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Clarification requests as a method of pursuing understanding in CLIL physics lectures

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ABSTRACT

Using multimodal conversation analysis, this article examines how students strive to resolve non-understandings through requests for clarification during teacher-fronted physics lectures taught in English in Finland. The findings provide new insights on the sequential environments in which students launch the requests (i.e. between or during teacher's explanation turns) and how different problem categories (e.g. language, conceptual, textual) are made relevant and oriented to in the requests. Moreover, the findings show the role of different textual objects (e.g. inscriptions on the board) in the formulation and resolution of the clarification requests as well as the relevance of students' note-taking to both their proximal and distal goals of trying to understand the instruction. Overall, the clarification requests are shown to influence in different ways the teacher's instructional process and offer valuable feedback to the teacher about the success of his explanations, i.e. how students understand them and whether he can proceed with his instructional agenda. Finally, the findings shed new light on how the integration of language and content is oriented to and accomplished by participants during teacher-fronted lectures in content-based lessons taught in a foreign language.

KEYWORDS

Non-understanding; clarification request; classroom interaction; CLIL; conversation analysis; multimodal resources

Introduction

In his explication of 'understanding' as a non-mentalist action, Wittgenstein (1953) uses a hypothetical case of algebra instruction.¹

A writes series of numbers down; B watches him and tries to find a law for the sequence of numbers. If he succeeds he exclaims: 'Now I can go on!' – So this capacity, this understanding, is something that makes its appearance in a moment (59).

For Wittgenstein, 'Now I can go on!' and the expressions 'Now I know!', 'Now I can do it!' and 'Now I understand!' (59) have in common that they are produced in 'particular circumstances, which justify me in saying I can go on' (60).

It is no coincidence that the 'particular circumstances' arise in a fictional instruction activity in which the student and teacher are co-present. In this activity environment displays of

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achieved knowledge or understanding not only formulate the student's readiness 'to go on', they also inform the teacher that he or she 'can go on', that is, proceed with the instructional agenda. Conversely, student displays of non-understanding or not-knowing inform the teacher that the students are not ready to proceed. Such negative epistemic actions (Lindström, Maschler, and Pekarek Doehler 2016) make responses by the teacher or other students relevant that address the problem before the instructional agenda is resumed. Either way, students' epistemic actions provide teachers with critical instructional resources (St. John and Cromdal 2016) and are consequential for the unfolding of the activity. Therefore, teachers regularly pursue students' epistemic displays with checks of understanding (e.g. Koole 2010; Waring 2012) and knowledge (e.g. Koole 2010; Sert 2015). With such actions teachers orient to their category-bound obligation to ascertain that students have attained access to the instructable matter, and to the possible need to invest further pedagogical work in case the pursuit returns negative.

But as Wittgenstein's scenario implies, students also exhibit epistemic access, or lack thereof, with uninvited actions. An increasing body of research specifies how students actively manage their participation with self-initiated actions in instructional activities with different overall goals and organisations. Although the first position in student-initiated sequences is populated with a range of actions (Garton 2012; Waring 2011), the most prevalent categories are guestions and other-initiations of repair that convey the speaker's problems of understanding or knowledge and that project answers and resolutions from the teacher or other students (Markee 1994; Merke 2016; Solem 2016a). As this literature documents, claims of not-knowing and non-understanding and requests for confirmation and clarification, are common as sequence-initiating displays of negative epistemic access. Furthermore, studies have begun to reveal distributional patterns of students' self- and other-initiated epistemic actions with relation to the interactional organisation of activity phases within the larger activity (e.g. 'discourse unit' vs. 'dialogue organisation', Koole 2010), between instructional arrangements such as teacher-led plenary discussions (Escobar Urmeneta and Evnitskaya 2014) and peer group work (Jakonen and Morton 2015; Lindwall and Lymer 2011), and between different categories of instructables and their interactional organisation (Lindwall, Lymer, and Greiffenhagen 2015). At the level of turn design, negative epistemic actions locate problems with different specificity (e.g. 'I don't understand anything' vs. 'I don't understand the use of the locatives here', Merke 2016, 5) and address different problem categories, such as procedural (Somuncu and Sert forthcoming), conceptual (Koole and Elbers 2014; Lilja 2014; Solem 2016a) and language-related (Jakonen and Morton 2015) problems. Lastly, alternative action formats also embody different types (understanding vs. knowing) and modes (claiming vs. demonstrating) of epistemic displays (Koole 2010) and locally construct epistemic relations (Solem 2016a, 2016b).

Our study extends upon this literature. Consonant with ethnomethodological and conversation-analytic perspectives, it views understanding as 'an embodied, situated and sequential achievement in interaction' (Mondada 2011). This perspective informs our analysis of students' pursuits of understanding in a Content-and-Language-Integrated-Learning (CLIL) programme taught in English in Finland. During teacher-fronted physics lectures, the students initiate epistemic sequences with a consistent method, a teacher-addressed request to clarify a physics concept related to the law that the teacher is explaining. Furthermore, the problematic items are not only located in preceding *talk* but in various kinds of *textual* materials. The analysis seeks to specify (1) the sequential context in which the requests for clarification are launched; (2) the problem category (e.g. talk, text, language, conceptual); (3) the action format of the requests, that is, their design with multimodal and multilingual resources, including syntax and prosody, embodied action and material objects; and (4) the consequences of the initiation for the resolution of the students' understanding problem and the progression of the lecture.

Understanding in praxeological perspective

In ethnomethodological and conversation-analytic perspective, understanding and knowledge, collectively referred to as epistemics, are considered fundamentally social in two senses: as being socially accomplished and as being made socially relevant at particular interactional moments. Participants make their understanding publicly visible in 'next' turn since any turn that addresses a previous turn unavoidably displays how its speaker analyses or understands that prior turn (Sacks, Schegloff, and Jefferson 1974). Exhibiting understanding contingently through next turn is a system constraint of interaction, reflexively interwoven with turn-taking and sequence organisation, and the locus at which intersubjectivity emerges in the evolving talk.

Recent work on multimodal interaction has significantly expanded the praxeological view of understanding, showing how participants mobilise the material and spatial ecology of the setting and coordinate it with talk, gaze, facial expression and bodily action as practices of making their understandings observable to each other (Hindmarsh, Reynolds, and Dunne 2011; Koschmann et al. 2011; Lindwall and Lymer 2011; Mondada 2011; inter alia). For instance, in such different instructional activities as group tutorials in a university setting (Day and Kjaerbeck 2012) and dental apprenticeship training clinics (Hindmarsh, Reynolds, and Dunne 2011), supervisors treat students' and trainees' vocal and embodied understanding displays as assessable matters. These studies investigate how understandings-as-action enable and accomplish specialised instructional agendas and show how the understanding assessments extend beyond local contingencies to extra-situational relevancies, such as the trainees' professional competence and the delivery of appropriate patient care, or students' upcoming reports. In contexts of teacher-fronted classroom interaction (e.g. Macbeth 2011; Merke 2016; Solem 2016a, 2016b; Waring 2012), students' and teachers' ongoing understanding displays constitute the epistemic infrastructure that makes formal classroom education possible in the first place.

The sequential position of understanding displays in classroom interaction

Research on the accomplishment of understanding in instructional settings commonly invokes Sacks' (1992) distinction between claiming and demonstrating understanding. This work also demonstrates that the pedagogical focus and interactional organisation of the larger pedagogical activity shape the emerging trajectory through which students' understanding displays are managed (e.g. Jacknick 2011; Koole 2010, 2012; Lindwall and Lymer 2011; Waring 2012).

In whole-class instruction, Waring (2012) shows that teachers produce understanding checks that invite students to claim understanding in two sequential environments: at activity closings before they move on to the next activity and after they have explained task instructions. Jacknick's (2011) study, while not addressing understanding per se,

demonstrates how students initiate requests for clarification in the sequential environments of inter- and intra-activity shifts. During group work, lab tasks or individual seatwork, students explicitly display non-understanding by initiating a range of instructional sequences to seek help from teachers or peers (e.g. Jakonen and Morton 2015; Koole and Elbers 2014; Lindwall and Lymer 2011). For instance, Koole (2010, 2012) sheds light on the sequential distribution of alternative epistemic displays in teacher-delivered explanations to individual students in math classrooms. When the explanation activity is organised as a 'discourse unit', an information delivery format in which the teacher is the primary speaker and the student the recipient, students produce recipient actions either to acknowledge the instruction and thus claim understanding or to initiate repair and thus claim non-understanding or uncertain understanding. Discourse units often end with the teacher's explicit invitation for the student to display their understanding. In 'dialogue organisation' sequences, the teacher's explanations are accomplished through guestion-answer sequences that set an expectation for the student not only to claim but also to demonstrate understanding. However, students occasionally make negative epistemic displays on their own initiative, in environments where there is no normative requirement for its production. This is also the case in the teacher-led plenary interaction that we will examine.

The design of students' non-understandings

Recent studies on the management of cognition and knowledge in interaction have directed attention to turn designs with negative epistemic constructions such as 'I don't know'² or 'I don't understand' (see e.g. Lindström, Maschler, and Pekarek Doehler 2016). In classroom peer activities, Lindwall and Lymer (2011) show that the turn format of 'I don't understand' serves as a boundary marker that initiates a help-seeking sequence. Such students' claims of non-understanding address either the teacher's preceding instruction or a peer's displayed understanding and thus interrupt the progressivity of the current activity until the problem is resolved. The study thus underlines that the position and format of the students' epistemic actions are consequential for the responses they engender.

Further on the issue of grammatical action formats, a routine method for students to display non-understanding is to request clarification of, for example, a previously defined concept or discussed topic (e.g. Day and Kjaerbeck 2012; Escobar Urmeneta and Evnitskaya 2014; Solem 2016a). Such clarification requests come in various formats, including 'what is X', 'what does X mean', 'what do you mean X' and variants thereof (e.g. Dalton-Puffer 2007; Markee 1994). Like claims of non-understanding ('I don't understand'), clarification requests work as 'display[s] of incomprehension' (Svennevig 2008, 337), but whereas claims of non-understanding make a solution by a coparticipant relevant, as first pair parts clarification requests structurally project the delivery of the solution. In this way, their speaker actively pursues a change of epistemic state. Although clarification requests can address a wide range of understanding problems (e.g. underspecified reference, Svennevig 2008), in the reported classroom studies they embody students' lack of knowledge and project a specific type of responsive action from the teacher, such as a definition (Markee 1994) or an explanation (Merke 2016). Furthermore, the ways in which the clarification requests influence 'the topical and interactional development of the whole-class interaction' (Solem 2016a, 19) incorporate the specific circumstances of their production, as we will elaborate below.

Data and method

The data originates from a video-recorded classroom corpus of CLIL lessons taught in English in Finland. The subset of the corpus used for this article comprises six 7th grade physics lessons. The lessons are organised through three 'phases of activity' (Heritage and Clayman 2010, 106): (1) a peer activity in which the students conduct the standard physical experiment; (2) the teacher's explanation of the physics law in plenary format; (3) textbook-based exercises in which the students apply the new physics concepts (Kääntä, Kasper, and Piirainen-Marsh 2016). The peer experiment affords the students first-hand experience of how the target physical law operates and generates resources for the teacher's explanations during the lecture, the activity phase of interest in this study.

The participants in the lessons are the teacher and six 13-year-old female students. The small group size affords the students opportunities to participate in the teacher's lectures as active recipients and make their understandings of the focal physics concepts publicly visible as the teacher's explanations unfold (see also Nikula 2017). The selected excerpts are representative of student-initiated sequences to address non-understandings in the physics corpus, which consists of three 90-min lessons.

The data is analysed from the theoretical and methodological perspective of multimodal conversation analysis (CA). CA examines how participants accomplish social interaction through shared methods of producing and understanding actions in turns and sequences (e.g. Sidnell and Stivers 2013). Multimodal CA contributes to this project by specifically examining how interactants accomplish actions and intersubjectivity through bodily-visual practices within the material and spatial ecology of physical settings (e.g. Deppermann 2013; Streeck, Goodwin, and LeBaron 2011). Since participants achieve the order of their social activities through multisemiotic actions and understanding displays moment-by-moment, transcriptions of talk and embodied conduct must represent vocal and nonvocal detail to make the data available for analysis. The data for this study are transcribed with standard conversation-analytic conventions (Jefferson 2004; see 'Online supplementary material') and a format for representing bodily visual actions (Mondada 2011), supplemented with frame grabs. Students' names are pseudonyms.

Participants' projects in the CLIL physics lectures

The CLIL physics lectures are embedded in a densely multisemiotic classroom ecology of spatial arrangements and objects that provide affordances for the teacher's explanations and the students' recipient actions. These include the spatial configuration of the classroom with rows of student desks and chairs facing towards the teacher's desk and the blackboard behind it (see 'Online supplementary material'), the physics textbook and subject-specific artefacts for demonstrating the operation of the instructable physics laws, and multi-purpose instructional media such as the blackboard and chalk and the students' notebooks and writing implements (Kääntä 2014; Merke 2016; Lilja 2014; Majlesi 2018; Majlesi and Broth 2012). In a companion paper, we described how the teacher mobilises these affordances as well as inscriptions and drawings on the board in conjunction with formulations and embodied actions to define the physics concepts (Kääntä, Kasper, and Piirainen-Marsh 2016).

In this paper, our analytical interest turns to the students to examine how they orient to *their* institutional projects during the lecture. While the students' conduct is by no means

uniform, it is noticeable that they all attend at one moment or another to the *written* formulations of the instructional objects, the physics laws and their concepts. This orientation is observable in the students' bodily orientations towards the inscriptions on the blackboard, reading in the textbook and note-taking.³ It is about these textual artefacts that the students show problems of understanding and recruit the teacher's assistance to solve them. The students' recipiency of the teacher's explanations is therefore not only oriented to their understanding in the here-and-now but to more permanent records for future use and review, such as the textbook exercises in the third activity phase of the lesson and an exam.⁴ The students thus treat the instructional objects as objects for learning and matters for future assessment. With such understanding pursuits beyond the locally contingent interaction, the students exhibit members' knowledge of what is required of them to successfully participate in formal education, particularly their obligation to appropriate instructional content for future display (also Day and Kjaerbeck 2012). As the analysis will show, the students' distal goals shape their proximate epistemic actions in specific ways.

Opportunity spaces for requesting clarification in the physics lectures

To request clarifications of the key concepts from the teacher, the students need to locate opportunity spaces within the interactional organisation of the classroom activity (Jacknick 2011; Mehan 1979). These opportunity spaces are afforded by the type of lecture the teacher adopts for the pedagogical project of explicating the physics laws and concepts and which serves as a consistent organisational format to structure the explanation sequences and the students' participation in them. This lecture format contrasts with the sequence structure not only of teacher-led small group (Day and Kjaerbeck 2012) and dyadic arrangements (Koole 2010, 2012; Koole and Elbers 2014) but also with other types of teacher-led plenary interaction, such as IRF/E-structured formats (Garton 2012; Waring 2011) or 'dialogic teacher-led discussions' (Escobar Urmeneta and Evnitskaya 2014). Specifically, the lectures are segmented into ordered series of multi-units turns (e.g. Kääntä, Kasper, and Piirainen-Marsh 2016; also Solem 2016a). After an explanation turn is completed the teacher makes an opportunity available to the students to show whether they understand the explanation-so-far. However, the teacher hardly ever invites students' understanding displays through understanding checks (cf. Koole 2010; Waring 2012). Thus, in these sequential contexts the students' recipient actions are relevant but not projected. Their absence is not treated as nonnormative but rather as an indication to the teacher that he can 'go on' with his pedagogic agenda. In addition to opportunity spaces for students' understanding pursuits between explanation turns (cf. Jacknick 2011), students also exploit such opportunities within the teacher's ongoing turn. Such opportunities arise when the teacher disengages from visual contact with the students and puts his talk on hold while doing some other activity, for instance walking towards or writing on the blackboard (also Mehan 1979). The ensuing analysis is organised via these opportunity spaces in which students launch the clarification requests: after an opportunity space that the teacher has made available and during the teacher's ongoing explanation turns. As teacher-addressed actions in first position, the requests are sequence-initiating and project a response from the teacher (e.g. Merke 2016; Solem 2016a, 2016b). The analysis examines how the two sequential environments for issuing clarification requests make other local contingencies relevant and how they shape the ensuing classroom activities.

Employing an opportunity space made available by the teacher

Extracts 1 and 2 demonstrate how students employ the 'opportunity space' (cf. Schegloff, Jefferson, and Sacks 1977) made available by the teacher to launch the initiations, albeit at different moments within that space.

Extract 1 comes from the beginning of a lecture on Hooke's law. Prior to the extract, the teacher has introduced the law and written its formal statement on the board ('Extension is proportional to the force'). All students copy the formulation in their notebooks and so treat the formal statement of the law as a learning object to be assessed in the exam (Kääntä, Kasper, and Piirainen-Marsh 2016). While the teacher proceeds to explain 'proportional' with an example, the students continue copying the inscription in their notebooks.

Extract 1. Proportional

40	Т	=which for instance means that if you double hhh the (0.6) T GAZE AT ST>
41		uhh *(0.6) *^double the <u>o</u> ne^ quantity then ^the other will *T GLANCE AT BB*T GAZE AT ST> ^T LH GESTURE^ ^T RH GESTURE>
42		be doubled^ as well. ^T GESTURAL HOLD>
43		(3.5) T GAZE AT ST. #Fig.1 AT 1.2s RELEASES GESTURE AND WALKS TOWARD BB LIISA WRITES IN HER NOTEBOOK UNTIL END OF SILENCE JAANA WRITES IN HER NOTEBOOK
44	Liisa	+extension is * <proportio°nal°>+ +LIISA LEANS BACK IN HER CHAIR & READS FROM HER NOTEBOOK+ JAANA WRITES*SHIFTS GAZE TO BB> T WALKS TOWARD BB></proportio°nal°>
45		(1.1) T WALKS TOWARD BB, GAZE AT IT LIISA GAZE AT HER NOTEBOOK JAANA GAZE AT BB
46	Jaana	what does that <pro+por-*ti-o-×nal> #mean¿× JAANA GAZE AT BB×GLANCES AT LIISA× +LIISA GAZE AT BB> #Fig.2 *T STOPS, GAZE SHIFT TO JAANA-></pro+por-*ti-o-×nal>
47		(0.9) T GAZE AT JAANA JAANA GAZE AT BB/TEACHER LIISA GAZE AT BB
48	Т	you mean in Finnish.=
49	Jaana	=yea Jaana Jiga
50		(0.3) T TURNS TO BB JAANA GAZE AT BB/TEACHER LIISA GAZE AT BB
51	Т	it's, hh <u>suo</u> raan verran^nollinen. <u>directly</u> commensurate ^T BEGINS TO WRITE
52		(1.1) T WRITES ON BB LIISA GAZE AT BB JAANA GAZE AT BB, AT 0.9s WRINKLES NOSE AND FOREHEAD
53	Liisa	SU [×] oraan directly ×JAANA GAZE SHIFT TO LIISA
54		<pre>(6.3) T WRITES ON BB LIISA GAZE AT BB, LEANS HEAD ON LEFT SHOULDER JAANA GAZE AT LIISA, AT 0.4s GAZE TO NOTEBOOK, WRITES IN IT</pre>
55	Jaana	<pre>* suoraan= directly *JAANA GAZE SHIFT TO BB</pre>

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56 Liisa	+=v <u>e</u> rrannollinen. commensurate +LIISA LIFTS HEAD UP, GAZE AT BB
57	(1.0) T STOPS WRITING, TAKES 2 STEPS BACK, GAZE AT BB LIISA GAZE SHIFT TO JAANA JAANA GAZE TO BB AT 0.5s GAZE SHIFT TO LIISA
58 Jaana	+(et s(h)ää) ymm(h)ärrä mit(h)ää+ (you don't) understand anything +LIISA PUTS LH IN FRONT OF HER MOUTH+
59 Liisa	+[ei (se ollu)] no (itwasn't) +LIISA TAKES LH AWAY AND SHIFTS GAZE DOWN
60 Jaana	×[.ihh heh he] hehe heh ×jaana gaze shift to notebook
61	(0.9) T GAZE AT BB LIISA GAZE IN FRONT OF HER JAANA WRITES IN HER NOTEBOOK LEENA & RONJA WRITE IN THEIR NOTEBOOKS
62 T	well
63	(1.5) T LOOKS FIRST TOWARD BB THEN SHIFTS GAZE TOWARD CLASS LIISA GAZE IN FRONT OF HER JAANA, RONJA & LEENA WRITE IN THEIR NOTEBOOKS
64 T	well, basically proportional means the (.) $% \left(\left({{{\left({\left({{{\left({{{\left({{{c}}} \right)}} \right)_{i}}} \right)}_{i}}}} \right)} \right)$
65	uh str <u>ai</u> ght line relationship. (.) so=

In line 42, the teacher's definition turn hearably and visibly reaches completion: it is produced with closing intonation and the culmination of a metaphorical gesture ensemble performed concurrently with the talk. At this point the teacher turns his gaze towards the students while holding the gesture in silence (I. 42–43, Figure 1), a multisemiotic method of 'making space' (Walsh 2006) for a recipient response from the students (Escobar Urmeneta and Evnitskaya 2014). However, the students do not register the teacher's visual action as they continue taking notes. For his part, the teacher ratifies the note-taking as the relevant current activity. Still without any vocalisation, he releases the gesture and begins to walk towards the board, that is, 'making space' for the students' writing (I. 43). The students and the teacher thus show through concurrent embodied activities a shared prioritising of students' note-taking as part of the interrelated projects of teaching, learning and assessing subject matter in the local educational order of the physics classroom.

Next, two students, Liisa and Jaana, who are sitting next to each other in the front row, individually finish their writing and review their notebook entries. These separate activities lead up to their emerging joint project to get clarification of the word 'proportional'. Liisa launches the sequence as she begins to read her entry aloud from her notebook (I. 44). After reading the first two items of the sentence with normal delivery and so treating them as unproblematic, she produces 'proportional' with slower speed and trailing off the last syllable and omits the remainder of the statement. In this way the partial quoting locates a specific understanding problem. Notably Liisa's turn is not addressed to anyone; rather she keeps gazing at her notebook throughout the following silence (I. 45). As a hearable public display of non-understanding, her action becomes available for all members of the classroom to respond to. It appears though that in these classrooms, students sitting next to each other at the same desk regularly act as a team and display epistemic obligations to their desk neighbour. This special relation is observably at work in the current instance. Jaana first

screens the board as if in search of a clue (I. 45) and then picks up Liisa's treatment of 'proportional' as an understanding problem by explicitly requesting a clarification (I. 46). The distal demonstrative pronoun 'that' operates as a negative stance marker, and in addition to producing the problematic word with decreased speed, Jaana also syllabizes it. Through these production practices Jaana upgrades Liisa's treatment of the word as an unfamiliar object. Jaana's gaze shift to Liisa also shows nonvocally that they share the same understanding problem (I. 46, Figure 2). By building on each other's actions and displaying congruent epistemic status, the two students act as a team. With the marked pronunciation, they also treat the lexical item as entirely unknown to them, as opposed to a word whose meaning temporarily slipped their minds.

Koole and Elbers (2014) report that a teacher in a multilingual math classroom consistently categorises students' clarification requests as targeting a math problem rather than checking the possibility that the problem may be language-related (see Lilja 2014 for Finnish as second language mathematics lessons). Here, the teacher launches an insert sequence (Schegloff 2007) in which he checks his understanding that Jaana wants to know the corresponding word in Finnish (l. 48). The other-initiation of repair is designed with declarative syntax and falling intonation, showing the teacher's certainty that Jaana is requesting a translation equivalent of 'proportional' in Finnish rather than a synonym or paraphrase in English (Dalton-Puffer 2007, 136; also Stivers and Rossano 2012 for question formats as displays of different epistemic strength). Jaana confirms the teacher's understanding (l. 49). The insert sequence thus closed, the teacher turns towards the board and provides a bilingual definition in two modalities, first by saying (l. 51) and then by writing the technical term in Finnish on the board (l. 51–56). With the verbal definition, the teacher answers Jaana's question and closes the base adjacency pair.

The bilingual definition makes a third-turn confirmation by the students relevant, yet instead Liisa and Jaana produce a collaborative reading of the Finnish translation on the blackboard (l. 53–56) and so maintain a joint attentional focus on the expression. Since the students read each of the two components of the Finnish phrase aloud fluently, their production suggests that they recognise each word but not the meaning of the compound expression either in nontechnical terms or as a physics concept. Having finished writing, the teacher, by shifting his bodily orientation from the board toward the class (l. 57), treats the bilingual definition sequence as closed.

In this extract, the students' collaboratively displayed non-understanding is categorised by the teacher as a gap in their English lexicon, as indicated with his understanding check and the subsequent bilingual definition. However, while the students show that they recognise each word in the Finnish translation, there is no indication that the bilingual definition helped them understand the science concept (also Dalton-Puffer 2007, 137). In fact, one student's *non*-understanding becomes the topic of talk in the sequence closing sequence (Schegloff 2007), where Jaana teases Liisa laughingly with an attribution of non-understanding (I. 58). Although Liisa readily confirms this (I. 59), she does not laugh along with Jaana; she may thus be rejecting the teasing or refusing to treat her non-understanding as amusing.⁵ It is noteworthy that their exchange is in Finnish, which indexes it as talk in the Jaana-Liisa team that is not meant to contribute to the official lesson (Nikula 2007). Whether the exchange prompts the teacher's next action is difficult to say, but he proceeds to elaborate *proportional* as a science concept with a multimodal definition in English (I. 62, 64–65) and so treats it as a continued matter for instruction (see Kääntä, Kasper, and Piirainen-Marsh 2016, Ex. 3). While in Extract 1 the students' initiations are produced quite far into the opportunity space due to their note-taking, in Extract 2 Leena launches her request at the transition-relevance place (TRP) of the teacher's explanation turn, whereby her request latches on to his turn. In the extract, the first term (i.e. 'extension') in the formal statement of Hooke's law becomes the target of Leena's request for clarification.

Extract 2. Extension

89	Т	×[#yeah# uhh it depends on such a way that *RONJA GAZE SHIFT TO DESK>
90		when you ^double one^, *then the other is also doubled.^ ^T BH GESTURE TO RIGHT^BH HAND GESTURE TO LEFT^ *RONJA LEANS BACK IN CHAIR, LEAFING PAGES-
91		<pre>(0.3) * or if you ^triple, ** then it * will be tripled*#= *T TURNS GAZE AND TAKES STEPS TO RIGHT</pre>
92	Leena	=uhh:: what *do you mean (0.5) (if you write) LEENA GAZE TOWARD T/BB> T BODY AND GAZE TO HIS RIGHT*TURNS BOTH TOWARD LEENA>
93		<pre>#like extension °is°= #Fig.4</pre>
94	Т	*=extension is (.) *well,^how much it is st^retched. FIGURE 4 *T GAZE TO BB*T GAZE TO LEENA> ^T HANDS IN FIST^T STRETCHES RH-
95		(1.2) T HANDS APART, Fig.5, GAZE TOWARD LEENA LEENA GAZE TOWARD T/BB
96	Leena	t <u>o</u> h °ojkay°
97	Т	so *[extension is what ^we mea]sured. *T GAZE SHIFT TO BB> ^T POINTS TO GRAPH ON BB>
98	Leena	[wha-what is astroitcheda] aLEENA GESTURE, Fig.6674
99		(1.6) T WALKS TOWARD GRAPH ON BB, LOWERS POINTING HAND LEENA GAZE AT T/BB AT 1.5s TURNS TO RONJA TO TALK TO HER RONJA ERASES SOMETHING FROM HER NOTEBOOK
100	Т	actually.
101		(2.6) T WALKS TO GRAPH ON BL AT 1.8s BEGINS TO WRITE ON BL LEENA TALKS TO RONJA
102	Т	so this is extension.
103		(4.7) T WRITES TO GRAPH ON BL LEENA TALKS TO RONJA RONJA GAZE AT HER NOTEBOOK
104	Т	we just- well, we meant it as a distance but it is (0.8)
105		in the case of uhh (.) these m-materials it's called $exte-$
106		extension.

We enter the scene when the teacher's explanation of the notion of proportionality visibly and hearably reaches completion: he produces the turn-final verb phrase in lower volume and shifts gaze and body position away from the students while taking steps towards the board (I. 91, Figure 3). The shift in the teacher's embodied orientation suggests that he is also closing the current extended explanation sequence.

At this juncture, Leena initiates the epistemic sequence, in response to which the teacher shifts his embodied orientation to her (l. 92). However, Leena's request for clarification does not address a problem in the teacher's preceding talk.⁶ Rather her gaze direction and the following turn-constructional unit index Leena's action as a request to the teacher to explain something he said or wrote earlier (*what do you mean*, l. 92). The request also locates the problem in the teacher's inscription on the board (*if you write*) and cites the inscription, as indicated by the quotative 'like' (*like extension* °*is*°, l. 93, Figure 4). With her voice trailing off as she produces the copula, the word 'extension' becomes foregrounded as the trouble source. The teacher, after checking the inscription on the board, provides a monolingual definition (l. 94). The self-repair suggests that he starts out with a formal definition ('X is Y', e.g. Dalton-Puffer 2007) but abandons it in favour of a vernacular version, which is accompanied by a pulling gesture that embodies an iconic representation of stretching (l. 94–95, Figure 5).

Leena's response (l. 96) treats the teacher's definition as new information ($\uparrow oh$) and indicates with a soft spoken $o_{\downarrow}kay^{\circ}$ that it addresses her problem, although her uptake claims rather than demonstrates understanding (Sacks 1992; II, 141; Koole 2010). Perhaps in orientation to that, and to the possibility that Leena's understanding difficulties may be shared by the other students, the teacher further develops the topic and expands the completed repair sequence with another multimodal definition (I. 97). He thus orients to the students' 'collective instructional need' (St. John and Cromdal 2016, 266). However, in overlap with the teacher's turn, Leena initiates repair on an element in the teacher's previous definition (wha- what is stretched) while repeating the teacher's pulling gesture on a smaller scale (I. 98, Figures 6 and 7). With the repetition of stretched and the modified return gesture (de Fornel 1992; Eskildsen and Wagner 2013), Leena now demonstrates her understanding that 'extension' means that something is 'stretched'. Her next problem is to identify the thing to which the predicate of 'stretched' refers. The question word ('what') locates the pronoun 'it' in the teacher's definition as the trouble source, implying that its referent is obscure. Yet Leena's repair initiation gets no uptake from the teacher or the other students, perhaps because the overlap does not make it sufficiently hearable or because the teacher's concurrent definition identifies the referent through his pointing gesture (l. 97). Rather than pursuing the repair as public classroom business, Leena turns to Ronja, ostensibly asking Ronja something in a private conversation.

In this extract, the teacher offers consecutive multimodal definitions with monolingual formulations and visual resources, thus demonstrably treating Leena's understanding problem as a conceptual issue (also e.g. Koole and Elbers 2014; Solem 2016a). The vernacular definiens ('how much it is stretched') gets a demonstration of partial understanding from Leena, only to be followed by a repair initiation that seeks further clarification of the teacher's definition. It remains unclear whether any of the versions is successful in getting the meaning of 'extension' across to the students in the class.

This section has shown that the students' requests for clarification are launched during different moments of an opportunity space, which is made available by the organisation of the teacher's lecture, i.e. after an information unit. What is common to these instances is that after having finished the turn, the teacher walks or takes steps toward the board and thus is either completely or partially disengaging from the participation framework he has established with the students. According to Mehan (1979; Jacknick 2011, 24), such instances when

the teacher is 'away' present the students opportunities to get their requests ratified by the teacher. What our analysis elucidates is that the teacher's 'aways' are different in the two sequential environments in focus. In extracts 1 and 2 the teacher's embodied orientation away from the students is signalling the completion of an explanation turn, while in Extracts 3 and 4 the explanation turn is ongoing, as is shown next.

Creating an opportunity space to launch clarification requests

Extracts 3 and 4 illustrate how the students themselves create an opportunity space to launch clarification sequences. Such requests are not produced at the end of a TCU where any next speaker can come in or in any other opportunity space following the TRP (cf. Schegloff, Jefferson, and Sacks 1977); rather students seize moments when the teacher halts his talk to do another action, such as writing on the board (Ex. 3) or walking towards the board (Ex. 4). In addition, Extract 3 highlights how the timing of the request is related to the students' note-taking practices.

Extract 3 comes from a lesson on waves. Prior to the lecture the students had carried out the standard experiment with Slinky springs to observe various physical properties of waves. Here the teacher defines the key term 'amplitude' (l. 10–11) and illustrates the concept with 'sound' as a specific type of wave (l. 13–15). Simultaneously, Ilona begins to write in her notebook (l. 13), ostensibly copying the wave the teacher has drawn on the board. As the teacher proceeds to the topic of wave propagation and gives examples of longitudinal and transverse waves, Ilona stops her note-taking and quietly⁷ talks with her desk neighbour Neea (l. 21, Figure 8). Subsequently Ilona shifts gaze towards the board (l. 24, Figure 10).

Extract 3. Amplitude

10	Т	an' amplitude sort of describes how (0.5)* ILONA GAZE DOWN AT BOOK*
11		*how strong the wave is. *ILONA GAZE TO BB>
12		(4.2) T TAKES STEPS IN FRONT TURNING TO THE BB ILONA GAZE TO BB AT 1.3s GAZE DOWN AT NOTEBOOK
13	Т	*and (0.9) for instance (0.6) in sound waves *ILONA BEGINS TO WRITE IN NOTEBOOK>
14		(1.3) a l <u>ou</u> der sound is always (0.3)
15		>has always a ^greater amplitude.< ^T POINTS W/ RH TO BB>
16		(6.3) T POINTS AT 'AMPLITUDE' ON BB AT 1.5s WITHDRAWS RH FROM POINTING GESTURE ILONA WRITES IN NOTEBOOK
17	Т	um (0.4) ^maybe I'll note a few^ things ^T RH GESTURE UP-AND-DOWN, NEXT TO LETTERS L & T
18		about these <u>t</u> an' l ^things. ^T BEGINS TO WRITE ON BB
19		(4.5) T WRITES 'TRANSVERSE' ON BB AT 3.8s STOPS ILONA WRITES IN NOTEBOOK
20	Т	<pre>^examples^ of transverse *waves ar:e ^T WRITES COLON AFTER `TRANSVERSE'^ ILONA STOPS WRITING>*ILONA GAZE TO BB-> FIGURE 8</pre>

21		^(0.9) *(0.9)# light (.)^ (0.5) ^T WRITES `LIGHT' ON BB^ *ILONA TURNS TO NEEA TALKING TO HER>
22		>light's probably a good example,=
23		an' then< ^(0.9) uhh longituditnal ^T WRITES 'LONGITUDINAL' ON BB>
24		(4.4) T WRITES 'LONGITUDINAL' #Fig.9 AND COLON AFTER IT ON BB ILONA TURNED TO NEEA AT 0.6s GAZE SHIFT TO BB, Fig.10
25	Ilona	>what di[d it] mean that< ^amplitude describes what;
26	Т	[(is)]
27		(1.0) T WRITES 'SOUND' ON BB ILONA GAZE TO BB
28	Liisa	(täh)^ (what) T^
29	Т	well ^amplitude is this^ ^T RH TO WAVE CREST AND LH TO HORIZONTAL
30		LINE^ ^(0.6) the size of the wave. # ^T LIFTS HANDS AND THEN SETS THEM BACK ON BB ^HOLDS GESTURE->#Fig.11
31		(1.1) T HOLDS GESTURE AT 0.6s WITHDRAWS HANDS FROM BB ILONA GAZE TO BB AT 0.4s GAZE DOWN AT NOTEBOOK FIGURE 11
32	Т	an' (0.3) it's *(0.6) it's really the str <u>e</u> ngth or,* *ILONA WRITES*
33		(0.8) ILONA TAKES ERASER FROM DESK, GAZE AT NOTEBOOK ((T NOT IN CAMERA VIEW))
34	Ilona	oka'
35		(4.2) ILONA ERASES AND THEN WRITES IN HER NOTEBOOK
36	Т	an' maybe you know this,
37		you need a bit more force to make a (0.6)
38		make a wave of (0.2) of greater *amplitude. *ILONA GAZE SHIFT TOWARD T
39	Ilona	NODS, GAZE TOWARD T
40	Т	uhh
41		(1.8)
42	Т	so, we notice that (.) with slinkies like this
43		we can (0.4) make both transverse and (0.5)
44		longitudinal twaves but in-

With her gaze fixed at the board llona launches her request for clarification (I. 25). It occurs shortly after the teacher has halted his talk to write on the board (I. 23–24) with his back turned to the students, an embodiment of his being 'away' from them (Mehan 1979; Figure 9). Ilona's initiation is thus produced concurrently with the teacher's ongoing explanation turn, during which he completes his unfinished verbal TCU by writing the projected

word ('sound') on the board. That Ilona 'breaks in' (Jacknick 2011) amid his turn is visible in that the teacher finishes the writing before he answers, and thereby ratifies⁸ Ilona's clarification request (I. 29–30).

The artful design of Ilona's clarification request requires attention. In the initial ' > what did it mean < ' construction (I. 25) the simple past form locates her understanding problem in an earlier portion of the teacher's lecture that had already been completed. Projected with the cataphoric *it*, the *that*-clause ('that amplitude describes what') partially cites the definition that the teacher produced verbally (I. 10–11) and indexes with the question word ('what') the definiens that Ilona did not hear or understand. The format of the clarification request suggests that Ilona is pursuing her project of writing the correct definition verbatim in her notebook.

The teacher orients to Ilona's request as an indication of a conceptual problem, instead of as a hearing problem, and defines the concept again. Unlike the previous occasion (I. 10–11), here the definition is accomplished multimodally through a verbal definition (I. 29–30), which is accompanied by a gesture that visually locates 'amplitude' on the wave drawn on the board (I. 29, Figure 11). In response to the teacher's multimodal definition, Ilona quickly shifts gaze down at her notebook (I. 31) and prepares to write in it (I. 32). Simultaneously, the teacher releases the gesture (I. 31) and provides the more technical term 'strength' for the concept (I. 32). At this juncture, Ilona indicates with a third-turn acknowledgement token (*oka'*, I. 34) that her problem has now been dealt with, but the acknowledgement does not claim or demonstrate understanding.⁹

This extract shows how Ilona's clarification request is timed in relation to her notetaking as it is launched at a moment where she ostensibly has run into a problem of not being able to continue writing her notes. This is visible when she turns to Neea to inquire something from her. When Neea, apparently, fails to provide an answer, Ilona addresses the clarification request to the teacher although he is occupied with writing on the board. Yet, Ilona is successful in creating the interactional space that advances her note-taking agenda. In addition, the extract illustrates how Ilona's non-understanding is salient vis-à-vis both the local and distal goals of note-taking: her actions indicate that to understand her notes later and thereby access the key concept, she needs to write down a definition of amplitude although the teacher did not write it on the board. However, her (continued) non-understanding is oriented to by the teacher, when he expands his definition with an example that references the experiment the students did (l. 36–38). In response to it, llona stops writing, shifts her gaze toward the teacher and nods, thereby claiming understanding through an embodied action (e.g. Koole 2010). She thus shows that her request has been dealt with sufficiently enough for her current, and future, purposes.

In Extract 4 Leena seizes an opportunity to launch a request for clarification when the teacher halts his current explanation. Here, the clarification request targets another formal statement related to Hooke's law that the students have copied from the board into their notebooks ('Materials with this property are called elastic'). The extract begins as the teacher explicates the statement to the students (l. 134–141). While he talks, Leena finishes writing and inspects her desk (l. 135). She visibly orients to the teacher's explanation when he labels the desks and chairs as elastic (l. 141), after which she shifts gaze to the board (l. 143), reading the statement from there.

Extract 4. Property

134	Т	<pre>^so ^(1.0) it's kind of interes^ting uh^ (1.2) ^T TURNS AROUND^T WALKS BEHIND T'S TABLE TO OTHER END </pre>
		LEENA WRITES IN HER NOTEBOOK>
135		^a that usually (2.3) [^]
		T ^a leena stops writing and shifts gaze at desk>
136		^well steel has been bent in such a way that you ^T TAKES SPRING FROM TABLE, GAZE AT IT>
137		can barely see the ^extension. (0.2) ^T STRETCHES SPRING>
138		but the same thing app^lies^ to (1.1) ^T LETS SPRING LOOSE^
139		*to any kind of steel really. (1.0) *T GAZE SHIFT TO CLASS, SWEEPS SLOWLY FROM RIGHT SIDE
140		like (1.1) the (0.8) frames of these desks *an' chairs TO LEFT SIDE TO T'S DESK AND BACK TO CLASS*T GAZE AT ST
141		(.) ^a are also elastic. ^a LEENA GAZE SHIFT AT T>
142		<pre>(0.8) T GAZE AT STUDENTS LEENA, ILONA, LIISA & NEEA GAZE AT T RONJA GAZE AT HER NOTEBOOK JAANA GAZE TOWARD LIISA</pre>
143	Liisa	<pre>a {++ hm= +LIISA GAZE DOWN AT DESK {LIISA STRAIGHTENS HERSELF ((slightly)) *LEENA GAZE SHIFT TO BB></pre>
144	Т	=but (.) you don't really notice it (0.2) T GAZE AT ST>
145		because *(.) uh *T GAZE TO BB
146		<pre>(1.2) T BEGINS TO WALK TOWARD BB, Fig.12 LEENA GAZE AT BB, Fig.13 LIISA GAZE DOWN AT HER DESK ILONA & NEEA GAZE TOWARD FRONT</pre>
147	Leena	(with) this <property> +(0.4)+ LEENA GAZE AT BB></property>
140		
140		T WALKS^*T STOPS, GAZE AT LEENA> +LIISA GAZE AT BB>
149		^a materil +materials *with this pro- property ^a *+ ^a LEENA READS FROM BB
		T GAZE DOWN FIGURE 13 +LIISA GAZE DOWN AT HER DESK+
150	Т	+*yeah= *T GAZE AT LEENA- +LIISA GAZE AT BB
151	Leena	="are called elastic." "LEENA READS FROM BB>"
152		(0.8) T STANDS IN FRONT OF BB, GAZE AT LEENA LEENA, RONJA & LIISA GAZE AT BB ILONA, NEEA & JAANA GAZE ELSEWHERE
153	Т	[yeah

154	Leena	[so what is this +°property° +LIISA GAZE AT LEENA>
155	Liisa	[<u>o</u> minaisuus+] +LIISA GAZE AT BB>
156	Т	*[this property, ^is] this (.) proportional *T GAZE TO BB>
157		extension proportional to the *force. *T GAZE TOWARD LEENA>
158		(1.3) T GAZE TOWARD LEENA LEENA GAZE TOWARD T LIISA GAZE TOWARD BB
159	Leena	+^↑¢h ª°okay.°^+ °LEENA GAZE DOWN AT HER BOOK ^T WITHDRAWS LH FROM BB^ +LIISA GLANCES TOWARD LEENA+
160		(1.0) T TAKES STEPS, GAZE AT HIS HANDS LEENA TURNS TOWARD RONJA ((who may be saying something to her)) LIISA GAZE DOWN AT HER DESK
161	Liisa	it's the *om <u>i</u> naisuus. property *T GAZE TO LIISA, AS HE WALKS
162	Т	>ya.<* *
163		(1.2) T WALKS TOWARD STUDENTS ILONA & NEEA TALKING TO EACH OTHER
164	Т	so I think you- (1.1) I think we: (0.4)
165		I mentioned something about this elastic thing uh

While Leena is reading, the teacher cuts off his extended explanation turn and begins to walk to the board (l. 146, Figure 12). Gazing at the board (l. 146, Figure 13), Leena launches her interactional project. Quoting *this < property >* from the board (l. 147), she flags the word 'property' as problematic by producing it with elongation, followed by a request for clarification (l. 148). Because Leena's production of the word lends it special salience, the anaphoric 'that' can be heard to index either the entire noun phrase 'this property' or only the high-lighted noun. In the first case, Leena's problem of understanding could be taken as referential, in the second, as semantic. As she secures the teacher's gaze but not a response (l. 148), Leena further contextualises her understanding problem by reading aloud from the board an earlier definition given by the teacher (l. 149 and 151) and then sums up her request, quoting again the complete noun phrase (l. 154).

Leena's request generates two responses – one from the teacher, the addressed recipient, and another one from Liisa, an unaddressed recipient. The teacher's response shows that he takes Leena's display of non-understanding as a request for reference clarification, not as a problem with the semantics of the word 'property'. The multimodal definition manifests this: he first repeats *this property*, from Leena's preceding turns, and gestures towards the inscription of Hooke's law on the board (*is this (.) proportional*, I. 156) and then expands the deictic reference to the formal statement ('extension is proportional to the force', I. 157).

Liisa, in contrast, treats Leena's problem as being related to the semantics of the word. Turning to Leena and then back to the front of the class, Liisa says <u>ominaisuus</u> in overlap with the teacher's turn (l. 155). By translating the concept in to Finnish, she categorises Leena's problem as a knowledge gap in Leena's English vocabulary. Dalton-Puffer (2007, 137) observes that students in CLIL classes commonly translate terms when the teacher or another student asks for clarification or explanation. In the present case, several production features in Leena's request may indicate to Liisa that Leena is not familiar with the word. In addition

to the initial elongated production (l. 147), Leena also stumbles over the word as she is quoting from the board (*this pro- property*) and produces it with lower volume in the final version of her clarification request (l. 154). Notice how Liisa's offering of the Finnish word does not get any uptake. The next move comes from Leena, who redirects her gaze toward her book and claims with a sequence-closing third ($\uparrow oh \circ okay$.°, l. 159) that her understanding problem has been resolved. With various embodied practices, the teacher (moving away from the board and gazing at his hands) and the students (gazing at and talking to each other) also treat the clarification sequence as completed.

However, the progression of the instruction is not yet resumed as Liisa further expands the sequence with a repeated and expanded version of her earlier response *it's the ominaisuus*. (I. 161). The position and design of her turn convey how Liisa interprets the preceding explanation talk. First, since her earlier translation of 'property' came in overlap, Liisa may be orienting to the possibility that Leena did not register it. With the second version, produced in the clear, Liisa gives Leena and the entire class the opportunity to hear the translation. Secondly, with the repeated bilingual definition, Liisa shows that despite Leena's claim that the teacher's clarification dealt with her understanding difficulty, the problem that Liisa took to be the target of Leena's request – the lexical equivalent of 'property' in Finnish – remained unaddressed. Liisa thus offers an alternative response from that of the teacher that potentially furthers the students' understanding of the concept. The teacher confirms Liisa's bilingual definition with a curt > ya.<, indicating that further talk on the matter is not warranted and bringing the clarification sequence to closure. After a short silence, he resumes his interrupted explanation turn (from l. 164 onwards).

This section has shown how students create an opportunity space to launch clarification requests when the teacher halts an ongoing explanation. That the students' requests interrupt the teacher' turn is visible in both extracts in that the teacher resumes his explanation of a physics concept from where he left off. In Extract 3 he returns to the topic of transverse and longitudinal waves (see I. 40–44) and in Extract 4 he continues explaining and demonstrating the concept of 'elastic'.

Discussion and conclusion

Previous research has highlighted several environments and practices for students' problematic understandings in differently organised pedagogical interaction and revealed how these negative epistemic displays affect the progression of the ongoing activity (Day and Kjaerbeck 2012; Jacknick 2011; Lindwall and Lymer 2011; Merke 2016; Solem 2016a, 2016b; Waring 2011). In the English-medium physics classes examined in this study, we showed how the students intervene in the teacher's lecture with a particular method that does not only claim non-understanding but actively pursues understanding, which is to request clarification of physics concepts related to the law that is the topic of the lecture. The understanding pursuits are issued in two sequential contexts. In the first, the students position the clarification request at a transition-relevance place after the teacher has completed an explanation unit (Ex. 1 and 2). In this way, they make use of a sequential opportunity afforded by the turn-taking organisation and enhanced by the teacher through nonvocal multisemiotic practices. In this environment, the target concepts are framed as further instructable matter and thus proposed for incorporation into the teacher's instructional agenda, a proposal that the teacher takes up as his subsequent explanation further elaborates the problematized concepts (proportionality, Ex. 1; extension, Ex. 2). In the second sequential context, the students exploit opportunity spaces that are not afforded through a transition-relevance place but emerge when the teacher suspends the progression of his explanation turn to accomplish another action, such as writing on the board (Ex. 3) or walking toward the board (Ex. 4). In these instances, the teacher resumes his local instructional project (such as explicating different types of waves, Ex. 3, or elasticity, Ex. 4) once the problem has been dealt with. Both parties – the students and the teacher – thus maintain a shared orientation towards the overall instructional agenda of the lesson while their local projects exhibit differential alignment.

The clarification sequences also exhibit the parties' orientations to a range of problem categories. Even when the trouble source is expressly located, it is still incumbent on the teacher as the addressed recipient to analyse what sort of problem the clarification request targets (Koole and Elbers 2014). In language teaching students' requests to clarify a lexical item are regularly taken to index a gap in their L2 vocabulary (Markee 1994). Conversely, in a multilingual mathematics class (Koole 2012; also Lilja 2014) the teacher consistently diagnosed the students' understanding problems as conceptual or procedural math problems and not as language related. Under the auspices of CLIL, teachers are normatively expected to address subject-specific content and language matters. Our analysis further contributes to the CLIL literature that examines how teachers put this programmatic mandate into practice (Dalton-Puffer 2007; Jakonen and Morton 2015; Kääntä forthcoming; Morton 2015). In the physics lectures, we demonstrate only one occasion on which the teacher offers a lexical equivalent of the problematic item in Finnish and so treats the problem as a gap in the student's English lexicon (Ex. 1). In the other cases, he addresses the target items with explanations and definitions of the physics concept, delivered in English and through multimodal resources. However, the students occasionally analyse their classmates' clarification requests differently. In Extract 4, Liisa's insistence on translating the word 'property' into Finnish reveals her understanding that Leena does not know the English word (also Dalton-Puffer 2007).

But even if the teacher's problem categorisation does not always converge with the students', it is not arbitrary. A closer look at the grammatical and prosodic format of the clarification requests reveals a methodic difference in turn design. The format 'what does that < pro-por-ti-o-nal > mean;' (Ex. 1, I. 46) requests a generic definition of the target item that is, furthermore, indexed as unfamiliar through the distal that and its prosodic composition. In contrast, the composition of the other clarification requests anchors the problematic item in its local context. Specifically, with you as the grammatical subject, the turn attributes an agentive role to the teacher (what do you mean (0.5) (if you write) like extension° is° (Ex. 2); what do you mean °by that° (0.5) material materials with this pro-property are called elastic. so what is this °property° (Ex. 4)). In Extract 3 (>what did it mean that < amplitude describes what;) the impersonal construction and past time reference locate the problem in an earlier definition that the teacher produced verbally but did not write on the board. Important clues for the teacher's diagnosis of the understanding problem as languagerelated, referential, or conceptual thus come from the design features of the clarification requests. What is more, through the turn design the students also build varying stances towards the teacher's explanations of the target concepts and his inscriptions on the board. In Extract 1, Liisa and Jaana display shared alignment to the understanding problem and formulate the clarification request as exhibiting their inability to attach generic sense to the word form. Ilona's request in Extract 3 orients to the absence of a written definition on the board as a noticeable omission that could be heard as a complaint. Leena's requests in

Extracts 2 and 4 locate the understanding problem in the teacher's inscriptions and thus hold him accountable for generating the problem in the first place. With the formats of the clarification requests and their embodied delivery the students thus allocate responsibility for the understanding problem either to themselves or to the teacher. Such differential blame attributions for interactional trouble were previously observed in other-initiations of repair with open-class-repair initiators (Robinson 2006; also Svennevig 2008). In the present setting they make visible how the participants understand their mutual rights and obligations in the moral fabric of the CLIL classroom.

Finally, our study brings attention to an underexamined theme in the study of understanding in formal educational settings, which is how the students' proximate efforts at achieving understanding of key instructional content are fuelled by their distal goals of accessing that content for future use in written assignments and exams (Day and Kjaerbeck 2012). This orientation is evident in the modality in which the problematic items are represented. What prompts the clarification requests is not the verbal definitions and explanations in the teacher's *talk* but their *textual* representation in the inscriptions on the board and the students' note-taking. To the extent that the students' note-taking practices can be gleaned from the video recordings, it appears that they routinely write down what they hear or read in the lecture without necessarily understanding what they write. Subsequently the students inspect their notes, the inscriptions on the board, or both, ostensibly to understand the written versions and secure a transportable record that they will be able to make sense of on future occasions. The clarification requests embody this orientation to future use.

In conclusion we want to emphasise that it is difficult to pin down exactly what understanding students gain: as the extracts show, the teacher's responses to requests for clarification get different claims of understanding, occasionally even humorous comments to fellow students' non-understanding. If and when (partial) demonstrations of understanding are produced, they manifest *an* understanding of the defined concepts. Yet, what eventually matters is the praxeological work that students do in making the requests since these serve to 'organise the sequential production and coherence of instructing occasions' (Macbeth 2011, 441) in ways that provide necessary feedback for the teacher to navigate and move forward in his instructional agenda. Such displays of non-understanding are part and parcel of what makes classroom interaction a contingently shaped, co-constructed instructional environment.

Notes

- '143. Let us now examine the following kind of language-game: when A gives an order, B must write down series of signs according to a certain formation rule. The first of these series is meant to be that of the natural numbers in decimal notation. – How does he get to understand this notation? – First of all, series of numbers will be written down for him and he will be required to copy them'. (1953, 56).
- 2. Sert and Walsh (2013) and Sert (2015) examine students' claims to lack of *knowledge* in whole-class interaction. Our study complements theirs in that it focuses on students' nonunderstandings.
- 3. Some of the students are more avid note takers than others when it comes to the physics concepts, but they all record the formal statement of the target physics law in their notebooks. This suggests that they share a sense of what instructional content to prioritise for future review.
- 4. In the physics lessons, the students formulate their orientation to the upcoming exam by asking the teacher whether the subject matter 'will be on the test' and when the test will be given.
- 5. In the latter case, Liisa may be showing a normative orientation to being a good student who should be able to follow the lesson content.

- 6. Notice how Leena claims understanding by nodding during the teacher's explanation (l. 91).
- 7. The talk is inaudible for the transcriber but based on Ilona's mouth movements, she most likely asks Neea about amplitude.
- Similarly, Solem (2016b) notes that in full class interactions with secondary school students' the teacher's ratification of the students' contributions is contingent on the timing of the initiatives' (745). Thanks to an anonymous reviewer for drawing our attention to Solem's observation.
- 9. An anonymous reviewer suggested that Ilona's acknowledgement did claim understanding. However, there is no evidence for an understanding claim in her turn, such as 'oh (okay)'. The teacher's subsequent action appears to support this analysis. Arguably Ilona's clarification request may have located a problem of hearing or note-taking instead of a conceptual problem since the teacher did not write the definition of 'amplitude' on the board.

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