exploring solutions through coherent discussion (Article 2). Students learn slowly through this orientation, and students' learning activities can be limited to information sharing and consumption in an online learning environment.

In a *complete teacher-constructed orientation*, the teacher creates a system of orientating activities that includes mediational tools and essential characteristics of the target concepts necessary to understand and solve problems. Instructors' epistemic intervention strategies in course discussion forums can be considered instructor-constructed orientation aiming to support students' learning by leveraging the affordances of asynchronous teaching and learning environments (Article 2). Instructors apply what I call *'guided orientation'* in asynchronous learning environments, directing students through comments and announcements on platforms such as Facebook (Article 2). The five EISs are textual, video, or video textual, referral, peer, and remote interaction are examples of the guided orientation. These indicate that instructors are required to orient students' learning using different means of communication and teamwork due to the substantial number of students' presence and evolving nature of learning activities in discussion forums. This type of orientation improves the quality and speed of learning, but students might not develop the ability to transfer and apply the skills learned in one course context into other different contexts (Engeness, 2021a). Thus, the applicability of knowledge and skills is limited,

which means students might not develop their agency in learning. Also, to orient students' learning activities in discussion forums, instructors need to provide more detailed descriptions of how to solve problems and which resources to utilise for fostering conceptual understanding. These descriptions can take the form of various EISs that instructors use to address student issues and enhance learning. While the orienting roles of instructors may become more intense, they can potentially limit students' agency in learning, especially if students do not engage with instructors' perspectives (Article 2). Therefore, while instructors' guidance is invaluable, they must also be aware of the potential limitations their role can impose on students' agency in learning. They should aim for a balanced approach that not only offers direction but also encourages students' active engagement with their ideas and comments.

Finally, in a *complete student-constructed orientation*, students themselves construct their own path of learning, following the approaches offered by course instructors. For example, students themselves orient their learning activities by voluntarily revealing their learning problems, the level of progress of their examination assignment development, and articulating expectations from the collaborative online meetings between course instructors and students (Article 1) and the OSCL sessions (Article 3). The experienced instructors might negotiate the orienting activities by making students aware of the available resources (allocated time for discussion, co-participants' roles) for learning, while novices rely on students' orientation (Article 1). However, instructors' orientating activities unfold as they immerse in facilitating and guiding students' learning activities in collaborative teaching and learning. Similarly, students also voluntarily negotiated their roles, which I call epistemic positionings, according to their prior knowledge about the assignment (Articles 1 & 3). Those who had developed ideas about how to solve the assignment chose to become feedback providers and guides to the peer learning process (Article 1), while those who were still in the process of developing their assignment led the process of collaborative meaning-making activities (Articles 1 & 3). Nevertheless, students need to establish the sense of connection and presence with fellow students before they engage in collaborative meaning making activities (Article 3). Students may experience discomfort with technology if they are unable to see themselves on screen alongside their peers. This visibility is crucial for feeling connected and present. Experienced peers play a pivotal role in mitigating these technical challenges, thus facilitating the learning process. The mediation of learning by peers is enhanced by digital tools like cursor pointing, serving as a means of interaction and guidance in the learning process. Thus, the voluntary intentions of participants in orienting and guiding, as well as being oriented and guided, in the joint meaning-making process can be termed as *'co-orientation'*. This co-orientation unfolds throughout the entire process of collaborative teaching and learning (Articles 1 & 2). Orientation, therefore, is not a one-time activity. Students who are aware of their goals, tasks to be learned, and problems to be solved do not require extensive orientation at the beginning of joint teaching and learning (Article 1). However, a thorough orientation that involves assessing course resources and identifying useful resources for understanding learning problems (e.g. examination assignments) and solving them can lay the foundation for developing students' zone of proximal development. This expands students' meaning-making activities and agency in learning (Article 3). Therefore, the quality and depth of orientation can influence the quality of students' learning and the development of their agency. Through this type of orientation, students develop their critical and scientific thinking, enhancing their agency as independent learners who can apply their knowledge and skills to understand and solve problems across

contexts and subject areas (Engeness, 2021a). Thus, pedagogical activities in online higher education should focus on collaborative teaching and learning, in and through which a third type of orientation in learning is created. This, in turn, has a direct implication for developing and enacting agency in teaching and learning.

Moreover, these orientating activities indicate that synchronous teaching and learning environments promote complete student-constructed orienting collaborative teaching and learning activities. Instructors' orientation in online meetings between instructors and students is minimal in the initial process, but instructors' orientation unfolds as they immerse themselves in facilitating and guiding students' learning activities (Article 1). On the other hand, students can actively engage in co-constructing orienting activities through mutual assistance in OSCL sessions (Article 3). Student-constructed and led orientation is extensive and thorough as they struggle to maintain social connection and presence and engage deeply in reflecting on their prior learning activities. In both synchronous and asynchronous settings, students' agency comes into play in orienting activities while instructors' agency unfolds as they engage in facilitating and guiding students' learning. However, asynchronous settings tend to promote instructor-constructed orientation as instructors enact their professional agency in orienting students' learning activities through five different epistemic intervention strategies in asynchronous teaching and learning environments, which might limit the possibilities of developing students' agency in many cases, especially if students fail to engage with instructors' activities.

To conclude, agentic students who are aware of their learning goals and the problems to be discussed can take the initiative to set the stage for learning, and instructors might negotiate this process. Instructors' orienting functions may evolve throughout the entire process of synchronous and asynchronous teaching and learning. This evolution becomes evident as instructors address students' questions using examples and prompt students to review these examples when crafting examination assignments. This insight represents a significant empirical contribution of this study. The third type of orientation serves as a crucial pedagogical activity, promoting students' active engagement in collaborative meaning-making activities and leading to the development of students' agency in learning. This process includes establishing and maintaining a sense of togetherness, reflecting on prior learning activities, and outlining subsequent learning activities in online collaborative learning environments. Students may mobilise the affordances of technologies in facilitating fellow students’ orientation in collaborative learning.

Engagement

Engagement concerns how instructors and students position themselves in joint teaching and learning activities and how these positions evolve during joint meaning-making activities. The fundamental premise of this exploration is how engagement in joint teaching and learning activities is influenced by the positional dynamics between instructors and students and how these positions evolve during joint meaning-making activities. Central to this is the concept of orientation and engagement, which are intrinsically linked. As evidence, while engaging in orienting activities such as deciding presentation tasks and providing feedback (Articles 1 & 3), students established their initial positions in the learning process. Although these stances were based on their prior preparations and experiences, I call these positions as co-learners in collaborative meaning-making activities. Subsequently, they also adopted the role of co-facilitators, supporting their peers through constructive feedback and suggestions

(Articles 2 & 3). Together, they engaged in collaborative learning to enhance their understanding of the examination assignment.

In synchronous teaching and learning sessions (Article 1), instructors initially act as facilitators and guides, addressing students' questions and ideas. However, as students delve deeper into the learning process, instructors take on the role of co-learners, actively engaging in understanding students' ideas and questions, probing them, and validating them against course literature and assessment criteria. Thus, facilitation involves actively engaging with students' ideas and perspectives, rather than simply responding to their questions. The evolution of instructors' roles as sense-makers, validators of ideas and perspectives, facilitators, and guides is a mutually inclusive activity in their online interactions. These roles, which embody both co-learners and facilitators in students' learning, evolve through engagement in students' learning activities. In contrast, within asynchronous teaching and learning contexts such as discussion forums (Article 2), instructors' roles are more focused on sense-making and answering questions, rather than extensively discussing students' ideas and perspectives. This is partly due to the limited opportunities for interaction in asynchronous environments, which prioritise idea sharing rather than in-depth discussion of these ideas. To overcome these constraints, instructors enact their professional agency by inviting students to online synchronous guidance meetings to address complex problems. They always refrain from intervening in peer interactions. This deliberate strategy employed by instructors appears to be effective, as they seldom encounter issues to address when students share their problem-solving ideas and approaches. This facilitates prolonged discussion among students, which is productive for engaging in meaning-making activities and thereby developing agency. However, when instructors directly address students' problems using disciplinary knowledge, it might limit the possibilities for discussion and thereby curtail opportunities for developing agency. This could be one of the reasons why many students drop out of conventional MOOCs. This also suggests that the role of instructors as mere dispensers of knowledge can be counterproductive to joint meaning-making activities and, consequently, to the development of students' agency as well.

Similarly, in OSCL sessions (Article 3), students can actively engage as both co-learners and co-facilitators of peer learning. They voluntarily take on roles such as task presenters, feedback providers, and facilitators, which emerge through peer interaction. Digital technologies play a crucial role in the evolution and enactment of these student roles. The more students interact with digital content, the easier it becomes for them to adopt various roles, questioning ideas, seeking clarifications, and suggesting improvements. Therefore, I suggest using 'the evolution of engagement roles' instead of 'co-participation', as the former term captures the intrinsic motivations and passions that drive active participation in knowledge practices. An example of this is the evident student motivation in online collaborative teaching and learning, where they actively choose their own positions in knowledge acquisition (Articles 1 & 3). Furthermore, these engagement roles evolve dynamically; some students transition from passive listeners to active contributors when exposed to diverse problem-solving methods in examination assignments. Digital artefacts, particularly examination assignment drafts, facilitate these shifts by stimulating inquiries. As a result, the traditional dichotomy of instructors as primary knowledge providers and students as mere recipients has been redefined. In joint teaching and learning activities, the

roles of instructors and students oscillate between co-learners and co-facilitators. This re-conceptualisation expands the opportunities for the development and manifestation of agency within joint meaning-making activities. Agency is developed when participants engage with other learners' perspectives and enacted when they effectively offer their own perspectives and suggestions as facilitators.

In conclusion, the roles of instructors and students in online collaborative teaching and learning activities are manifested through the dynamics of collaborative meaning-making activities. The active participation of students as co-learners, coupled with their utilisation of digital technologies, enables instructors and students to navigate between the roles of co-learners and co-facilitators. The agency of both instructors and students in collaborative meaning-making activities develops at the intersections where these roles unfold while actively positioning and attempting to move forward in learning trajectories.

Contribution

Contributing to a collective process of meaning-making is a central activity that facilitates the enactment, development, transformation, and limitation of engagement positions. This process significantly influences the evolution of participants' agency. Engagement transcends mere presence in group teaching and learning; it encompasses actions and contributions to joint meaning-making activities in line with dynamic epistemic positionings. Across all three studies (Articles 1, 2, & 3), I observed students actively contributing to joint learning by showcasing their problems, sharing their examination assignment drafts, elucidating their viewpoints, seeking assistance, and reflecting on their learning experiences. Similarly, instructors posed questions concerning students' ideas, elucidated the challenges, vetted students' conceptions or disciplinary knowledge, and shared essential resources to enhance students' understanding of learning tasks. The more actively students contributed to raising questions and comments about learning tasks, the more actively instructors contributed to clarifying, verifying, and assessing students' ideas and approaches to solving the examination assignment, deepening the processes of meaning-making (Article 1). Similarly, the more actively students shared their questions and comments in discussion forums, the more actively instructors attempted to address them using different EISs, and fellow students shared their experiences and knowledge of addressing issues raised in the questions and comments posted in discussion forums (Article 2).

Furthermore, the more actively students share their ideas and approaches to solving problems, the more actively fellow students engage in learning by providing feedback and raising questions (Article 3). This mutual process of making contributions is expanded by the mediation of digital resources, such as the draft of the examination assignment, as students learn to mobilise resources to present ideas and raise questions while keeping track of what is being presented and discussed (Articles 1 & 3). Contributing to joint meaning-making activities establishes and nurtures a dialectical relationship in developing conceptual understanding. From a dialectical perspective, mistakes, failures, and contradictions constitute essential moments of learning and knowledge building (Dafermos, 2018), as participants attempt to understand and solve them, forming a spiral chain of problem-posing, identification, and solving. By engaging in this mutual process of teaching and learning, participants become co-learners and co-teachers, learning from each other and

assisting each other in learning (Stetsenko, 2017). Instructors' agency in teaching comes into play in this process, as they use their professional knowledge, experiences, and skills to address students' questions and comments. They also learn to make sense of students' unique questions and problems and develop their professional agency to address them rationally.

This mutually influencing and expanding relationship in engaging in teaching and learning allows participants to develop, enact, and expand their agency in teaching and learning. The quality of meaning-making processes neither evolves nor expands without this dialectical relationship. Therefore, I argue that this dialectical relationship, constituted by the contributions of each participant in collaborative meaning-making activities, allows for the co-development of participants' agency. Co-agency is required to expand meaning-making activities, develop critical thinking, and advance shared understanding. Otherwise, collaborative teaching and learning activities in online education may reduce to information sharing and acquisition.

Crucially, students' agency in learning is cultivated and demonstrated through contributing to collaborative meaning-making activities. They learn to present and articulate ideas, understand peers' comments and perspectives, and debate their learning strategies, thereby forming new viewpoints and linking to real-world problems. While some studies describe these changes as micro shifts linked to the network between human and non-human actors in online synchronous learning activities (e.g. Zoom) (Sobko et al., 2019), I argue that these subtle shifts in learning arise in and through instructor-student and student-student interactions. Technologies play a role in fostering and broadening these shifts, provided that students understand how and when to employ them in collaborative activities. Such understanding evolves while contributing to collective teaching and learning processes.

However, whilst instructors' contributions to students' learning can enhance meaning-making activities, they might also limit students' agency in learning. Instructors' interventions may not always be effective when directly addressing students' questions. This approach can make it challenging for students to engage further with the instructors' ideas. It is often more beneficial to allow students to discuss amongst themselves to find answers, as this can foster their agency better than providing direct answers that may discourage further discussion. When instructors solely rely on their professional knowledge to answer students' questions, students may find it difficult to delve deeper into those ideas and may simply accept them at face value (Article 2). Therefore, simply sharing and answering may not expand instructor-student interactions in discussion forums. Instead, letting students find answers collaboratively can nurture their agency in learning. Consistent with the findings of previous studies (Blum-Smith et al., 2021; Ntourmas et al., 2022), this research suggests that instructors need to be strategic in their interventions in students' learning, offering opportunities for exploration through interaction and collaboration within discussion forums. Moreover, this study demonstrates that instructors proactively utilised technologies (e.g., remote interaction interventions) to address challenging topics in collaboration with students. This approach fostered agency in both teaching and learning, as evidenced in Articles 1 and 2.

Thus, collaborative teaching and learning activities enable participants to actively contribute to joint meaning-making processes through their unique perspectives and experiences, which are open to scrutiny. This scrutiny fosters interaction among participants, and the

mobilisation of digital resources enhances the potential for more agentive contributions to the meaning-making processes. Through these processes, participants realise, develop, and enact their agency, expanding it within the teaching and learning contexts. Therefore, authorial contributions are vital in nurturing and enacting agency in learning to advance conceptual understanding.

Transformation

Contributing to joint meaning-making activities leads to transformation, which is concerned with developing and advancing conceptual understanding of target concepts in learning tasks, leading to fostering participants' problem identification, problem-posing and problem-solving capabilities. It emerges from the unified process of orientation, engagement, and contributions to collective meaning-making activities. Transformation is not the final static capacity but a dynamically evolving capacity of instructors and students in and through joint teaching and learning activities conducted synchronously (Articles 1 & 3) and asynchronously (Article 3). Engaging systematically with other perspectives and ideas in any mode of communication and interaction may lead to transformation. Both modes of communication and interaction have their own unique affordances for teaching and learning. For example, in live interactions, as in Articles 1 and 3, instructors or fellow students can directly facilitate meaning-making processes as they assess ideas by asking questions, clarifying ideas, and providing evidence. However, there is an immediate epistemic need to develop a shared understanding of questions, which expands or deepens the interactions, and the given time slots (45 minutes) may not be sufficient. On the other hand, teaching and learning activities in asynchronous contexts (e.g. discussion forums, Article 2) provide instructors and students with more flexibility in understanding and responding to questions. In these contexts, individuals have more time to formulate their questions and comments and can access and revise their contributions. However, for instructors and students to effectively engage in this process, they must take initiative in identifying the questions they raise and how they are addressed. It is important to note that some students may struggle to participate actively in discussion forums due to a lack of knowledge in posing questions, discussing ideas, and following discussions. This limitation hinders the development of their agency. Therefore, fostering a sense of connection and encouraging reflection on prior learning experiences are crucial for the development and enactment of agency. It is worth mentioning that OSCL sessions are more conducive to enhancing agency (Article 3) compared to asynchronous settings. In asynchronous settings, student engagement is vital for transformative learning as instructors and fellow students rely on their contributions to facilitate and guide the learning process. However, instructors need to approach students' learning activities with caution. Directly addressing students' questions and comments may discourage them from exploring and discussing ideas (Article 2). Consequently, the collective exploration of problems and their solutions becomes limited, hindering the development of agency in learning. To address this challenge, instructors consciously employed peer intervention and remote interaction interventions to facilitate collaborative problem-solving in discussion forums (Article 2). By doing so, instructors enact their professional agency by exploring affordances of technologies to promote collaborative meaning-making activities. These interventions have direct implications for the development of agency and transformation in teaching and learning.

In addition, digital artefacts or resources can facilitate the transformation process. For example, ideas presented in materialised forms like digital resources/artefacts become essential resources for active engagement in collaborative teaching and learning (Articles 1 & 3). By utilising these resources, students can actively question ideas and approaches, assess them, and consolidate their logical thinking through collaborative meaning-making activities. This allows students to develop and enact agency in their learning. Instructors and students are both provided with opportunities to reflect retrospectively, introspectively, and prospectively on what they have learned, how they have learned it, and why they want to continue learning. Instructors may use these reflections to enhance their facilitating and guiding abilities, while students may reconsider their ideas and problem-solving approaches, engaging in self-reflection on effective problem-solving strategies. This self-reflection and assessment were particularly evident when students reflected on their conceptual understanding of target concepts in learning tasks (Articles 1 & 3). In contrast, instructors consistently engaged in similar reflection throughout the synchronous teaching process (Article 1), drawing on how previous students approached similar problems (such as creating multimodal text) and providing suggestions for creative solutions. Teaching and learning activities that promote self-reflection and self-dialogue ultimately enhance higher psychological functions, such as critical thinking and scientific reasoning.

In this way, both instructors and students can actively develop and enact agency, thus fostering transformation. This led me to conclude that contributing to collaborative meaning-making activities from individual perspectives enhances conceptual understanding and nurtures participants' agency in learning. This fosters transformative processes that occur through micro epistemic shifts within collaboration, with technology (specifically digital resources) acting as a pivotal catalyst in mediating this transformation. However, the transformative potential of technologies depends entirely on participants' intention to utilise them to make sense of ideas and develop a shared understanding of how to approach learning tasks. While the efficacy of short collaborative teaching and learning activities in developing participants' ZPD may be subject to debate, I assert that they constitute the foundational sources for creating the ZPD. Several research studies support the notion that collective knowledge-building activities can indeed foster students' ZPD (Lave & Wenger, 1991; Murphy, 2022; Varma-Nelson & Cracolice, 2020). However, the creation of the ZPD necessitates that participants actively develop and enact their agency. For students, developing and enacting agency involves actively identifying problematic issues, engaging with others to dissect how and why problems occur, and seeking and assisting in their resolution. For instructors, it means engaging with students to comprehend their difficulties, assessing students' knowledge claims, soliciting input from co-participants, clarifying and expanding ideas, and suggesting solutions within the context of online collaborative teaching and learning activities. This mutual process of engaging in developing a conceptual understanding is inherently dialectical, as joint interaction entails a series of problem-posing, problem-identification, and problem-solving activities. Such a process is further enhanced by the strategic mobilisation of digital resources.

Thus, collaborative teaching and learning activities serve as vital resources for the development and enactment of agency in collective meaning-making processes. As participants draw upon their lived experiences and grapple to engage meaningfully with diverse perspectives, the dynamics of utilising prior knowledge and striving to forge new understanding instigate a dialectical spiral of problem-posing and problem-solving. This

dynamic process ultimately leads to the growth and advancement of understanding of target concepts within learning tasks, thereby fostering the development and expansion of the ZPD, a construct that remains provisional in nature.

6.2 Theoretical, empirical, and methodological contributions

6.2.1 Theoretical contributions

The main *theoretical contribution* of this dissertation is the proposed OECT framework, synthesised from the findings of the three empirical studies. This framework includes four micro-pedagogical activities: orientation, engagement, contribution, and transformation. These activities are interdependent and evolving, implicating that both instructor and student agency evolve and expand in performing these activities collectively within the contexts of synchronous and asynchronous teaching and learning. Previous studies have focused mainly on arranging resources for students to learn by collaboration, and instructors remain as peripheral feedback providers (Altowairiki, 2021; Sobko et al., 2019), facilitating activities focused on answering students' questions and guiding without challenging ideas (Goshtasbpour et al., 2020). This study shows that advancing conceptual understanding necessitates instructors and students to become co-contributors to joint meaning-making activities in which they function both as co-learners and co-facilitators (Articles 1 & 2).

Another theoretical contribution of this study is that students who are aware of their learning goals and problems to be solved can co-orient, engage, and contribute to joint meaning-making activities without instructors' support and guidance. Digital resources can play a significant role in facilitating collaborative learning and enhancing learners' agency in the process (Article 3). However, students may face provisional epistemic uncertainty if their ideas are not accurately assessed and validated. This mutual process of meaning-making, where erroneous, inconsistent, and contradictory meanings emerge, sets a dialectical process in motion (Dafermos, 2018; Stetsenko, 2017), enabling new perspectives to emerge and allowing participants' agency to develop and expand as they present, explicate, defend, and assess ideas. This leads to a more profound understanding of learning tasks. Evidence of this dialectical process is found in Articles 1 and 3, demonstrating an interconnected series of collaborative activities that enhance the conceptual understanding.

The third theoretical contribution is that instructors' direct answers to students' questions fail to engage students in exploring answers by interaction and collaboration, thus limiting the possibilities of developing agency in discussion forums (Article 2). The more instructors tend to assert their professional knowledge in facilitating and guiding students' learning, that is, enacting their professional agency, the less actively students may engage in asynchronous learning environment, relegating students to the position of knowledge consumers (Harasim, 2017; Losh, 2017).

The fourth theoretical contribution of the thesis is the combination of Vygotsky's ideas, Galperin's pedagogical phases, and Stetsenko's collaborative practices in the analysis of case studies. This amalgamation can foster analytical and methodological innovation in conceptualising joint teaching and learning activities as fundamentally constitutive practices of intellectual development. Orienting and being oriented to engage both as co-learners and co-facilitators in making contributions to joint meaning-making activities leads to

transformation. Mobilisation of digital resources or artefacts qualitatively enhances and expands this process of developing and advancing conceptual understanding. Thus, the OECT framework manifests this perspective by highlighting instructors and students as co-contributors in collective meaning-making activities. This co-development as learners and instructors underscores a dialectical characteristic that evolves through contributions, fostering students' scientific thinking and conceptual understanding. The framework aligns with the pedagogical theories of Vygotsky (2012) and Galperin (Engeness, 2021a), emphasising collaboration and the mobilisation of materialised objects or ideas. Online collaborative environments provide opportunities to share, create, and modify materialised ideas, expanding the possibilities of developing and enacting agency in meaning-making activities. However, developmental affordances of mediational tools (digital resources) emerge in and through collective meaning-making activities as participants share them, learn to engage with them, and recreate them.

Also, participants in online education remain physically isolated, creating challenges for nurturing online collaborative platforms as spaces of meaning-making. Many students might not feel comfortable with technologies and may not know how to connect, leading to a lack of connection and belonging. This, in turn, can hinder students' active engagement in joint meaning-making activities and the development of their agency. Therefore, cultural-historical theory needs to be expanded to explain and understand online collaborative teaching and learning activities. The OECT framework may serve this purpose.

Nevertheless, conceiving agency merely as the ability to engage in meaningful activities risks simplifying the concept into a process of doing or achieving. This approach may tether us to pre-existing models and metaphors, hindering fresh insights and alternative conceptualisations of agency. The OECT framework is intended not as a model to mould agency but as an analytical tool to explore its evolution and manifestation in collective meaning-making activities. While the OECT framework may aid participants in fostering their agency in online teaching and learning, caution must be exercised to ensure that it does not become a prescriptive model.

6.2.2 Empirical contributions

This thesis offers key *empirical contributions*. First, the findings underscore the pivotal role of instructors in guiding students' learning processes to help them develop and deepen their understanding of learning tasks. Article 1 shows that instructors, collaborating with students in preparing the backdrop for online meetings, helped clarify and define students' ideas while assisting them in grasping the conceptual understanding of the target concepts related to the examination assignment. These orienting, executive, and controlling functions of instructors contribute to shaping their roles as co-contributors in joint meaning-making processes in online teaching and learning. This aids students in enhancing their conceptual understanding. Beyond the findings of previous studies that focused more on the managerial role of instructors for creating background, accumulating resources and encouraging students to learn from each other (Altowairiki, 2021; Sobko et al., 2019), this study shows that the roles and functions of instructors evolve and are dependent on how students position themselves and engage in collaborative teaching and learning activities. Instructors' active engagement is essential to advancing the conceptual understanding of target concepts in

learning tasks, but such engagement is contingent upon students' agentic engagement in collaborative learning activities.

Second, the findings from Article 2 demonstrate that instructors employed five EISs, considering the complexity of students' learning problems and the nature of peer interaction. These EISs that course instructors employ contribute to conceptualising practical approaches to facilitating students' learning in asynchronous teaching and learning contexts involving synchronous interventions (remote interaction), fostering discussion among participants that results in developing the agency of instructors in strategically addressing students' problems and facilitating their learning activities. However, if instructors address students' questions too directly, asserting their professional agency, this may limit the room for further discussion, thereby limiting opportunities to develop and enact agency in learning (Article 2). Thus, an asynchronous learning environment may promote instructor-constructed and guided orienting activities, which improve students' learning, but may limit opportunities for developing students' agency as students fail to engage with instructors' disciplinary ideas and comments.

Third, the study revealed that students can effectively collaborate in the absence of pedagogical support from instructors (Article 3). They can function as co-learners and co-facilitators, providing and receiving pedagogical assistance for understanding tasks. What is essential are authentic, challenging tasks that encourage peer collaboration. The quality of digital resources, that is, systematically created and organised materialised ideas, can enhance active engagement in collaborative activities (Article 3). Active sharing of individual digital resources within the group is equally vital.

Fourth, while this study acknowledges findings from previous research that digital technologies mediate participant interaction and foster micro shifts in thinking in OSCL (Sobko et al., 2019), it argues that such micro shifts in thinking occur due to participants' active engagement in utilising digital resources to develop their agency in learning. Contrary to Sobko et al. (2019), who attributed these shifts to a network of human and non-human actors (e.g., Zoom and Blackboard), this study contends that the affordances of technologies emerge in and through active engagement in joint meaning-making activities. Mobilising digital resources can further cultivate and enhance these micro shifts in learning, thereby advancing conceptual understanding. Moreover, the use and creation of technologies depend on the intentional actions of human beings (Mitcham, 1994). Therefore, the developmental potential of technologies is most effectively realised when students learn to harness digital resources in the process of contributing to enhanced meaning-making activities. However, in the absence of instructors, students may face epistemic uncertainty if complexity in developing conceptual understanding occurs.

Finally, agentic students who are aware of their learning goals and the problems to be solved can orient themselves, engage actively in making contributions to joint meaning-making activities, and develop their agency in learning (Articles 1 & 2). Synchronous collaborative teaching and learning environments allow students to engage in student-constructed orienting activities, which have immense potential for developing agency in online learning. Instructors in these environments actively contribute to students' learning and meaning-making processes by interpreting their ideas, asking questions, providing clarification, and validating ideas. This helps develop and expand their professional agency

in facilitating and guiding students' learning. This mutual process of making contributions nurtures the dialectical process of developing and advancing conceptual development, leading to enhancing and expanding agency in online pedagogical activities.

6.2.3 Methodological contributions

Regarding methodological contributions, the investigation of teaching and learning as a joint process, wherein contributions to meaning-making activities evolve and expand both instructors' agency in teaching and students' agency in learning through the mediation of digital resources, is of particular value. This is because collaborative practices offer valuable insights into the mutual evolution of agency within online teaching and learning. This thesis notably contributes to understanding the natural processes through which agency in joint meaning-making activities develops and unfolds in online collaborative teaching and learning contexts. Combining Vygotsky's concept of ZPD with Galperin's pedagogical phases in performing Stetsenko's collective activities offers a novel methodological approach to investigate dialectical meaning-making activities. These perspectives, which have rarely been combined, open new doors to investigating joint teaching and learning processes that examine collective meaning activities through interaction and collaboration in higher education. Through the interaction analysis of video recordings involving online instructor-student and student-student interactions, this study documents how dialectical meaning-making processes unfold as participants position themselves as active contributors to the development and advancement of the target concepts in learning tasks. This forms an important methodological contribution of the thesis. Moreover, the combination of thematic and epistemic network analyses provided insight into how instructors employ formative EISs to address students' problems and support their learning in course discussion forums. Uniquely, pedagogical activities in MOOCs have never been examined by this amalgamation of interaction analysis, TA, and epistemic network analysis, focusing on how participants engage in contributing to collaborative meaning-making activities. This novel approach is another substantial methodological contribution of the thesis. Lastly, this study illuminates the ethical challenges encountered in conducting research within online environments. It highlights the complexities of gaining informed consent, especially in discussion forums, and navigates the dilemmas concerning the extent to which anonymisation can truly safeguard information, particularly in light of the comprehensive GDPR that categorises online teaching and learning activities as personal data.

6.3 Practical implications

The key recommendations stemming from this thesis, particularly with regard to the OECT framework, have several practical implications for shaping and enhancing pedagogical activities aimed at fostering agency in online education, including institutionally run MOOCs.

First and foremost, institutional MOOCs should prioritise offering authentic, challenging learning tasks over than pre-packaged content. While some critically presented content is required for learning, authentic learning begins with knowing how to engage with learning content, assess it, and develop the capacity to solve real-world problems, which evolve through collaboration.

Secondly, institutionally operated MOOCs are required to promote student-initiated orientation in learning. Effective orientation in how to engage and develop conceptual understanding of target concepts in learning tasks evolves through processes where participants become co-learners and co-teachers of joint meaning-making processes. Providing an environment that enables students to define their own learning goals and make active contributions to joint learning activities is crucial for developing their agency in learning. Therefore, MOOCs should offer flexible joint teaching and learning activities as main approaches, not only to allow student-driven orienting activities but also to foster quality pedagogical practices. Quality in teaching and learning emerges through interaction and collaboration.

Thirdly, joint teaching and learning activities are foundational resources for developing and enacting agency in enhancing conceptual understanding and problem-solving capabilities in higher education. Allowing students to learn collaboratively at their own pace and in their own spaces expands the possibilities of meaning-making and becoming independent thinkers. Many students in the ICTPED MOOC are experienced teachers with rich experiences in dealing with problems, which could become formative resources for less experienced teachers and new students. Thus, institutional MOOCs should prioritise both instructor-student and student-student interactions as key pedagogical approaches to learning and problem-solving.

Fourthly, instructors should transition from mere facilitators to active co-learners and co-contributors. This change in approach facilitates a collaborative process of constructing meaning, which in turn promotes the agency of both instructors and students. In contrast to current pedagogical practices observed in MOOCs, where instructors are positioned as knowledge providers and students are passive recipients, there is a need for a shift towards what can be termed as 'collective learnshops'. These 'collective learnshops' prioritise collective problem identification and solving, thereby transforming the online education environment from a teacher-centric model to a collaborative one. In this context, instructors and students collaborate in their preferred learning spaces to collectively enhance and deepen their understanding of the target concepts.

Fifthly, the sharing of digital resources is crucial for developing and fostering student agency. Individually created materials, such as examination drafts, can be used as mediating tools for less-prepared students while also aiding the students who share them. Therefore, more focus should be given to allowing students to learn collectively by sharing their materialised resources. The ICTPED MOOC is rich in multimodal resources, which are required for learning. However, to foster transformative learning, only resources that exemplify how problems can be understood and solved should be given priority, as such resources guide problem-solving activities.

Finally, transformation in meaning-making occurs through joint activities, in which participants present their ideas, position themselves agentically, make contributions to the learning process by sharing their experiences and ideas, and reflect upon their understanding collaboratively. The OECT framework can function as a guiding tool in designing and analysing transformative teaching and learning activities in the context of institutionally operated MOOCs.

6.4 Limitations, future research directions, and concluding remarks

I conclude this thesis by discussing its limitations and identifying potential areas for future research. In the first study (Article 1), which focused on instructors' facilitation of students' learning in online synchronous settings, students share digital resources during joint teaching and learning activities. A more specific emphasis on how these shared digital resources influence instructors' engagement could deepen our understanding of the instructor's role in facilitating learning. Therefore, future research may benefit from a more nuanced analytical focus on how digital resources shared by students shape instructors' facilitative roles.

In the second study (Article 2), I reported findings from thematic and epistemic network analyses of discussion forum exchanges, examining how instructors' epistemic interventions unfolded in response to students' queries and comments. I employed a TA; however, I could not provide additional data related to instructors' and students' various activities because of the DPIA protocols and space limitations. The inclusion of such data would have enhanced the reliability of the findings presented in the article.

In addition, in two of my articles (Articles 1 & 3), I stated that I followed the Jeffersonian transcription convention for transcribing video recordings of interactions. However, upon writing this dissertation, I realised that my approach was closer to what Mercer suggested, involving non-technical ways of presenting data. Including linguistic features, such as pauses and intonations, and paralinguistic elements, such as bodily movements, in the transcriptions could have yielded more nuanced insights into the unfolding interaction trajectories during joint meaning-making activities.

Should I conduct this study again, I would place greater analytical focus on how digital resources either promote or constrain students' agency in both synchronous and asynchronous learning environments. While I have attempted to address this limitation explicitly in Article 3 and less overtly in Article 1, extended engagement with students' activities while they learn in discussion forums would offer further opportunities to explore how students' agency is either facilitated or constrained by instructors' intervention strategies.

Future research should focus on several key areas: exploring how digital resources affect both instructors' facilitative strategies and students' agency in learning and integrating diverse analytical approaches. In addition, extended analysis of instructors' intervention strategies could elucidate how these either enhance or restrict student agency in online forums. The latest technologies such as ChatGPT, Bard, Claude, and so on have the potential to function as interactional partners, which can facilitate and guide students' learning in online education, provided that students engage actively with them through questioning and prompting. It would be interesting to explore how these technologies assist students in facilitating their learning and developing their agency. Comparative studies between synchronous and asynchronous settings and the application of the OECT framework in varied institutional contexts could also provide valuable insights into how agency evolves in joint meaning-making activities.

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Appendix

Samtykkebrev om deltakelse i forksningsprosjekt Læring og undervisning i IKTPED MOOC

* Required

1. Skriv inn ditt navn *

2. Samtykkeerklæring
Jeg har lest og forstått informasjon om prosjektet Læring og undervisning i IKTPED MOOC 2020/21 og har fått anledning til å stille spørsmål. Jeg samtykker til:
· At mine avtalte videoveiledningsmøter med elevene kan tas opp.
· At mine Canvas og Facebook diskusjon forum innlegg kan brukes.

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. 01.12.25Spørsmål *

- ◯ JA, jeg samtykker
- ◯ Nei, jeg samtykker ikke

3. Vil du delta i forskningsprosjektet Læring og undervisning i IKTPED MOOC

Dette er en invitasjon til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke ulike aspekter ved læring og undervisning i nettbaserte omgivelser. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Formålet med dette forskningsprosjektet er å undersøke ulike aspekter av læring og undervisning i IKTPED MOOC. Vi ønsker å bruke våre funn til å videreutvikle faglige innhold i MOOCen, samt til forskningsformål og formidling, primært til andre lærere og lærerstudenter.

Alle informanter er anonyme, og deltakelse har ingen sammenheng med, eller påvirkning på karakterer og vurdering av ditt arbeid i studiet.

Hvem er ansvarlig for forskningsprosjektet?
Høgskolen i Østfold er ansvarlig for prosjektet.

Hvorfor får du spørsmål om å delta?
Du får forespørsel om å delta fordi du er student ved vår IKTPEDMOOC.

Hva innebærer det for deg å delta?
Det innebærer det at du samtykker i at vi kan bruke svar du skriver på oppgaver i MOOCen, samt at vi kan ta videoopptak av noen avtalte samarbeidsmøter fra kollokviegruppa. Ikke noe ekstraarbeid påregnes.

I tillegg kan det være at du blir spurt om å delta i ytterligere aktiviteter etter endt studietid, f.eks. klasseromsobservasjoner eller intervju, men dette vil i så fall innebære et nytt samtykke fra deg.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Du kan når som helst trekke samtykke tilbake uten å oppgi noen grunn. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.
Kun faglærerne som er med i prosjektgruppen, ser opplysninger under, vil ha tilgang til dataene.

Deltakere i prosjektet vil ikke kunne gjenkjennes i eventuelle publikasjoner.

Forskerne som vil ha tilgang til dataene er:
Ammar Singh, stipendiat, HiØ
Stine Brynildsen, høgskolelektor, HiØ
Irina Engeness, professor, HiØ

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Prosjektet skal etter planen avsluttes 01.12.2025. Ved prosjektets slutt slettes video- og lydopptak og personidentifiserbare opplysninger fjernes.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:
- innsyn i hvilke personopplysninger som er registrert om deg,
- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål om prosjektet, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:
- Høgskolen i Østfold ved Irina Engeness, e-post: irina.engeness@hiof.no

Med vennlig hilsen,

Irina Engeness
Professor, HiØ
Prosjektansvarlig

Ammar Bahadur Singh
Stipendiat
*

◯ Jeg har lest og forstått informasjonsbrevet

Name of candidate: Ammar Bahadur Singh

Dissertation title: Teaching and Learning in an Institutional Massive Open Online Course: Implications for Agency in Online Pedagogy

Abbreviations for type of fixes:

Cor – correction of language

Cpltf – change of page layout or text format

Side	Line	Foot note	Original text	Type of correction	Corrected text
x	Article 2		Singh, A. B. & Mørch, A. (2022) …Accepted for publication in 2024	Cor	Singh, A. B. & Mørch, A. (2024)… Journal of Educators Online, 21(1). https://doi.org/10.9743/JEO.2024.21.1.5
21		1	(Norman, 1999)	Cpltf	Norman (1999)
24	16	6	…engaging activities or problems,	Cor	…engaging in activities or problems,
33	33		…of collaborative.	Cor	…of collaborative learning.
40	31		…conducting…	Cor	…conducting research activities…

44	2		Singh, A. B. & Mørch, A. (2022) …Accepted for publication in 2024	Cor	Singh, A. B. & Mørch, A. (2024) … Journal of Educators Online, 21(1). https://doi.org/10.9743/JEO.2024.21.1.5

Part II: Articles

Article 1

Singh, A. B., & Engeness, I. (2021). Examining instructors' roles in facilitating students' learning process in pedagogical information and communication technology massive open online course. *Cultural-Historical Psychology, 17*(2), 76–89.
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Examining Instructors' Roles in Facilitating Students' Learning Process in Pedagogical Information and Communication Technology Massive Open Online Course

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This study examines how course instructors facilitate students' learning in the Pedagogical Information and Communication Technology (ICTPED) Massive Open Online Course (MOOC) aiming to develop professional digital competence in pre-service and in-service teachers in Norway. It also provides an insight into how students' agentic engagement in learning may affect the course instructors' guidance. Students' online meetings with the course instructors and students were observed and recorded. The meetings aimed to develop students' understanding of the examination assignment. The data (4.5 hours video recordings) analyzed by the method of interaction analysis revealed that the instructors performed four pedagogical functions: (1) setting up the learning process, (2) reifying students' ideas;(3) assisting students in developing their conceptual understanding; and (4) summarizing and structuring students' understanding about target concepts. These pedagogical functions evolved out of mutual collaboration of the instructors and students. The students' agentic engagement in learning was visible when they took the initiative to explicitly share their ideas related to their examination assignment. Instructors' agency in guiding came into play when addressing students' ideas and questions emerged during the interaction process. Students' agentic engagement in learning shaped the course instructors' pedagogical functions and enhanced their agency. In doing so, the dialectical interplay between the students' and course instructors' agency comes to the fore as an essential aspect of learning and teaching in online environments.

Keywords: instructors' guidance functions, students' agentic engagement, online meeting, learning and teaching, agency. P.Ya. Galperin.

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1. Introduction

This study examines the online course instructors' role facilitating participants' learning process in the ICTPED MOOC offered by a Norwegian University College aiming to develop professional digital competence in pre- and in-service teachers. The study also provides an insight into how participants' agentic engagement in learning may affect the course instructors' guidance. Several studies suggest that instructors perform approximately four roles while facilitating students' learning in online environments: managing (setting agenda, managing, leading, and directing interactions), pedagogical (promoting interactions to develop students' understanding of the target concepts), social (creating a friendly environment and promoting group learning), and technical (facilitating students' engagement with digital technologies [1—3]. Instructors, focusing on adopting a facilitating role, emphasize an experiential, collaborative, and problem-solving nature of the learning processes, while those who prioritize teaching as a knowledge transmission direct their attention mostly to content delivery [4—6]. This distinction might be contested, but it aptly describes instructors' role in the so-called two types of MOOCs: cMOOCs and xMOOCs. The initial cMOOCs, also called connectivist MOOCs, emphasized network creation, learner autonomy, and interaction among learners [7, 8] and instructors are ex-

pected to act more like facilitators by helping learners to connect to and learn from each other [9]. On the other hand, "xMOOCs are built as an extension of the conventional campus course" [8] providing more structured learning resources such as video lectures, reading materials, automated quizzes, and assignments [8, 10, 11]. Instructors take the role of knowledge/content experts in xMOOCs by delivering premediated contents for learners [12, 13]. However, facilitating students' learning in online environments, including MOOCs, may depend upon how students present and (re)position themselves in particular learning events (i.e., online meetings), and in doing so, manifest their agency.

By taking the Vygotskian perspective, students' agency is understood as an ability to propel themselves forwards, recognizing and responding to the demands in tasks, and, with increasing competence, repositioning themselves within the epistemic domain (Edwards, 2015). Such a perspective has been adopted in other studies that discuss how students may develop their agency while learning online. For example, [14] found that learners were able to address their agentic needs by engaging in interactions with video resources in the ICT MOOC. The video resources in the ICT MOOC offered an approach for students to engage in online learning and, in doing so, may have contributed to enhancing their agency. Repositioning themselves as active agents in the epistemic educational practices in MOOCs, students might enhance their digital agency [15]. Therefore, in online learning, instructors' roles might become "the guide on the side" rather than "the sage on the stage" [1, 16]. In this sense, instructors' roles to facilitate students' learning are contingent upon how students (re)position themselves in learning activities while making their needs explicit and responding to the arising demands. However, instructors are rarely engaged in facilitating students' learning due to a massive number of participants[8, 17], and their guidance remains mostly underresearched [18]. Several studies have expressed the need to examine a course instructor's role to facilitate online learning [19, 20]. This study addresses this gap by examining instructors' facilitating of students' learning in the synchronous online meetings in the ICTPED MOOC aiming to help students to solve the examination task.

The following research questions are addressed:

RQ1: How did the course instructors facilitate students' learning in the ICTPED MOOC during online meetings?

RQ2: How did the students' engagement in online learning affect the course instructors' guidance?

2. Instructors' roles in online learning environments

Several studies outline different roles that an online course instructor performs to facilitate teaching-learning practices[1, 21—23]. Online course instructors may perform a pedagogical role [2, 24], managerial role [1, 25], or facilitating role [26]. The pedagogical role, for Maor [24], is concerned with micro-level practices such as stimulating discussion, raising questions, promoting interactions, providing feedback, synthesizing students' comments, and referring to resources. Other studies [2, 22, 27] have found that the pedagogical role concerns both micro-level practices as well as the designing of those practices (designing instructional strategies, developing appropriate resources for learning). The managerial role [1, 25] includes agenda setting, recordkeeping, and initiating and facilitating interactions. It focuses on how to engage participants in the learning process. Instructors' facilitating role is concerned with welcoming students, responding to students' questions or needs, providing feedback, and promoting interaction [26].

In the MOOC context, a course instructor's role may differ according to the types of MOOCs [12, 13]. Literature shows, besides the existing two types of MOOCs (cMOOCs and xMOOCs), other types of MOOCs emerging in terms of learning functionality such as tMOOCs (transfer MOOCs), sMOOCs (social or participatory MOOCs), and ahMOOCs (Adaptive Hybrid MOOCs) [28] and instructors' role might differ according to different types of MOOCs. However, how instructors perform their functions to support students' learning in various types of MOOCs is considerably absent in the literature. Considering [29] acquisition and participation metaphor, we reiterate the two existing categories of MOOCs, cMOOCs, and xMOOCs, as the majority types of MOOCs are grounded in the acquisition metaphor since they emphasize delivering highly structured content for learning [8]. A suitable description of the learning process of these two types of MOOCs is provided by [Moya 2013, cited in 28]: cMOOCs emphasize a more participatory, active, collaborative, and interactive learning process while xMOOCs focus on a teacher-led, less participatory learning process. Thus, in cMOOCs, course instructors function more like facilitators by creating networks, connecting students to learning resources, and promoting collaboration and interaction [9, 13, 30]. Instructors in xMOOCs, on the other hand, take knowledge/content experts' roles by transmitting expert knowledge to students with minimal engagement in their learning [12, 13]. It is often the teaching assistants, rarely the instructors, who engage in facilitating students' learning by posting questions, replying to queries, and providing resources for learning [8].

In summary, the above-discussed studies point out that online instructors are expected to play multiple roles in online learning environments. The most recurring roles are pedagogical, managerial, social, and technical. Most of these studies emphasize the pedagogical role (course designing and content delivery) as crucial to facilitate students' online learning. They suggest that the social role (connecting students, building a learning community, sharing experiences, and providing feedback) is underexplored. These studies provide important insights into how instructors facilitate students' online learning. However, they do not adequately capture what instructors do in this process. There is a gap between general strategies to organize the learning process in online environments and what instructors do to facilitate students' online learning. This study addresses this gap

by examining instructors' roles in the ICTPED MOOC through the lens of cultural-historical theory.

3. Theoretical framework

From a cultural-historical perspective, the quality of teachers' guidance is crucial for the development of students' conceptual understanding [31]. Teaching-learning is a two-way, collaborative, and transformative process, originating in the external practices with tools[32] that mediate students' learning and enhance their development as learners [33, 34].

However, Vygotsky did not explain how the gradual transformation of students' external interactions with material or materialized tools to their internal plane happens [35-37]. Galperin, a contemporary of Vygotsky, expanded Vygotskyan ideas by explaining that the transfer of the original, external, socially meaningful activity to learners' internal plane happens through six dialectically evolving phases: (1) motivation, (2) orientation, (3) materialized action, (4) communicated thinking, (5) dialogical thinking, and (6) acting mentally [36]. In the initial motivational phase, a learner's attitude and relation to the learning outcomes that have to be achieved is formed. In the second orientation phase, Galperin identified three types of orientation: (i) incomplete, where mediational means and the essential features of the target concepts are identified by learners through multiple trials and errors; (ii) complete, where learners are informed about all mediational means that encapsulate the essential features of the target concept; (iii) complete, but constructed by learners following a general approach identifying the essential features of the target concept. In the third phase of a materialized action, learners interact with material or materialized objects, and over time become less dependent on the material support they give and more aware of the meanings they carry. Speech becomes the main guiding tool in the fourth phase of communicated thinking. The fifth phase, dialogical thinking, establishes a dialogue of a learner with him or herself so that the action is being transformed mentally. In the final phase of acting mentally, an action is performed by means of mental images and meanings that help a learner to deal with similar or differing situations on the basis of previous experience. These phases are used as an analytical resource to understand what the course instructors did at different times in the learning process in the ICTPED MOOC.

Students' increasing agentic engagement as independent learners is visible in their move from orientation to materialized action, communicated thinking, dialogical thinking, and acting mentally. While at the beginning of their learning, students are dependent on explicit orienting information and meanings encapsulated in the materialized objects they interact with, gradually, their agentic capacity becomes enhanced as they become less dependent on the support of the materialized objects and gradually move forward in their learning by making a transfer to the phases of communicated and dialogical thinking.

Such a transfer and transformations the students undergo during the learning process can be explained from the position of the transformative activist stance (TAS) perspective, which posits agency as collectively developed and expanded through participants' engagement to solve a common task [38, 39]. Agency is enacted in "transactional and collaborative dynamics of social practices in the process of individuals contributing to their realization" and transforming practices as well as actors involved in the practices [39]. Such a perspective is useful to examine how students' agentic engagement in learning during online meetings may affect the roles of the course instructors.

4. Methodology

4.1. Participants and setting

Data were collected during the online meetings, which were arranged on the Whereby video conferencing platform. The meetings aimed to help students to develop their understanding of the examination assignment they were to engage in. In the examination assignment, "Creating a Multimodal Text," the students were to submit: (i) an original monomodal text, (ii) a remediated multimodal text, and (iii) a reflection video. Table 1 presents a description of the examination assignment.

Students' participation in online meetings was voluntary, and in total, 30 meetings were offered and 17 different students participated in eight different meetings. Each meeting lasted for 45 minutes and was facilitated

Table 1

Examination assignment: creating a multimodal Text
The main goal of this assignment is to remediate a self-selected monomodal text into a new, multimodal text. The multimodal text should be used as a self-produced teaching resource that provides added pedagogical value in relation to the original text. Use an analogous printed or digital text (monomodal) as a starting point for the remediation. The remediated, multimodal text will be put into a pedagogical context, and you should be able to argue why and how the remediated multimodal text will enhance the development of students' conceptual understanding. You will need to submit the following three elements, which together constitute the examination assignment: 1. Original text (file/link) 2. Remediated, multimodal text (file/link) 3. Reflection video in which you reflect on the theoretical grounds to justify the chosen modes. You will also need to reflect on the pedagogical value of the remediated text by explaining how the remediated text may enhance the development of students' conceptual understanding. You may also write a declaration giving other participants the right to use your remediated texts in their teaching practice if they follow the copyright law in the correct manner.

by two-course instructors. One course instructor had been involved in the course designing and facilitating of students' learning for about six years and another was a novice who had joined the course in his first time facilitating students' learning online. The first author participated in the meetings as an observer, and he did not take part in the course instructor-student interactions. The online meetings were recorded in Studio as integrated into the Canvas Platform. Participants' consent was taken prior to the meetings. Table 2 provides an overview of the number of participants and instructors involved in the meetings, which were recorded for further analysis.

4.2. ICTPED MOOC

ICTPED MOOC (Pedagogical Information and Communication Technology Massive Open Online Course) is a credit-bearing course aiming to develop digital competence with pre- and in-service teachers. ICTPED MOOC is an xMOOC; it consists of seven modules and includes video lectures, information texts, automated quizzes, and assignment tasks. In the ICTPED MOOC, students have an opportunity to interact with the course instructors and their fellow students in discussion forums on Canvas and engage in online meetings. Table 3 presents the structure and the progress plan of the MOOC that students are to follow.

Module 3, "Multimodal texts," was selected for the data collection to examine how instructors facilitated students' learning during the online meetings.

4.3. Data and analysis

Video recordings of the supervision meetings were the primary data source. In the initial phase of data analysis, we went through all recordings (8 meetings, 360 minutes). Two recordings (90 minutes) that represented the patterns of facilitating as performed by an experienced instructor and a novice instructor (engaging for the first time in online instructional activities) were selected. The rationale behind selecting these two recordings was to examine whether the novice instructor considerably differed in his approach to facilitate students' learning from the experienced one.

The recordings of the online meetings were transcribed in Norwegian by using Jefferson's transcription notation (Appendix 1) [40]. Then the data were translated into English by the research team. Both authors examined the recordings separately and then discussed the patterns of facilitation together. The researcher triangulation was thus applied.

Eight extracts (four from each meeting) were selected for further analysis. The selected extracts representing the patterns of interaction between the students and the course instructors were analyzed by the method of interaction analysis [41—44]. The primary unit of analysis was sequences and turn-takings in sequences of interactions between the instructors and the students [45]. Each utterance was analyzed in relation to the previous one in the ongoing learning trajectories.

The interaction analysis was conducted in three steps [46]: first, the instructor-student interactions were described by referring to the numbered lines; second, interactions were analyzed from the perspective of the research questions; and third, the emergent findings were outlined. Finally, after the completion of interaction analysis, the extracts were examined following the analytical lens offered by Galperin's pedagogical phases

Table 2

Supervision meetings

Number of online meetings	Length of the meeting (in minutes)	Number of participants	Facilitators
1	45	1	Instructor 1
1	45	2	
1	45	3	
1	45	2	
1	45	2	Instructor 2
1	45	2	
1	45	3	
1	45	2	
8	360	17	2

Table 3

Structure and progress plan of ICTPED MOOC

Module	Progress plan (week)
0. Pre-course	2
1. ICT and learning	3—4
2. Digital studying techniques	5—6
3. Multimodal texts (examination module)	7—9
4. Cyberethics	10—11
5.Classroom management in digital learning environments	12—13
6. Assessment for learning	14—16
7. Flipped classroom (examination module)	17—21

to examine what course instructors did to facilitate students' learning at different times in the online meetings.

Additionally, students' reflection videos submitted as a part of their examination assignment were also analyzed. The aim was to examine how the ideas that students discussed in the online meeting were developed further into their examination assignment. Additional data were collected through the questionnaire administered to the students upon their completion of the course. The questionnaire consisted of 33 questions, and a question related to the online meeting was selected for the analysis (Q31: To what degree were you satisfied with the online meetings?). The question consisted of two parts: one part used a five-point Likert scale, and in the second part, the students were to provide their comments. By analyzing this question, we were interested in gaining further insights into students' experience of participating in the online meetings.

5. Findings

5.1. Analysis of quantitative data

We start our analysis by presenting participants' responses to Q31: To what degree were you satisfied with the online meetings (Table 4)? Initially, the questionnaire was administered to 365 students, and 25 students responded to Q31. However, 17 students participated in online meetings with instructors (see Table 2) and gave their consent to record the meetings. The students' responses to the first part of the question (that used a five-point Likert scale) are presented in Table 4.

The data show that the majority of the students were satisfied with the meetings, and a few students remained neutral about their opinions. For example, the students explicated their attitude to the online meetings by saying:

S1: It was useful to know if the examination assignment works as a pedagogical resource.

S4: It was excellent to discuss ideas, get confirmation and further guidance. It made me more confident when working on the examination assignment.

S6: Rather than answering the questions, the instructors could have given more advice about how to improve the examination assignment.

5.2. Analysis of qualitative data

5.2.1. Analysis of instructor-student interaction: Experienced instructor

Initiating the learning process

In the following extract, Table 5, the instructor and student are in their starting phase of the online meeting. From the Galperian perspective, the instructor and the student are in the orientation phase.

The instructor starts the meeting by explaining the requirements of the multimodal text the student will create (line 1). The student states that he has already started working on the task (line 2) and has chosen a book for remediation (lines 3 & 4). He explains the approach he

Table 4

Students' degree of satisfaction with online meetings

Responses	Frequency
Very satisfied	4
Satisfied	14
Neutral	6
Unsatisfied	1
Very unsatisfied	0
Total	25

Table 5

Initiating the learning process

1	Thomas (instructor)	Let me say something briefly before you start presenting your thoughts. The examination task you are going to solve should have a pedagogical value. You should explain this in the reflection video. I suggest you use a resource that is old or monomodal. For example, a book from the 1950s is often better than a book from the 2000s, as a lot of pictures are included in the textbooks created after the 2000s. However, you may use several books, not one.
2	Henrik (student)	Okay, yes. I have already started working on the assignment. I have chosen a book.
3.	Thomas	Yes. What is the name of the book? What is it about?
4	Henrik	The book is called "Breed Knowledge"; it is about dog breeds. This is the book that I used in my teaching before. It is no longer available. First, I have created a PowerPoint about the content of the book. Then, I have uploaded the PowerPoint further into Book Creator. Therefore, I think that I have come a long way. However, there are still some things that I wonder about. I have also created a series of educational films about dog breeds. I wonder if I should include links to these films in my multimodal text.
5	Thomas	Yes. Can you just show me the book?
6	Henrik	(Showing the book to the instructor). There is a lot of text, a good deal of pictures of different dog breeds. Text, text...
7	Thomas	Yes.
8	Henrik	It is roughly like that throughout the whole book.

has pursued to solve the assignment (line 4). The student is wondering if the videos he has created previously can be used in the examination assignment (line 4). The instructor is curious about the book the student has selected for remediation (line 5). The student presents the book to the instructor while commenting on its content (line 6). The instructor clarifies the examination assignment, and the student presents the draft he has created. He also explains how he intends to create a multimodal text. The instructor attempts to make sense of what the student has done. The instructor performs an orienting role by opening up the online meeting while reminding the student about the requirements of the examination assignment. In doing so, the instructor might have initiated students' reflections about what he has already done. However, by explaining his work-in-progress and presenting his ideas about how to further develop his multimodal text, the student might have affected the instructor's further advice about how to solve the examination assignment.

Reifying ideas

In the extract in Table 6, the instructor and student are engaged in making the student's ideas about how to solve the examination assignment explicit. From the Galperian perspective, the instructor and student are in the materialized action phase—they are engaged in discussing the student's draft.

The instructor explains how to select the content and present it in the multimodal text (lines 1, 3, & 5). He also points out the need to reflect upon the pedagogical value of the multimodal text in the reflection video (line 3). The student is wondering about the number of cases to be included in the assignment (line 4). The instructor explains the required length of the text (line 5) and the student is willing to share what he has done (line 6).

The instructor explains how a good multimodal text can be created by exemplifying the characteristic features of the breeds. He points out that it is important to make each characteristic feature visible, preferably by using different modes. However, the student insists on the variety of breeds and different species within each breed. By offering the student to select two to three breeds, the instructor clarifies the requirements of the multimodal text.

By explicating how the characteristic features of different dog breeds can be presented by using different modes, the instructor may have initiated the student's reflections about how different modes may complement each other in a multimodal text. The student's comments about a variety of species within one breed may have evidenced his confusion concerning the amount of information that needs to be included in the multimodal text. Such a comment might have initiated the instructor's further clarification of the assignment requirements.

Developing conceptual understandings

In the following extract (Table 7), the instructor and the student are engaged in the discussion about how the student's draft can be developed further. From the Galperian perspective, they are in the communicated thinking phase.

The instructor encourages the student's ideas about how the multimodal text can be developed further (line 4). The student explains his approach to the content presentation (line 2). The instructor points out the

Table 6

Reifying ideas

1.	Thomas	We do not expect you to include the whole book in your multimodal text... Let's say there are 20 dog breeds in that book. We are not necessarily interested in you presenting the same case twenty times.
2.	Henrik	I understand.
3.	Thomas	Insert several pictures of the dog. Take close-up pictures of the distinctive features of the dog. Make a movie showing the dog... animation [...]. You have to create a multimodal text. In the reflection video, you need to explain your choices and reflect on the pedagogical value of your multimodal text. For example, last year a student made a video about how football moves could be performed, and it was very good also.
4.	Henrik	Yes... but there are different species of a dog breed. For example, there are many types of a hunting dog.
5.	Thomas	I think two breeds can be enough. However, students may fail the examination because they take far too short text as a starting point.
6.	Henrik	Would you like to see what I have done so far?

Table 7

Developing conceptual understandings

1.	Thomas	Tell me about your further thoughts.
2.	Henrik	There will be a presentation of different breeds of dogs one by one. I will present videos about dogs' breed and insert links to further information and activities.
3.	Thomas	But what I'm thinking here, after I heard your thoughts, you should visualize the characteristics of the dogs better than it is done in the original text. For instance, let's say that there was a vampire dog, which had vampire teeth. Then it is important to get a picture of its teeth. If it also had three stripes under the belly, then there should be a picture of three stripes, then you know that it was a vampire dog.
4.	Henrik	(Pointing the cursor to the dog on the shared screen) We have a bit of it on the one standing here, fast-running hunting dogs. For example, their eyes are much more out on the sides than other dog species.

need to present the characteristic features of the specific breeds (line 3). The student shows that he has already attempted to do so (line 4).

The instructor offers the student advice concerning how to explicitly present the characteristic features of the selected dogs' breeds. The student explains how he intends to make these characteristic features visible.

By asking the student to explicate his further actions, the instructor might have encouraged the student's reflections about his further steps. However, the student's ideas initiated the instructor's explanations about how a multimodal text might enhance students' conceptual understanding of the target dogs' breeds. In doing so, the ideas explicated by the student might have initiated the guidance offered by the instructor.

Summarizing

In the following extract, Table 8, the online meeting is coming to an end, and from the Galperian perspective, the student and the instructor are in the phase of dialogical thinking.

The instructor encourages the student's further reflections about the assignment (line 1). He provides advice on how to create a reflection video and draws the student's attention to the assessment criteria (line 3). The instructor offers further support to the student (line 5). The student reflects on his understandings (lines 1 & 3) and explicates his ideas about how to organize and present various modes in the text (lines 2 & 4).

The instructor initiates the student's further queries. The student outlines his further actions by summarizing the ideas they discussed at the meeting. As an extension of the student's thoughts, the instructor offers technical advice about how videos may be created and reflects on the need for a universal design when creating a multimodal text. In addition, he reiterates the assessment criteria for the reflection video. The student explicates his understanding by detailing how the advice offered by the instructor will be taken in his work. Finally, the instructor reminds the student about the other available lines of support.

In the reflection video submitted as a part of the examination assignment, the student mentioned:

> I revised the tutorials that I had prepared for students with dyslexia last year [...] I have selected some dog breeds and highlighted their characteristic features in bullet points. I have also prepared audio and video files of the presented breeds. I have also embedded links for quizzes [...] I have embedded the link to the Swedish dog kennel club that describes many breeds of goods for further information and deeper understanding. I used the Book Creator for remediating my text (...) I have uploaded it in It's learning for my pupils.

This extract indicates that the student has implemented ideas discussed in the online meeting in his multimodal text. Such reflections might evidence his understanding of the examination assignment.

5.2.2 Analysis of instructor-student interaction: Novice instructor

Initiating the learning process

Two students and an instructor are participating in the online meeting. One student takes the initiative to open up the meeting. From the Galperian perspective, the instructor and the students are in the orientation phase.

Ellen takes the initiative to open up the online meeting (line 1) and makes a four-minute-long presentation about her task-in-progress in detail. She explains and justifies how she has planned to present the content of a book chapter she has selected. The instructor encourages the student to present her ideas (line 2). He, along with another student, listens to her.

By encouraging the student to share her examination task-in-progress, the instructor initiates the student's reflections about the examination assignment. The student's detailed reflections set up the scene for the meeting to shape the instructor's further guidance.

Reifying ideas

Table 10 shows that the students and instructor are engaged in a discussion to make the student's ideas about

Table 8

Summarizing

1.	Thomas	We have a few minutes left, so if you have any questions, go ahead.
2.	Henrik	I think I will work on videos and pictures of dogs' breeds and try to make [them] more explicit. And then I wonder if I should put an audio file on each breed where I explain the characteristic features of each breed in bullet points.
3.	Thomas	Remember the standard icons for sound. An important advice for the reflection film: do not record it in one click. Besides, make sure that you reflect on all assessment criteria. Remember that the multimodal text task you create should have a pedagogical value.
4.	Henrik	Yes. I will do so. Recoding at one go can be difficult for me... I am thinking about short sequences in the reflection video (...) Now, I think I have picked up the key ideas for this assignment. Some students will be able to listen to the audio file I have made, and others will be able to read the text.
5.	Thomas	I wish you good luck with the examination assignment. Ask questions in the discussion forum if there is anything else you are wondering about. Alternatively, we offer tutoring sessions. You can participate in these sessions if you have further questions about the examination assignment, but note that the instructors are available only 20 hours in a week. You can also contact the student service center and they can also provide you some assistance.
6.	Henrik	Yes, this sounds good.

solving the examination assignment explicit. From the Galperian perspective, they are in the phase of materialized action.

The instructor prompts the student to choose various resources (line 1). The student explicates her ideas about the topic of marketing (line 2). The instructor indicates the availability of various resources for creating a multimodal text with pedagogical value (line 3). He emphasizes the learning design of the multimodal text and elaborates what a learning design entails (lines 1, 3, & 5). He draws the student's attention to the need to enhance student-centered learning (line 5). The student gets an insight into the design of the examination assignment (line 6).

The instructor draws the students' attention to the need to use various resources. The student elaborates on the details of the topic marketing, and the instructor reveals how the design of a multimodal text can enhance student-centered learning.

By explicating the details of the topic "marketing," the student might have shaped the instructor's further guidance to reveal the various aspects of a learning design. In doing so, he might have helped the students to understand the complexity of creating multimodal texts to enhance student-centered learning.

Developing conceptual understandings

In the following extract, Table 11, two students and the instructor are engaged in developing their understanding of the examination assignment. From the Galperian perspective, they are in the phase of communicated thinking.

The student explicates her understanding of how to organize her multimodal texts to address the needs of different pupils (lines 1 & 3). However, she expresses her concerns about the amount of information in the videos and written texts (line 1). The instructor acknowledges her challenges; however, he suggests making a video

Table 9

Initiating the learning process

1.	Ellen (student)	Who would you like to start first, Geir?
2.	Geir (instructor)	You can just start, Ellen.
3.	Ellen	Okay. Well, I am going to remediate a chapter from a marketing and leadership textbook used in the upper secondary school. The text is about pricing strategies. It explains how the company should set reasonable and correct prices for its goods. I chose this text because I think it is difficult for the students. Both textbook authors have given their consent to publish the multimodal text based on their book. The content I have selected also meets the curricular goals. I am going to use the Book Creator to create an e-book. I would like to change the original order of the content because I think it is presented in a fragmented way. Then I will prepare an audio file of the whole text. I have also prepared some tutorials explaining how to do price calculations, followed by the problems that students will engage with. I use Explain Everything to show how multimodal texts I have selected for the examination assignment are interrelated. I will add quizzes that will help students to check their understanding of the concepts. However, here, I am a little uncertain whether one can do the quiz as it opens in a separate tab, so students have to go back to the main task when they finish it. Then I thought I should also make a multiple-choice test for students to check their understanding. I will also end the entire task with a case study... So, I use both text, audio recordings, tutorial videos, practical exercises, links, explanatory videos, quizzes, and other types of activities. That is what I have been thinking.
4.	Geir	[...] Okay, we discuss it now in the meeting [...]

Table 10

Reifying ideas

1	Geir	Well, I think you should go beyond the linear design of multimodal texts. Imagine that you have a learning design with various quizzes, multiple-choice questions, etc. It seems like you have had a lot [...] You said that you were working on the topic "marketing," right?
2	Ellen	Yes. [...] Pricing strategies is the topic now [...] Moreover, there is psychological pricing; for example, we put 299 and not 300. It is one of the ways of competing with pricing. After all, it does not influence digital marketing as a theme.
3	Geir	Okay. But if you are going to develop an examination assignment that has a pedagogical value, there are many ways to do it. For example, YouTube videos and other courses address how to work with marketing in such a social media context. I think you should select various resources, but you just talk about the practical use of marketing.
4	Ellen	[...] Okay.
5	Geir	You should build up a learning design. You should somehow break the design down into something like 1, 2, 3, 4 modules. You can call it a learning path. In other words, it is about specifying when the teacher should have an active and a passive role in the students' learning activities. Then you have learning activities for students to work on. Another element that you may consider is to what extent your learning design itself promotes sharing, collaborative, and individual learning. How does your multimodal text facilitate your students' learning? Thus, these things should be clear in your design.
6	Ellen	I have not really thought about this dimension of the assignment. I have to write it down.

rather than presenting a text (lines 2, 4, & 6). Both the instructor and the student acknowledge the usefulness of developing understanding of marketing concepts by watching tutorials rather than reading textual information (lines 5 & 6).

The student explicates her concerns about presenting information in videos and texts in a balanced manner. Admitting the challenges, the instructor suggests creating a video. The student agrees with the instructor.

By raising questions about how to present multiple modes in a balanced manner, the student initiates the instructor's guidance to address the challenges indicated by the students. The instructor suggests creating videos and the student explicates her agreement.

Summarizing

In the following extracts (Table 12), the online meeting is coming to an end, and from the Galperian perspective, the instructor and the students are in the phase of dialogical thinking.

Following the instructor's indication about the end of the meeting (line 1), the students summarize their ideas about solving the design of the examination assignment. Both students decide to create an e-book combining multiple modes to cater for varied students' needs (lines 2, 3, 5, & 7). The instructor is curious about the usefulness of his guidance (line 4) and emphasizes the need to consider a learning context (line 6).

The students explicate their further steps to solve the examination assignment. However, they remain somewhat uncertain about balancing content in multiple modes.

The students summarize their understanding of their approaches to solve the examination assignment. They express their concerns about balancing content in multiple modes to cater for students' individual needs. Their concerns might have called for further clarifications

Table 11

Developing conceptual understandings

1.	Ellen	I am thinking of making an audio file of all texts because students with visual impairments will take advantage of it. However, I think it is a bit difficult to make videos. For example, if I am going to write everything I say in the videos, then I have both text and videos, but is it necessary? Should I write in the text about what comes in every video? I think I should either say the key things in the videos or write in the text. A video of just a few minutes will correspond to many pages as a text. What do you think?
2.	Geir	I think it is a difficult question to consider. I do not know exactly what to say about that.
3.	Ellen	Okay. When I record something in the videos, I say a lot more than I write. If someone prefers reading the text, then she/he will get less information than those who prefer watching videos.
4.	Geir	[...] I think an audio-visual explanation is better [...] You should focus on making a video, and you do not necessarily need a text. So avoid offering redundant information.
5.	Ellen	Yes, I have not seen anyone who managed to learn these calculations by reading the textbook. Therefore, I have decided to make a tutorial rather than an e-book. In the talking head videos, I show them calculations in Excel and explain different elements.
6.	Geir	When you explain things in that way, then I think it enhances the pedagogical value of your examination assignment. Making mathematics tutorials is not unusual in an online course. Such videos are more effective for learning than reading a textbook.
7.	Ellen	Yes.

Table 12

Summarizing

1.	Geir	I think our time is over.
2.	Ellen	Yes. Thank you for your feedback [...] I have also thought a bit about the examination assignment that I have created. The pupils will also be able to complete it alone at home. If, for example, they are away for a week due to the flu, they should be able to solve the task on their own and learn the target concepts.
3.	Maya (Student 2)	Yes. I have had similar thoughts.
4.	Geir	Was my advice helpful?
5.	Ellen	Yes [...] I am just a little unsure (...) Whether I should create an e-book that pupils should follow. As Maya said, I am concerned about an individual approach. For example, I have some pupils with dyslexia in my class, and they need much time for reading. These students will benefit from watching videos, but they might be unwilling to collaborate on classroom tasks.
6.	Geir	Think about different learning contexts as well. The task you create for the classroom might not be useful for the online context.
7.	Maya	Yes, at least we have some ideas. I feel that I end up creating a type of e-learning book. However, I disagree concerning what has the greatest pedagogical value. Therefore, I will focus on collaborative tasks. We will collaborate to work on the ideas we have discussed.

from the instructor, but he neither clarifies nor informs the students about the possible resources for further guidance. This might have led the students to seek out their own resources (peer collaboration) to discuss the examination assignment further.

In the reflection video submitted as a part of the examination assignment, Ellen mentioned:

> [...] Setting psychological pricing strategies is the topic of the multimodal text [...] I have created audio-visual and textual resources accompanied by different tasks. I have used many text types. I have also used the Explain Everything tool for summarizing key concepts in the multimodal text. I have added some exercises for students to reflect their understanding [...] At the end of the text, I have assigned a case study work for pupils because it is a normal practice in [the] marketing and leadership subject [...] Students can solve the case study as an online exercise. I have attempted to be creative when designing my multimodal text [...]

This extract indicates that the student has implemented the ideas discussed in the online meeting in her multimodal text. Such reflections might evidence that the guidance of the course instructor offered in the online meetings might have contributed to the development of the student's understanding of the examination assignment.

6. Discussion

By taking a cultural-historical perspective, this study examined how the course instructors facilitated students' learning during online meetings in the ICTPED MOOC. Additionally, it also attempted to provide an insight into how students' engagement in the meetings affected the instructors' guidance. The quantitative data showed that the students were satisfied with the online meetings. The findings of the qualitative analyses are discussed in relation to previous research. The patterns of instructors' guidance are presented in Table 13.

The analyses of instructor-student interactions with both the experienced and the novice instructors revealed the patterns of facilitating students' learning in the online meetings. These patterns make visible that the instructors (i) set up the learning process, (ii) discussed the students' drafts in detail, (iii) assisted the students to develop their understanding about their further steps to solve the examination assignment, and (iv) structured the students' understanding by clarifying the target concepts and offering further support. These findings corroborate with the studies that have examined teachers facilitating students' learning in technology-rich classroom contexts [35, 47]. The findings in the previous research indicated that instructors offered more guidance to the students in the orientation phase and in the phases of communicated thinking than in the phase of dialogical thinking. In this study, the course instructors, especially the experienced instructor, offered limited information about how to engage in the examination assignment task in the orientation phase. In the case of the novice instructor, the students themselves set up the learning process by sharing their examination assignment drafts. The instructors offered more elaborate guidance in the phases of materialized thinking and communicated thinking than in other phases. They probed into students' ideas and explained in detail how multimodal texts can be combined to enhance the pedagogical value of the examination assignment. The instructors' orienting function was partly similar to the managerial role discussed in the literature, which includes creating conditions for learning by setting an agenda, approaches to carrying out the agenda, and directing learners' activities [1, 24].

While performing the executive role, the instructors assisted the students in developing their conceptual understanding of the examination assignment. They vetted and reified the ideas embodied in students' drafts in the phase of materialized action. Students' assignment drafts

Table 13

Patterns of instructors' facilitative activities

Phases of guidance	Instructors' functions	Galperin's pedagogical phases and instructors' roles
Initiating the learning process	Setting up the meetings by explaining the examination assignment Encouraging students to present drafts	Orientation — Orienting
	Making sense of the students' drafts	Materialized action
Reifying ideas	Discussing students' drafts Reifying students' ideas and concepts	Executive
Developing conceptual understanding	Encouraging students to express their ideas about the further development of their multimodal texts Providing feedback on the students' ideas	Communicated thinking
Summarizing	Encouraging students to reflect upon their final understanding of the examination assignment Structuring students' understanding	Controlling Dialogical thinking

as the objects of discussion functioned as the meditational resources for visualizing the target concepts. The experienced instructor used examples from students' drafts shared on the screen and referred to the sample examination assignments to help the students understand how multiple texts could be combined using various technological tools to create a multimodal text. By doing so, the instructors might have helped the students to understand various dimensions of the assignment. In the phase of communicated thinking, the instructors encouraged the students to express their ideas about the further development of the multimodal texts and provided feedback on them. The experienced instructor explicitly asked the students for their reflections, while the students interacting with the novice instructor took the initiative to reflect upon their understanding. However, both instructors encouraged the students to explicate their further thoughts and develop their understanding of the examination assignment. The analyses of students' reflection videos indicated that the students implemented the concepts discussed in the meetings in their examination assignments. The instructors thus helped the students to cultivate their thinking and reasoning about the examination assignments and develop their conceptual understanding. The instructors' executive functions can be compared with the pedagogical role [1, 21, 24] and facilitative role [26] as instructors stimulated interactions and reflection, provided feedback, and asked probing questions.

While performing a controlling role in the phase of dialogical thinking, the instructors encouraged the students to explicate their understanding. They summarized and structured the target concepts and offered advice for further guidance. Synthesizing students' comments, clarifying dilemmas, and offering further assistance is a part of the instructors' pedagogical role [1, 21, 24]. The experienced instructor explicitly checked students' understanding by encouraging them to reflect upon what they had understood and thought of further steps to improve the assignment drafts, while the novice instructor was more interested in the students' feedback concerning the usefulness of his guidance. This suggests that novice instructors might feel a little uncertain about the impact of their guidance.

More interestingly, unlike in the classroom context where instructors performed their explicitly designed preplanned activities [e.g., 47], none of the instructors had pre-prepared content in the meetings. Their facilitating activities were contingent upon what and how students presented their drafts and ideas about how to solve the examination assignment. The instructors primarily focused on making sense of students' thoughts related to their drafts and adjusted their guidance to their needs. In doing so, the instructors became the co-participants and co-contributors to the learning process as the students chose what to discuss, enacting their agency.

The orienting, executive, and controlling guidance offered by the instructors evolved as they engaged in the interactions with the students. The instructors' guidance and students' learning in these interactions were cyclic and mutually inclusive, forming a coherent learning ecology where both instructors and students engaged in making sense of how to design the examination assignment.

The online meetings were student-initiated as they first explicated their needs in the meetings by sharing their assignment drafts, which were the objects of interactions between the instructors and students in the meetings. The students extensively engaged in and contributed to the learning process from the beginning to the end of the meetings. The instructors engaged in making sense of students' ideas embodied in their drafts, vetting and reifying them to help students develop and enhance their conceptual understanding of the examination assignment. Their guidance functions were subject to change according to students' articulations of their needs. Students' active engagement in the learning process immersed the instructors in students' learning, as they explicated and validated students' ideas and directed the learning process. The students' agentic engagement and their contributions to the learning process positioned the instructors as co-contributors to develop and expand their conceptual understanding of various aspects of the examination assignment. Students' meaningful immersion in the learning process also demanded the instructors' guidance, which brought the instructors' agency into play by engaging them in understanding students' ideas, structuring them, and guiding them forward while addressing their needs [48]. This might suggest that students' agentic engagement might affect the guidance the instructors provide in online meetings, and by immersing in meaningful learning activities, both students and instructors can enhance their agency as active participants of and contributors to the learning process [39, 47].

To summarize, the instructors performed three mutually inclusive and evolving roles: orienting, executive, and controlling to assist the development of students' conceptual understanding during online meetings. The students' active engagement and contribution to the meetings made the instructors actively participate and contribute to students' learning. Thus, the instructors' guidance was contingent upon students' articulations of their needs in their pursuit to design the examination assignment.

7. Implications and directions for further research

There are several pedagogical implications for designing and facilitating social, collaborative learning activities in MOOCs and online courses. First, the course instructors performed three mutually evolving roles: orienting, executive, and controlling. While performing these roles, they set up the background for the online meetings, engaged in reifying and explicating the students' ideas, and assisted the students in developing their conceptual understanding of the examination assignment. However, these roles evolved out of collaborative practices aimed at designing the examination assignment. This indicates the need to integrate goal-oriented collaborative learning activities in MOOC and online

learning environments to assist students in developing their understanding of the target concepts.

Second, the differences in the guidance offered by an experienced and a novice instructor demonstrate different approaches to develop students' conceptual understanding. In particular, the guidance offered by the experienced instructor suggests the need to assist students in developing their understanding of the examination assignment by validating their actions and ideas against the text of the assignment and the assessment criteria.

Third, probably a more profound implication is that students' agentic engagement might affect the course instructors' guidance in online learning environments. The findings indicate that students were active in setting up and driving the learning process by expressing their ideas, justifying their approaches, to solve the assignment task, and articulating their needs for guidance. Such student engagement positioned the instructors as sense-makers and providers of feedback to students' ideas. In their words, the instructors' guidance was contingent upon students' contributions to the learning process. Students immersing themselves meaningfully in a collaborative learning process may activate their agency, calling for instructor agency in responding to as well as (re-) directing students' pursuit to solve the task. Such student engagement in the online meetings positions them as central drivers of their learning, which might contribute to enhancing their agentic capacity to learn. The instructors' guidance adjusted to students' needs might contribute to further enhancing their agentic development as professionals.

Finally, the instructors' guidance shaped by the students' agentic learning in online meetings might offer useful considerations about how to realize, expand, and enact agency. These considerations suggest that collaborative practices are of paramount importance for students' learning and development and indicate the need to offer synchronous, collaborative social learning activities in the predominantly asynchronous MOOCs format. Instructors have a vital role to play in supporting students' collaborative social learning activities. Numerous technologies are available to enable synchronous collaborative learning; however, the instructors have a vital role in including these technologies to help students develop their conceptual understanding and agentic capacity to learn.

These findings inform the practitioners, MOOC, and online course developers about how instructors facilitate students' learning online and how students' agentic online learning may influence their guidance. The instructors' and students' engagement in online meetings might therefore contribute to the development of students and instructors as learners and professionals. Further research would therefore benefit from a longitudinal study examining how students' engagement in online learning might enhance their agentic capacity to learn.

Appendix 1

Transcription notations

Symbol	Description
[ ]	Speech overlapping.
( )	Unclear section
Underlining	Denotes a raise in volume or emphasis.
CAPITALS	Louder or shouted words
[...]	Utterances removed from original dialog
...	Incomplete sentences

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Исследование функций преподавателей в процессе обучения студентов в онлайн-курсе о педагогическом использовании информационных и коммуникативных технологий

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В статье исследуются функции преподавателей в процессе обучения в онлайн-курсе с целью формирования навыков преподавания с применением цифровых технологий студентами педагогических вузов и учителями норвежских школ. В статье также рассматривается, как участие студентов в процессе обучения влияет на функции преподавателей в данном процессе. Онлайн-встречи студентов с преподавателями наблюдались и записывались. Встречи были направлены на развитие понимания студентами экзаменационного задания. Данные (4,5 часа видеозаписи) были проанализированы с использованием метода коммуникативного анализа. Результаты анализа показали, что преподаватели выполняли четыре основные функции: 1) начинали учебный процесс; 2) выясняли идеи студентов по выполнению экзаменационного задания; 3) помогали студентам в формировании их концептуального понимания; 4) обобщали и структурировали понимание студентами основных концепций. Данные функции педагогов возникли в ходе совместного обучающего процесса преподавателей и студентов. Активное участие студентов в процессе обучения было особенно заметно, когда они проявляли инициативу и открыто делились своими идеями по выполнению экзаменационного задания. Преподаватели, в свою очередь, играли важную роль в обсуждении идей и вопросов студентов, возникающих в совместном процессе обучения. Таким образом, активное участие студентов оказало влияние на педагогические функции преподавателей онлайн-курса. При таком подходе диалектическое взаимодействие между студентами и преподавателями является важным и одним из основных аспектов обучения в онлайн-среде.

Ключевые слова: функции преподавателя, активное участие студентов, онлайн-преподавание, обучение, взаимодействие, агентность, П.Я. Гальперин.

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INSTRUCTORS' EPISTEMIC INTERVENTION STRATEGIES IN MOOC DISCUSSION FORUMS

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ABSTRACT

Facilitating students' learning in a massive open online context is challenging for instructors in online teaching. The instructors should enact their professional (epistemic) feedback-giving skills to understand when, how, and why to address learning problems. In this study, we address this issue in terms of agency and suggest strategies that teachers can use to address these problems constructively. This study examines how instructors' professional agency comes into play in selecting how to intervene to assist students in solving problems in course discussion forums (Facebook group and Canvas discussion forums), which we refer to as an epistemic intervention strategy (EIS). By analyzing discussion forums' dialogical posts using thematic analysis and epistemic network analysis, we found that instructors adopted five different EISs to address students' learning. The EISs emerged during the processes of facilitating students' learning and were influenced by the complexity of students' questions and positioning in learning in the discussion forums. The findings of this study can inform practitioners that facilitating learning in online discussion forums may demand that instructors go beyond their feedback-giving skills to enact professional agency.

Keywords: *professional agency, student agency, epistemic intervention strategy, zone of proximal development, MOOCs*

INTRODUCTION

This study examines how instructors enacted their professional feedback-giving skills, which we refer to as teachers' epistemic intervention strategies (EISs), to support students' learning in the Facebook group and Canvas discussion forums of an institutional massive open online course (MOOC) offered by a Norwegian university college aiming to develop students' (preservice and in-service teachers) professional digital competence. It also examines how instructors' EIS was affected by student agency in learning in the discussion forums. The first generation of MOOCs, also called connectivist MOOCs or cMOOCs, envisioned students working as autonomous actors who could build up and expand learning networks, with instructors being able to participate in the working of these networks (Downes, 2012). Learning as a process of connecting, growing, and navigating resources occurs through the construction and traversing of the networks; thus, knowledge and cognition are distributed across networks (Siemens & Tittenberger, 2009). Therefore, the emphasis was given to promoting the principles of autonomy (contributions to interaction according to one's space, pace, means, and values), diversity (approaching the matter from multiple perspectives), openness (mechanisms allowing various views), and interactivity (connection and interaction between participants) for learning and creating knowledge together (Downes, 2012). However, empirical studies indicate that open landscapes of cMOOCs may challenge learners to find and engage in proper networks independently. Thus,

instructors' proper pedagogical support is required to promote students' learning in different spaces (e.g., discussion forums) (Bozkurt & Keefer, 2018; Downes, 2019).

The second generation of MOOCs, also called xMOOCs, emphasizes offering fine-tuned quality content for learning independently (Bates, 2020). However, the distinction between cMOOCs and xMOOCs remains blurry as current versions of MOOCs tend to take a hybrid form (Bayne & Ross, 2014), and different types of MOOCs are emerging in different national and international contexts (Liyanagunawardena et al., 2019). Principles of original cMOOCs may also be promoted in xMOOCs because they emphasize connection, discourse, and collaboration among participants, mainly through discussion forums. Although the Pedagogical Information and Communication Technology Massive Open Online Course (ICTPED MOOC), the object of this study, is like an xMOOC, it encourages participants' active engagement in sharing ideas and interacting with fellow participants and instructors through synchronous (e.g., Teams and Zoom) and asynchronous (e.g., discussion forums) means. Research studies have consistently documented that one of the reasons students drop out of MOOCs is the lack of instructor presence and engagement in facilitating students' learning (Aldowah et al., 2020; Kotzee & Palermos, 2021). This study examines various intervention strategies instructors used to support students' learning in discussion forums of the ICTPED MOOC, which may have consequences for collaborative learning and students' retention in online courses (Kotzee & Palermos, 2021).

Course discussion forums are one of the primary tools and spaces for communicating and exchanging ideas and social learning in MOOCs (Aldowah et al., 2020; Almatrafi & Johri, 2019). Communication and the exchange of ideas in these forums create an interactive learning environment, which aims for the development of a zone of proximal development (ZPD) (Vygotsky, 2012). ZPD is a sociopedagogical space that allows instructors or more knowledgeable participants to know, clarify, and assess students' knowledge claims or actual understanding of learning content or problems and to conceive possible interventions to address the lack of knowledge (Kostogriz & Veresov, 2021). Facebook group and Canvas discussion forums can nurture what Derry (2013) calls the "space of reasons" (p. 230), which is developed in and through collaborative teaching and learning activities. However, the mere availability of forums does not ensure learning (Parks Stamm et al., 2017), and discussion forums should be nurtured as "spaces of reasons." This can be accomplished when teach-ers think strategically about when, how, and why to intervene in students' learning activities, as too little or excessive interventions may discour-age students engaging in learning (Palloff & Pratt, 2011). Teachers need to enact their epistemic agency—the capacity to make principled choices in taking actions to address students' learning by participating in collective discourse (Maclellan, 2017). Furthermore, the ways instructors intervene to encourage learning in MOOC discussion forums may influence student agency—the capacity to learn how to engage meaningfully in learning to develop and advance conceptual understand-ing (Engeness, 2021). Thus, we conceptualize instructors' EISs as the enactment of instructors' professional knowledge, which is defined as the capacity to make pedagogical choices in decid-ing when, why, and how to intervene in students' learning in MOOC discussion forums, which we report in this study. From the cultural-historical theory perspective, which we adopted for this study, knowledge is not information to be stored and retrieved but a set of activities to be developed, enacted, and re-enacted while solving problems in the shared space (Arievitch, 2020). Higher-order thinking develops in the spaces of engagement, but MOOCs often fail to promote student engagement, interaction, and collaborative learning (Margaryan et al., 2015). We address these challenges by iden-tifying and illuminating the relative importance of intervention strategies that instructors use to address students' learning problems in MOOC dis-cussion forums.

LITERATURE REVIEW

The debate concerning when and how instructors should intervene in students' learn-ing processes still looms in traditional and online learning environments. Scholars recognized the importance of instructor intervention in online learning long before the MOOC era (Chiu & Hew, 2018; Garrison, 2017). When it comes to fostering constructive learning in online education, previous studies offer conflicting and inconclusive findings.

For example, instructors' excessive interventions, such as correcting every question, might discourage student engagement and participation in online learning environments (Andresen, 2009; Palloff & Pratt, 2011). The more instructors post in the discussion forums, the shorter the length of the discussion becomes (Dixson et al., 2006; Mazzolini & Maddison, 2003), but lengthy discussions might foster deep learning (Mazzolini & Maddison, 2003). Thus, student engagement (Martin & Bolliger, 2018) and teachers' strategic facilitation (Martin et al., 2020) matter for more productive learning in discussion forums. Engagement as a key driver for learning (Deng et al., 2020) is promoted when active learning and peer interaction are supported by course instructors (Hew, 2016; Martin et al., 2020). Engaging with peers and instructors fosters meaning-making activities in MOOC discussion forums (Hew, 2016; Shea et al., 2022). Instructors need to have in-depth professional knowledge and enthusiasm to monitor students learning activities and mobilize resources to facilitate students in discussion forums (Hew, 2016; Martin et al., 2020).

Martin et al. (2020) conducted a qualitative (interview) study with eight award-winning faculty members in the United States and outlined five different roles for online teaching: facilitator, course designer, content manager, subject matter expert, and mentor. Their common task was course design and teaching. They found the facilitator's role was the most important one, which includes pedagogical tasks of welcoming students, helping students feel comfortable and managing time, being responsive to students' queries or needs, providing feedback, and promoting interaction and engagement. Therefore, recent studies suggest including both synchronous and asynchronous approaches to facilitate students' learning in online environments (Martin et al., 2023).

In conventional MOOCs (i.e., the xMOOCs offered by big platforms such as FutureLearn, Coursera, and edX), instructors, especially teaching assistants (TAs), are the main actors in supporting students' learning in MOOC discussion forums by keeping track of their learning activities and intervening to address learning problems (Ntourmas et al., 2019; Singh & Mørch, 2018). However, Ntourmas and colleagues found that some TAs lacked knowledge about how to address students' learning needs and promote interaction and collaboration among them. Their study raised questions about the capacity of TAs to address these needs and promote collective knowledge-building in MOOC discussion forums. For instructors, discussion forums remain a vital tool for monitoring students' learning activities and devising strategies for further interventions (Jiang et al., 2015). For students, discussion forums are spaces for offering and receiving help in their learning (Breslow et al., 2013). Those who engage in peer interaction are more likely to complete the course than those who do not (Sunar et al., 2016), and those who never receive responses in discussion forums are more likely to drop the courses than those who do (Schaffer et al., 2016). Therefore, several studies indicate the importance of integrating social media such as Facebook into MOOCs, as they might augment the exchange of ideas, interaction, personal learning, network-building, student motivation, and retention (Chen & Chen, 2022; Ripiye et al., 2017). Lack of social interaction leads to feelings of isolation, resulting in disengagement and dropping out (Badali et al., 2022). Interaction and dialogue, which MOOCs often fail to promote, are required to enact and enhance human agency in learning (Harasim, 2017). Individual learners grow from interaction with fellow learners, improving their social and cognitive learning abilities (Galikyan et al., 2021).

Social (engaging collectively with others) and cognitive (meaning-making) activities are interdependent. Empirical studies drawing on the community of inquiry framework (Garrison, 2017) have consistently demonstrated that establishing and sustaining social presence in MOOC discussion forums foster students' meaning-making and knowledge construction efforts (Shea et al., 2022). For example, feedback or comments that instructors or fellow students provide on students' postings are the most important factors affecting participation and persistence in online courses (Aldowah et al., 2020; Giacumo & Savenye, 2020). Instructors' prompts, such as icebreakers, including introductory posts (e.g., seed questions), hands-on exercises, and self-test assignments, and triggered discussions, including ambiguous questions, might promote student participation and collaborative learning in MOOCs (Giacumo & Savenye, 2020). Instructors and students consider

instructors' participation in discussion forums to be an essential factor contributing to quality online learning (Hew, 2015). Thus, teacher presence and feedback positively affect engagement and discussion in discussion forums. More engaged students learn more effectively, develop critical thinking, and demonstrate improved learning outcomes (Dyment et al., 2020).

Findings from previous research studies on ICTPED MOOC (and our research object) show that students mainly engage in learning through textual information and audio-video materials in the course (Engeness & Nohr, 2020; Engeness et al., 2020). By engaging with video tutorials, students learn how to engage in learning resources and use them to solve their learning problems, creating the possibility for fostering student' agency (i.e., the capacity to know how to engage meaningfully with learning resources) (Engeness et al., 2020). These studies point out the need for further research on how the actual facilitating and learning processes take place in online learning environments.

Beer (2019) observed that students' activities of listening and watching audio-video resources and posting questions and comments on MOOC discussion forums contributed to reflective and interactive activities, leading to transformative learning development. However, such activities remained at the lower levels (e.g., posting and commenting) of Mezirow's seven stages of critical reflection. The higher levels of transformative learning, according to Mezirow (2003), such as challenging perspectives, critical reflections, and discourses, rarely existed in the discussion forums, which may demand instructors' engagement in supporting students' learning.

To summarize, the literature mentioned above clearly indicates the importance of teacher engagement in MOOC discussion forums for promoting participation and engagement in learning and reducing the number of student dropouts from the course. These studies overwhelmingly demonstrate that the instructors' presence in discussion forums promotes productive learning. They mainly focus on improving MOOC design to promote instructors' participation, but none of the studies discuss how instructors address students' ever-emerging discussion forum learning activities. Our study addresses this by examining how instructors enact their professional agency in addressing students' learning problems. We address the gap in previous research by asking the following research questions:

RQ1: How did the instructors' professional agency come into play when selecting intervention strategies to support the students' learning?

QR2: How was the instructors' intervention affected by the students' agency in learning in discussion forums?

THEORETICAL FRAMEWORK

Zone of Proximal Development

Vygotsky argued that concept formation and conceptual change occur when "empirically rich but disorganized" everyday concepts meet systematically organized adult concepts or scientific concepts (Vygotsky, 2012, p. l). The meeting between these two concepts refers to a collaborative teaching and learning situation where instructors engage in sensemaking with students and assess students' ideas, questions, and comments, which results in scaffolding or pedagogical supports in developing and expanding students' conceptual understanding of learning content or problems. Vygotsky asserted that instruction should therefore be carried out in students' ZPD (Vygotsky, 2012).

We conceptualize the ZPD as a sociopedagogical space where collaborative teaching and learning activities take place and where learners and instructors are interconnected in "a holistic process of interaction, intellectual development, and upbringing" (Kostogriz & Veresov, 2021, Contextualizing the ZPD, para. 2). We also conceptualize ZPD as a diagnostic tool by which instructors assess students' learning activities and devise strategies to address their learning needs. The sociopedagogical space is created through three distinct and interrelated domains of practice: "the material-semiotic, the cultural-historical, and the lived" (Kostogriz, 2005; cited in Kostogriz & Veresov, 2021, Pedagogical implications of the ZPD for Teaching in Diverse Settings, para. 1). The first domain is the availability and arrangement of organized material-semiotic resources or historically produced signs, tools, and means for learning and development, such as various multimodal resources (texts, audios, videos, tutorials, or reference materials) in the MOOC. The second domain encompasses "cultural-historical practices that create social environments," that is, "an intellectual space" (Kostogriz & Veresov, 2021,

Pedagogical implications of the ZPD for Teaching in Diverse Settings, para. 1) for education and development where relational practices are formed using material-semiotic tools for accomplishing joint activities. The third domain is the space of lived experiences or an intersubjectivity space where instructors and learners engage in dialogical communication, meaning-making, and collaborative learning. In the third domain, a new meaning is produced when students and instructors engage in exchanging ideas. Therefore, from the cultural-historical perspective on teaching and learning, instructors and students learn from each other when they engage in problem-posing and problem-solving activities collectively (Stetsenko, 2017). Professional agency as the capacity to understand and explain how to solve problems systematically by positioning in epistemic practices is learned, enacted, and developed in and through practices (Edwards, 2015).

We argue that MOOC discussion forums may be developed as the shared space for intellectual development if students and instructors systematically engage in making sense of and clarifying ideas with the aim of solving problems. However, they should go beyond simply posting and commenting in discussion forums to enact agency in teaching and learning. The instructors should actively engage in making sense of students' questions, think carefully about the ways of addressing them, and make sure that students' questions are addressed properly. Such processes require instructors' epistemic agency to promote students' learning. Agency as the capacity to make principled choices in selecting appropriate intervention strategies by participating in discourse (Maclellan, 2017) is relevant in this case as instructors should work with students and draw on their resources as well as the resources distributed across systems (Edwards, 2015). Instructors' enactment of their epistemic agency can influence student agency—the capacity to meaningfully engage in learning activities (Engeness, 2021)—and vice versa, as agency as the capacity to engage meaningfully in learning activities is realized, enacted, developed, and expanded in and through collaborative teaching and learning practices (Stetsenko, 2017). The focus of collaborative interventions is to help students advance their understanding of existing (spontaneous) concepts by "demonstrations, leading questions, and by introducing the initial elements of the task's solutions" (Vygotsky, 1987, p. 209). In online, credit-based courses, instructor interventions are usually required to clarify misunderstandings or misconceptions, to provide accurate feedback, to ensure that the criteria for academic learning—such as the use of evidence of claims, clarity of argument, and so on—are being met, and to ensure the necessary input and guidance so that students seek deeper understanding (Harasim, 2017).

METHODOLOGY

This study is primarily a qualitative research inquiry using nonparticipant observation and survey methods to examine how instructors adopt intervention strategies to support students' learning needs in an online learning context. Discussion forum exchanges are the primary data sources. The secondary data source is a postcourse survey designed to gain further insight into students' online learning experiences.

Setting and Participants

ICTPED MOOC is a credit-bearing course to develop digital competence among preservice and in-service teachers. The MOOC is an xMOOC; it consists of seven modules and includes video lectures, textual information texts, automated quizzes, and assignment tasks. The MOOC offered through the Canvas platform was in Norwegian and open to all Norwegian teachers (preservice and in-service). In the ICTPED MOOC, students had an opportunity to interact with the course instructors and their fellow students on Facebook group and in Canvas discussion forums and could also join online meetings with them. A total of 365 students signed up for the course, and 238 students completed it. The Facebook group contained 299 people, including six instructors and the Ammar Bahadur Singh as an observer. The number of participants varied in the discussion forums of each course module, but 78 students and six facilitators/instructors (two facilitators and four course instructors) engaged actively in the Canvas discussion forum of Module 3. One of the facilitators was engaged in handling technical issues for several in the same course, while another was a teaching assistant who had already completed the same course. Most of the discussions in the forums were about the examination assignment, and in Module 3 the students had to complete obligatory individual examination assignments. Therefore, the discussion forum of Module 3 was selected for the data analysis. On

average, 122 students responded to various questions in the postcourse survey. The primary data materials were the postings made by instructors and students in the Facebook group discussion and a Canvas discussion forum. The postcourse survey was the secondary data material.

Data Materials and Data Collection

The discussion forum data were collected using the method of nonparticipant observation (Mann & Stewart, 2000). Ammar Bahadur Singh was authorized to see, read, and use discussion forum data for research purposes. After the course was over, the students' discussion forum exchanges were carefully read and documented manually. Following the institutional guidelines for personal data protection, the data were anonymized in the documenting process. The anonymized survey data were obtained from the course administrator.

The survey questions consisted of two parts: the first part used a five-point Likert scale and in the second part students provided their comments. By analyzing the questions, we were interested in gaining further insights into students' perceptions and experiences of giving and receiving learning support from fellow students and course instructors or facilitators. The selected survey questions were integrated into different themes derived from the thematic analysis so they could provide further insight into the themes. The main survey questions selected for the analysis were:

1. To what extent were you satisfied with the feedback and guidance you received on the Facebook group and in the Canvas discussion forum?
2. To what degree have you been active in discussions in the Facebook group and the Canvas discussion forum?
3. To what degree were you satisfied with the guidance through video meetings?
4. From whom did you mainly seek help with your studies in the course?
5. How do you assess your experience of peer review assessment (only the pedagogical value, not the technical challenges)?
6. What is your assessment of the video feedback in the course?
7. How did you experience providing video feedback to fellow students?

DATA ANALYSIS

Thematic Analysis of Discussion Forum Data

The discussion forum data consisted of three types of data: thread posts without any discussions (information shared mainly by instructors), thread posts that invited discussion between instructors and students, and thread posts that invited discussion only between students. The thread posts inviting discussion between instructors and students and between students were considered dialogical exchanges, which aimed to solve various problems and contradictions related to course content. Each discussion thread contained a question or comments and replies from instructors and students, referring to the instructors' interventions in this study. Out of 218 posts, 194 were dialogical posts in the Facebook discussion forums, and all 79 posts in the Canvas discussion forum of a course module called Multimodal Text were dialogical. All dialogical posts were thematized. Significant activities that instructors and students carried out were also thematized during the process of thematic analysis. We conducted an inductive thematic analysis (Braun & Clarke, 2012, 2020) following the procedure shown in Table 1. The themes generated are shown in Table 2.

Table 1.
Process of Thematic Analysis

Steps	Activities
Gaining familiarity with the data	Reading, rereading, note-taking, and translating discussion threads Consulting with course instructors to understand some confusing posts
Generating themes	Listing discussion thread posts and coding them Giving a code to each discussion thread post and each discussion post that follows Combining thread post codes and discussion post codes
Searching for themes	Rereading the discussion lines and discussion threads to find new themes Comparing themes
Reviewing themes	Listing themes Combining or collapsing themes
Defining and naming themes	Naming, defining, and exemplifying themes Categorizing themes based on the modality of interventions and based on teamwork
Reporting themes	Developing a theme book

Epistemic Network Analysis

As a supplementary analytical method, we also conducted epistemic network analysis (ENA) to visualize the patterns of instructors' feedback-giv-ing activities by measuring the numerated and the centrality values in the discussion forums, using the themes gen-erated from thematic analysis and comparing the weighted values of relations of the themes for each instructor. ENA is based on the theory of epistemic frames (Shaffer, 2017), which stipulates that human activities are situated in communities of practice and involve knowledge-based (epistemic) conver-sation. Learning is embedded in these interactions, and thus learning is an interpersonal process where learners are engaged with peers or instructors. The themes generated through the thematic analysis were used to characterize the instructors' feedback-giving strategies (see Table 2). To the best of our knowledge, instructors did not devise intervention strategies in advance; they emerged while addressing students' learning needs in the discussion forums. We refer to them as the EISs that emerge from the combined thematic analy-sis and ENA. Following the national guidelines for privacy protection, according to the General Data Protection Regulation, the instructors were informed that this study was being conducted. All instructors agreed to participate in this study by signing an informed consent form.

FINDINGS

Findings from Thematic Analysis

Using thematic analysis of dialogical post-ings in the discussion forum, we identified five major types of intervention strategies: (a) textual interventions, (b) video or textual-video tutorial interventions, (c) referral interventions, (d) remote interaction interventions, and (e) peer interven-tions. These strategies are defined and exemplified in Table 2.

Textual Intervention

The most common type of intervention was textual intervention. In both discussion forums, instructors and students were heavily engaged in replying to questions and writing comments. Textual inventions functioned as a catalyst for developing dialogue between instructors and stu-dents and between students and students.

Table 2.

Defini	Intervention strategies	Explanations	Examples
1	Textual intervention	Students post a question, and one instructor attempts to explain it in written comments.	S1: How can I show that I have copyright? T2: Show it in your reflection video.
2	Video intervention or Textual-video tutorial intervention	Instructors reply to students' questions with a self-made video that contains a much more elaborate explanation of a question or comment. Instructors answer students' questions in writing with a link to video tutorials that provide further information about the topic or question asked.	S35: How can the examiner open the file created in LearnLab? T1: Video reply to the question. S159: I could not import video clips into OneNote. T2: Find the menu on the top right side and click on import. You can see the video tutorial here also (link...).
3	Referral intervention	Instructors sometimes asked fellow instructors to answer students' questions by tagging them in the comments section.	S45: Video is not working in PowerPoint. T2: T6, will you please check it? T6: Will you please join the online video guidance meeting?
4	Remote interaction intervention	Instructors invite students to online guidance meetings as they think the problems need to be seen in detail and solved jointly.	S204: I cannot upload audio files in iBook Creator. I need urgent help. T3: Could you join the online guidance meeting this evening?
5	Peer intervention	Instructors and fellow students join in sharing their situations or problems and how they dealt with them.	S192: I cannot figure out how to send links to my videos to the examiners. S81: I have the same problem. S206: Copy the links in Word docs and attach the doc in the comments field.

The major types of textual intervention are:

a. answering students' questions;
b. elaborating and verifying students' ideas or thoughts;
c. figuring out students' problems or challenges; and
d. inviting students into discussions.

Video Intervention and Textual-Video Tutorial Intervention

Video interventions were exclusively used in the Canvas discussion forum by one instructor. The video contained a detailed explanation of students' questions with suggestions for possible learning resources. Textual-video tutorial interventions were mainly used in the Facebook group. Some instructors replied in written form and embedded links to video tutorials that could help students further understand the questions or content. Video interventions and textual-video tutorial interventions did not allow much discussion of the issues between instructors and students as students stopped raising questions or posting comments after this type of intervention. Survey data demonstrated that most respondents were satisfied with the video interventions that instructors used to support their learning process.

Figure 1.
Students' Assessment of Video Feedback (N=121)

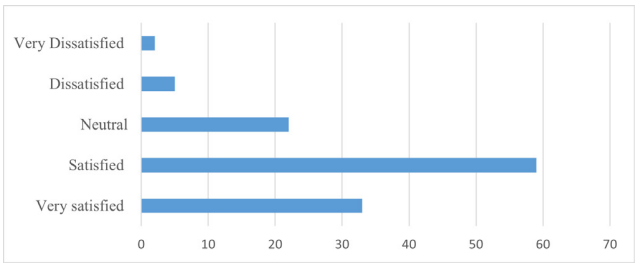


Figure 1 shows that most respondents were satisfied with the video interventions. This was because video feedback offered personalized feedback to the students, and students could also repeatedly use it. Some students did not know whether video feedback helped them or not, and a few remained dissatisfied.

Referral Intervention

In referral interventions, two or more instructors replied to students' questions and comments. Instructors in both discussion forums engaged in referral interventions, but instructors' referral intervention frequency was much higher in the Facebook group than in the Canvas discussion forums (see Figure 2). This type of intervention allowed more dialogue and discussion among instructors and students.

The main activities of referral interventions are as follows:

a. answering students' questions and explaining their comments;
b. referring students' questions or comments to fellow instructors;
c. joining fellow instructors in replying to students' questions and comments; and
d. sharing reference resources (video tutorials and reading materials).

Peer Intervention

Peer interventions were more frequent in the Facebook group than in the Canvas discussion forum. The peers (e.g., students who worked together in small groups) were frequently engaged in sharing their experiences, answering each other's questions, and commenting on their opinions or posts. Instructors rarely engaged in peer intervention. The instructors let students engage in prolonged discussion in the Facebook group and did not intervene to answer questions. Peer intervention was very limited in the Canvas discussion forum, where instructors more commonly engaged in answering questions and comments.

The significant activities of peer interventions are as follows:

a. posting questions, comments, or opinions;
b. answering fellow students' questions;
c. sharing experiences of solving a problem; and
d. finding fellow students working in the same subject area or school level for further discussion in online meetings.

Table 3 shows the frequency of different interventions in the Facebook group and Canvas discussion forum.

Survey data also suggest that students were more active in the Facebook group than in the Canvas discussion forum. Instructors mainly used textual intervention in Canvas, while peer intervention was the most common intervention strategy on Facebook.

Table 3.
Overview of Instructors' Intervention Strategies in Facebook Group and Canvas Discussion Forum

Epistemic intervention strategies (EISs)	Facebook group	Canvas discussion forum
Textual interventions	26%	65%
Video or textual-video tutorial interventions	1%	7%
Referral interventions	12%	5%
Peer interventions	57%	5%
Remote interaction interventions	4%	18%

Figure 2.
Students' Degree of Activeness in the Facebook Group and Canvas Discussion Forum

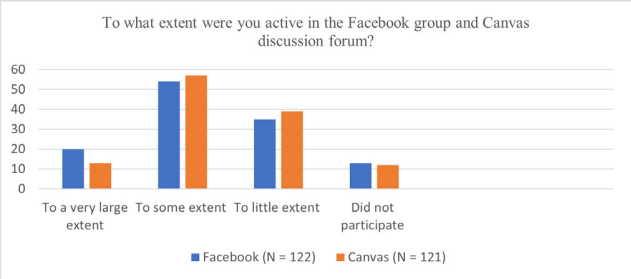
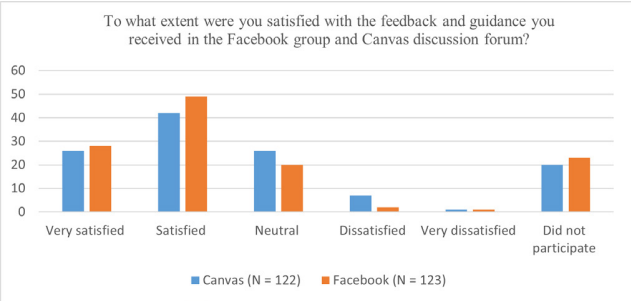


Figure 2 shows that only some students remained active in the discussion forums, and many reported that they were active to a little or very little extent. A slightly higher number of respondents were more active in the Facebook group than in the Canvas discussion forum. Most respondents were active to some degree in both forums, while some respondents did not participate in either.

Figure 3.
Students' Degree of Satisfaction with Instructors' Feedback and Guidance in Discussion Forums



As shown in Figure 3, most respondents were satisfied with the instructors' feedback and guidance in the discussion. Slightly more students were satisfied with the feedback and guidance in the Facebook group compared to that of the Canvas discussion forum. One of the reasons for this was that instructors were quicker at responding to questions and comments on Facebook than in Canvas.

Remote Interaction Intervention

Instructors used remote interaction intervention to support students' learning processes in both discussion forums. The frequency of remote interaction intervention in the Canvas discussion forum was higher than in the Facebook group. The instructors asked students to join the Canvas discussion forum for more detailed answers to questions raised. Remote interaction interventions were the maximum support that instructors could offer to the students to help them learn collaboratively.

Survey data suggested that most students who participated in online meetings with instructors were satisfied with the engagement. Online meetings were part of the instructors' remote interaction intervention strategy.

Figure 4.
Students' Degree of Satisfaction with Instructors' Guidance in Online Meetings

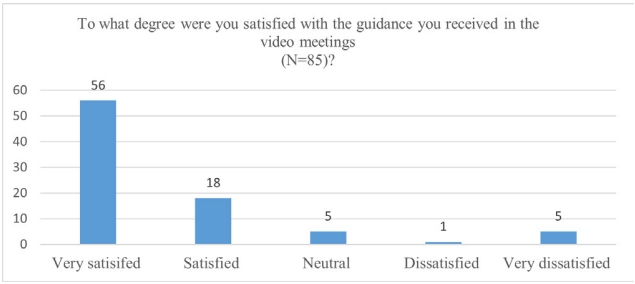


Figure 4 shows that respondents were *satisfied* or *very satisfied* with the instructors' guidance in the video meetings. The reason for this was that students were eager to engage with course instructors who could help them understand and solve problems. Some remained uncertain whether the video meetings helped them understand the issues, and a few were dissatisfied.

FINDINGS FROM ENA

We used a freely available online epistemic network analysis tool (https://www.epistemicnetwork.org/) to characterize and visualize six instructors' (T1, T2, T3, T4, T5, and T6) feedback-giving

strategies based on the five thematic codes outlined in Table 2. The depiction shows the structures of the relative importance of the different intervention strategies for each instructor below.

The ENA tool successfully visualized four instructors' feedback-giving strategies, but two instructors (T5 and T6) were not shown as their activities were low and unevenly dispersed in the Canvas discussion forum (Figure 5). There was a strong connection between referral and textual interventions for all instructors. T1 and T2 were more frequently engaged with textual, peer, video, and remote interaction interventions, T3 with referral, textual, and remote interaction interventions, and T4 with textual and referral interventions.

The ENA tool depicted five instructors' feedback-giving strategies in the Facebook group (Figure 6). These instructors were more frequently engaged with textual, peer, and referral interventions. They were all strongly connected to peer intervention as they did not unnecessarily engage in the students' discourse in the Facebook group, reaffirming the findings from the thematic analysis. T1, T2, T3, and T6 were less frequently engaged with remote interaction interventions and textual-video tutorial interventions, whereas T4 was more frequently engaged with textual-video tutorial interventions.

DISCUSSION

In this section, we will first summarize our findings and then discuss the findings regarding how instructors' professional agency came into play in selecting the EISs to address students' problems and foster their learning in discussion forums (RQ1). Finally, we will discuss how students'

Figure 5.
ENA of Instructors in the Canvas Discussion Forum

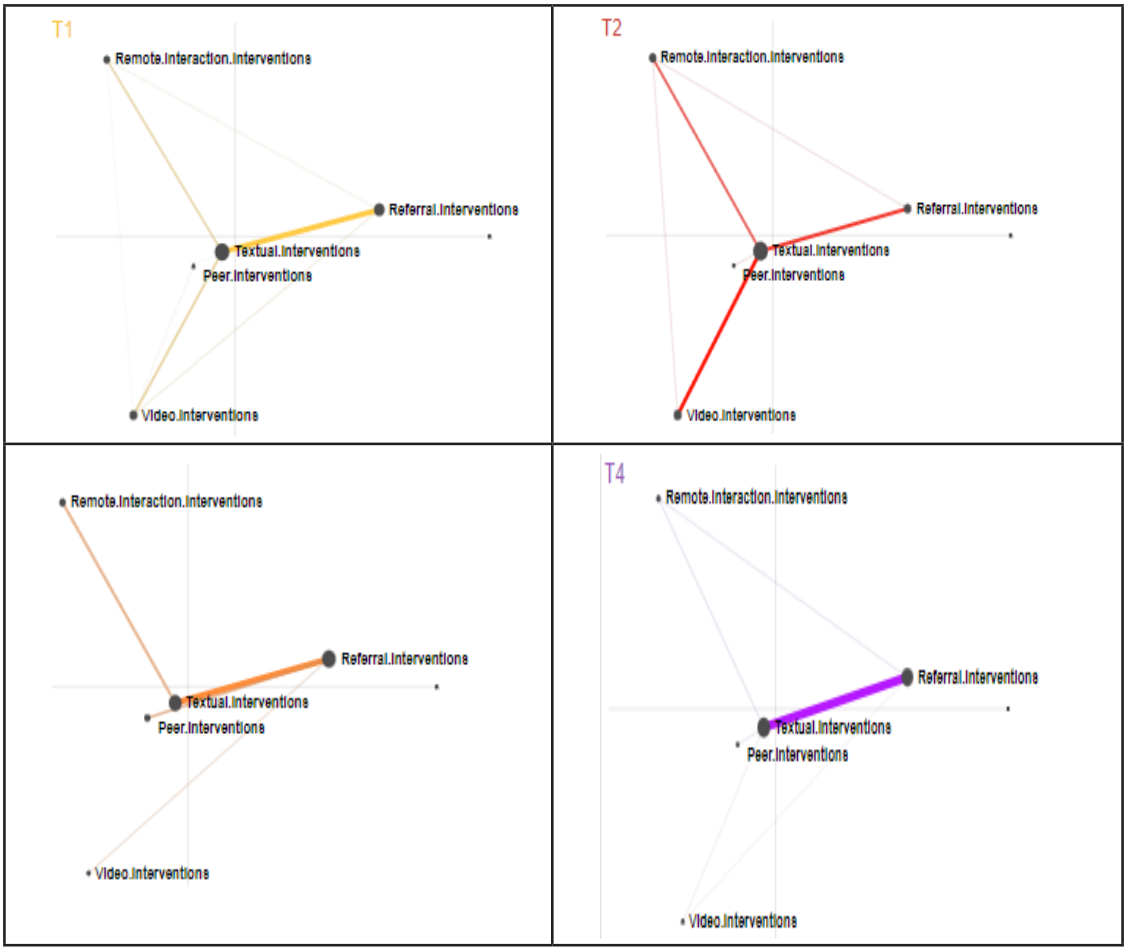
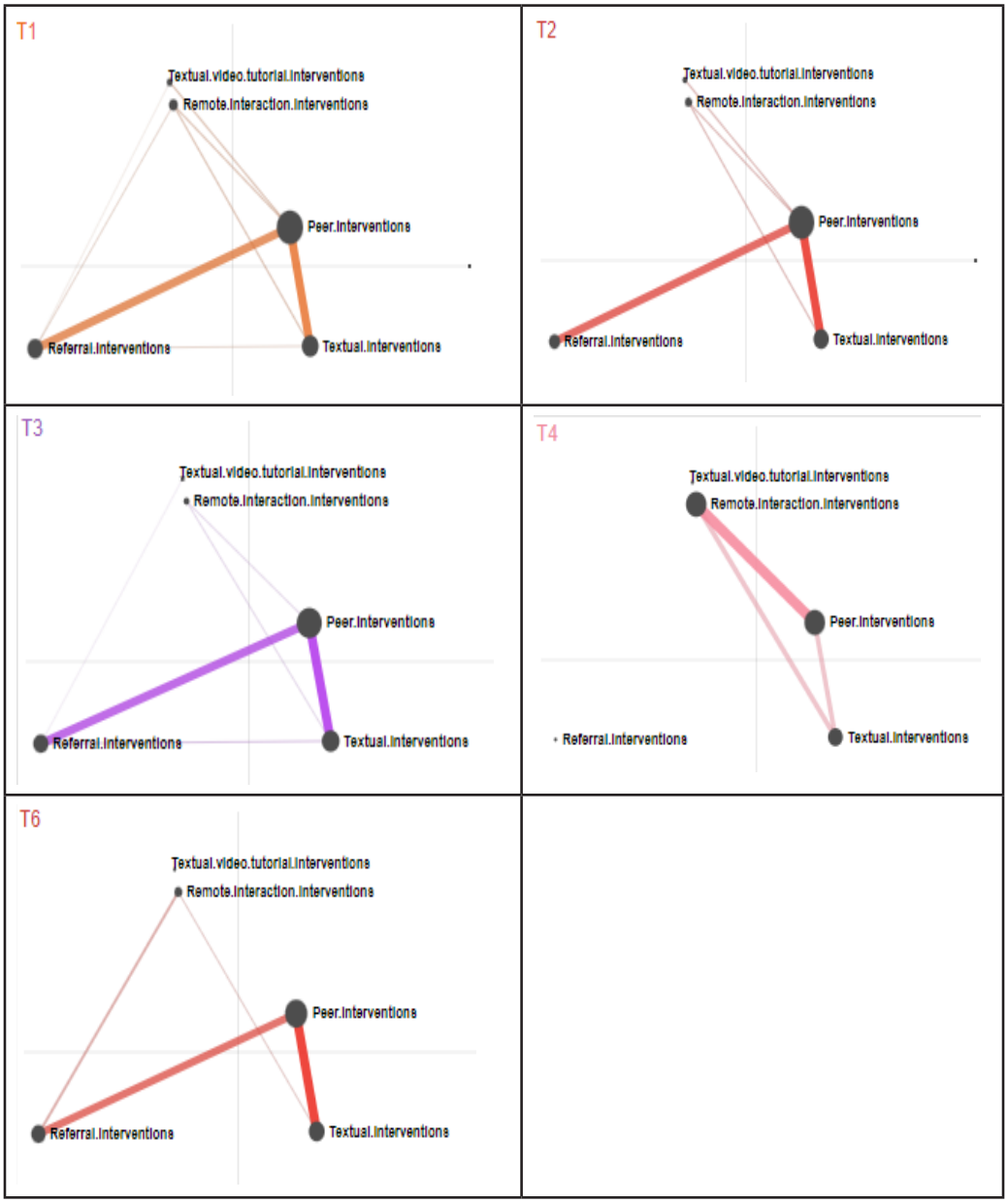


Figure 6.
ENA of Instructors in the Facebook Group



agency influences instructors' selection of EISs to address students' problems (RQ2).

Epistemic Intervention Strategies

The analysis of the findings showed the instructors employed the five EISs to address students' learning problems in course discussion forums. We briefly summarize them below:

- **Textual intervention:** Instructors used written language to address students' questions and comments in the discussion forums. It is the most common EIS that the instructors used to communicate with students and foster their engagement and learning, confirming the findings from previous studies that text-based interaction is the most dominant mode of interaction between participants in MOOCs (Oh et al., 2018; Shea et al., 2022).

- **Video or textual-video tutorial intervention:** Some instructors created short videos to provide detailed explanations and personalized feedback to students about their problems, which was well received by most students. It is a new form of pedagogical scaffolding in the MOOC. Some instructors replied to students' questions in written language and shared links to video tutorials to help students develop a deeper understanding of their problems. Videos can also assist students in developing a conceptual understanding of how to solve individual learning problems, thus enhancing their agency in learning (Clark et al., 2018; Engeness et al., 2020).
- **Referral intervention:** Instructors asked fellow instructors or facilitators to address students' problems when they are unsure about how to answer the questions themselves. It may foster instructor collaboration in facilitating students' learning. The more instructors communicate together concerning how they can address students' problems, the more effectively they can foster students' learning. Thus, the referral intervention can be a promising strategy to support students' learning in MOOCs.
- **Peer intervention:** Instructors allowed more peer interventions in the Facebook group discussion than in the Canvas discussion forum by not intervening in their activities. When students shared their experiences and reflections on how they solved their problems, instructors disengaged with peer discussions. Peer intervention can become a critical tool to foster peer collaboration, which develops students' critical thinking in MOOCs (Dyment et al., 2020; Oh et al., 2018).
- **Remote interaction intervention:** Instructors invited students to online, live guidance meetings to address their queries, especially for how-to-solve questions. Most students were satisfied with online guidance meetings that promoted social and collaborative learning in MOOCs (Singh &Engeness, 2021). Logical thinking or higher-order thinking is developed in and through instructor-student interactions (Margaryan et al., 2015).

The abovementioned EISs can be grouped into two modes: communication and teamwork. Textual intervention and video intervention are based on communication, whereas referral, peer, and remote interaction interventions can be described as teamwork. However, these two modes (communication and teamwork) are not mutually exclusive. For example, in the referral intervention and peer intervention, the mode of communication was primarily the written text. On the other hand, the mode of communication in teamwork-based intervention included both written and spoken forms of language. These EISs emerged when instructors engaged in making sense of students' problems and scaffolding pedagogical supports to address the problems in the best possible manner. Thus, engaging with instructors' learning activities, figuring out problematic issues, and taking actions to address problems aiming to foster students' learning is the enactment of instructors' professional agency in teaching in online learning environments. In the next section, we discuss how instructors' professional agency came into play to devise appropriate pedagogical supports to solve students' problems.

Instructors' Professional Agency and Epistemic Intervention Strategies

The EISs emerged as a result of instructors' active engagement in making sense of students' learning problems (e.g., how to solve the examination assignments) and in scaffolding appropriate EISs to address the problems by mobilizing and creating resources. We conceive of this as instructors' professional agency in teaching (Edwards, 2015; Stetsenko, 2017), and agentic instructors can make appropriate pedagogical choices in when, how, and why to intervene in students' learning activities (Maclellan, 2017). For example, questions like how to submit the examination assignment, and what a particular term or expression in the course means were often immediately answered by the instructors in written texts. If students required more detailed explanations and personalized feedback, some instructors employed video or textual-video tutorial intervention that involves creating short video feedback and sharing this and other tutorials to answer students' questions and

deepen their understanding of the questions. Since the video feedback was posted in the discussion forums, all students could access it and learn from it, despite it being directed to one student. Creating video feedback was a challenging task as instructors had to organize their knowledge and present it succinctly. Video intervention can be taken as one of the sophisticated EISs that instructors could use to provide more detailed and personalized answers as well as feedback to students' questions and comments rather than just a mode of intervention. Creating videos to give feedback and address students' problems is a new form of scaffolding that can also enhance instructors' professional digital competence. Video can effectively assist students' learning and develop their agency in learning as students learn to understand and solve problems (Clark et al., 2018; Engeness et al., 2020).

When some instructors/facilitators were unsure about how to address students' questions, they asked fellow instructors with the expertise to address the questions more appropriately. Assessing who could correctly answer questions can be taken as the enactment of instructors' epistemic agency because "epistemically agentic teachers take responsibility for their own and their learners' cognitive advancement, and when they recognize gaps, they take steps to address them" (Maclellan, 2017, p. 144). Thus, enacting epistemic agency can foster communication and collaboration between instructors aiming to facilitate students' learning.

Likewise, instructors employed remote intervention to discuss the problems and resolve them collaboratively when they found students struggling with complex issues, such as creating multimodal texts in iBook Creator. Remote interaction between instructors and students is much-needed pedagogical support in MOOCs because students drop out of the course because of the lack of interaction with instructors (Gamage et al., 2020; Hew, 2016). Interacting with instructors encourages students' cognitive development (Shea et al., 2022). Most importantly, the agency in teaching and learning is enacted and developed in and through interaction and collaboration (Harasim, 2017; Singh & Engeness, 2021; Stetsenko, 2017).

Finally, the instructors allowed more peer interventions, especially in the Facebook group discussion, by not intervening in students' activities. Instructors seemed to be aware of when, why, and how to intervene. They decided to disengage in students' activities when students shared resources, requested fellow students to share their experiences, and described their approaches to solving problems. The decision to disengage with peers during problem-solving may directly influence students' agency in learning. For example, the students did not engage in peer discussion in the Canvas discussion forum because instructors replied to each comment and question. This suggests that students may find it challenging to engage with instructors' direct answers to their questions, which may not provide room for further interpretation and discussions, reaffirming findings from the previous studies that instructors' more frequent intervention in students' learning may discourage students' engagement in peer discussion (Dixson et al., 2006; Mazzolini & Maddison, 2003). In large MOOC platforms, such as FutureLearn and Coursera, peer interaction as a learning strategy emerged partly due to the lack of opportunities to interact with course instructors, so students engaged with fellow peers to complement instructors (Kotzee & Palermos, 2021). However, in our case, peer intervention appeared as a well-thought-out pedagogical strategy that instructors employed to foster peer interaction, as long as the students engaged in sharing in reflecting on how they solved their problems in the Facebook group. Peer interaction in MOOCs is one of the most promising forms of learning that fosters collaboration leading to the development of students' critical thinking (Dyment et al. 2020; Oh et al., 2018).

Thus, the EISs were contingent upon the nature of the complexity of students' problems. Instructors' reasoned capacity came into play in figuring out challenging issues and mobilizing resources by using their professional repertoire of knowledge and skills. This capacity is called instructors' professional agency in facilitating students' learning in the online learning environment. This capacity is enacted when instructors position themselves as knowledgeable actors to assist and guide students in understanding and solving their problems by invoking available resources such as fellow instructors, students, and video tutorials (Edwards, 2015; Maclellan, 2017).

To sum up, these EISs were not planned activities but rather they emerged while instructors

volitionally engaged in making sense of and addressing students' learning problems, thus enacting their professional agency in scaffolding pedagogical supports to address students' questions.

Student Agency and Instructors' Epistemic Intervention Strategies

The analysis of the findings indicates that students were active in sharing their problems and experiences, and in seeking assistance in solving their problems, which were mainly related to the examination assignments. Agentic students have the capacity to know how to engage in learning, articulate their problems, and seek assistance to solve them (Engeness, 2021; Stetsenko, 2017). They also take on fellow participants' problems (Stetsenko, 2017). Whenever a student posted something in the discussion forums, the instructors would read and reply to it if it contained a question. For example, the instructors provided suggestions if students were wondering about what digital tools to use to create the examination assignment. The more students enacted their agency, that is, the more active they were in raising questions, seeking explanations, and attempting to develop a more logical understanding of tasks and problems, the more the instructors enacted their professional agency to intervene to address students' problems and provide guidance to them. Critical thinking is developed when instructors and students actively interact to question ideas, seek explanations, and solve problems collectively in MOOC discussion forums (Dyment et al., 2020; Oh et al., 2018). This indicates a reciprocal relationship between instructors' interventions and students' agency in learning in discussion forums.

However, we also observed nuances in the mutually influencing relationship between students' agency in learning and instructors' professional agency in intervening to facilitate and guide students' learning. For example, when students shared their experiences of solving problems and aided fellow students, the instructors employed peer intervention, which means they did not intervene in students' learning when students shared their experiences of how they resolved problematic issues. This suggests that the nature of students' postings in discussion forums may influence instructors' professional agency. It can also be instructors' more hands-off approach that allows students to take the lead in the discussion. We believe that this was the instructors' conscious decision to allow students to share how they solved the problems. Allowing students to be exposed to different ways and perspectives of solving problems also assists them in interpreting and solving their individual problems. Vygotsky (2012) also suggests that we learn through the ideas and approaches others have used in solving their problems, as they might function as conceptual models to understand and solve our own problems.

Furthermore, discussion forums may be developed into spaces and tools (Bozkurt & Keefer, 2018) for enacting and developing the agency of both instructors and students. Questions and comments posted by students may reflect their attempts to develop a conceptual understanding of course content and examination assignments. That means students' conceptual understanding of problematic issues was mainly disorganized (e.g., using everyday language) and was in the early stages of intellectual maturity. Their queries, comments, and thoughts as epistemic beliefs and stances might be considered manifestations of the "trial and error" stage of learning in a digital learning environment (Engeness, 2021). Intervening in such a process of learning was a challenging and delicate epistemic task for instructors. For example, the more instructors tended to answer students' questions, the shorter the discourse became among students, especially in the Canvas discussion forums. This suggests that instructors need to reconsider their approach to directly answer students' questions and foster discourse among students through which they can learn to solve problems collaboratively, which reaffirms the findings from previous studies (Ntourmas et al., 2019).

Finally, systematic interaction and collaboration between instructors and students may foster students' ZPD. The ZPD is created when instructors and students engage in interaction, during which instructors assess students' understanding of academic content, recognize insufficient knowledge or understanding, and devise strategies to develop and expand students' knowledge (Vygotsky, 2012). The EISs can be taken as instructors' attempts to develop students' scientific understanding of academic content and learning problems. As stated by Vygotsky (2012), students' questions and comments in discussion forums can be taken as the expression of spontaneous (every day) concepts

that are formed while engaging in solving practical problems. These concepts are expanded into systematic, logical concepts when instructors use their professional knowledge (scientific understanding) to reorganize them. We also argue that EISs may contribute to creating a relational zone of learning (Goldstein, 1999) as instructors and students develop a sense of belonging and community, which is critical to learning in an online environment where participants are remotely located and mostly unacquainted with one another (Garrison, 2017; Shea et al., 2022).

PEDAGOGICAL IMPLICATIONS AND LIMITATIONS OF THE STUDY

This study has some important implications for online, especially MOOC, pedagogical practices. First, understanding students' learning problems and addressing them demands more dialogue with students through different modes of communication to solve problems more productively. The instructors need to be aware of their professional knowledge and competence when choosing various intervention strategies in online learning environments.

Second, online learning environments demand that instructors enact and be aware of their epistemic agency. They may not be able to understand and solve all the students' problems individually, so they should rely on their fellow instructors. The more instructors are involved, the more productively they can solve such problems and expand their own professional knowledge. Third, answering students' every comment and question may discourage peer engagement in learning and restrict student agency in learning. Providing direct answers to students' questions is tempting for instructors, but it may narrow down the possibility of expanding dialogue, thus diminishing the possibility of fostering students' agency in learning. Thus, when, why, and how to intervene in students' learning may be the most challenging aspect for instructors as they should balance different factors. Instructors need to be mindful in enacting their epistemic agency.

Finally, the study had some limitations. For example, we could not provide direct statements of the research participants' spoken utterances to make our claims more robust due to personal data protection regulations. The study only used data from one module of a Canvas discussion forum. Arguably, using data from all the Canvas discussion forums we had access to might have provided a better picture of the instructors' intervention strategies. Thus, we compared all Facebook group discussion data with data from a single Canvas discussion forum. This asymmetrical comparison might not provide a balanced picture of the nature of instructor EISs in these two discussion forums. Moreover, we could not highlight the role of technologies in developing and expanding epistemic activities. Further research is needed to explore these limitations.

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Article 3

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