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Disagreeing About the Problem in PBL: How Students Negotiate Disagreements Regarding the Problem in PBL

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ABSTRACT

An essential part of Problem-Based Learning (PBL) is the students' groupwork. What happens in students' group work when no tutor/facilitator is present is normally a hidden land. Thus, there is limited research on students' interactional way of doing PBL, this study tries to amend this by looking at how students conduct group work without any tutor/facilitator present. In this study, our research question is: How do students negotiate disagreements in their decision-making regarding their problem construction, and which element(s) in the interaction establishes if the decision is made or not? With a focus on students' interactional work, we used video-observation to gather data of a 3rd semester Engineering Group at Aalborg University, Denmark. Our findings indicate that the conversation's structure has a profound impact on whether a decision proposal is accepted. Thus, the individual's ability to hold on to their position and answer questions towards one's proposal determines if other group members follow your suggestion. The study provides knowledge to an under-researched area of PBL and recommends a focus on PBL students' interactional work in relation to near future cases of PBL.

Keywords: Problem-Based Learning, PBL, Higher Education, Problem, Problem Identification, Problem Design, Problem Construction, Decision-Making, CA, Ethnomethodology

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INTRODUCTION

Problem-Based Learning (PBL) first emerged in Canada at McMaster University's medical education in 1963 (Barrows & Tamblyn, 1980). Today more than 500 higher education institutions around the world use PBL (Servant-Miklos, 2019). An essential part of PBL is students working in groups where the learning process starts with a problem (Barrows 1996; De Graaff and Kolmos 2003; Kek and Huijser 2017; Servant, Schmidt, and Frens 2016). According to Hung, "Problems are at the heart of PBL" (Hung 2009:199). While considerable research attention has been directed towards developing problems in PBL (Holgaard et al. 2017; Hung 2006, 2009, 2016, 2019; Hüttel and Gnaur 2017), there is limited research investigating the interactional work students do concerning the construction of their problem.

As PBL is characterized by students working in groups to a great degree, one could argue most of their learning takes place in group work; thus, to understand what goes on in this group work, the interaction between the students becomes a relevant focus. In this context, we define learning as a social process situated in particular social and material ecologies (Jordan and Henderson 1995). Consequently, the way to examine these ecologies is by focusing on the dialogue in the collaborative construction of shared understandings (Benwell and Stokoe 2002). In this perspective, language is viewed as a site of action rather than transmission (Benwell 1999). The focus becomes to explore the studied interaction's conversational features, practical accomplishments, and discursive organization. We know that most of the PBL studies we see today rarely focus on the students' interaction (Koschmann, Glenn, and Conlee 1997). However, it is important to have this focus as a great deal of PBL is students doing the work for themselves. To quote Schegloff, we are left with a sense of "how the world works, but without its detailed specification"(Schegloff 1992:106). According to Koschmann, Glenn, and Conlee (1997), these kinds of studies will also provide us with a better understanding of PBL. As this paper is submitted to a special issue dealing with the next practice within PBL, asking what kind of theoretical and methodological frameworks we need to understand, analyze, and envision PBL, we hope to show how looking at students' interactional work is a relevant and much needed theoretical approach to researching PBL. This becomes especially important regarding the students' development of the problem, which will be the focus of this paper.

In the PBL literature an emphasis is put upon how the learning takes its point of departure in a problem (De Graaf & Kolmos 2003; Savin-Baden & Major 2004; Barrows 1996). Thus, as the problem becomes the starting point, a greater emphasis should be put on how these problems are constructed. At Aalborg University (AAU) students are allowed to construct the problem and find their own case on the condition they align with the learning goals of the semester (Servant et al. 2016). The learning goals always require the problem

to be explored academically. The term problem construction is applied concerning Markauskaite and Goodyear (2017), who quotes Belth (1977), stating that problems are: "what we form them to be, and thus are as unique as the individual minds that create them" (Belth, 1977; Markauskaite and Goodyear 2017:4). In the literature, terms like problem design or problem identification are often used (Holgaard et al. 2017; Hung 2019). We believe problem construction more adequately describes the process of how the interlocutors in engagement with their specific field construct a problem that adheres to their learning goals and the specific needs of other relevant stakeholders. The question thus becomes, how do students engage in this process? We will argue that problem construction is a decision-making process located in the interactional work of the students.

Problem Construction as a Decision-Making Process

As Hung states: "PBL problems require undergoing an instructional design process that is a rigorous, systematic, and analytical decision-making orchestration" (Hung 2019:250); although this design process is meant for instructors in their design of problems for students, we want to emphasize his focus on: "analytical decision-making orchestration". Constructing (or as Hung formulates it designing) a problem requires rigorous, systematic, and analytical decision-making. One could argue these three adjectives are often associated with the social practice of academics. These adjectives describe the specific contextual way of how decisions should be made in academic practice.

Reviewing the literature on decision-making, numerous interaction studies (Arminen 2005; Heritage 2005; Jones and Corsby 2015) refer to Garfinkel's research in juror's decision-making practices. First, Garfinkel stated that specific institutions encourage certain ways of decision-making that differ from how decisions are made in daily life. However, when we are engaged in the specific institutional practice, we do not adhere 100% to how that practice encourages our decision-making. On the contrary, he claims that 95% of our decision-making process in institutions is determined by how we make daily life decisions. What does then determine if we orient towards the institutional way of making decisions and how we make decisions in our daily life? According to Garfinkel (1967) the two ways of making decisions are performed in parallel. Thus, it is not one way or the other, but the management of the ambiguity of the different practices that characterize a specific social practice (Garfinkel 1967).

As decision-making is deemed important in constructing the problem, our aim becomes an exploration of how the students, through their interaction, make decisions regarding their problem. Accordingly, our focus will be on the socially shared decision-making taking place in the group. In this paper, we define decision-making as a commitment to future action (Huisman 2001). We will argue that decisions, where the students disagree,

are the most obvious point to start. In a university setting, we teach students they have to argue for their decisions and why they think their approach is the right one. When the students disagree about a problem, ideally, what should happen is that scientific debate should start in which the students argue for the merits of their belief. The best argument (which often should be the most scientific) ought to be the one the group follows.

Consequently, examining how the students argue in a disagreement can shed light on what kind of knowledge they utilize in their group discussions to accomplish a certain decision. This illumination of the knowledge they utilize thus allows us to examine the potentials of the student-centered problem construction process. Thereby, our focus will be on the students' decision-making without any supervisor/tutor present.

This paper will contribute towards what potentials can be derived from the decision-making processes regarding the negotiation of the problem, providing us with a better understanding of PBL. What happens interactively when a disagreement occurs? And what determines the outcome of the disagreement? In other words, what determines whether a decision is made or not made? Is it the academically best formulated argument as we try to teach the students?

Thus, our research question becomes:

How do students negotiate disagreements in their decision-making regarding their problem construction, and which element(s) in the interaction establishes if the decision is made or not?

In other words, we would like to examine why some decision proposals gets accepted even though there are disagreements while others do not. What does the interactional structure state about how some decisions are accepted while others are not?

THEORETICAL FRAMEWORK

Conversation Analysis as our Theoretical Framework

To answer our research question, we use Conversation Analysis (CA). The purpose of CA is to identify structures that underlie social interaction (Stivers and Sidnell 2013). This is done by producing detailed transcriptions of the interaction taking place. Thus, by analyzing different instances of interaction you can elucidate generalizations while being open to the fact that you are not describing the "one way" or "only way" of performing this kind of interaction.

Another central element in CA is it examines what an utterance does in relation to the preceding one(s) and what implications an utterance poses for the next one(s) (Arminen 2005), as such CA links to ethnomethodology (Garfinkel 1967), a sociological approach studying members' way of being-in-the-world. An essential part of ethnomethodology is that even the smallest amount of interactions can provide general insights into the nature of social interaction (Garfinkel and Rawls 2002). When examining interaction and how the students negotiate disagreements in their decision-making, CA provides us with a theoretical framework that enables us to study their dialogue's micro-processes to illuminate what kind of knowledge they utilize in their group discussions to accomplish a certain decision. This illumination of the knowledge they utilize thus allows us to examine the potentials of student-centered problem construction. In the following, we will define some specific concepts used in CA relevant to our analysis.

The concept of Turn Construction Unit (TCU) indicates a speaker's turn in which they can construct an utterance (Sacks and Jefferson 1995). Transition Relevant Place (TRP) marks the transfer of speakership, which normally only happens at certain specifiable junctures (Clayman 2013); in our extracts, this will be especially relevant in the pauses shown in the transcripts by a punctation. Preference indicates the principles participants follow, often implicit, when they act and react in various interactional situations (Pomerantz and Heritage 2013). One can answer in a preferred way (accepting an invitation), and one can answer in a dispreferred way (not accepting an invitation) (Sacks and Jefferson 1995). Another term used in CA is repair, which is defined as the interlocutor's practice where they interrupt the ongoing course of action to attend to possible trouble in speaking, hearing, or understanding the talk (Kitzinger 2013). This can happen by a co-participant; other-initiated repair, or by the speaker's self-initiated repair. Although CA contains more than the above-described concepts, these will be the most relevant for our analysis. When examining interaction, it is equally important to have an embodied view of the interaction (Goodwin 2018; Heath and Luff 2013). The term embodied should be understood as:

"the ways in which the production and intelligibility of action are 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 p. 295).

Our focus will also be on the embodied nature of the interaction. This will be shown in the analysis with direct screenshots of the video-recordings embedded in the transcriptions.

VIDEO-OBSERVATION

As our research question is centered around students' interaction video provides an ideal source of data as it allows us to study in detail how the students negotiate and reach an agreement towards the content of the problem they wish to work with. As we aimed to study what happened in detail, we used 360-degree cameras to collect video. According to McIlvenny (2020), 360-degree recordings: "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.

The data collection procedure

We collected our data at Aalborg University, Denmark, following a 3rd semester Engineering group in 2018-19. We followed the students from their first day of the semester until their last day. At AAU, all educations use PBL. At the Engineering studies students choose an initial problem or case and form a group based on their mutual interests. They write a project over a semester while simultaneously following coursework. When the students do not attend courses, it is expected they work on their projects. The group is provided with a group-room, where they gather when they are not following courses. It is up to the students to negotiate how often they meet. This group chooses a working time between 8:00–16:00 every day; if not participating in lectures or other courses, they would be in the group room. Two cameras were placed in the room. One backup camera in the corner of the room and one 360 degrees camera in the middle (Fig. 1).

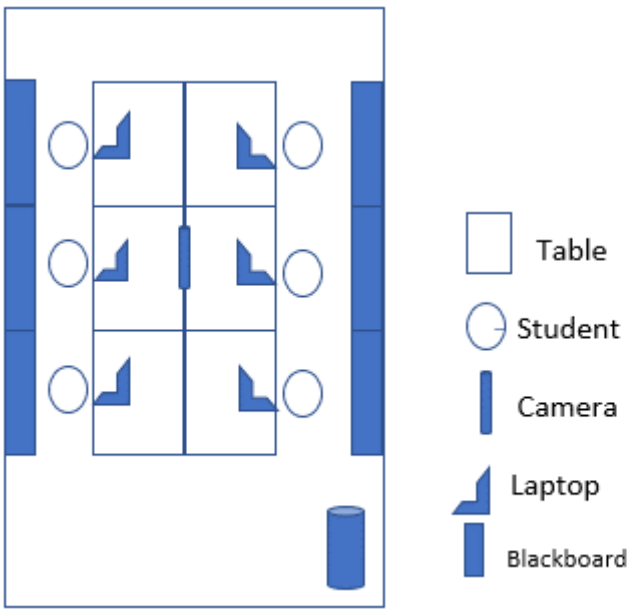

Figure 1. Layout of the room.

The 360-degree camera was placed on a stand in the middle of the tables. This meant the focus was on the students' facial expressions. It also meant we did not focus on the content of their laptop screens.

Ethics and Collection of Data:

To collect our data, written consent was given from both the students and supervisor to follow, record, and present the data in journals, teaching activities, and workshops without any kind of anonymization. They were all provided with the opportunity to withdraw this consent if they came to regret their decision.

Selection criteria for analyzed segments:

Following group work over a semester produces a vast amount of data. At the time of this publication, the first two months of video were indexed. This meant the video was watched, and a short log was written describing the contents of the video. During this process, it became clear that the problem was most actively discussed during the first month. We focused on clips where there was an active negotiation of the problem fostered by an internal disagreement in the group. Focusing on specific cases of interaction is also termed "hot spots" by Jordan and Henderson (1995), which is defined as: "sites of activity for which videotaping promises to be productive" (Jordan and Henderson 1995:43). The detailed understanding provided by the microanalysis of interaction informs on a general understanding of the practice studied. During the first month, the group met 16 times. During these meetings, there were a total of eight examples where the problem was addressed. Out of these eight examples, there were three examples where the group disagreed about a decision concerning their problem's content. It is these three examples we will be looking into in this paper.

Presentation of data in this paper – Jefferson Transcription System

To present our data, we will use the Jefferson Annotation system (Jefferson 2004). What is important to remember in this regard is that normal grammatical conventions are not used and lines with punctation means small breaks in the interaction. At some relevant points, an arrow will link the utterance to a picture of the nonverbal action performed at the end of that specific utterance.

FINDINGS

As will be shown, the interactional structure in the three examples might seem different. Still, a precise conversational structure of which factors establish what kind of decision the students make, will be evident in all examples. Thus, our concern becomes how the conversational structures establish whether a decision proposal will be accepted or not.

The group consists of six members:

P: Patricia
S: Stine
J: Jacob
M: Magnus
F: Franz
T: Teitur

Figure 2. Student names.

Shown in the pictures below

Figure 3. Picture of students.

The first instance was recorded with a handheld camera. The students communicated in Danish, but the transcripts were then translated to English by the author. Only the English transcripts will be shown in this paper.

Extract 1:

In this sequence, we jump into the group's first meeting. It is their first day of a new semester. They have just formed the group, been assigned a group room, and brainstormed towards a more concrete subject for their project. They formed the group on the notion that they wanted to write a project about storing energy produced from sustainable energy sources; the brainstorm focuses on which sector of energy storage they should choose; private or business. Stine is writing on the blackboard and is asked by Magnus to draw a house on another blank blackboard. We enter the interaction after she has drawn the house. As the example will show we see how Magnus proposes a decision that is questioned by Stine, Magnus then addresses these questions, and his decision proposal is accepted without much debate. A conversational structure is then presented showing how the decision was made.

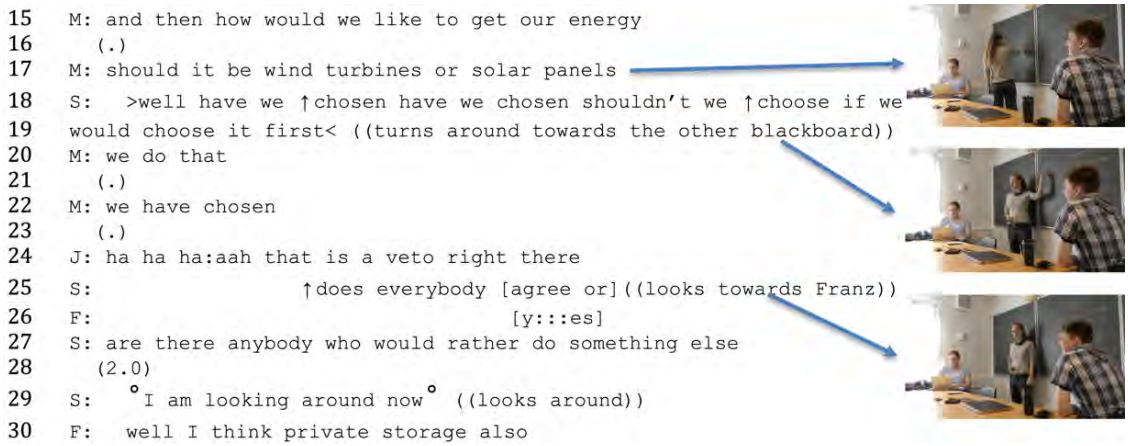

Figure 4. Extract 1.

In the interaction shown above, we see a disagreement on whether a decision regarding their project's subject has been made. The discussion has centered on whether to focus on private energy storage or business energy storage. In line 15, after Stine has drawn a private household (as told by Magnus to draw), Magnus asks how they would like to get their energy and ends his Turn Construction Unit (TCU), creating a Transition Relevant Place (TRP). Nobody else takes the turn, so Magnus takes another TCU in line 17, where he performs a repair of his utterance in line 15, making his question more concrete by offering different options to his question. Stine infers he is talking about private storage, so while replying in a rapid talk, she turns around, orients her hand, and gazes towards the other blackboard with the subject, and then afterward, at the end of her turn, directs her gaze towards Magnus, choosing him as the next speaker. As Goodwin (1980) states, the speaker should obtain the gaze of her recipient during the talk; however, in this instance, one could argue that Stine allocates a turn towards Magnus as she is directing her question towards him by orienting her body towards him (see picture at line 18). However, before this, she orients towards the blackboard. One could argue that by pointing towards the blackboard, she is directing the whole group's attention towards the discussed subject; the blackboard thus serves as an artifact to collect the attention of the participants in the room and creates a form of cohesion or focused attention towards one single point of attention. In that way, she is including the rest of the participants in the room in her questioning of Magnus. He replies in line 20 by stating, "first; we do that". Although not that clearly shown in the transcript Stine now shifts her gaze from Magnus towards Franz in line 25 before Franz replies, Magnus repeats his utterance resulting in laughter from Jacob and Stine. Stine now verbally asks if people agree, and Franz replies immediately in line 26, which could be due to the previous gaze or turn allocation Stine tried to allocate towards him. Stine then tries to make sure everybody agrees on the subject, which they do (although not shown in the presented extract).

In the above instance, we have shown an example of one type of decision-making regarding the students' problem or subject area. One student makes the decision, which is then questioned by another. The initiator of the decision defends the decision, and the rest of the group agrees with the decision, as such the following sequence can be made:

1. One member initiates a decision (line 15 and 17)
2. Another questions the decision (line 18)
3. The initiator addresses the questions (line 20 and 22)
4. The other members agree with the decision (line 26 and 30)

In this example, we see how the discussion about a given topic is formalized into a discourse of procedure (did we or did we not choose that subject) instead of a more academic discourse such as; “what are the arguments for choosing this topic instead of the others?”. As such, it lacks the use of academic or theoretical discourses. The argument thus becomes whether or not the other group members agree with the topic and not why or what in that given topic, they wish to examine further. As such, one could state that the students make decisions like they would do in their daily lives, focusing on whether all agree with the decision instead of the decision's academic merits.

Extract 2

In the next example, we will see an instance where a decision towards the problem is presented, but not picked up by the group. We finish by focusing on the conversational structure again to see what have changed from the first example.

A week has passed since the first meeting analyzed above. The group has decided to write a project about private energy storage from solar cells in batteries connected to the household. A discussion about the battery's size has led to a discussion about where the battery should be placed in the household (as the placement decides which sizes are relevant to work with). We enter when Patricia proposes an idea:

```
1   P: °like ↑if you put it down in the floor then you could make so:::me
2      (1)
3   F: but if you put [it down in]
4   P:                [heat in it]
5   F: if you put it down in the floor then it is difficult to remove
```

Figure 5. Extract 2.

Patricia introduces the idea of putting the battery down in the floor for it to be able to produce heat in line 2, followed by a pause, which seems to be interpreted as a TRP by Franz as he produces a turn in line 3. However, it seems like Patricia does not see it as a

TRP, as she is overlapping Franz in line 4, making Franz stop his turn, wait until Patricia has completed hers, and then resume his turn. The suggestion is turned down because you have to switch the battery every 5–10 years, and you cannot do that if the batteries are in the floor. Patricia responds by providing an option of how to deal with that difficulty:

```
11  P: couldn't you but you can have like a[do::::or thing]
12  M:                                     [yes yes ye:ah]ye::s
13  P: if you had like a giant
14  S: a do:::or thing ↑ like in the floor
15  F: yes like a hatch
16    (0.5)
17  F: a hatch in the floor
18    (1)
19  M: like a trapdoor in the floor
20  F:                  [like und]er under a carpet like you see in the old movies
21  M:                                                                    ((laughs))
22  S                   [YES YES]
23    (1)
24  F: where they have that safe underneath
25  P: [yes]
26  S: [yes]
27  F: you could do something like that
```

Figure 6. Extract 3.

The above transcript will not be analyzed in detail but is included to show how Patricia in line 11 introduces the concept of a "door" (both verbally and nonverbally), with her body movement from down to up as shown in line 11, imitating a door/hatch being opened. It is interesting to note here that M in line 12 produces minimal response towards P's previous utterance, and after explaining what they mean to Stine, Franz states: "you could do something like that" in line 27. Nobody has criticized the idea of placing the battery in the floor with a hatch to produce heat; however, Patricia now changes her suggestion/idea:

```
24  (1)
25  F: where they have that safe underneath
26  P: [yes]
27  S: [yes]
28  F: you could do something like that
29  P: like you you could also [do it like have a giant closet]
30  M:                         [°a dungeon](( laughs))
31  (0.5)
32  P: and then have like some small battery packs that like is taken up and down
33  (1)
34  P: then you don't have to have a big battery but it is like small components
35  F: yes then you don't neee need batteries in a series
36  M: [e:::::::::::::::::::::::::::::::::::::::::::::::::::hm] but you would like to get
37  the batteries'
38  (0.5)
39  M: cells drained
40  (1)
41  M: e:::qualy  to get like when it is finally drained then it is the whole
42  battery you just switch
43  (2)
```

Figure 7. Extract 4.

In line 29, Patricia is adjusting or providing an additional idea to the group. Instead of having the batteries on the floor, you could have them in a giant closet as she shows

nonverbally in line 29 as well, where the width of her hands figuratively symbolizes the size of the closet. This gestural representation of her utterances continues in line 32, where she figuratively shows the size of the small batteries. Her suggestion thus becomes to switch the batteries little by little. It is interesting to note that nobody had turned down her previous idea of having the batteries in the floor, if there was a hatch in the floor, that idea was complimented by Franz in line 28. Patricia's new suggestion seems to be an orientation towards the idea of switching batteries, so she is developing her idea by incorporating the other group members' feedback to her first idea. Franz' utterance in line 5 and Stine's utterance that followed (which is not shown in the extracts) mentions the requirement of being able to switch the battery. By introducing a "giant closet" where switching batteries or part of a bigger battery is easy, Patricia orients more towards the problem of switching batteries than her first idea of providing heat in the floor. The idea is, however, put down by Magnus in line 36. Notice his long way of formulated his e::::hm, this could indicate that he knows his response might be a dispreferred response as he is criticizing the idea, arguing it cannot be done because batteries of the size they are working with contain multiple cells and you want those cells drained equally, you cannot just take one cell out. The fact that his response is dispreferred can also be seen by the two-second pause following his statement. Stine then questions this statement by Magnus. After Stine questions Magnus, Patricia suggests testing her idea:

61 P: but it is not something we could test on
62 (0.5)
63 P: we could see if li:::ke if maybe two batteries in a series is the same as one
64 battery that should have the same capacity like the two
65 M: but it is
66 (2)
67 P: does it drain like what what drains more what is better
68 F: what
69 M: o::::h
70 S: THEORETICALLY I think it doesn't matter
71 P: [yeah theoretically] but like
72 S: [((laughs))but]
73 M: but [I know]
74 F: [in prac]tice
75 M: like
76 (1)
77 S: like it [helped]
78 M: [if] you buy a battery a bbbb bigger battery then it is not one
79 then it is not one cell
80 (1.5)
81 M: then it is several cells that are connected
82 F: it is
83 (3)
84 F: they are connected in some sort of way
85 S: and it is like if you have it in ONE box or what you say then you would like
86 to have it all drained e::::qually for then you switch the whole battery
87 otherwise you have to switch something if some of it is too drained and some of
88 the cells is not too drained then you will have to switch a battery where some
89 of it is actually all right

Figure 8. Extract 5.

In line 61, when Patricia suggests they test her idea, a TRP occurs afterward (line 62). No other person initiates a turn, which then prompts Patricia to elaborate on her testing idea, which Magnus questioned in line 65. One could again argue his response is dispreferred as a 2-s pause follows. However, Patricia continues to elaborate her idea in line 67, to which Magnus replies: o:::h in line 69, giving the idea that Magnus can now follow Patricia's notion of thought. Stine then states that, theoretically, there should be no difference. This utterance is quite interesting because Stine is criticizing the experiment. Thus the problem Patricia suggests, like Magnus has done several times before, but it is not treated as a dispreferred answer by the participants, as no longer pause follows. So why is Magnuses' statement followed by a pause when Stine's is not? Looking at the transcript, one could argue that it is his short-determined answer in line 65: but it is, where Stine in line 70 states, THEORETICALLY, I think, thus her statement: "I think" downgrades the contents of her utterance, making it easier to challenge. Then Patricia in line 71 utters: "yeah theoretically but like", after which Magnus states: "but I know" and Franz continues Patricia's utterance from line 71: "in practice" however nonverbally, something interesting is happening. P starts to orient towards her computer, as seen in line 74, and she does not produce any further utterances. Nonverbally, she thus might have withdrawn from the conversation as she lets the other team members discuss her suggestion and reject it. In line 78, we see Magnus repeats his previously uttered comment about bigger batteries containing more cells; this is backed up by Franz and Stine, who give a longer explanation for why the idea/decision will not work. The suggested decision is thus abandoned.

Interestingly enough, the students seem to take what they believe are theoretically informed decisions (line 70). They state that theoretically, there should be no difference, and one battery contains multiple cells; thus, P's idea of changing parts of the battery will not work. From the example given above, we can present this structure:

1. Initiator of a decision introduces a decision (P line 1)
2. The decision is questioned by another (F line 3 and 5)
3. The initiator addresses the questions (P line 11)
4. One member of the group states that could be done (F line 28)
5. The initiator changes the decision (P line 29)
6. This decision is then questioned (M line 36-42)
7. The initiator addresses the questions (P line 61-67)
8. The questioning of the decision continues (M line 78-81, F line 82, S line 85)
9. The initiator withdraws from the questioning (line 74)
10. The decision is abandoned.

We can see that questioning a decision proposal seems to be the preferred way to deal with disagreements towards a decision. However, this example also shows how the

initiator changed her decision-proposal in the process. As such, she started with one initiation that received questions that were answered and, even though this decision then received praise, the initiator came up with a different decision proposal, to which new questions were raised, and an elaboration happened, but it was in the end declined. We also saw how the initiator withdrew from the interaction and started orienting towards her computer. From this, we can conclude that persistence seems to be of the essence when you want your decision to go through. You need to be able to argue for the merits of your decision.

Looking more qualitatively at the content of the discussion, we can see that different kinds of designs are discussed; batteries in the floor or a giant closet; what seems to be evident by the group in these discussions is not the visual layout, but the practical accomplishments of a given product. Batteries in the floor are good because they can provide another practical feature by producing heat in the floor. Batteries in a giant closet are a good idea because they might help with the practicality of switching the cells in the battery, thus reducing the costs of a battery switch. However, this is not possible due to larger batteries containing multiple cells that you want to be drained equally. According to the theory, there does not seem to be any difference between multiple batteries or one large battery. Thus, the decision taken here is more theoretically informed than the first one, as they cannot find a theoretic argument to justify their lab experiments.

In our last example, we will focus on an instance where no questioning is directed towards a decision proposal. However, at the last point of this interaction we see how they return to the structure described in the last two examples.

Extract 3

A week has passed since extract two. In the following example, we will only focus on the verbal transcripts as we are incorporating a long example. The group has just discussed a questionnaire by the semester coordinators on whether their project is suitable for this semester. They agree that it is according to the learning goals, but Jacob questions whether it is in accordance with the coursework. The other members quickly agree it is. However, later on, Jacob asks if he can elaborate on why he thinks it is not, which is when we enter the conversation:

```
1   J: so can I try to come with a for example of why I don't believe
2      (1)
3   J: that we will like go in depth and look at stuff like that
4   S: yeah
5   J: it is for example that
6      (1)
7   J: if we talk about err
8      (2)
9   J: >it is the whole system right and also if now for example when we talk about
10  dimensioning or our analysis of in relation to err or simulation of in relation
11  to err when will the power be used and so on<
12  S: yes
13  J: it is more about
14    (1)
15  J: the concrete units like how
16    (1)
17  J: big this battery should be
18    (1)
19  J: in relation to err how much power in relation will ehh how much power will be
20  used and so on it is not okay
21    (1)
22  J: it is relvan that it is
23    (1)
24  J: detailed okay like it is because it is from AC to DC
25    (1.5)
26  J: for example
27    (1)
28  J: it is more like the system of wha where the ussage is
29    (1)
30  J: and effect and the effect necessary for it for example
31    (1)
32  J: it is not
33    (2)
34  J: the w:::::ay it is used if that makes sense
35  S: [yeah]
36    (3.5)
37  S: it does maybe
38    (2)
39  J: yeah I don't know
40    (0.5)
41  J: but ° (unclear) °
42  M: no °I can see your point° you you think more like that it will become an ehh
43  J:                  [it will]
```

Figure 9. Extract 6.

Although this extract is pretty long, we want to draw the attention to the number of turns Jacob has even though numerous points of TRPs occur (lines 2,6,8, 14,16,18,21,23,25,27,29,31,33,36). We can see that Jacob's reaction to the lack of turn initiation by the other participants is a continuing elaboration of his point. In line 9-11, he talks very fast as well, which might indicate that he is nervous. Therefore, he speaks faster, backed up by line 12 when Stine utters yes, and Jacob then slows the speed of his talking. In line 34, we see that Jacob is directly requesting a response with his utterance: "if that makes sense". This follows a 3.5-s pause, which might further indicate Jacob being done with his elaboration. Afterward, a small acknowledgment is provided in line 37. However, in line 39, Jacob states: "yeah, I don't know" which might seem a bit contradictory given his numerous previous turns where he elaborates on his point. This might be due to a dispreferred answer from the group. Although Jacob does initiate a turn in line 41, we do not know if he intended to argue further for his proposal or downplay it. However, in line 42, Magnus states that he can follow Jacob's point.

This extract shows that feedback to one's decision proposal seems important to examine whether the decision can be made. However, as no response is coming, the initiator seems to backtrack for a moment, shown in line 39 above. In the continuing interaction, we see that it returns to a previously described conversational structure where the decision is questioned:

```
67  M: yes but we get like ehh we get like the AC power that we can describe with a
68  sinus or a cosine curve
69  J: that we can of course do but
70  M: shouldn't we be able to do that
71  S: yeah
72  J: but how much
73    (1)
74  J: it needs to be done because we should still like what we are >thinking on it
75  is like if we just say like okay it needs to transformed to AC power because it
76  needs to get out of our power sockets for example< and >THERE are some different
77  devices that runs with different effects for example<
78    (2)
79  M: so that we THAT WE
80  S:    [when]
81  M: should make sure that maybe we will write a
82    (1)
83  M: problem
84    (1)
85  M: what is it ca::led it no what is it called
86  S: >problem statement<
87  M: a problem statement THAT makes sure we can't
88    (1)
89  M: e:::r settle with
90    (1)
91  M: and
92    (0.5)
93  J: yeah that can
94  S: yeah
95  M: and look at e:::h
96    (2)
97  M: that which you are talking about
98  J: ehmmmm
```

Figure 10. Extract 7.

Magnus formulates a question towards Jacob in line 67-68, which is supported by Stine in line 71. Jacob then elaborates on his decision proposal in line 74-77. After that a new TRP occurs, and Jacob does not take the word. Magnus does, and the result is that Jacob's proposal for a decision is met, and they are now discussing how to account for his objection. The overall structure of this decision-making process can thus be summed up in the following way:

1. Initiator proposes a decision (line 1-25)
2. No reactions from the other group members (line 21, 23, 25)
3. Initiator elaborates his decision and asks for a response (line 26, 28, 30, 32, 34)
4. No reactions from the other group members (line 36)
5. Initiator questions the knowledge of his decision (line 39)
6. Group members support the initiator (line 42)
7. Initiator elaborates (line 45, 49, 52, 57-58)

8. Group members question the decision (line 67-68, 70, 71)
9. Initiator elaborates (line 74-77)
10. Decision is met and worked into the project (line 81-95)

Although this decision structure is again structurally different from the others, more academic discourses seem to be put into play by discussing what kind of power (AC or DC) they use and whether they go in-depth with the coursework in their project. As such, we see a gradual increase in the theory used in the students' work.

CONCLUDING REMARKS

Our research question for this paper was:

How do students negotiate disagreements in their decision-making regarding their problem construction, and which element(s) in the interaction establishes if the decision is made or not?

We analyzed three discursively different instances of internal disagreement toward a decision in the students' group work. However, at some point all three examples contained this structure:

1. Initiation of a decision
2. Questioning of the decision
3. Initiator addresses the questions
4. Decision is either met or declined depending on the initiators ability to address the questions.

We find it interesting that even though the discursive content of the three examples shown are so different, they all in some way contain or return to the same structure regarding decision-making marked by a disagreement. As we studied the conversational features, practical accomplishments, and discursive organization of the students' interaction, we found a conversation structure present in all examples regarding how students interactively state their disagreements towards a suggestion. Instead of stating directly; "I disagree with what you are saying", they start asking questions about the suggested decision. Even in the third example, where no questions were asked, they returned to a formula where they asked questions about the decision proposal. This questioning could mark a non-alignment towards the decision proposal, which is then negotiated in the following dialogue. We also see what determines whether a decision proposal is accepted or not is the ability to hold on to your suggestion and elaborate on the merits of that

suggestion. As shown in example two, Patricia changed her decision proposal and withdrew from the questioning with the result that the group did not accept her proposal.

Although we couldn't find other studies that relate to decision-making among students in higher education, we would like to relate to the famous I-R-E form found in educational institutions (Mehan, 1979). Here a structure into which there is an Initiation by the teacher to the student (by asking the student questions that the teacher knows the answer to), Response by the student, and Evaluation of the response by the teacher. In the same way we argue disagreements have the following structure: Initiation of a decision (by proposing a decision). Questioning towards the decision (marking non-alignment towards the decision). The initiator addresses these questions (determining if the decision is accepted or not). Decision is then either met or declined. An interesting finding in this regard is that the strength of the argument did not seem to be the most important factor into which the decision was met, but the ability to hold on to the decision and keep arguing for it.

From a critical point of view, one could question if it makes sense to draw these conclusions on the limited amount of data, we have of one group's work. Although this is accepted according to our ethnomethodological framework, that states social actions are part of both micro and macro structures (Garfinkel & Rawls, 2002) we welcome further studies in this area, especially in other higher educations could be interesting to see if the structure is the same. Another critical point is the lack of academic discourses utilized in the students' discussion and decision-making in relation to their problem. However, suppose we see these instances as a gradual academic development of the students' theoretical knowledge and, thus, a more qualifying problem construction, as time progresses. In that case, it might look a bit different. As mentioned in the introduction, Garfinkel stated that when engaged in a specific institutional practice, only 5% of the institutional way of making decisions are evident in the social interaction. Within this framework, if we look at the interaction, it could seem surprising that the first example shows no deep discussions about the content of the problem. Thus, one could argue the students approach this, not from an academic angle, but from how they would approach this in daily life. However, what also seems evident is that the discussions become more academic and theoretical informed as the students progress with their studies. Thus, the students engage from what they know, and as their knowledge increased, they incorporate more theory in their discussions as they progress. For example, two, they discuss the merits of batteries and how they drain; in example three, they discuss what kind of power they will use in their project; thus, we see a gradual academization of their discussions.

What relevance does this study have for Near Future Cases of PBL? The study provides an insight into how students make decisions and what seems to determine the outcome of

whether a decision is met or not. In this regard it is worth noticing that a questioning or non-alignment towards a decision proposal is not equal to a decision-proposal not being accepted. Thus, to prepare the students for their PBL work we need to encourage them to actively discuss the merits of their proposal and emphasize how questioning towards their proposal is not equal to a proposal not being met. In other words, we need to strengthen their ability to argue for the merits of their decision. Some would state this is already an essential part of PBL and nothing new. In that case this study shows exactly how it is done and what might determine a decision's outcome.

Furthermore, we want to emphasize that students constructing their own problems has been a practice for nearly 50 years. To our knowledge, this is the only research looking at the interactionally work of this practice. Additionally, the problem will consistently be relevant for Problem-Based Learning. In near future practices, knowledge of how the students approach the problem will be relevant to further develop these practices. We hope our study provides knowledge for how PBL is done in practice. Thus, it gives us a better foundation for developing both near future cases and inspiring others to focus their research on students' interaction.

References

Arminen, Ilkka. 2005. *Institutional Interaction Studies of Talk at Work*. Farnham: Ashgate.

Barrows, H. S. 1996. *Problem-Based Learning in Medicine and beyond: A Brief Overview. New Directions for Teaching and Learning*. Los Angeles: Springer.

Barrows, H. S., & Tamblyn, R. M. (1980). *Problem-Based Learning: An Approach to Medical Education.* Springer.

Benwell, Bethan. 1999. "The Organisation of Knowledge in British University Tutorial Discourse: Issues, Pedagogic Discourse Strategies and Disciplinary Identity." *Pragmatics* 9(4):535–65. doi: 10.1075/prag.9.4.06ben.

Benwell, Bethan, and Elizabeth H. Stokoe. 2002. "Constructing Discussion Tasks in University Tutorials: Shifting Dynamics and Identities." *Discourse Studies* 4(4):429–53.

Clayman, Steven E. 2013. "Turn-Constructional Units and the Transition-Relevant Place." Pp. 150–67 in *The Handbook of Conversation Analysis*, *Blackwell Handbooks in Linguistics*. Oxford: Wiley Blackwell.

De Graaff, Erik, and Anette Kolmos. 2003. "Characteristics of Problem-Based Learning." *International Journal of Engineering Education* 19(5):657–62.

Garfinkel, Harold. 1967. *Studies in ETHNOMETHODOLOGY*. New Jersey: Prentice-Hall.

Garfinkel, Harold, and Anne Warfield Rawls. 2002. *Ethnomethodology's Program: Working out Durkeim's Aphorism*. Lanham, Md: Rowman & Littlefield Publishers.

Goodwin, Charles. 1980. "Restarts, Pauses, and the Achievement of a State of Mutual Gaze at Turn-Beginning." *Sociological Inquiry* 50(3–4):272–302. doi: 10.1111/j.1475-682X.1980.tb00023.x.

Goodwin, Charles. 2018. *Co-Operative Action*. New York: Cambridge University Press.

Heath, Christian, and Paul Luff. 2013. "Embodied Action and Organizational Activity." in *The Handbook of Conversation Analysis*, *Blackwell Handbooks in Linguistics*. Oxford: Blackwell Publishing Ltd.

Heritage, John. 2005. "Conversation Analysis and Institutional Talk." Pp. 103–49 in *Handbook of language and social interaction*. Lawrence Erlbaum Associates, Inc.,.

Holgaard, Jette Egelund, Aida Guerra, Anette Kolmos, and Lone Stub Petersen. 2017. "Getting a Hold on the Problem in a Problem-Based Learning Environment." *International Journal of Engineering Education* 33(3):1070–85.

Huisman, Marjan. 2001. "Decision-Making in Meetings as Talk-in-Interaction." *International Studies of Management & Organization* 31(3):69–90. doi: 10.1080/00208825.2001.11656821.

Hung, Woei. 2006. "The 3C3R Model: A Conceptual Framework for Designing Problems in PBL." *Interdisciplinary Journal of Problem-Based Learning* 1(1):55–77. doi: 10.7771/1541-5015.1006.

Hung, Woei. 2009. "The 9-Step Problem Design Process for Problem-Based Learning: Application of the 3C3R Model." *Educational Research Review* 4(2):118–41. doi: 10.1016/j.edurev.2008.12.001.

Hung, Woei. 2016. "All PBL Starts Here: The Problem." *Interdisciplinary Journal of Problem-Based Learning* 10(2). doi: 10.7771/1541-5015.1604.

Hung, Woei. 2019. "Problem Design in PBL." in *The Wiley Handbook of Problem-Based Learning*, *Wiley Handbooks in Education*. Hoboken, NJ: John Wiley & Sons.

Hüttel, Hans, and Dorina Gnaur. 2017. "If PBL Is the Answer, Then What Is the Problem?" *Journal of Problem Based Learning in Higher Education* Vol 5 No 2 (2017). doi: 10.5278/OJS.JPBLHE.V5I2.1491.

Jefferson, Gail. 2004. "Glossary of Transcript Symbols with an Introduction." Pp. 13–31 in *Conversation Analysis Studies from the first generation*. Amsterdam: John Benjamins Publishing Company.

Jones, Robyn L., and Charles Corsby. 2015. "A Case for Coach Garfinkel: Decision Making and What We Already Know." *Quest* 67(4):439–49. doi: 10.1080/00336297.2015.1082919.

Jordan, Brigitte, and Austin Henderson. 1995. "Interaction Analysis: Foundations and Practice." *Journal of the Learning Sciences* 4(1):39–103. doi: 10.1207/s15327809jls0401_2.

Kek, Megan Yih Chyn A., and Henk Huijser. 2017. *Problem-Based Learning into the*

Future. Singapore: Springer Singapore.

Kitzinger, Celia. 2013. “Repair.” Pp. 229–57 in *The Handbook of Conversation Analysis, Blackwell Handbooks in Linguistics*. Oxford: Blackwell Publishing Ltd.

Koschmann, Timothy, Phillip Glenn, and Melinda Conlee. 1997. “Analyzing the Emergence of a Learning Issue in a Problem-Based Learning Meeting.” *Medical Education Online* 2(1):4290. doi: 10.3402/meo.v2i.4290.

Markauskaite, Lina, and Peter Goodyear. 2017. *Epistemic Fluency and Professional Education*. Vol. 14. Dordrecht: Springer Netherlands.

McIlvenny, Paul. 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* 146879412090546. doi: 10.1177/1468794120905460.

Pomerantz, Anita, and John Heritage. 2013. “Preference.” Pp. 210–29 in *The Handbook of Conversation Analysis, Blackwell Handbooks in Linguistics*. Oxford: Blackwell Publishing Ltd.

Sacks, Harvey, and Gail Jefferson. 1995. *Lectures on Conversation: Volumes I & II*. 1. publ. in one paperback volume 1995, [Nachdr.]. Oxford: Blackwell.

Savin-Baden, M., & Major, C. H. (2004). *Foundations of Problem-Based Learning*. Open University Press.

Schegloff, Emanuel A. 1992. “On Talk and Its Institutional Occasions.” Pp. 101–36 in *Talk at work: Social Interaction in institutional settings*. Cambridge: Cambridge University Press.

Servant, Virginie Felicja Catherine, H. G. Schmidt, and M. A. Frens. 2016. “Revolutions and Re-Iterations: An Intellectual History of Problem-Based Learning.” Erasmus University Rotterdam, Rotterdam.

Servant-Miklos, V. F. C. (2019). Fifty Years on: A Retrospective on the World’s First Problem-based Learning Programme at McMaster University Medical School. *Health Professions Education*, *5*(1), 3–12. https://doi.org/10.1016/j.hpe.2018.04.002

Stivers, Tanya, and Jack Sidnell. 2013. “Introduction.” Pp. 1–9 in *The Handbook of Conversation Analysis*. Oxford: Wiley Blackwell.