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Teachers′ Demonstrations of Epistemic Access in Teacher-Student Interactions in a Digital Setting

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ABSTRACT: This paper is concerned with a Conversation Analytic (CA) study of teachers' demonstrations of epistemic access to a student's domain or territory of information in teacher-student interactions in a digital setting. It describes interactional practices analyzed in 12 excerpts with an explicit reference to information about students' progress provided by the digital system. It will be shown that teachers initiate interactions about already fulfilled assignments that are shown to be problematic. In the opening of the interaction, teachers more or less explicitly refer to the digital programme as an information source and/or to the hitches in student's progress. In the continuation of the interaction, teacher and student are concerned with a redoing of assignments. In this phase of the interaction, the teacher demonstrates epistemic access to possible causes for students' mistakes. In all cases, students do not show resistance to teachers' demonstrations of epistemic access to knowledge and experiences falling into their epistemic domain. The findings confirm teachers' and students' orientation to the educational context as being a specialized context where students' problems are not treated as 'theirs to know and describe'. The findings in this paper shed light on interactional practices in relation to epistemics, as well as on interactional practices in a digital setting.
Keywords: conversation analysis, teacher-student interaction, epistemics, digital tools

1. INTRODUCTION

This paper presents an analysis of how teachers in interaction with their students demonstrate to have epistemic access to a student's domain or territory of information (Heritage, 2012a, 2012b). These demonstrations of knowledgeability are studied in teacher-student interactions in an educational setting in which digital tools are used for learning because this setting potentially influences how knowledge and understanding are negotiated. Previous research on the negotiation of knowledge and understanding in classroom interactions has shown that Conversation Analysis (CA) is a valuable methodology to describe different practices teachers and students use to address (a lack of) knowledge in interaction (e.g. Koole, 2010; 2012a; Macbeth, 2011; Sert, 2013; Sert & Walsh, 2013; Solem, 2016). Following these studies, this papers aims to contribute to this continuously growing body of research that investigates the management of ownership and distribution of knowledge accomplished in and through social interaction (e.g. Raymond & Heritage, 2006; Heritage, 2012a, 2012b; Stivers, Mondada & Steensig, 2011).

The reason for a close investigation of epistemics in this particular setting of digital classroom interaction is that in this case epistemic access seems to be complex. In the dataset, the knowledge and experiences of students are discussed in interaction with the teacher. Normally, one would expect that teacher and student treat the student as having privileged access to this knowledge and experiences and as having specific rights to narrate them (Sacks, 1984). However, teachers in this setting derive information about students' knowledge and experiences by the use of digital tools. It is studied how teachers demonstrate epistemic access to these "type 2 knowables" - matters that are known by report, hearsay, or inference (Pomerantz, 1980) and how students respond to these demonstrations about information that falls into their epistemic domain (Heritage, 2012b).

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By drawing on Conversation Analysis, this study contributes to the advancement of our understanding regarding teaching practices in a developing institutional setting, as well as to the emergent field of epistemics in interaction (Heritage, 2012a, 2012b). It will be shown that teachers initiate interactions about student's problems, while these problems can be said to be lying within students' epistemic domain. Teachers demonstrate epistemic access to student's progress and underlying problems in the opening of the interactions, as well as in the continuation of the interactions. They do so more or less explicitly and with more or less certainty in different phases of the interaction. Nevertheless, in all cases students do not show any resistance to teachers' demonstrations of epistemic access to knowledge and experiences falling into their epistemic domain.

2. EPISTEMICS AND INTERACTION IN A DIGITAL SETTING

2.1. Epistemics in (classroom) interaction

The field of epistemics in interaction is concerned with how issues related to knowledge become visible in social interaction. This is defined by Heritage (2013) as ″knowledge claims that interactants assert, contest, and defend in and through turns-at-talk and sequences of interaction″ (Heritage, 2013: 370). Following this definition, there is a whole range of notions addressing several aspects of epistemics in interaction. The basis for these notions is that ″speakers, A and B, each have their own territories of information, and that any specific element of knowledge can fall into both of them, but often to different degrees″ (Heritage, 2013: 376). The other important ingredients are the speakers' positions on a dynamic epistemic gradient as more (K+) or less (K-) knowledgeable (Heritage, 2010, 2012a; Heritage & Raymond, 2012). This relative positioning is referred to as *epistemic status* that needs to be distinguished from *epistemic stance* since this concerns ″how speakers position themselves in terms of epistemic status in and through the design of turns at talk″ (Heritage, 2012b: 32).

Interactants′ relative *epistemic access* as more or less knowledgeable to a domain lays down norms on social interaction, since interactants are expected not to inform already knowing recipients about some state of affairs (Goodwin, 1979; Sacks 1992) and they should avoid making claims for which they have an insufficient degree of access (Heritage & Raymond, 2005). Speakers′ differential access becomes visible in social interaction. This goes back to what Pomerantz (1980) described as "type 2 knowables" that are addressed in interaction as matters that are known by report, hearsay, or inference. For institutional settings, differential access as expressed in interactional practices is described by for instance Raymond (2000), Roth (2002), and Whalen and Zimmerman (1990). Whalen and Zimmerman (1990) for instance distinguished between reports to emergency services done by bystanders in comparison to those reports done by victims. For journalists, a difference has been described for first-hand and derivative access to breaking news (Raymond, 2000; Roth, 2002). But as Heritage (2012a) underlines with an example of Peräkylä's study of medical interaction in which a doctor and a patient look at an X-ray together (1998), even simultaneous experience of something may be no guarantee of equality of epistemic access.

What participants ′can accountably know, how they know it, whether they have rights to describe it and in what terms′ (Heritage, 2011) is also related to *epistemic primacy*. This is defined as speakers′ ″asymmetries in their relative rights to know about some state of affairs (access) as well as their relative rights to tell, inform, assert or assess something, and asymmetries in the depth, specificity or completeness of their knowledge″ (Stivers, Mondada & Steensig, 2011: 13). For epistemic primacy, as well as for epistemic access, one might portray the difference between speaker A and B in terms of *epistemic (in)congruence* (Stivers, Steensig

& Mondada, 2011). At the same time, a speaker's personal discrepancy between epistemic status and epistemic stance is labelled in terms on (in)congruency since ″epistemic status can be dissembled by persons who deploy epistemic stance to appear more, or less, knowledgeable than they really are″ (Heritage, 2012b: 33).

In classroom interaction, all mentioned notions may become visible just as in ordinary conversation. There are, however, also some specific aspects about epistemics in interaction that have been described for this particular institutional setting. Within this institutional setting, the social identities of teacher and student play an unmistakable role. Epistemic primacy can in this setting therefore be traced back to these social categories (Koole, 2012a; Raymond & Heritage 2006; Sacks 1972a; Sacks, 1972b; Schegloff, 2007). However, teachers downgrade this epistemic primacy whenever they ask ′known information' questions (Mehan, 1979) in a typical three-part Initiation–Response–Evaluation sequence (Sinclair & Coulthard, 1975). These questions display a teacher's incongruence between his epistemic status and stance since they ask for information already known to the teacher as a way to test student's knowledge. So, it is not the knowledge of the student that is already known to the teacher, but the information that is asked for. While a teacher's question design apparently takes the stance of searching for information, the teacher still occupies a K+ status as is confirmed by the evaluative third position affirming or denying the correctness of students' contributions (Drew, 1981; Sinclair & Coultard, 1975).

Except for the interplay between K+ and K- for teachers, the convergence of these two positions is also at stake for students. More than in ordinary conversation, classroom interaction can be said to aim for *epistemic progression* (Gardner, 2007; Balaman & Sert, 2017a) changing a student's status from K− to K+. In educational interaction, students may either show or claim their position as K- in response to a teacher's initiative (e.g. Park, 2012; Sert, 2013; Sert & Walsh, 2013), but they may also direct a teacher's attention to an imbalance of information in first position by doing a request for assistance (e.g. Koole, 2010; 2012a; Merke, 2016; Park, 2012). In doing so, they are possibly confronted with what Koole (2012a) described as the *epistemic paradox* "of having to 'know what you don't know' or 'understand what you don't understand'" (Koole, 2012a: 1902).

Koole (2012a) showed that in dealing with this paradox, teachers claim epistemic access to the problem, although the student can be said to occupy a K+ position on what the problem is since this belongs to his epistemic domain. Teachers' epistemic primacy on the problem is displayed in the openings of the interactions in which teachers start an explanation based on a problem *localization* only. Rusk, Pörn and Sahlström (2016) do a similar observation in their dataset of L2 learners in which the teacher displays epistemic access to the expressed knowing of the students by asking an incongruent counter question. That teachers express access to students′ knowledge and experiences makes Koole (2012a) conclude that education is a specialized context where students' problems are not treated as 'theirs to know and describe' (Heritage, 2012a: 6).

This contrasts with the establishment of problems in other institutional contexts like, medical interviews (Heritage & Maynard, 2006) or call-centers (Baker, Emmison & Firth, 2005) that do contain a phase in the beginning of the interaction in which both interactants sort out what the problem is. For medical interactions, it has been described that patients′ problem descriptions are related to physicians′ demonstrations of epistemic access in question design (Robinson & Heritage, 2006; Heritage & Robinson, 2006). The opportunity to describe problems is best provided by open-ended general inquiries assuming a stronger imbalance of information in contrast to closed-ended requests for confirmation demonstrating epistemic access to patients'

problems (Robinson & Heritage, 2006; Heritage & Robinson, 2006). This access can be obtained from the patient's charts or computer records (Heritage & Robinson, 2006).

The question rises how teachers demonstrate epistemic access to student's problems whenever information can be obtained from digital tools comparable to patients′ charts or computer records. In a non-digital, educational context, teacher and student already orient to teachers' epistemic primacy in relation to the social category of the teacher (Koole, 2012a; Raymond & Heritage 2006; Sacks 1972a, 1972b; Schegloff, 2007). Teachers' epistemic primacy is expected to increase when they possibly obtain epistemic access from digital classroom tools like tablet computers and the accompanying learning applications.

2.2. Interaction in a digital setting

With its above mentioned interest, this study fits in with the growing body of conversation analytic studies with an interest in interaction in a digital setting. One part of the studies focuses on how participants organize their social interaction *via* digital tools. These studies either analyze chat utterances (e.g. Çakır, Zemel & Stahl, 2009; Zemel & Koschmann, 2013) or investigate video-mediated verbal communication (e.g. Hjulstad, 2016; Luff, Heath, Yamashita, Kuzuoka & Jirotka, 2016). The other part of conversation analytic research concentrates on co-present participants′ organization of social interaction in relation to digital tools at hand.

Most of these studies on the organization of talk-in-interaction and on-screen activities focus on peer interactions. A main interest is how participants shape these interactions, for instance by alternating between social interaction and typing and/or mouse work (Gardner & Levy, 2010; Greiffenhagen & Watson, 2009; Levy & Gardner, 2012), by jointly using a touch-screen (Davidsen & Christiansen, 2014) or by managing participation in video game interactions (Baldauf-Quilliatre & Colón de Carvajal, 2015; Keating & Sunawaka, 2010). Furthermore, it is investigated how interacting in relation to digital devices contributes to (collaborative) learning. There is research on for example collaborative writing in a digital environment (Cekaite, 2009; Musk, 2016) or on joint searches on the web (Davidson, 2009; Houen, Danby, Farrell & Thorpe, 2017; Spink, Danby, Mallan & Butler, 2010). Less research is done on collaborative group work that is explicitly framed in terms of co-construction of knowledge, except for a couple of very contributive studies on second language learning in either a game environment (Piirainen & Tainio, 2009; Piirainen-Marsh & Tainio, 2014) or an online leisure-time conversation club (Balaman & Sert, 2017a, 2017b).

Besides peer interaction, there are some studies on the organization of social interaction in a digital setting in which participants do not share equal epistemic primacy. There has been relatively much work on doctor-patient interaction with a focus on the influence of computer use on the organization of the interaction (Greatbatch, 2006; Greatbatch, Luff, Heath, & Campion, 1993; Greatbatch, Heath, Campion, & Luff, 1995; Greatbatch, Heath, Luff, & Campion, 1995; Beck Nielsen, 2014; Robinson, 1998; Robinson, 2006). Similarly, Van Charldorp investigated the use of the computer during police interrogations in which epistemics plays an interesting role as well (Van Charldorp 2011; Van Charldorp, 2013). For teacher-student interaction, one only comes across a study of an interaction between a student with cerebral palsy and an adult using a specialized digital communication device (Norén, Svensson & Telford, 2013).

All studies mentioned so far, share an interest in how the use of digital tools shapes social interaction. This is in line with a broader line of studies within the field of conversation analysis exploring how objects feature in social interaction and activity. An overview of studies regarding interacting with object in interaction has for instance been given by Nevile,

Haddington, Heinemann and Rauniomaa (2014). This book addresses interaction with different kinds of objects, ranging from paper documents to machines to the human body, across various ordinary or institutional settings (Nevile et al., 2014). Analyses reveal in precise detail "how objects feature in the moment-to-moment conduct of social interaction and activity" (Nevile et al., 2014: 4). That digital tools can be defined as an object is expressed by some of the chapters of the above-mentioned book (e.g. Beck Nielsen, 2014), as well as by individual studies within this field (e.g. Raclaw, Robles & DiDomenico, 2016). The latter study for instance zooms in on how participants in face-to-face interaction employ mobile phones to provide epistemic support for assessments (Raclaw, Robles & DiDomenico, 2016).

It is surprising that for teacher-student interactions in which knowledge plays such a crucial role, the employment of digital tools to provide epistemic support has not been investigated yet. The current study aims to explore how students' individual use of digital devices and the resulting data on their progress that become available for their teachers plays a role in teacher-student interactions in a digital setting. In particular, it is studied how teachers demonstrate epistemic access based on the data derived from the digital system in interaction with the individual students.

3. METHOD

In this section, the educational context in which the data collection has been established is described. In doing so, it is also addressed how this study relates to the broader field of more social scientific studies on learning in a digital society. Furthermore, more information is provided about the particulars of the data collection and the analytical steps taken to reach this paper's conclusions.

3.1. Educational context

Over the last decade, mobile devices have become widely available, more convenient and less expensive. The generation that is educated nowadays has therefore been socialized in a society imbued with technology and digital media (Bidin & Ziden, 2013). It is therefore not surprising that educators and researchers are interested in designing and evaluating educational applications for mobile devices that promote teaching and learning (Wu et al., 2011).

The use of digital devices for learning can be referred to as Mobile learning or M-learning (e.g. Crompton, 2013). M-learning has been mostly studied by means of surveys and experimental methods with a focus on effectiveness (Crompton, Burke & Gregory, 2017; Wu et al., 2011). The majority of the in reviews included M-learning studies showed positive overall group effects (Crompton et al., 2017; Sung et al., 2016; Wu et al., 2011). How the use of these applications affects classroom interaction in which a teacher discusses learning with individual students has not been studied before.

Therefore, I have collected classroom data in which teachers interact with individual students involved in M-learning. The three primary schools participating in this study all used digital applications for mathematics, like *Rekentuin, Smartrekenen* and *Snappet*. Students in these classrooms fulfill assignments with subjects like telling the time, division or addition in these applications designed for mathematics education. Working with these applications means that students get immediate feedback on their assignments in terms of correctness and that the difficulty of the assignments is automatically adapted to their current level. For teachers, working with tablet computers means that they have real-time access to students′ progress and performance by means of so-called learning analytics that are defined as 'the measurement, collection, analysis and reporting of data about learners and their contexts' (Gašević,

Buckingham-Shum, Long, Dawson & Haythornthwaite, 2015). These analytics can be displayed at teacher's own (tablet) computer. The use of these applications thus provides students as well as teachers with access to students' mathematical progress and performance. It is for instance shown that students stay behind in a particular type of assignment or that their pace is relatively low in fulfilling the assignment.

The access to students' progress and performance occasions teacher-student interactions after students′ individual work on the assignments. These interactions are of particular interest since it is only in interaction with the teacher that potential underlying problem(s) in students′ mathematical progress and performance can become visible and can be solved.

3.2. Data collection and data analysis

The paper draws on video-recorded data from mathematics lessons that took place in 2015 in three primary school classrooms in the Netherlands (students aged 8-10). Three participating teachers were asked to record all interactions with individual students or small groups of students during a series of mathematical lessons. Recordings were made either by the participating teacher or by the researcher. The interactions were captured by one video camera, focusing on teacher and student. This implies that the assignments on the (tablet) computer screens were not always brought into vision. This resulted in 34 videotaped teacher-student encounters ranging in length from 40 seconds till 24 minutes. In all 34 interactions in the dataset, teacher and student(s) have access to either one or two personal computer(s) or tablet computer(s) and the information that is provided by the digital system.

The dataset investigated for the current study contains the 12 excerpts in which teachers explicitly refer to the information provided by the digital system. These interactions caught interest since in these cases the use of digital tools directly influences "the moment-to-moment conduct of social interaction and activity" (Nevile et al., 2014: 4). The particular use of digital tools as information source for students' progress and performance is closely investigated, because this directly touches upon ″the local distribution of rights and responsibilities regarding what each party can accountably know, how they know it, whether they have rights to articulate it, and in what terms″ (Raymond & Heritage, 2006: 681). As Sacks already illustrated, conversationalists treat one another as having privileged access to their own experiences and as having specific rights to narrate them (Sacks, 1984), while in the interactions in this dataset teachers refer to their conversational partners' experiences with mathematical assignments.

The dataset of interactions is analyzed within a Conversation Analytic (CA) framework (e.g. Ten Have, 2007). With these analyses, insight is given in how teachers and students manage (rights to) knowledge in a digital setting that influences the relative access to knowledge and information. It should be noted here that knowledge in this case not necessarily refers to students′ mathematical knowledge. The digital system firstly displays information about student's experiences and progress; a lack of mathematical knowledge is just a possible cause for what the system shows about this progress. In this study, the management of knowledge thus rather refers to knowledge of a student's learning experiences and progress than mathematical knowledge.

4. FINDINGS

The interactions in this dataset all address problems with students' mathematical progress. Although these problems can be said to be owned by the students, all interactions except for one are initiated by the other participant in interaction; the teacher. Additionally, the interactions can

all be characterized by a redoing of assignments that have been worked on by the students preceding the interaction. This means that a problem is detected retrospectively (by the teacher) based on the information provided by the digital system. This is in contrast with earlier studies showing how *students* initiate an interaction when running into a problem *while* doing the assignment (Koole, 2010, 2012a; Merke, 2016).

In the following, it will be shown that teachers demonstrate epistemic access to student's progress and underlying problems in the opening of the interactions, as well as in the continuation of the interactions. They do so more or less explicitly and with more or less certainty in different phases of the interaction. In response to these demonstrations, students do not show any resistance. They generally go along with the redoing of assignments and show confirmation in response to teachers′ demonstrations of epistemic access that prefer a second pair part.

4.1. Epistemic access in the opening of the interaction

In eight out of twelve openings of the interaction, the teacher demonstrates epistemic access to a student's progress and underlying problems in the opening of the interaction. As will be illustrated, it differs how and to what extent teachers demonstrate access. It will be shown that the explicit reference to the digital programme as an information source plays a role, as well as teachers' explicit or implicit reference to the hitches in student's progress.

In the following excerpt, the teacher explicitly refers to the information source and demonstrates to have epistemic access to a student's learning progress. The teacher first refers to the computer programme *Rekentuin* and then points at a mismatch between the amount of credits earned in the digital application and the claim of understanding (Koole, 2010) the student apparently has done preceding the interaction. Here, teacher and student are both looking at the teacher's tablet computer showing the individual scores of the student.

Excerpt 1: Teacher's reference to the information source and explicit demonstration of epistemic access [video 30]

1	→	Teacher:	moei es luisteren, we hebben vanmorgen rekentuin gezien he? *listen up, we have seen rekentuin this morning TAG?*
2			((turns on tablet computer)) (2.4)
3			even wachten *wait a second*
4			((turns tablet computer on)) (1.5)
5			°moet ie weer anders°. *it should be different*
6			((logs in at tablet computer, looking up data)) (4.5)
7			°eeuh hoe gaat ie weer terug° °*eeuh how is it returning*°
8			((opens programme, looking at the data)) (8.0)
9	→		jij zei net (.) dat je eh echt alles wel snapte, maar je hebt nog ↑niet zoveel punten gehaald. *you just said (.) that you eh really understood everything, but you did ↑not earn that many credits yet*
10			(1.0)
11		Student:	nee (maar) *no (but)*
12		Teacher:	(en) ›hoe komt dat dan‹ *(and) ›how is that possible then‹*
13			(0.8)
14		Student:	(rekentuin)
15		Teacher:	((selects data on tablet computer)) (1.5)
16			Mm?

17		(1.1)
18		((points at tables on tablet computer))
19	→	zie je dat?
		you see?
20		((clicks on tablet computer)) (4.5)

The teacher explicitly refers to the programme *Rekentuin* in line 1 and demonstrates with a negatively formatted declarative question in line 9 that she has reasons to believe that there might be a problem because of the discrepancy between what a student said and what the analytics show. The student aligns with the teacher's observation with the preferred response 'no' in line 11, but does not show to be capable of elaborating on the signaled problem once asked for a possible cause (line 12). It seems that the student just refers to the programme in line 14 in response to the teacher's question. In line 19, she then selects the student's data on the tablet and explicitly draws his attention to the data. This substantiates her explicit demonstration of epistemic access based on the information from the digital system. Hereafter, teacher and student start discussing the possible causes for this problem before a redoing of some assignments (not in excerpt; for part of the continuation see excerpt 6).

In excerpt 1, the teacher shows an explicit orientation to the tablet computer as revealing more information about a student's progress. This is seen more often in the data when a teacher refers to the programme and/or points to the data in terms of credits earned or mistakes that have been made. In the following excerpt, the teacher demonstrates epistemic access in a more implicit manner. She does not refer to the programme, except for looking at the computer screen. Additionally, she mentions a rectification, which only implies an error. It is only somewhat later in the interaction, the teacher more explicitly mentions the underlying error. This interaction also shows teachers' concern with a redoing of problematic assignments demonstrating student's ability to solve the assignment in this dataset. In this particular case, this is emphasized because of the student's recurrent stress on the assignment as being correct after rectification.

Excerpt 2: Teacher's implicit demonstration of epistemic access [video 8]

1	→	Teacher:	had je hem al verbeterd?
			did you rectify it already?
2			((kijkt van pc scherm naar leerling))
			((looking from screen to student))
3		Student:	jah
			yeah
4			(.)
5			als u die ververst
			if you refresh that one
6			((student positions himself next to the teacher)) (0.4)
7		Teacher:	↑als je hem ververst
			↑if you refresh it
8		Student	°jah°=
			°yeah°=
9		Teacher:	=leg is- want leg eens uit hoe <u>hoort</u> deze,
			explain- cause explain to me how <u>should</u> this one be done
10			(0.4)
11			hier ↓staat negenennegentig<u>duizend</u> plus vijfentwintig<u>duizend</u>
			here it ↓says nine and ninety <u>thou</u>sand plus twenty five <u>thou</u>sand
12		Student:	ja,
			yes,
13			(.)
14		Teacher:	hoe ↓heb je dat gedaan,
			how ↓did you do that one,
15			(1.1)

16	→		wat is hier ↑fout gegaan dan,
			what went ↑wrong here then,
17			(0.8)
18		Student:	eeh weet ik ook niet precies?
			eeh I don't know exactly?
19			(0.7)
20		Teacher:	en eh maar hoe doe je ↑deze dan?=
			and eh but how do you do ↑this one then?=
21	→	Student:	=eh #deze was nu wel goed=
			=eh #this one was correct now
			#((points at screen))
22	→	Teacher:	oh die heb je nu wel [goed gedaan
			oh you have now done that one [correct
23		Student:	[ja
			[yes
24		Teacher:	[kan je uitleggen hoe je dat doet?
			[can you explain to me how you do that?
25	→	Student:	[°(ja dis) goeie antwoord°
			[°(yes this is) the correct answer°
26			(.)
27		Teacher:	>wat zeg je?<
			>what do you say?<
28	→	Student:	#dit is t goeie antwoord
			#this is the correct answer
			#((points at screen))
29		Teacher:	dit is het goed-
			this is the correct-
30		Student:	[maar ik doe negenennegentig plus vijfentwintig,
			[but I do nine and ninety plus twenty five
31		Teacher:	[jah
			[yeah

In line 1 the teacher shows an orientation to an error by asking a polar interrogative mentioning a rectification which implies an error in the first place. In line 9, the teacher then asks for a redoing of the assignment. What follows is a pause of 0.4 where after the teacher pursues by redirecting the student's attention to the assignment and asking again how it is done in line 14. She then more explicitly orients to the error by asking what has gone wrong in line 16. When the student claims not to know what went wrong in line 18, the teacher asks for a redoing twice more in lines 20 and 24 answered by the student who just claims that the answer is now correct in lines 21 and 28. This illustrates that students may consider rectification as sufficient and show resistance to a redoing or a discussion of an assignment that has been rectified already. This implies that students might be more interested in the learning outcome, while teachers are more interested in the learning process. It is only in line 30 that the student gives in and starts a redoing of the assignment in the end.

Another example of a teacher's more implicit demonstration of epistemic access is shown in excerpt 3. In this excerpt, the teacher is not referring to errors in an explicit (excerpt 1) or implicit manner (excerpt 2) by asking a polar question. Instead, the teacher refers to a student's possible difficulties by asking a content question. This is preceded by an explicit reference to the digital system and the information about the student's progress and performance that is displayed by the system. The explicit reference to the system in combination with the content question implicitly demonstrates that the teacher has access to student's progress, but the question leaves room for the student to display her difficulties and to select a (specific type of) assignment(s). Again, teacher and student have a joint orientation to the analytics shown on the tablet computer; they are both looking at the individual scores of the student as displayed on the teacher's tablet.

Excerpt 3: Teacher's reference to the information source and implicit demonstration of epistemic access [video 29]

1	→	Teacher:	↑nou ›moet je es even kijken.‹
			↑now ›you should have a look.‹
2			((teacher graps tablet computer))
3			#groe:p 6.
			# gra:de 6
			#((clicks))
4			laatst gespeeld willen we niet hebben,
			we do not want recently played,
5			gemaakte #opgaven.
			completed #assignments.
			#((clicks))
6			en dan gaan we naa::r # Sanne toe.
7			*and then we go to:: # Sanne*
			#((clicks))
8			bekijken.. (.)
			examine
			(.)
9	→		nou (.) ↑WElke van deze zeg je vind ik heel erg moeilijk,
			well (.) ↑WHIch one of these you say I consider it very difficult,
10			(.)
11		Student:	e:h.
12			(0.4)
13	→		optellen want dat moet een beetje sneller ↑gaan,
			addition since that has to ↑go a little bit faster
14		Teacher:	ja dat gaat op tijd he.
			yes that's based on time TAG
15		Student:	((knikt))
			((nods))
16	→	Teacher:	>nou zullen we eens< kijken? of dat ↑echt zo is.
			>well shall we have a< look? whether that is ↑really the case.
17			(1.2)
18	→		#want je oefent best wel vaak.
			#cause you practice quite a lot
			#((clicks))
19			zie je dat?
			you see?
20		Student:	*((nods))*
21		Teacher:	*((scrollt door tablet))* (3.6)
22	→		ja. en die fouten zitten dan ↑eigenlijk ook (.) een beetje in het tempo,
			yes, and those mistakes can then actually also (.) be blamed a bit on the pace,

In this excerpt, the teacher opens the interaction in lines 1-8. Here, she creates a joint object of attention by opening the analytics of the student and by focusing on the assignments that have been completed already. The teacher then invites the student in line 9 with a content question to select an assignment or set of assignments that she considers difficult. In doing so, the teacher orients to the fact that the student's realization of the assignments has not been flawless. So, she does not explicitly state that there have been errors that are or should be rectified, but seems to take this for granted by asking to indicate difficulties causing the trouble in learning progress.

The student's answer in line 13 shows that the student not only selects a type of assignments but also provides an argument why these assignments might be problematic. It cannot be said with certainty that the student bases herself on the information that is directly in front of her on the tablet. However, her argument surely shows that she discusses her learning progress from an analytical standpoint instead of just answering the teacher's question in terms

of her personal experience with the assignments. The teacher aligns with this analytical perspective, by explicit reference to the system as the decisive factor to confirm the student's difficulties in line 16. Teacher and student then again use the digital system to conclude something about the student's personal experience (practicing) in lines 18-19. It is in line 22 only, that the errors of the student are explicitly addressed. The use of the demonstrative pronoun 'die' illustrates that the difficulties discussed so far indeed presupposed underlying mistakes. Hereafter, the interaction is again centered around sets of sequences with a redoing of the assignments.

In the foregoing it has been illustrated that both teacher and students orient to possible problems brought to notice by means of learning analytics. Only problems that are related to already completed assignments in which an error occurred get the interaction going. In their reference to the programme as well as in their questions teachers demonstrate more or less explicitly epistemic access to the student's learning progress. Although the problematic assignments lie within the student's epistemic domain, students do not show any resistance to teachers launching these interactions. It is only in excerpt 2 that it takes more interactional work to get the redoing of the assignments started, when the student stresses repeatedly that the error has been solved already. This implies that an observable error is conditionally relevant to get the interaction going. The fact that errors are captured and objectified by the digital system might explain students′ lack of resistance to the opening up of an interaction by an interactant that has no epistemic primacy about the topic under discussion.

4.2. Continuation of the interaction

The continuation of the interactions in the dataset can be characterized by a redoing of assignments and by a more or less explicit identification of possible causes for the signaled problems. During and/or after the redoing teachers also demonstrate epistemic access to the possible causes for students′ problems in their learning progress. This is of particular interest, since causes underlying a problem cannot that easily be objectified in the learning analytics and are therefore not expected to become directly available to the teacher by means of the digital tools. Nevertheless, this section will show that teachers demonstrate to have their thoughts about possible causes. In contrast with their demonstrations of epistemic access in the opening of the interaction, teachers most often demonstrate their epistemic access to causes with more reserve. However, as will be illustrated students also align with these carefully formulated demonstrations of access and do not show resistance to epistemic claims that are actually lying within their epistemic domain.

Most access to possible causes is demonstrated after the redoing of one or more assignments once the redoing shows a discrepancy between what the system revealed and what a student shows to be capable of during the redoing. It will be shown that teachers refer to causes that are more general as well as to causes that are more specific. It is found that the more specific the cause, the more reserve the teacher demonstrates in her epistemic access.

An example of a teacher's reference to a general cause is shown in excerpt 4. This excerpt belongs to the set of four interactions in which there is no demonstration of epistemic access in the opening of the interaction. In excerpt 4, as well as in the other three interactions without a demonstration in the opening of the interaction, the teacher starts with a direct request for a redoing of one or more assignments. It is only in the continuation of these interactions that teachers demonstrate epistemic access. In excerpt 4, teacher and student are sitting next to each other while looking at the screen. The interaction starts with the teacher's request to show how a particular assignment has been done.

Excerpt 4: Teacher's demonstration of epistemic access after the redoing of an assignment: a general cause [video 7]

1		Teacher:	leg es uit
			please explain
2			(0.3)
3	→		hoe je die hebt ge↓daan,
			how did you ↓do this one,
4			(1.0)
5	→	Student:	nou (.) ik dacht drie keer acht i:s vierentwintig
			well (.) I thought three times eight i:s twenty four
6			(0.6)
7			ehm ohja (drie dus)
			ehm oh yes (so three)
8		Teacher:	kijk es goed
			have a close look
9			(0.7)
10	→		drie keer acht is vierentwintig.
			three times eight is twenty four.
11			↑had je goed gedacht.
			↑*you had thought that correctly*
12			(0.2)
13			en TOEn?
			and THEn?
14		Both:	((looking at screen)) (1.1)
15		Student:	plus twee nullen
			plus two zeroes
16			(0.4)
17	→	Teacher:	#plu-
			#plu-
			#((turns to student))
18			↑zie je m?
			↑*you see?*
19		Student:	ja
			yes
20			(0.4)
21	→	Teacher:	vergissing
			miscalculation
22		Student:	((nods))

In this excerpt, the teacher does a request in perfect tense in line 3. This displays that she proposes to discuss an already fulfilled assignment visible on the computer screen. However, the teacher does not in any sense demonstrate epistemic access to the student's progress provided by the information of the digital system. The student aligns with the teacher's request by starting to explain how the assignment has been done in lines 5-7. By going along with the redoing of the assignment the student implicitly aligns with the unmentioned problem with the assignment since excerpt 2 explicitly showed that a redoing appears to be legitimate only once something has gone wrong in the first place.

After the student has illustrated the first step in doing the assignment, the teacher confirms the student's thoughts in line 11 and asks to show the next step in line 13. By addressing the first step as being correct, it can be said that there seems to be an underlying assumption that something in the assignment has been incorrect. However, the teacher or the student still not explicitly addresses this. After the student has come up with the next step in line 15, the teacher in line 18 implicitly and in line 21 explicitly refers to this step as being done incorrectly in the first place and being done correctly now. The student responds with a preferred positive response to both the polar interrogative in line 19 as well as the declarative in line 22.

It is thus only after the redoing that the teacher in line 21 explicitly mentions a miscalculation and herewith demonstrates epistemic access to a possible cause for the student's mistake. The mistake itself is not mentioned explicitly but can be inferred from labelling something as a miscalculation. Since a miscalculation may have underlying, more specific causes, it is described as a general cause that is brought up in the interaction by a declarative question. The following excerpt shows an example of a teacher's less assertive questions addressing a more specific cause for mistakes that became visible during the redoing of assignments.

In the interaction before the start of excerpt 5, a student was asked to redo the assignment and showed to be capable of solving the assignment. The excerpt starts with the teacher's formulation of what the student showed while redoing the assignment. She then underlines the discrepancy between what the student showed during the redoing and the mistakes shown by the digital system and carefully addresses a specific cause for his mistakes.

Excerpt 5: Teacher's demonstration of epistemic access after the redoing of an assignment: a specific cause [video 21]

59	→	Teacher:	.hh dus als ik je goed snap dan doe je het doe je 't snap je het ↑wel goed
			.hh so if I understand you correctly then you do- you understand it correctly
60			#jij ↓telt eerst de getallen samen bij elkaar op,
			#you first ↓add the numbers,
			#((points at screen))
62			#.hh en dan vul je het ↑aan tot het getal wat het moet zijn.=
			#.hh and then you fill ↑up till the number that should be it.=
			#((points at screen)
63		Student:	=hmhm=
64	→	Teacher:	=das wel goed
			=that is correct
65			(0.3)
66	→		maar ik denk dat jij foutjes maakt doordat je t niet precies.
			but I think that you make mistakes because you do not exactly
67			#doordat je [het niet op je papier gebruikt
			#because you [do not use your paper
			#((lifts notebook))
68		Student:	[°nee°
			[°no°
69	→	Teacher:	[klopt [dat?
			[is that [right?
70		Student:	[((nods))
71			jhaha dat is wel een beetje zho
			yhehes that is kind of like iht
72			(.)
73	→	Teacher:	das ↑wel een beetje zo
			that ↑is kind of like it
			(.)
74			•h en dan vergis je- dan vergis je je want (.) •h EEN ernaast (.) bij rekenen
			•h and then you make a- then you make a mistake cause (.).hh ONE off the mark with math
75			das de hele som fout
			that is the whole sum incorrect
76			>ook al heb je< goed be (.) grepen hoe het moet.
			>even if you< have un (.) derstood correctly how it should be done.
77		Student:	hmhm
78	→	Teacher:	JA?
			YES? (.)
			(.)
79			gebruik je papier maar

		please use your paper
80		(.)
81		oke?
		okay?
82	Student:	((rises and walks away))

After the student's demonstration of knowing how to solve the assignment (not in excerpt) by redoing the assignment, the teacher starts a post-expansion with a formulation of the procedure the student just demonstrated. By indicating ′if I understand you correctly′ in line 59 the teacher explicitly stresses that her conclusion is derived from the foregoing. When the student confirms the teacher's interpretation in line 63, she continues by suggesting that instead his errors appear to be a matter of mistakes in performance in lines 66-67. The teacher demonstrates epistemic access to this quite specific possible cause for the student's mistakes in a careful manner by using ′I think′ with stress on think in line 66. The student's confirming 'no' is placed in overlap in line 68, after the teacher orients to the notebook by lifting it up.

Still, the teacher turns her declarative in lines 66-67 into an interrogative by asking for a stronger confirmation of her assumption in line 69. The interrogative is positively formatted and the student responds accordingly by nodding in overlap in line 70 and by a verbal confirmation with a laughing voice in line 71. However, the student mitigates this response by using ′that's kind of like it′. This suggests that the student accepts somewhat reluctantly that the teacher demonstrates access to a possible cause lying within his epistemic domain.

Hereafter the teacher concludes by means of another declarative illustrating that she assumes that the student knows the procedure, but that his mistakes are caused by a doing problem in lines 74-76. This is confirmed by the student in line 77. In line 79, the teacher then ends the interaction with an advice that also hints at the possible cause for the discussed mistakes. Similar advices are regularly found in the dataset. Herewith the teacher seems to not only point at a possible cause, but also to aim for improvement of the procedure in upcoming assignments.

In the foregoing two excerpts, the teacher posed polar questions that demonstrated her thoughts about possible causes for the mistakes that became apparent by the digital system. The next excerpt illustrates that teachers in the dataset also ask content or alternative questions after the redoing of one or more assignments. These questions demonstrate some epistemic access to specific possible causes, but offer more room for the student than simple confirmation of one cause that is suggested by the teacher by means of a more or less carefully formulated polar question.

Excerpt 6 shows part of the continuation of the interaction started in excerpt 1. In excerpt 1, it could be seen that teacher and student agreed on the fact that there was a problem with the credits earned in the digital programme and that the teacher asked for a possible cause for the student's problem (excerpt 1, line 12). It is exceptional in the dataset that such a question is asked before the redoing of assignments and it might therefore not be surprising that they do not reach conclusions about possible causes at that moment in the interaction. In excerpt 6, the student has just correctly redone an assignment when the teacher again poses a content question asking for a possible cause for the mistakes as displayed by the digital system. In total, teacher and student address three assignments of the same type. Later in the interaction, it is shown how the teacher also demonstrates access to student's feelings and thoughts.

Excerpt 6: Teacher's demonstrations of epistemic access after the redoing of an assignment: A specific cause in relation to thoughts and feelings [video 30]

50	→	Teacher	zie je wat je fout gedaan hebt?
			do you see what you have done incorrectly?
51		Student:	((nods))
52	→	Teacher:	hoe komt dat, want je hebt maar, #in ↑een seconde had je t.
			how come, cause you only have, #in ↑one second you had it.
			#((points at tablet computer))
53	→		hoe komt dat. denk je dan
			how come. do you think then
54		Student:	*((clicks on own tablet computer))* (0.8)
55			ehm:
56			(1.6)
57	→	Teacher:	komt dit #omdat je heel snel moest?
			is it #since you had to do it very fast?
			#((points at tablet computer))
58		Student:	eeh=
59	→	Teacher:	=of niet goed gelezen,
			=or did you not read it correctly,
60			(0.3)
61		Student:	ik had wel (.) goed gelezen maar de- die: tijd ging heel snel.
			I did read (.) it correctly but the- tha:t time was running very fast.
62	→	Teacher:	ja. daar word je n beetje,
			yes. that is making you a bit,
63			(0.6)
64			[>zenuwachtig van denk ik.<
			[>nervous I think.<
65		Student:	[((nods))
66	→	Teacher:	#drie plus vijf. nou dat weet jij wel
			#three plus five. well that is something you know
			#((points at tablet computer))
67			((writes down something))
68			denk dat dat ↑ook weer aan de (.) tijd ligt.
			I think that ↑also has to do with (.) time again.
69			drie plu- plus vijf is?
			three plu- plus five is?
70		Student:	acht,
			eight,
71	→	Teacher:	ja zie je ↑wel? #>weet je best.<
			yes you ↑see? #>you do know that.<
			#((points at tablet computer))
72			#↑tien plus vijfenvijftig
			#↑ten plus fiftyfive
			#((points at tablet computer))
73			(1.1)
74		Student:	honderd (.) zesenzestig?
			hundred (.) sixtysix?
75		Teacher:	°ja°.
			°yes°.
76			(.)
77			en hoe heb jij dat dan gedaan?
			and how did you do that then?
78			#tien plus vijfenvijftig.
			#ten plus fiftyfive.
			#((writes))
79			((looks at student))
80			zie je wat je fout gedaan hebt?
			you see what you did incorrectly?
81		Student:	((nods))
82	→	Teacher:	ja?
			yes?

83			(.)
84			want je hebt er zesenzestig van gemaakt.
			cause you made it sixtysix
85			#>je hebt gedacht van,< oh daar moeten der tien bij dan daar der ↑een bij.
			#>you thought,< oh there should I add up ten and then there ↑one.
			#((wijst op papier))
86			((writes))
87		Student:	((nods))
88		Teacher:	ja?
			yes?
89			(.)
90	→		#want je hebt het wel ↑heel snel gedaan.
			#cause you did it ↑very quickly
			#((wijst op tablet))

In excerpt 6, teacher and student address three assignments of the same type. After the student has redone the first assignment (prior to the excerpt), the teacher underlines the mistake by doing an 'understanding check' that is not formulated in terms of understanding but in terms of 'seeing' in line 50. Hereafter, she poses a content question asking the student to formulate a possible cause of the observed error in line 52. With this content question, she comes to the conclusion that the original answer was filled in rather quickly. Her repetition of the content question in line 53 is completed with the marker of consequence ′then′. This seems to point at her conclusion about the filling in as a possible cause, but this is not picked up by the student. In lines 54-55, the student responds non-preferably. The teacher then poses an alternative question in lines 57 and 59 that elaborates on the possible cause related to the pace of filling in an answer. The student answers this alternative question by picking one of the alternatives as well as by eliminating the other alternative in line 61. The teacher aligns with this and elaborates on it by demonstrating to have epistemic access to how the student feels about this (being nervous in line 64). However, her demonstration is comparable to excerpt 5 mitigated by the use of ′I think′. The student then confirms this in line 65.

In the following, teacher and student talk about a second assignment of the same type. It is remarkable that the teacher stresses the discrepancy between the mistake and the underlying cause (the pace of filling in answers) and the student's capability of solving the assignment before the student has redone the assignment in lines 66-68. She thus demonstrates epistemic access to what a student knows without any direct interactional or digital proof, comparable to what Rusk, Pörn and Sahlström (2016) showed. She again uses ′I think′ to address the possible cause in line 68, but uses a firm declarative when stating that the student knows the answer to the assignment in line 66. When the student indeed gives the correct answer in line 70, the student's capability in terms of knowing is underlined once more by the teacher in third position in line 71.

The interaction around the third assignment of the same type is also displayed in the excerpt, since in this case the teacher is demonstrating epistemic access to the student's thoughts while doing the assignment in the first place in line 85. Before she does so, teacher and student come to the conclusion that there was a mistake in a similar vein as when discussing the first assignment in this excerpt. When the teacher's formulation of the student's thoughts is confirmed by the student in line 87, the teacher again underlines the pace of doing the assignments in the first place.

This particular excerpt shows that teachers in the dataset also ask content questions that leave more room for the student to fill in a possible cause that is lying within their epistemic domain. Additionally, this excerpt again shows that teachers carefully formulate their hypotheses about specific possible causes when they notice a discrepancy between a mistake displayed by the digital system and the capability of a student to solve the same assignment in interaction with

the teacher. In the dataset, the pace of doing assignments in relation to mistakes is a recurrent possible cause. Teachers repeatedly stress that students have to be quicker in answering assignments or have to practice more to train these skills of answering in a rapid and adequate manner. This occurs in interactions in which teacher and students discuss multiple assignments that should be automatized by students. The speed of filling in these assignments is directly visible in the learning analytics and it might therefore not be surprising that teachers relate back to this information in formulating the possible causes.

However, in addressing these possible, specific causes teachers are careful in their formulations. They frequently mitigate their suspicions by means of phrases like 'I think'. This is in interesting contrast with these moments as displayed in excerpt 6 a teacher demonstrates epistemic access to student's feelings or thoughts. This is done in a surprisingly determined way. Still, students in this dataset generally align with teachers′ demonstrations of epistemic access. There is no difference in students′ responses to carefully formulated demonstrations probably derived from the digital system or to strongly formulated demonstrations to their personal experiences that cannot be derived from the digital system.

5. DISCUSSION and RESULTS

In this paper, it has been reported how teachers demonstrate epistemic access to the digital system with information about students' learning progress and performance. The central question underlying this study was not necessarily concerned with how the use of digital tools shapes the social organization of interaction. Above all, this study was performed on the basis of an underlying interest in the possible increase of teachers' epistemic primacy when they possibly obtain epistemic access from digital classroom tools like tablet computers and the accompanying learning applications. In digital classrooms in which students are doing their assignments on tablet computers, teachers get access to so-called learning analytics that provide teachers with real-time insight into students' progress and performance and therefore their possible problems underlying this progress and performance.

All instances in which teachers explicitly demonstrate epistemic access to students' progress and performance provided by the use of tablets were closely investigated. The dataset consisted of 12 interactions that can all be characterized by a redoing of assignments that have been fulfilled during the students' individual work on the tablet computer preceding the interaction. In the interactions in this dataset, it is the teacher who retrospectively localizes a problem. This differs from problems that become promptly visible in interactions initiated by requests for assistance of the student when running into a problem while doing the assignment (e.g. Koole, 2010; 2012a; Merke, 2016) or by claims of insufficient knowledge after a teacher's initiation in interaction (Sert, 2013; Sert & Walsh, 2013). It has been shown that it is an observable error as displayed by the digital system that justifies an interaction based on a problem localization by the teacher rather than by the student whose problems can be said to be lying within their epistemic domain.

In the majority of the openings of the interaction, the teacher demonstrates epistemic access by explicit reference to the digital programme as an information source (cf. type 2 knowable, Pomerantz, 1980) and/or by explicit or implicit reference to the hitches in student's progress. In these excerpts, teachers are clearly oriented to the digital devices as an object that provides epistemic support (Raclaw, Robles & DiDomenico, 2016) for the identification of a problem. Excerpt 3 illustrates that students also use the information provided by the digital device to address their progress from an analytical perspective, rather than from an experiential point of view. Teacher and student can therefore potentially be said to have equal epistemic access to

students' progress and performance as something that is objectified by the digital system. This may also explain why students in the dataset do not show any resistance when teachers demonstrate epistemic access about progress and performance that lies within their epistemic domain. Still, the question is whether the simultaneous experience of the analytics shown by the digital system is a guarantee of equality of epistemic access (cf. Peräkylä, 1998), since the teacher might be better capable of analyzing the results than the student.

The causes for hitches in progress and performance do not become directly visible in the digital system and can therefore not been said to be objectified by the analytics. Nevertheless, in the continuation of the interactions teachers also demonstrate to have their thoughts about possible causes. Most access to possible causes is demonstrated once the redoing of one or more assignments showed a discrepancy between what the system revealed and what a student shows to be capable of during the redoing in interaction. This gives sight of teachers' assessment of students' problems as doing problems rather than understanding or knowing problems (Koole, 2012b).

Compared to the demonstrations of epistemic access in the opening of the interaction, teachers demonstrate their epistemic access to causes with more reserve by mitigating phrases like 'I think', especially when addressing a more specific cause. Surprisingly, there are some examples in the dataset in which teachers demonstrate epistemic access to students' feelings or thoughts that cannot be derived from the digital system or a discrepancy between the problems and the redoing of the assignments. However, students still do not show resistance to teachers' demonstrations of epistemic access.

The agreement of students with teachers' demonstrations of epistemic access underlines teachers' epistemic primacy in the institutional setting of the classroom. This study thus aligns with Koole's (2012a) conclusion that education is a specialized context where students' problems are not treated as 'theirs to know and describe' (Heritage, 2012a: 6). This contrasts with other institutional contexts like medical interaction in which patients, dependent on a physician's question design, fulfill a greater role in describing their medical problem (Robinson & Heritage, 2006; Heritage & Robinson, 2006). This might be not that surprising, because students do not enter the classroom with a problem as is the case with patients entering the consultation room. Still, this study also reveals differences in teachers′ question design offering more or less room for students to contribute to the formulation of a problem.

Nevertheless, it is remarkable that it is the teacher who initiates the teacher-student interactions in the digital classroom about already fulfilled assignments. Therefore, this study shows that individual work on tablet computers does not occasion teacher-student interactions while working on the assignments. This can be explained by the immediate digital feedback of tablet computers. The use of digital devices like tablet computers is often praised for the opportunities for differentiation (e.g. Faber & Visscher, 2016) since the application shows students their mistakes and immediately adapts the difficulty of the assignments to what a person shows to be capable of. So-called mobile-learning studies with a focus on these possibilities of educational applications showed positive overall group effects (Crompton et al., 2017; Sung et al., 2016; Wu et al., 2011). This study casts new light on the effects of mobile-learning, since it illustrates that digital feedback does not replace teacher-student interactions about mistakes and underlying problems. It is shown that teacher-student interactions might only be delayed.

However, from an interactional perspective, one might wonder in what sort of activity teacher and student are involved in these delayed interactions. So far, studies on individual teacher-student interaction around students' problems could be categorized as explanation

activities (Koole, 2010, 2012a, Merke, 2016). These interactions were characterized by diminishing the incongruence in epistemic status by working on the knowing and understanding of students. In this paper, it became apparent that teacher and students are mostly working on doing problems rather than problems of knowing and understanding (Koole, 2012b).

Merke (2016) claimed for her data that speakers are simultaneously engaged in problem-solving and knowledge building during the activity of explaining. In the dataset central to this paper, teacher and students are definitely engaged in problem-solving. However, as it seems they are less involved in knowledge building since they are mainly working on correcting (the computation of) an assignment that has shown to be troublesome. Nevertheless, the teacher's explicit labelling of causes of errors and their explicit advice at the end of interactions can be said to show an orientation to building knowledge that is relevant for future assignments. Although the interactions are clearly centered around the rectification of errors, the teacher appears to aim for an improvement of a strategy or procedure rather than an improvement of the selected assignment(s) only. As such, it seems that epistemic progression (Gardner, 2007; Balaman & Sert, 2017a) is supposed to occur in what follows the interactions that are analyzed in this dataset.

One might say that if the learning analytics accompanying working with tablets in the classroom are mainly used to detect and talk about errors, the digital system is mainly used as a tool to check the correctness of students' work. In the data, this is also shown in instances teachers explicitly refer to the system as having the final saying about the accuracy of the answers. They for instance say something like 'please fill in the answer. Is it okay now?' or 'what do they want to know?'. This implies that the responsibility of the teacher as the more knowledgeable expert seems to shift at least partially to the digital system. These interactional references to the system as the decisive and omniscient are subject for a closer investigation to get more grip on the influence of the use of digital objects on classroom interaction.

The current analysis already gave sight of teaching practices that come along with technological changes in institutional setting. Simultaneously, this study contributes to our insights in our knowledge about the management of ownership and distribution of knowledge accomplished in and through social interaction. It has been shown that a problem of speaker B that is made topic of joint attention by speaker A appears not to be problematic in this institutional setting. Expectedly, this could be explained by the objectification of the problem by the digital system. The information from the digital system that becomes available as a joint object of attention may ease the epistemic distance between two speakers with a different epistemic status. It would be worthwhile to study the influence of external sources on epistemic management more extensively to bring new insights into the ways in which knowledge and understanding become visible in social interaction.

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7. APPENDIX

Transcription symbols (based on Jefferson, 1984)

[text	overlapping speech; point at which an ongoing utterance is joined by another utterance
=	break and subsequent continuation of contiguous utterances
(0.4)	pause (in seconds)
(.)	micro pause (less than 0,2 seconds)
.	stopping fall in tone (not necessarily at the end of a sentence)
,	continuing intonation (not necessarily between clauses of sentences)
?	rising inflection (not necessarily a question)
!	animated tone (not necessarily an exclamation)
-	halting, abrupt cutoff
↓	marked falling shift in intonation
↑	marked rising shift in intonation
∘	talk that is quieter than surrounding talk
TEXT	talk that is louder than surrounding talk
<u>text</u>	emphasis
:	extension of the sound that follows (0,2 seconds for every colon)
>text<	speech is delivered at a quicker pace than surrounding talk
<text>	speech is delivered at a slower pace than surrounding talk
hhh	audible aspiration
·hhh	audible inhalation
(text)	transcriber is in doubt about the accuracy of the transcribed stretch of talk
( )	transcriber could not achieve a hearing for the stretch of talk
((text))	description of a phenomenon, of details of the conversational scene or other characterizations of talk
[...]	deletion of part of original transcript
text	translation of original transcript
#	onset point of non-verbal activity during the talk