Journal of
Problem Based Learning
in Higher Education

VOL 12, No. 1, 2024 – Page 92-116
doi.org/54.337/ojs.jpblhe.v12i1.8284

VOL 12 • 1

Negotiating Epistemic Experience vs. Epistemic Expertise in PBL Supervision

Exploring confrontations between students and their supervisor in PBL

Giajenthiran Velmurugan * | Aalborg University, Denmark
Jacob Gorm Davidsen | Aalborg University, Denmark

Abstract

Supervision in higher education (HE) often balances the tension between fostering student autonomy and providing sufficient guidance, especially within undergraduate programs. This paper explores an under-researched area: the dynamics of group supervision in undergraduate education, specifically how students challenge their supervisor's expertise. Using video recordings of a group of engineering students at Aalborg University working within a Problem-Based Learning (PBL) framework, the study investigates moments of disagreement between students and their supervisor during project supervision. Employing conversation analysis (CA), the study examines the negotiation of epistemic claims—where students draw on their experience to challenge the supervisor's expertise—and the subsequent impact on the learning trajectories. The findings highlight that students use their epistemic authority from experience to challenge their supervisor's proposed academic direction, while the supervisor defends their stance based on disciplinary knowledge. The study emphasizes the importance of aligning cognitive congruence and situated learning to facilitate productive supervision interactions. Ultimately, the paper sheds light on the critical yet often overlooked role of student agency in supervision and offers insights into improving the supervisory process in HE, particularly in group settings.

* Corresponding author:
Giajenthiran Velmurugan, Email: vel@plan.aau.dk

Keywords: Supervision; Higher Education; Epistemics; Resistance; Conflict; Undergraduate; CA; Conversation Analysis

Introduction

Supervision in higher education (HE) presents a complex and sometimes conflicting relationship between autonomy and support (Del Río et al., 2018). In one aspect, the focus is to assess the skills acquired by students to determine whether they have gained relevant competencies and knowledge. In another aspect, the challenge is to provide sufficient support to students through supervision to make them capable of writing at the required level (Todd et al., 2004). According to West (2020): "supervision remains a largely hidden encounter" (p.2) thus, it is rare to see empirical interactional investigations of supervision. Furthermore, most research on supervision is focused on the dissertation process, and there is a lack of international literature on the supervision of undergraduates (from 1st to 6th semester). The difference in this regard seems to be the level of autonomy to expect from undergraduates compared to graduate students. Thus, the goal for undergraduate students becomes supported autonomy and not competent autonomy (Gurr, 2001). Here, a supervisor guides the students to improve their academic and scientific level. What happens, then, when students disagree or challenge the supervision given to them? West (2023) points towards a gap in the literature in: "the exploration of the tension between the supervisor's expertise and the student's competence and experience" (p.591) thus these challenges and direct disagreements from undergraduate students towards the supervisor are, to these authors' knowledge, an overlooked aspect of supervision research—and will be the main scope of this paper.

To analyse what happens when undergraduate students challenge their supervisor, we looked at video data of one supervision meeting in which a group of engineering students challenged their supervisor's approach. In interaction research the focus is typically on micro instances of the interaction, thus it is quite normal for this type of research that the data only entails one case (Antaki et al., 2008; Bridges & Imafuku, 2020; Goodwin, 2018; Hendry et al., 2016; McQuade et al., 2019; Sacks & Jefferson, 1995; Velmurugan et al., 2021) Furthermore, we want to highlight, that according to our knowledge international research about supervision in higher education tends to be focused on a single supervisor and a single student. Thus, to these authors' knowledge, there is a lack of international research on the supervision practices entailing one supervisor and a group of (undergraduate) students.

The video data is from Aalborg University (AAU), where problem- and project-based learning (PBL) is a university-wide pedagogical approach (Askehave et al., 2015; Kolmos et al., 2004)[1]. In this model, the students must work in groups each semester to write up a project with a point of departure in a problem, which counts up to 50 percent of their ECTS. Thus, we want to emphasise our data consists of engineering students working together in a group, who are provided with one supervisor to guide them. This differs from the normal situation in HE, where a single student is often provided with a supervisor at the end of their degree. The students are provided with a supervisor who is a researcher and will provide guidance and feedback on the students' work, ensuring the academic quality of their project. Throughout the project writing phase, the supervisor's task is to guide the students in addressing the problem academically with the use of specific theory and methodology (Kolmos et al., 2004; Moallem et al., 2019; Servant, 2016). During the project, the supervisor might suggest a course of action that the group of students disagrees with. Thus, the question becomes how the group manages this disagreement. From the opposite perspective, how do supervisors handle this dilemma and approach the group's wishes to do something that may not align with that specific discipline's practice while respecting their autonomy? Thus, to improve supervision in the future, we need to understand how students challenge their supervisor and how the supervisor and students handle these challenges to improve supervision practice, in relation not just to PBL but to all cases of supervision in HE. Thus, our research question becomes:

How do students challenge their supervisor, and how do students and supervisor interactively handle these disagreements?

Theoretical framework

Cognitive Congruence

When looking at the PBL literature about supervision, the term 'cognitive congruence' is often mentioned (Hmelo-Silver et al., 2019; Hmelo-Silver & Barrows, 2006; Schmidt & Moust, 2000; Yew & Yong, 2014). Cognitive congruence can be defined as a supervisor's ability to understand and express themselves at the student's level of knowledge (Schmidt and Moust 2000; Yew and Yong 2014). Furthermore, it requires a supervisor's sensitivity towards the students who are encountering a problem in their work. A requirement for cognitive congruence is that the supervisor has relevant subject knowledge, as this is required to identify knowledge gaps in students and thus actively pose questions to get them to reflect and identify relevant learning issues. Other tools

the facilitator can use in this regard are asking open-ended questions; asking students to argue for their thinking processes; pushing for an explanation; using what, why, and how questions; revoicing or rephrasing what the students just said; summarizing; and asking a student to summarise the discussion (Hmelo-Silver et al., 2019; Hmelo-Silver & Barrows, 2006). The concept of questions as effective tools in a supervision context has previously been documented in papers examining supervision in HE (Donaghue, 2020; Engin, 2015). Thus, as existing studies point out, the role of the supervisor is complex and requires variation in interactions with students (Savin-Baden & Wilkie, 2004). The concept of cognitive congruence describes the 'textbook way' of handling an interaction during supervision; it will be interesting to see if this happens in actual practice. Although empirical literature exists about supervision in higher education (Leyland, 2018; West, 2020, 2023), to these authors' knowledge, there have not been any video observational studies looking at supervision at the undergraduate level towards a group of students. By examining the social practices with video data, focused on microanalysis, we get an insight into how supervision unfolds and how this relates to the literature on supervision that often lacks this interactional empirical perspective. Furthermore, the video provides insight into the nonverbal ways of conducting supervision and how this affects supervision.

Situated learning trajectories

In this paper we are inspired by Lave and Wenger's (1991) situated view of learning; a further development of this theory's perspective is the notion of situated trajectories of learning (de Saint-Georges & Filliettaz, 2008). De Saint-Georges and Filliettaz (2008) elaborate that: "The notion of trajectory aims to capture that (a) learning occurs through situated and highly contextualized micro activities and (b) that these activities occur within historical sequences of events, which come to form over time dynamic trajectories" (p.213). This concept embraces two propositions: first, a situated perspective that focuses on actions in real-time through the accomplishment of the interlocutors, and, second, the idea of a learning trajectory that goes beyond the immediate horizon of situated action to account for longer time frames (de Saint-Georges & Filliettaz, 2008). The term should be understood as a heuristic notion, consisting of linked portions of empiric events that the researcher deems relevant in an exploration of the concrete learning activity. They argue learning should be conceptualised from three perspectives, firstly: "As situated, that is as phenomena to be approached in the real-time conditions of their accomplishment" (de Saint-Georges & Filliettaz, 2008, p. 214). Thus, if you adhere to this perspective, learning is best explored by analysing these situated social situations where they occur. Secondly as: "collective processes, that is

processes involving the participation of various "others" in their accomplishment" (de Saint-Georges & Filliettaz, 2008, p. 214) testifying to the social nature of learning, thirdly they highlight how learning is also a multimodal activity involving the use of material objects, visual props and the performance of various kinds of actions to make meanings. These processes of learning are often examined using a conversation analysis (CA) approach to produce microanalyses to show diverse learning trajectories created in different instances of interaction. The learning trajectories are dynamic and can change at any time in the ongoing interaction. They are marked by a co-configuration, in which we in the present constitute the future of the trajectory and the place where the past of the trajectory is mutually reinterpreted (R. Scollon & Scollon, 2004; S. W. Scollon & de Saint-Georges, 2012). In a concrete learning situation, a trajectory manager (often the teacher) projects a specific course of learning (several things needed to be done to state that the learner has learned the content or practice aimed for) that the learner engages with and helps shape by appropriating or reconfiguring it to make sense of it (Kress et al., 2014). Thus, the trajectory is always open for a reinterpretation or renegotiation. We look at these trajectories because we assume that when students and their supervisor interactively disagree about something, they are negotiating which trajectory to follow; to see how these trajectories are negotiated and produced, we use a CA approach. To analytically find these trajectories, we orient towards how the interlocutors orient toward past interactions to explain or in our example question a future action.

In our microanalysis, we will use a CA approach. CA aims to identify structures that underlie social interaction (Stivers & Sidnell, 2013). This is done by producing detailed transcriptions of the interaction taking place through a reliance on a case-by-case analysis that leads to generalisations across cases without allowing them to set into an aggregate (Stivers & Sidnell, 2013). CA examines what an utterance does to the preceding one(s), and what implications an utterance poses for the next one(s) (Arminen, 2005). Specific CA tools we will use are Turn Construction Units (TCU) which marks a speaking turn and the concepts of turn initiation and transition relevant place (TRP), which mark the transfer of speakership that normally happens at certain specifiable junctures (Clayman, 2013). In our extracts, this will be especially relevant in the pauses and gaps shown in the transcripts. A pause happens within a TCU and a gap between two different TCUs (Hepburn & Bolden, 2013). Thus, as turn-taking often happens fluently in conversations, gaps and pauses of more than 0.5 seconds will be marked as trouble in the conversation (Clayman, 2013). The last term we wish to introduce is 'repair', which is defined as practices to interrupt the ongoing course of action to attend to possible trouble in speaking, hearing, or understanding the talk (Kitzinger, 2013). This can be an other-initiated repair by a coparticipant or the speaker's self-initiated repair. These specific concepts

within CA will help us determine whether the interaction happens 'fluently' or is marked by dispreferred answers and long gaps and pauses indicating the participants are experiencing trouble within their interaction. Although focusing on the interlocutors' utterances is important, it is equally important to have an embodied view of the interaction (Goodwin, 2018; Heath & Luff, 2013). The term 'embodied' should be understood as:

> the ways in which the production and intelligibility of action is accomplished in and through bodied action, the spoken and the visible, and where appropriate, the use of various objects and artifacts, tools and technologies. (Heath and Luff 2013, 295)

Correspondingly, an additional focus will be on the embodied nature of the interaction with the use of various artefacts and technologies. This will be shown in the analysis with direct screenshots of the video recordings embedded in the transcriptions. As our focus is on how students and supervisor interactively negotiate the direction of the project when encountering disagreements, we argue the first place to start the analysis is by focusing on the students' challenge of epistemic claims from the supervisor. Thus, we will shortly account for the literature on challenging epistemic claims in a CA context.

CA research in epistemics focuses on the knowledge claims that interactants assert, contest, and defend in their turn-taking (Heritage, 2013). Within social psychology and sociology, it has been recognised that mutual action and interaction rest on parties' abilities to recognise what each knows about the world and to adjust actions and understandings with that recognition (Garfinkel, 1967; Heritage, 2012; Mead, 1934). The social significance of epistemics became clear with the recognition that knowledge is socially distributed (Knorr-Cetina, 1999), which can form the basis for specific epistemic communities. Furthermore, epistemic claims that are enacted in turns-at-talk are central to the management and maintenance of identity (Heritage & Raymond, 2005). The way we produce our utterances orients towards specific recipients, often entailing a categorisation of the recipients. Thus, it might be considered quite normal and within the script when a supervisor challenges students' epistemic claims, as this is often the supervisor's role; however, the opposite is rarely expected. When these epistemic claims produced by the supervisor are challenged by students, one could argue the students are challenging the learning trajectory the supervisor has set out for them. The difference is that the epistemic claim is focused on the present interaction, where a reconfiguration of previously stated learning trajectories takes place and new trajectories might be produced. Thus, the learning trajectory is oriented towards a past and future trajectory for the group to follow; the

challenge of epistemic claims becomes a present challenge of a proposed trajectory for the group.

Materials and Methods

The setting for data collection

The research data for this study comprises video recordings of one group of engineering students' PBL work. The group was provided with their room, where they could work on their project during the semester. In this room, a 360-degree camera was placed as part of a data collection for a Ph.D. study looking into students' group work. A total of 225 hours of video was recorded, and so far, only 80 hours have been looked through by the first author of this paper. This section was chosen because it showed something that we don't see that often in the literature: a confrontation between students and supervisor. Furthermore, it also shows how the nonverbal signals influence the atmosphere in the room. All participants signed an agreement providing us with written consent from both students and supervisor to record and present the data in journals, teaching activities, and workshops without any kind of anonymisation. They were all provided with the opportunity to withdraw this consent if they came to regret their decision. As we had permission to show the data without anonymisation in journals, we have chosen to do this because we believe this provides a more authentic view of the interaction. We further highlight the purpose of this research is to show how supervision takes place and how students and supervisors might handle disagreements. By choosing this approach it is within our interests to show body language as truthfully as possible because research on interaction has shown the importance of body language to create and foster meaning in interaction (Derry et al., 2010; Goodwin, 1994, 2004, 2013; Heath et al., 2010) This does not mean we do not consider the ethical consequences of the clips we choose to publish, and there are clips in our material that we will not publish (even though we as of now have the legal right to do so) because we think it is not ethically justifiable to show to a wider audience. This has not been the case for the clips chosen for this analysis, although they foster quite different reactions. The clips have been shown at different research seminars and conferences, the reactions we got there will be described further at the end of this paper.

The recordings took place in 2018, before the COVID-19 pandemic. To answer our research question about how students challenge their supervisor, we have chosen a clip where the supervisor is present, and the students directly challenge the supervisor's epistemic claims.

360-degree video recordings

A chart of the students' group room is shown below.

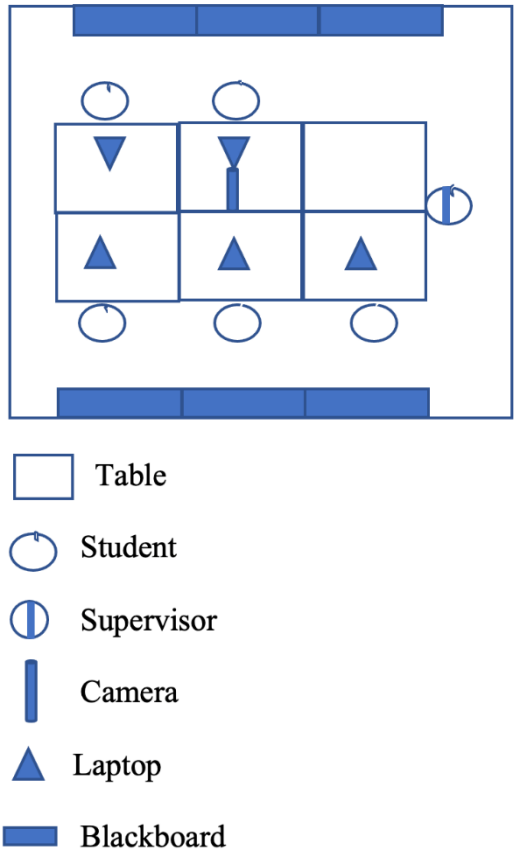
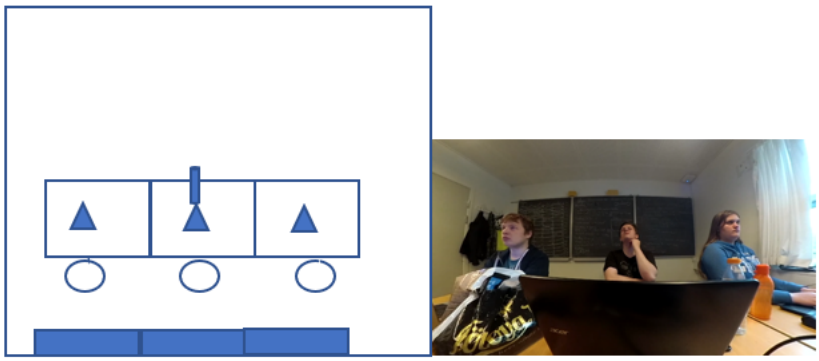


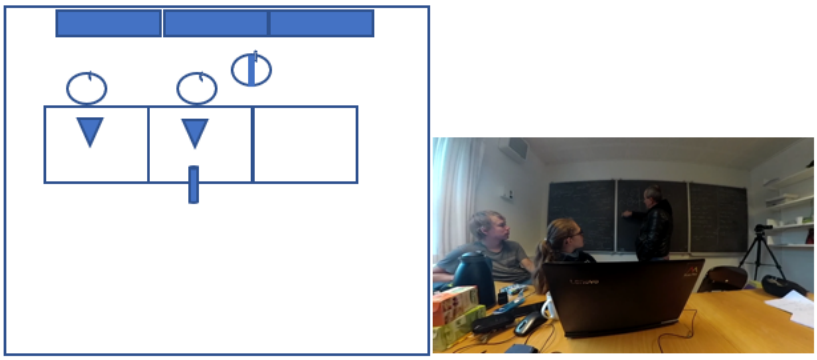
Figure 1. Layout of the room.

A 360-degree camera was placed in the middle of the room. As McIlvenny (2020) reports, a 360-degree recording 'allows a viewer to see a flat 2D visual representation of the *totality* of a scene from a single location but in all directions at once' (p. 3, original emphasis). In other words, the researchers can view the interaction taking place from different angles and can zoom in on specific participants in the recordings. When using 360-degree video recordings, it is important to be aware of the reproduction of spatial relations, which differs on video from what an eye would see (McIlvenny, 2020). When we focus on embodied actions in our transcripts, we zoom in on that specific action; however, in some cases, we will show the whole room, but the picture's spatial relations will be distorted, as seen in the example below. In this first instance we are showing two pictures of a 180-degree view, and in the last picture we are showing the same instance in a 360-degree view:



Students, from left: Teitur, Franz, Patricia

Figure 2. 180-degree View of Room 1.



From left: Magnus, Stine, and the supervisor

Figure 3. 180-Degree View of Room 2.

Figure 4. 360-Degree View of Room.

We found that the last example, even though the dimensions are distorted, gives the best overview of the entire interactional scene, showing how the different participants orient towards each other. Thus, when we want to give an overview of the whole room, we will be using the last example.

The transcript is produced in accordance with the Jefferson Annotation system (Jefferson, 2004), and, when relevant, arrows will point towards screenshots of the embodied interaction with a short written description of the multimodal action. In other parts of the transcript, written transcriptions of multimodal features will be kept to a minimum, as they are not relevant to the analysis. According to Hepburn and Bolden (2012) transcripts are selective in the details represented which is further elaborated by Mondada's (2007) point stating it is impossible to include all potentially relevant aspects of the interactions. Thus, we solely focus on multimodal parts relevant to our analysis. As the group primarily communicated in Danish, the transcript will show both the Danish utterances and the English, as translated by the first author. In the English translation, emphasis was put on how one would frame the same sentence in English; it is thus not a direct word-for-word translation. The Danish word for supervisor is *vejleder*; in the transcript, the supervisor's utterance is indicated with a V.

The context for the specific video recording

The group comprised third-semester engineering students writing a project about private energy storage from solar cells, and whether it makes sense from an economic perspective to incorporate a battery to store energy from the cells in private households. The group had a meeting with their supervisor at which they discussed the group's proposals for different tests to conduct in their project related to their problem statement. During this meeting, two members of the group were absent due to illness. The supervisor went through the group's different test proposals and complimented the group on their suggestion for a particular test the group had suggested. He then spent 45 minutes explaining the details and merits of the test and the way the group should approach it. The next day, one of the absent group members was filled in on the meeting and the test they had decided upon. The absent group member, Magnus, could not understand why that test was chosen and kept questioning how the test was related to their problem statement. The group could not answer Magnus's questions. The next day, Magnus suggested they organise a new meeting with their supervisor to thoroughly understand the relevance of the test for their problem statement. The group agreed to do this and sent an email to their supervisor requesting such a meeting. It should be mentioned that during the first meeting they had with their supervisor this semester, the supervisor told the group not to complicate things too much as they were only third-semester students. The students were surprised they had

to 'keep it that simple'. Furthermore, it should be noted the supervisor is not natively Danish; sometimes creating language barriers with the students. We start our analysis from the point when the supervisor enters the room.

Results/Analysis

First, we want to show different examples of the students challenging the supervisor's epistemic claims, focusing on how that is done interactively. This part of the analysis will answer the research question concerning how the students challenged the supervisor. Then we focus on the ongoing dialogue to answer our research question concerning how the students and supervisor interactively handled these disagreements. To shed further light on how the disagreement was handled, we focus on the different learning trajectories produced in the interaction.

Challenging Epistemic Claims

```
1   ((vejleder kommer ind i rummet og sætter sig))
    ((supervisor enters the room and sits down))
2   M: ((færdiggør en joke med Stine de havde påbegyndt inden vejleder kom ind))
     ((finishes a joke with Stine they had started before the supervisor enters the
    room))
3   M: såeh
       so
4      (2.0)
5   M: vi har nogle spørgsmål til de her forsøg vi skal lave
       we have some questions regarding these tests we should do
6   V: jaeh
       yeah
7      (2.0)
8   M: jeg var nu var jeg der ikke sidste gang
       I was now I was not there the last time
9      (1.0)
10  M: [og såe:::::h kom jeg bagefter] og så var jeg måske lidt skuffet over det
11  forsøg vi så havde fået valgt
       [and the::::n I came afterwards] and so I was maybe a little disappointed
    over the test we had chosen
```

Figure 5. Transcript 1.

Magnus starts the meeting by stating 'so' in line 3. This creates a gap in line 4 where the floor is open, and others can initiate a turn. As no other person does this, Magnus self-selects and utters that they have some questions regarding the tests they should do (line 5). Notice how the supervisor replies only with 'yeah', creating the second gap. Magnus then self-selects as the speaker (line 8) and, instead of following up on his last utterance and explaining about the test they want to question, he provides some background information stating that he was

not present at the last meeting, creating another gap in line 9. Thus, we see three gaps (lines 4, 7, and 9) indicating there is trouble in the interaction. As stated earlier, the transition of speakership often happens fluently, and gaps within interactions are often evidence of trouble in the interaction. This trouble could be due to the fact the students know they are entering into an unfavourable situation, as the setup for the meeting is the students questioning the supervisor's proposed direction for their project. To legitimize the students' right to question this direction, we see how Magnus in lines 8 and 10 tries to explain why they don't agree with the direction. As such, one could state that line 8 is presented to legitimize why the students have the right to question the test discussed in the previous meeting with the supervisor. Also, notice how his criticism of the test is explained by a feeling of disappointment (line 10). This feeling is also downgraded with the utterance 'I was maybe' (line 11), again pointing to the fact they are entering into an unfavourable situation. To legitimize this, they try to explain how they feel about it, as a person's feeling is rarely something you can delegitimize. Thus, the way Magnus tries to challenge the supervision is through an "epistemic of experience" contrasted with the supervisor's "epistemic of expertise", West (2023) found a similar conversational pattern in her data of supervision meetings.

In the following discussion, we will focus on how the supervisor reacts to these utterances:

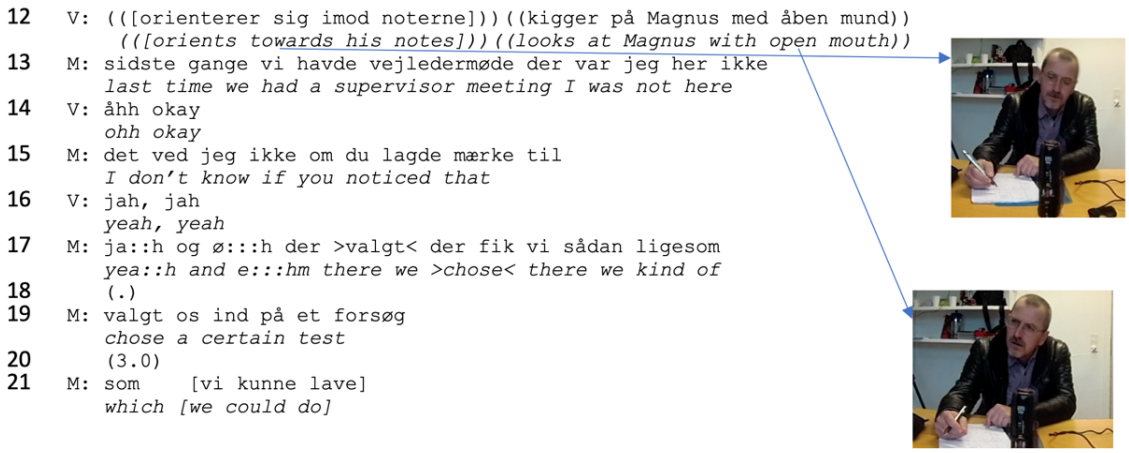
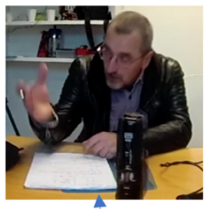


Figure 6. Transcript 2.

Line 12 corresponds to the second picture, where the supervisor might be interpreted to be surprised or confused by the statement. He changes his posture from orienting towards his notes with his pen, shown in the first picture, to directing his gaze towards Magnus with a slightly open mouth and squeezed eyes, likely focusing on what Magnus just stated. Magnus orients towards this changed posture by repeating he was not there the last time (line

13). In this way, he is through his epistemics of experience trying to legitimize why it is okay for him to feel disappointed about the selected test. The supervisor then replies, 'oh okay'. Whether he agrees with Magnus's way of legitimizing their right to be critical of the test or just acknowledges Magnus was not present at the last meeting, we don't know. However, we see how Magnus again orients towards the surprised facial gesture in line 14, where he states: 'I don't know if you noticed that'. This utterance can thus be evidence of how Magnus interprets the supervisor's surprise. Thus, Magnus interprets the surprised facial gesture of the supervisor as directed towards his uttering of his lack of presence at the last meeting, but it might also be oriented towards Magnus's feeling of disappointment towards the test. We interpret the facial gesture as oriented towards Magnus's feeling of disappointment, as this is not something usually connected with academic discourse. We also see how Magnus's words become more hesitant when addressing the test in line 17, a stance also shown in line 10 of the previous extract. A commonality in the content of these utterances is that they address a test the students do not want to do but that the supervisor has suggested they do. As such, he becomes hesitant when challenging the supervisor's epistemic claim. Notice how he states, 'we kind of', indicating with his use of a plural pronoun that he is presenting the group's opinion and not just his own. Additionally, there is a gap in line 20, where it would seem relevant for other people to initiate a turn but, as no one does so, he continues elaborating in line 21, 'which we could do'. However, an overlap happens in this instance; we focus on that next.



21 M: som [vi kunne lave]
which [we could do]
22 V: [det er ik simpelt] det er ik simpelt
[it is not simple] it is not simple
23 T: hvad
what
24 M: nej simpelt
not simple
25 V: ((løfter blokken og lader den falde ned på bordet igen)) okay ((række håndenimod M. og peger med kuglepennen på sin blok))
((lifts the block and lets it fall down on the table again)) okay ((gestures his hands towards M and then points with his pen towards his bloc))
27 M: nej vi fik valgt os ind på et forsøg som vi skulle lave til vores projekt
no we chose a test which we should do in our project
28 V: ja
yes
29 M: ja og det var jeg lidt skuffet over det blev valgt fordi jeg ikke kan se hvad
30 det har med vores
yes and I was a little disappointed over what was chosen because I could not see what it had to do with our
31 (1)
32 M: projekt at gøre
Project

Figure 7. Transcript 3.

Notice in line 21 the overlap by the supervisor in his comment 'it is not simple'. This statement seems to take by surprise both Teitur, who says 'what' in line 23, and Magnus, who repeats 'not simple' in line 24. Then we see some body language from the supervisor that can be interpreted as frustration: he lifts the papers, let them fall again with a loud sound, says okay, and nonverbally gestures to Magnus. Magnus tries to perform a repair in line 27, where he again states that they chose a test with their project—here Magnus emphasizes 'test' in his utterance. The supervisor offers minimal response (line 28), and then Magnus continues to elucidate how he was disappointed with this choice, and here he emphasizes the choice. Thus, we see how Magnus does not orient to the fact of the test being or not being simple but emphasizes the choice of the test as the relevant factor for the ongoing interaction. We now skip to the point in the interaction at which the supervisor again addresses the group's concerns:

50 V: ((flytter papirerne imod s))
((moves the papers towards s))

51 S: så vi havde bare svært ved at se hvordan vi sku
so we had a little difficulty seeing how we should
52 (.)
53 M: fordi [vi (utydeligt)]
because [we (unclear)]
54 S: [decideret bruge det]
[distinctivly use it]
55 V: [jeg har] skrevet visse dele op for den test
[I have] written some parts of the test
56 (.)
57 V: hvor faktisk I:::::::: til sidst
Where actually y:::::ou in the end
58 (.)
59 V: du skal have noget som den der ((peger på et specifikt sted på papirerne))
60 laver en øh model
you (in singular) should have something like that one ((points at a specific place on the papers))make an ehh model
61 M: ((rejser sig fra stolen og går imod papirerne))
((gets up from his chair and walks towards the papers))
62 (.)
63 S: ja:er
ye:ah
64 V: som ø:::h kan bruges for charging discharging
which e:::hm can be used for charging discharging

65 (1)
66 V: jaer((retter blikket imod M)) og det er ikke nemt
yeah ((looks towards M)) and it is not easy
67 (3.0)
68 M: NEJ de:::::t det er meget muligt øhm
NO tha:::::t seems very possible ehm

Figure 8. Transcript 4.

We see the supervisor moving some papers towards Stine while they are continuing their talk. The supervisor then starts an overlap in line 55, resulting in Stine and Magnus stopping their utterance. In line 55, he presents the content of the papers—some part of the test he has written. Then a TRP occurs, after which the supervisor initiates another turn and explains the end product of the test, pointing towards a model they should create. Magnus gets up from his chair and starts looking at the papers, and the supervisor again addresses the

fact that the test is not easy while looking at Magnus. Thus, Magnus's previous effort to focus the conversation on the choice of the test has still not succeeded, as the supervisor again orients towards the 'easiness' of the test. This creates the impression that the supervisor has a conviction that the students, especially Magnus, are critical about the test because they see it as simple, a concern the students have not explicitly stated in this meeting but was discussed in a previous supervision meeting about the project in general. In the next extract, we enter the interaction when Magnus again challenges the supervisor's epistemic claim:

86 M: men som vores problemformulering er lige nu
but as our problem statement is right now
87 (1.0)
88 M: der siger vi at vi gerne vil ((går imod sin plads igen og sætter sig ned))
we say we we want to ((walks towards his seat again and sits down))
89 V: ((læner sig tilbage og sidder med armene over kors))
((leans back and crosses his arms))

90 (1.0)
91 M: se om det kan svare sig
look at whether it makes sense
92 (.)
93 M: eller hvord
or ho
94 (.)
95 M: hvordan det kan svare sig at implementere et batteri i et solcellesystem
how it makes sense to implement a battery in a solar cell system
96 V: jaeh
yeah
97 M: for at se om det kan spare nogle penge på
to see if you can save some money
98 (1.5)
99 M: for forbrugerens side
from the consumer's side
100 V: jaeh
yeah
101 M: frem for ikke at skulle have det
compared to not having it
102 (1.0)
103 M: ø:::h hvis vi så laver et forsøg om hvordan
eh::m if we then test how
104 (1.0)
105 M: øh batteriets
ehm the battery's
106 (.)
107 M: discharging og charging er ift. temperaturen
discharging and charging is according to the temperature
108 (1.0)
109 M: så har jeg svært ved at se hvad sammenhængen skulle være
then I have some difficulty in seeing what the connection should be
110 (.)
111 M: den information vi får ud af forsøget hvor s::: hvad skal jeg bruge den til
the information we get out of the test what sho::: what should I use it for
112 (6.0)

Figure 9. Transcript 5.

In line 86 we see how Magnus starts orienting towards the problem statement. Notice how he emphasises the problem while walking towards his seat in the room. At the same time, the supervisor is leaning back and away from Magnus, crossing his hands. It is relevant that Magnus, with both his verbal statement and embodied behaviour, is distancing himself from the supervisor's previous utterances, and that the supervisor is doing the same by leaning back and crossing his hands. Magnus tries to address the relevance of the test for their problem statement. He does this by explaining the content of the problem statement, which could serve to ensure that the supervisor understands it. Thus, Magnus might operate from the perspective that the supervisor does not understand the content of their problem, and consequently, he does not realise how the test he is suggesting is not relevant to the specific problem. Again, we see numerous TRPs followed by gaps in the interaction (lines 98, 102, 104, 108, 112) pointing towards trouble, which we again argue is due to Magnus challenging the supervisor's epistemic claims. By questioning these epistemic claims, we argue Magnus is producing a different learning trajectory. Once again, he is using an epistemic of experience to challenge an epistemic of expertise.

Producing different learning trajectories

The group tries to produce a trajectory in which the supervisor does not understand the content of the problem and accordingly suggests the wrong test for them. However, as we saw earlier, the supervisor has produced a trajectory in which he thinks their resistance to the test is due to the group seeing the test as 'simple'. The challenge in the interaction is, then, for the different participants to agree on a certain trajectory. We see that the supervisor aligns himself with the content of the students' problem in lines 96 and 100; thus, the trajectory of the supervisor not understanding the content does not seem to be accurate. Magnus then details the aim of the test and talks about how that is connected to their problem statement. His use of pronouns is relevant: notice how in line 109 he uses the pronoun I—*then I have some.* Then in line 111 he switches to the plural pronoun—*the information we*—and later states *what should I use it for?* We can see that the plural pronoun is used for the actions the group has set out to do, and when he questions these actions, he switches to a personal pronoun. One could thus argue Magnus is distancing himself from the supervisor's proposed trajectory for the group with the test. Additionally, he produces a new trajectory in which he questions the relation of the test to their problem statement. As stated before, the challenge becomes for the supervisor and students to align their trajectories, which will be the last focus of this analysis.

Aligning different learning trajectories

The students have elaborated on how they cannot see the relevance of the test for their problem statement. The supervisor now chooses to use the blackboard to answer their questions. We enter the interaction after the supervisor is done; his drawings are on the table.

Figure 10. Transcript 6.

We interpret the supervisor's switch to English as his realisation that there might be a language barrier between him and the students. The students don't react to this interactively but just continue their interaction, where they reply in Danish, and the supervisor replies in English. However, another relevant point is how the blackboard becomes an artefact that serves to teach the students relevant knowledge about their test. By using the blackboard, the supervisor adds a new method of mediation—drawing. Including drawing with verbal mediational means helps students visualise the way a typical household gets

energy and how their battery fits into this system. If we look at line 201, we see a relevant alignment. Magnus states, 'then I can of course see it,' overlapping with the supervisor, who says, 'you don't know jaer'. Jaer in this regard could be translated to 'yeah'. Thus, he corrects Magnus, stating they still don't have the correct knowledge Magnus states 'he can see'. We see later how Stine, through minimal response, is still able to follow the supervisor's explanations. Thus, the addition of the mediational means of the drawing on the blackboard makes it possible for the supervisor to point at exactly the visual that illustrates what he is describing. The blackboard also ensures a more embodied interaction, as he points to the relevant spots of his drawing, making sure the students can follow his train of thought, and the students keep giving him minimal responses (lines 191, 193, 196, 200, 201, and 209). These minimal responses ensure that the students follow the supervisor's line of argument. One could argue that continuing pointing at the drawing ensures the participants are on the trajectory set by the supervisor, and their minimal response gives them an option to state if they can no longer follow this trajectory. It is also evidence of epistemic claims from the supervisor to the students, which they acknowledge through their minimal response. Furthermore, it goes back to the definition of learning mentioned earlier, focused on the situated collective processes that involve the use of material objects to foster learning. Looking at the interaction, we cannot determine whether the knowledge is new for the students, but we can conclude they are interactively stating they can follow the claims produced by the supervisor. By the end of the meeting, they have understood each other, and the students can now see the relevance of the test for their project. Thus, the students seemed to have lacked a vital understanding of how energy was transferred in the household, which then led to the fact they could not see the relevance of the test for their project. It is relevant because this trajectory that the students lacked understanding of how energy was transferred in the household was not something the students or the supervisor seemed to realise in the beginning of the meeting. Our analysis thus points towards a meeting where both students and supervisor enter with different trajectories regarding what seems to be the issue: the supervisor with a trajectory of the students seeing the test as too easy and the students with a trajectory of the supervisor not understanding the content of their problem. However, both trajectories are 'wrong'. The students don't object to the test because it is too simple, they object because they cannot see the relevance of it to their problem; thus, they think the supervisor does not understand their problem statement. However, he does understand it and the trouble seems to be the students' lack of knowledge about private energy storage in households, which the supervisor eventually realises, after which he explains to the students how it works and how their test is related to private energy storage.

Discussion

Looking at the interaction, we see how Magnus is the primary speaker for the group occasionally backed up by Stine. This could provide the impression, that this is solely Magnus' agenda, and not the group's. As we see the supervisor often looks directly at Magnus (line 12, 26, 66) this might indicate he is of the same observation. However, have we had more space in this article we would have provided extracts from the interaction before and after the supervision meeting in which the group backs Magnus up, and supports him in his quest, and there are other instances of interaction in which some members of the group challenges Magnus, thus based on the group's interaction this is not a case of one member controlling what the group should or should not do. On the contrary, we argue that Magnus and Stine being the only ones able to confront and oppose the supervisor, is a testament to the fact, that this is not an easy thing for students to do. It further highlights the fact, that they are strong students, meaning they dare to confront a supervisor although it is not easy. As is evident in the analysis, Magnus is hesitant every time he challenges his supervisor; thus, it is not an easy thing to do, he is also the only one who directly confronts the supervisor, later with some assistance from Stine. In the institutional setup, the students know their supervisor is more knowledgeable about the content than they are; therefore, their trajectory is more focused on the fact that the supervisor might not have understood their problem well enough, and they challenge the connection of the test to their problem statement, thus we can see that when students challenge their supervision they talk out from an epistemic of experience, where supervisors want to talk from an epistemic of knowledge, thus creating confrontations between students and supervisors.

If we relate our findings to the theory of cognitive congruence. We can state the supervisor is not using any of the techniques related to cognitive congruence: he is not asking clarifying questions; he is not summing up or rephrasing the group's utterances. Regardless, the result is continuing elaboration from the students' side. Thus, the long gaps, in which he does not say anything, force the students to try to resolve their problem with his advice—and by coincidence, they use many of the communicative techniques mentioned about cognitive congruence: they rephrase what the supervisor has said regarding their problem and about the test (lines 88–112), they ask the supervisor questions (lines 15, 54, 111), and they formulate how they understand the supervisor's trajectory, even while questioning the relevance of it (lines 109–112). This results in the supervisor's change of strategy in his interaction with the students when he realises their level of knowledge. Thus, the supervisor becomes able to explain the knowledge on the students' level (lines 190–209), even though it is the students and not the supervisor asking the questions. A finding relevant for

several institutions of HE is that we can see supervision is a dialogical process with shared responsibility between the students and supervisor. As most research looks at the role of the supervisor (Acker et al., 1994; Benwell & Stokoe, 2002; Stokoe, 2000; West, 2020), an interesting perspective for future research could be looking at the role of students and educating students in ensuring a productive outcome for their supervision.

To answer our research question, we can see that students challenge their supervisor with an epistemic of experience which often conflicts with the supervisor's epistemic of knowledge. The challenge is thus to balance these two types of epistemics. The Aalborg PBL model was founded on the notion that students should solve problems they found themselves among other things because it was believed this would lead to better learning (Illeris, 1974; Servant, 2016; Velmurugan, 2022). Thus, in the model, there was an emphasis on students actively using this epistemic of experience. However, there is another perspective in this regard to pay attention to. This still has to be confined to the academic traditions for that specific degree. Thus, this conflict between these two discourses is something both students and supervisors have to deal with in this model, and maybe a solution could be to strengthen the dialogical techniques of both supervisors and students, so it is not only the strong students who can challenge their supervisor. Furthermore, as mentioned in the introduction the supervisor is not natively Danish, maybe this also led to some misunderstandings between the students and the supervisor, again arguing for the need to practice dialogical techniques. Here we want to highlight the fact, the issues were addressed in this meeting.

Ethical considerations

The video analysed in this paper has been shown at different meetings or research seminars, where the reactions are mixed. People who have a STEM background and teach in STEM often sympathise with the supervisor and feel the students are not treating him fairly. They highlight the fact that he has chosen a proposal for testing the students came up with themselves, he has prepared himself before the meeting with notes on the experiment they had to do, and of course, he is upset because he is now repeating himself for something he had already explained once, just because one student thinks he is the one running the show. On the other hand, people with a social sciences or humanities background often sympathise with the students. Perhaps this is because the students are doing things that are actively encouraged in social sciences and humanities, they are questioning the relation between things and remaining critical of things they don't understand, they do this by engaging in

a dialogue, thus they are actively trying to take steps into understanding what they don't understand. Perhaps these differences testify to a nuance in the difference of supervision in a STEM and Social Science/Humanities perspective, but that is beyond the scope of this paper to examine. However, the authors of this paper do want to highlight the supervisor is investing a lot of resources and time to help the students with their project.

References

Acker, S., Hill, T., & Black, E. (1994). Thesis Supervision in the Social Sciences: Managed or Negotiated? *Higher Education*, *28*, 483–498. https://doi.org/10.1007/BF01383939

Antaki, C., Biazzi, M., Nissen, A., & Wagner, J. (2008). Accounting for moral judgments in academic talk: The case of a conversation analysis data session. *Text & Talk*, *28*(1), 1–30. https://doi.org/10.1515/TEXT.2008.001

Arminen, I. (2005). *Institutional Interaction Studies of Talk at Work*. Ashgate.

Askehave, I., Prehn, H. L., Pedersen, J., & Pedersen, M. T. (Eds.). (2015). *PBL - Problem-Based Learning*. Aalborg University. https://www.aau.dk/digitalAssets/148/148025_pbl-aalborg-model_uk.pdf

Benwell, B., & Stokoe, E. H. (2002). Constructing discussion tasks in university tutorials: Shifting dynamics and identities. *Discourse Studies*, *4*(4), 429–453. https://doi.org/10.1177/1461445602004004020l

Bridges, S. M., & Imafuku, R. (Eds.). (2020). *Interactional Research Into Problem-Based Learning*. Purdue University Press. https://doi.org/10.2307/j.ctvs1g9g4

Clayman, S. E. (2013). Turn-Constructional Units and the Transition-Relevant Place. In J. Sidnell & T. Stivers (Eds.), *The Handbook of Conversation Analysis* (pp. 150–167). Wiley Blackwell.

de Saint-Georges, I., & Filliettaz, L. (2008). Situated trajectories of learning in vocational training interactions. *European Journal of Psychology of Education*, *23*(2), 213–233. https://doi.org/10.1007/BF03172746

Del Río, M. L., Díaz-Vázquez, R., & Maside Sanfiz, J. M. (2018). Satisfaction with the supervision of undergraduate dissertations. *Active Learning in Higher Education*, *19*(2), 159–172. https://doi.org/10.1177/1469787417721365

Derry, S. J., Pea, R. D., Barron, B., Engle, R. A., Erickson, F., Goldman, R., Hall, R., Koschmann, T., Lemke, J. L., Sherin, M. G., & Sherin, B. L. (2010). Conducting Video Research in the Learning Sciences: Guidance on Selection, Analysis, Technology, and Ethics. *Journal of the Learning Sciences*, *19*(1), 3–53. https://doi.org/10.1080/10508400903452884

Donaghue, H. (2020). 'Time to construct positive identities': Display questions in post observation teacher feedback. *Classroom Discourse*, *11*(3), 193–208. https://doi.org/10.1080/19463014.2019.1581626

Engin, M. (2015). Trainer talk in post-observation feedback sessions: An exploration of scaffolding. *Classroom Discourse*, *6*(1), 57–72. https://doi.org/10.1080/19463014.2014.919867

Garfinkel, H. (1967). *Studies in ETHNOMETHODOLOGY*. Prentice-Hall.

Goodwin, C. (1994). Professional Vision. *American Anthropologist*, *96*(3), 606–633. https://doi.org/10.1525/aa.1994.96.3.02a00100

Goodwin, C. (2004). Practices of Seeing Visual Analysis: An Ethnomethodological Approach. In *The Handbook of Visual Analysis* (pp. 2–30). SAGE Publications Ltd. https://doi.org/10.4135/9780857020062

Goodwin, C. (2013). The co-operative, transformative organization of human action and knowledge. *Journal of Pragmatics*, *46*(1), 8–23. https://doi.org/10.1016/j.pragma.2012.09.003

Goodwin, C. (2018). *Co-Operative Action*. Cambridge University Press. https://doi.org/10.1017/9781139016735

Gurr, G. M. (2001). Negotiating the "Rackety Bridge"—A Dynamic Model for Aligning Supervisory Style with Research Stud. *Higher Education Research & Development*, *20*(1), 81–92. https://doi.org/10.1080/07924360120043882

Heath, C., Hindmarsh, J., & Luff, P. (2010). *Video in Qualitative Research Analyisng Social Interaction in Everyday Life*. SAGE Publications Ltd. https://doi.org/10.4135/9781526435385

Heath, C., & Luff, P. (2013). Embodied Action and Organizational Activity. In J. Sidnell & T. Stivers (Eds.), *The Handbook of Conversation Analysis*. Blackwell Publishing Ltd. https://doi.org/10.1002/9781118325001.ch14

Hendry, G., Wiggins, S., & Anderson, T. (2016). Are You Still with Us? Managing Mobile Phone Use and Group Interaction in PBL. *Interdisciplinary Journal of Problem-Based Learning*, *10*(2). https://doi.org/10.7771/1541-5015.1600

Hepburn, A., & Bolden, G. B. (2013). The Conversation Analytic Approach to Transcription. In J. Sidnell & T. Stivers (Eds.), *The Handbook of Conversation Analysis* (pp. 57–76). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118325001.ch4

Heritage, J. (2012). Epistemics in Action: Action Formation and Territories of Knowledge. *Research on Language & Social Interaction*, *45*(1), 1–29. https://doi.org/10.1080/08351813.2012.646684

Heritage, J. (2013). Epistemics in Conversation. In J. Sidnell & T. Stivers (Eds.), *The Handbook of Conversation Analysis* (pp. 370–395). Blackwell Publishing Ltd. https://doi.org/10.1002/9781118325001.ch18

Heritage, J., & Raymond, G. (2005). The Terms of Agreement: Indexing Epistemic Authority and Subordination in Talk-in-Interaction. *Social*

Psychology Quarterly, *68*(1), 15–38. https://doi.org/10.1177/019027250506800103

Hmelo-Silver, C. E., & Barrows, H. S. (2006). Goals and Strategies of a Problem-based Learning Facilitator. *Interdisciplinary Journal of Problem-Based Learning*, *1*(1). https://doi.org/10.7771/1541-5015.1004

Hmelo-Silver, C. E., Bridges, S. M., & McKeown, J. M. (2019). Facilitating Problem-Based Learning. In M. Moallem, W. Hung, & N. Dabbagh (Eds.), *The Wiley Handbook of Problem-Based Learning* (pp. 297–321). John Wiley & Sons. https://doi.org/10.1002/9781119173243.ch13

Illeris, K. (1974). *Problemorientering og deltagerstyring*. Unge Pædagoger.

Jefferson, G. (2004). Glossary of transcript symbols with an introduction. In G. H. Lerner (Ed.), *Conversation Analysis Studies from the first generation* (pp. 13–31). John Benjamins Publishing Company. https://doi.org/10.1075/pbns.125.02jef

Kitzinger, C. (2013). Repair. In J. Sidnell & T. Stivers (Eds.), *The Handbook of Conversation Analysis* (pp. 229–257). Blackwell Publishing Ltd.

Knorr-Cetina, K. (1999). *Epistemic cultures: How the sciences makes knowledge*. Harvard University Press. https://doi.org/10.4159/9780674039681

Kolmos, A., Fink, F. K., & Krogh, L. (Eds.). (2004). *The Aalborg PBL model—Progress, diversity and challenges*. Aalborg University Press.

Kress, G., Jewitt, C., Ogborn, J., & Tsatsarelis, C. (2014). *Multimodal Teaching and Learning: The Rhetorics of the Science Classroom*. Bloomsbury Academic. https://doi.org/10.5040/9781472593764

Leyland, C. (2018). Resistance as a resource for achieving consensus: Adjusting advice following competency-based resistance in L2 writing tutorials at a British University. *Classroom Discourse*, *9*(3), 267–287. https://doi.org/10.1080/19463014.2018.1480966

McIlvenny, P. (2020). The future of 'video' in video-based qualitative research is not 'dumb' flat pixels! Exploring volumetric performance capture and immersive performative replay. *Qualitative Research*, *20*(6), 1–19. https://doi.org/10.1177/1468794120905460

McQuade, R., Ventura-Medina, E., Wiggins, S., & Anderson, T. (2019). Examining self-managed problem-based learning interactions in engineering education. *European Journal of Engineering Education*, 1–17. https://doi.org/10.1080/03043797.2019.1649366

Mead, G. H. (1934). *Mind, Self, and the Society*. University of Chicago Press.

Moallem, M., Hung, W., & Dabbagh, N. (Eds.). (2019). *The Wiley Handbook of Problem-Based Learning*. John Wiley & Sons. https://doi.org/10.1002/9781119173243

Mondada, L. (2007). Commentary: Transcript variations and the indexicality of transcribing practices. *Discourse Studies*, *9*(6), 809–821. https://doi.org/10.1177/1461445607082581

Sacks, H., & Jefferson, G. (1995). *Lectures on conversation: Volumes I & II*.

Blackwell.
Savin-Baden, M., & Wilkie, K. (Eds.). (2004). *Challenging research in problem-based learning*. Open Univ. Press.
Schmidt, H. G., & Moust, J. H. C. (2000). Factors Affecting Small-Group Tutorial Learning: A Review of Research. In D. H. Evensen & C. E. Hmelo-Silver (Eds.), *Problem-Based Learning A Research Perspective on Learning Interactions* (pp. 19–53). Routledge.
Scollon, R., & Scollon, S. W. (2004). *Nexus analysis—Discourse and the emerging internet*. Routledge. https://doi.org/10.4324/9780203694343
Scollon, S. W., & de Saint-Georges, I. (2012). Mediated discourse analysis. In M. Handford & J. P. Gee (Eds.), *The Routledge Handbook of Discourse Analysis* (pp. 66–78).
Servant, V. F. C. (2016). *Revolutions and re-iterations: An intellectual history of problem-based learning*. Erasmus University Rotterdam.
Stivers, T., & Sidnell, J. (2013). Introduction. In J. Sidnell & T. Stivers (Eds.), *The Handbook of Conversation Analysis* (pp. 1–9). Wiley Blackwell. https://doi.org/10.1002/9781118325001.ch1
Stokoe, E. H. (2000). Constructing Topicality in University Students' Small-group Discussion: A Conversation Analytic Approach. *Language and Education*, *14*(3), 184–203. https://doi.org/10.1080/09500780008666789
Todd, M., Bannister, P., & Clegg, S. (2004). Independent inquiry and the undergraduate dissertation: Perceptions and experiences of final-year social science students. *Assessment & Evaluation in Higher Education*, *29*(3), 335–355. https://doi.org/10.1080/0260293042000188285
Velmurugan, G. (2022). *Problem Construction in Problem-Based Learning How Students Deal with Disagreements in Decision-Making*. Aalborg University.
Velmurugan, G., Stentoft, D., & Davidsen, J. (2021). Disagreeing about the Problem in PBL: How students negotiate disagreements regarding the Problem in PBL. *Journal of Problem Based Learning in Higher Education*, *9*(1), 42–62. https://doi.org/10.5278/ojs.jpblhe.v9i1.6241
West, M. (2020). 'I'm Not Going to Tell You Cos You Need to Think About This': A Conversation Analysis Study of Managing Advice Resistance and Supporting Autonomy in Undergraduate Supervision. *Postdigital Science and Education*. https://doi.org/10.1007/s42438-020-00194-5
West, M. (2023). Advice Resistance in Undergraduate Supervision Meetings: The Competing Relevance of Expertise and Experience. *Journal of Language and Social Psychology*, *42*(5–6), 589–609. https://doi.org/10.1177/0261927X231185750
Yew, E. H. J., & Yong, J. J. Y. (2014). Student perceptions of facilitators' social congruence, use of expertise and cognitive congruence in problem-based learning. *Instructional Science*, *42*(5), 795–815. https://doi.org/10.1007/s11251-013-9306-1

[1] Aalborg University (AAU) uses Problem-Based Learning (PBL) at all its educations. However, the AAU PBL model is a little different than other versions of PBL. Here students write projects over the course of a semester instead of solving cases, thus the model is also called Problem-and Project Based Learning.