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Eye gaze as a resource in handling trouble around mobile devices in classroom interaction

This paper offers an insight into how interaction is multimodally built during task-accomplishment around mobile devices in classroom interaction. More specifically, it investigates eye gaze as a resource in recruiting help and pursuing response from peers during interactional or task-related trouble sequences. The data come from video-recorded lessons at Finnish comprehensive schools where mobile devices are used for learning tasks. Drawing on multimodal conversation analysis, the article demonstrates that gaze is employed by pupils as one of the first resources to display and address trouble. Although tasks often require gaze to be directed at devices, it can be flexibly reoriented to peers when needed. The findings increase our understanding of functions of eye gaze and peer interaction in today's technology-rich educational contexts.

Keywords: eye gaze, classroom interaction, multimodal conversation analysis, mobile device
Asiasanat: katse, luokkahuonevuorovaikutus, multimodaalinen keskustelunanalyysi, mobiililaite

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1 Introduction

Technology has become a pervasive resource in educational settings. It has modified pedagogical practices and the ways in which teachers and pupils interact, and therefore has implications for classroom research, which must account for not only what is done with technology but also what happens *around* it. To contribute to an understanding of today's classroom interaction, this paper investigates the multimodal practices used by pupils to deal with trouble in peer interaction while performing learning tasks on mobile devices. Specifically, it aims at describing how eye gaze is used by participants to seek mutual focus while recruiting assistance or pursuing a missing response. Recruitment encompasses different ways in which help is sought and offered (Kendrick & Drew 2016), and the notion of response pursuit refers to the action of soliciting a response from a coparticipant when one is missing (e.g., Pomerantz 1984). To successfully recruit help and pursue responses, participants need to achieve joint attention, or a shared interactional space (Mondada 2009, 2013), through the ways in which they arrange their bodies, embodied resources, such as gaze and gestures, as well as the material resources of the physical context.

The study draws on methodology from multimodal conversation analysis (CA), which investigates the sequential and temporal organization of interaction and how it is orchestrated through an ensemble of different multimodal resources, such as talk, gaze, body posture, gestures, and facial expressions (Lilja 2022; Mondada 2013, 2016). Using video-recordings from classrooms, this paper describes how gaze operates as a constituent of these ensembles in a context that has been largely neglected in previous research: children and teenagers using mobile devices for learning tasks within basic education. The multimodal, emic perspective will offer insights into how gaze is treated by the participants as one of the first resources to display and address trouble.

2 Gaze in interaction

CA research has mainly been interested in the role of gaze in participation, regulation of social interaction, and action formation (Rossano 2013; Ruusuvuori 2016). As to participation, gaze can, among other things, signal participants' attention to a speaker (Goodwin 1980; Goodwin 1981; Holler & Kendrick 2015; Kendon 1967). Rossano and his colleagues (Rossano 2013; Rossano et al. 2009), however, have demonstrated that gaze in showing participation is culturally variable and dependent on the social activity involved. Moreover, studies focusing on the allocation of multimodal resources while handling objects or during multiactivity suggest that gaze is typically on the objects manipulated but can also be used flexibly to show

orientation to multiple activities, including talking to a coparticipant (Deppermann 2014; Nishizaka 2014; Tuncer et al. 2019).

The regulating functions of gaze also seem to vary according to the context (e.g., Lerner 2003) and social activity. Speakers gaze away from recipients more during longer utterances (Kendon 1967) but tend to gaze at them when asking questions (Rossano et al. 2009). Gaze is also effective in choosing the next speaker in multiparty settings (Auer 2021; Tiitinen & Ruusuvuori 2012). In addition, while it has been shown that gaze is used to pursue a response from a recipient (Duran & Jacknick 2020; Stivers & Rossano 2010), it seems to be more powerful in soliciting response in side-by-side formations (i.e., participants sitting or standing next to each other) than in other settings (Auer & Zima 2021). Moreover, it has been suggested that gaze is more frequent in initiating and closing interactional sequences than in other sequential positions (Rossano 2013).

Research on classroom interaction has explored gaze as one of the many embodied resources systematically deployed for interaction. The focus has often been on the embodied conduct of teachers, who have been shown to allocate turns to students using gaze and other embodied resources (Kääntä 2012), to select next speakers based on whether students are gazing at them (Fasel Lauzon & Berger 2015), and to display a listener role during student discussions through gaze, gestures, and laughter, for instance (Willemsen et al. 2019). Duran and Jacknick (2020) also show how a teacher uses multimodal resources, including gaze, to pursue response, and thus, to secure the progressivity of whole-class interaction. In the context of peer interaction, Jakonen (2014) analyses how secondary-school students address lack of knowledge and recruit possible knowers through gaze and verbal addressing, and Juvonen et al. (2019) describe how students use gaze to display being stuck with a task. Tuncer et al. (2022) take a more experimental approach to study how children use gaze to ask for or give instructions and share emotions in robot-mediated interaction. Adding to this line of research, the present study aims to offer insights into the functions of gaze, alongside other resources, in peer recruitments and response pursuits around mobile devices in classroom settings.

3 Recruitments and response pursuits

Recruitment refers to a continuum of different ways in which participants in interaction seek or offer assistance to resolve trouble in performing an action. The methods range from explicit verbal approaches (i.e., requests, reports of trouble) to more indirect, embodied displays of trouble (Kendrick & Drew 2016). The more implicit embodied displays, such as searching for something with gaze, may precede explicit verbalizations of trouble, or they may be effective in recruiting help by themselves (Drew & Kendrick 2018; Kendrick & Drew 2016). As to children, it has been shown

that, even before the age of three, they start using gaze in conjunction with verbal reports of trouble, such as *oh!* to recruit assistance (Pfeiffer & Anna 2021).

Whereas recruitments involve mobilizing help to perform an action, response pursuits occur when the trouble lies in the progression of interaction. When a speaker produces a first pair-part of an adjacency pair, such as a question, the second pair-part (e.g., an answer) by the interlocutor(s) is made relevant (Schegloff 2007: 14). If an interlocutor fails to respond, the producer of the sequence-initiating action may try to pursue a response through different resources. They may, for instance, verbally clarify or modify their initial turns (Pomerantz 1984), initiate self-repair (Bolden et al. 2012), or use embodied resources, such as gaze and nods (Duran & Jacknick 2020). While teachers' response pursuits have received some attention in research on classroom interaction (see e.g., Duran & Jacknick 2020; Okada 2010), pupils' attempts at mobilizing response seem to have been largely neglected (see, however, Jakonen 2014). To bridge this gap in research, the present study illustrates how gaze functions in both recruitments and response pursuits in peer interaction during technology-mediated tasks.

4 Method and data

The data (ca 51,5 hours) come from 19 English as a Foreign Language (EFL) lessons video-recorded at four Finnish comprehensive schools as a part of a larger study on classroom interaction around technology. To capture the actions performed on mobile devices, additional screen recordings were made of the iPads used on four of the lessons. Seven groups from 4th to 9th grade of basic education participated in the research, with group sizes of 12 to 22 pupils. At the time of data collection, the pupils were from 10 to 15 years old. The teachers and most pupils spoke Finnish as their first language. Participants were recruited by contacting schools, and depending on local practices, a permission to collect data was granted either by the participating school or the municipality. All participating teachers and the guardians of all participating pupils gave an informed, written consent for participation in the study. At the beginning of each recorded lesson, participants were reminded that participation was voluntary and that they could withdraw from the study at any time. Safety measures to protect participants' health were taken during data gathering amidst the Covid-19 pandemic.

When analysing the data, the focus was on tasks for which technological devices such as mobile phones, tablet computers, or laptops were used. Participating teachers were instructed to plan their lessons as usual to ensure interactions would unfold as naturally as possible, and data collection was scheduled for lessons on which they had planned to use technology. There was great variation in the amount of time used on devices per lesson, from short games to whole lessons. The technol-

ogy-mediated tasks varied from games to information searches and writing tasks and included both individual and group work.

During preliminary analysis, it became evident that gaze to coparticipants while working on devices is quite infrequent throughout the data. Thus, it becomes particularly significant when it does occur (cf. Auer & Zima 2021). In the present data, it is often associated with trouble, either with task accomplishment or the sequential progression of interaction. Gaze shifts or a sustained gaze to a coparticipant frequently occur when a participant cannot proceed with a task due to insufficient knowledge or technological problems, or when the negotiation of an interactional space does not proceed smoothly (e.g., there is a missing response from a peer). Both trouble types create the need to renegotiate the interactional space or to restore a momentarily fragmented one, resulting from competing lines of activity (i.e., multiactivity; see e.g., Haddington et al. 2014). The phenomena in focus here, recruitments (20 cases) and response pursuits (17 cases), illustrate two techniques that were observed to be deployed systematically when addressing trouble. In both, gaze was found to be a central resource used to seek mutual focus as well as to occur in sequentially similar positions.

The cases have been analysed using multimodal CA, investigating how sequences of (inter)action are collaboratively built from and negotiated through the dynamic use of different embodied resources (Mondada 2013). Participants' talk has been transcribed using conversation analytic conventions (Jefferson 2004), with translations of Finnish talk into English beneath the line for the original talk. Gaze and other embodied actions have been transcribed adapting multimodal conventions (Harjunpää et al. 2020) to show their temporal and sequential relation to talk and other embodied actions. Pseudonyms are used for all participants. In the following sections, I will present a detailed analysis of four representative examples to illustrate how gaze is a recurring resource in the data to recruit help from a peer (Section 5) and to pursue a missing response (Section 6).

5 Gaze in recruitments

In the present collection, 20 recruitments involving a gaze shift to a peer have been identified. Almost all recruitments also include verbal utterances, either requests (n = 14) or reports of trouble (n = 5). In one of the cases (Extract 2), however, the recruiting participant initially seems to treat her gaze shift as a sufficient resource for recruiting but, in the face of a missing response, adds a verbal report of trouble to mobilize a response. Six of the recruitment sequences are preceded by an embodied display of trouble (e.g., searching for a word in a book) and two, by trouble alerts (Extract 1). The gaze shifts occur in sequence initial positions, either preceding the

verbal formulations or co-occurring with talk. In addition, the gaze shifts often result in a transformation of the interactional space.

In Extract 1, recruitment is achieved through a combination of gaze and verbal resources. Pupils on a 9th grade EFL lesson are doing tasks on an e-learning platform, using the school's tablet/laptop hybrids. Each pupil must hand in their own tasks but is allowed to ask others for help. Martta and Nora, seated around the same desk, have started working on the tasks individually but have recruited each other several times and have gradually moved closer to each other. They are translating sentences from Finnish to English and have just finished one together with help from the teacher. As they begin working on a new sentence, Nora sighs heavily, burying her head in her hands, and Martta starts a recruitment sequence. The gaze shifts focused on in the analysis are marked with an arrow (l. 3 and 4). The original verbal turns are given in bold, with English translations below them in italics and other embodied conduct in grey font (see Appendix for the transciption conventions).

(1) A tiny zebra
* = Martta's embodied conduct
+ = Nora's embodied conduct

01	**MARTTA**	**öö::::,**
		um::::
	martta	gaze to laptop
	nora	gaze to Martta's laptop, scratches forehead with right hand, moves left hand to forehead
02	**NORA**	**hhhhh+[hh]#**
	nora	+gaze down, head in hands
	fig.	#Fig.1
03	**MARTTA**	**[ä*ä] #voiks >täsä< nii ku:;=**
		um can one here like
→	martta	*gaze to Nora
	fig	#Fig.2

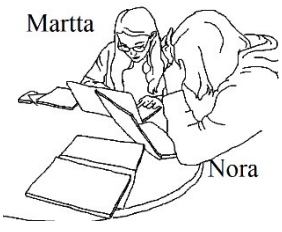

FIGURE 1.

FIGURE 2.

04 MARTTA = *mikä mikä (o) seep#ra. (.) nh.*öh*#h=
what what (is) zebra nh uh
martta *gaze to phone, grabs it
→ *gaze to Nora
*drops phone
fig. #Fig.3 #Fig.4

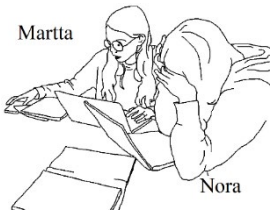

FIGURE 3.


FIGURE 4.

05 NORA =zeb*ra;
martta *gaze to phone

In Extract 1, Martta uses vocalizations (l. 1 and 3) as trouble alerts (Kendrick & Drew 2016) as well as a gaze shift to Nora (l. 3), indicating that there is trouble but not specifying it. The verbal component of the recruitment consists of a cut-off question (l. 3) and the subsequent self-repair, a request for the English translation of *seepra* ('a zebra', l. 4). Martta's embodied conduct shows double orientation to both Nora and her phone as possible sources of information: after directing the question to Nora, she shifts her gaze between Nora and her phone and picks up the device (l. 4 and 5). Even though a mutual gaze is not achieved, Martta's gaze shifts and verbal question (l. 3–4) are effective in recruiting Nora, who responds in line 5. Thus, the recruitment also occasions a slight modification of the interactional space: the two have been negotiating the previous translation together and the collaboration continues quite seamlessly in this extract but, with the recruitment, Martta shifts the focus to a word search requiring Nora's assistance. After the extract, however, Martta's embodied conduct is oriented more towards the trajectory of finding the answer on her phone. She shifts her gaze to the phone, starts handling it, and verbally expresses her need to know the spelling of the word. She thus relies on her phone after Nora's response proves insufficient for her purposes (cf. Musk 2022). Consequently, Martta breaks the momentary space of a mutual orientation on the word search and adopts a more independent line of action on the phone. Gaze, in conjunction with other embodied resources, is therefore flexibly used to display a changing orientation to different possible trajectories.

Extract 2 is an example of gaze used as the primary resource in a recruitment by the recruiting participant. It is taken from a 5th grade EFL lesson during recap activities on iPads. The teacher has instructed the pupils to work independently on vocabulary tasks on an electronic learning platform, but they sometimes negotiate answers together. Anna and Sara are seated next to each other in a side-by-side formation at their individual desks, with Oliver and Daniel behind them. Anna is trying to type the word *valley* and quietly utters it twice, mispronouncing it as [wʌlley] (l. 1). It should be noted that she uses this type of self-talk throughout the task when typing answers, and it does not seem to be directed at other participants. All participants are gazing at their iPads before Anna initiates the recruitment sequence (l. 2).

(2) Doesn't work

* = Anna's embodied conduct

\+ = Sara's embodied conduct

♠ = Daniel's embodied conduct

◊ = Oliver's embodied conduct

01	**ANNA**	**#°wal-ley°? (0.7) °°wali°°;**
		wuhl-le[y] *wuhley*
	anna	gaze to her iPad, typing
	sara	gaze to her iPad
	daniel	gaze to his iPad
	oliver	gaze to his iPad
	fig.	#Fig.5
02		***(1.0)+(0.2) *(1.1)#**
→	anna	*hits 'y' 3 times*stops typing, gaze to Sara
	sara	+gaze ahead
	fig.	#Fig.6

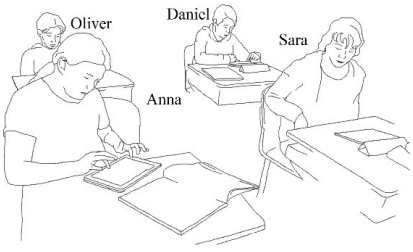

FIGURE 5.

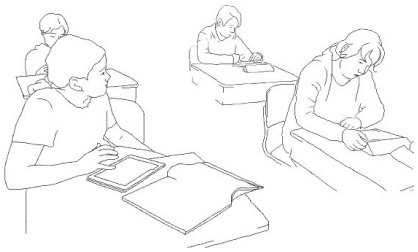

FIGURE 6.

03 OLIVER **MITÄ?+**
what
sara +gaze to her iPad

04 **(0.3)*(0.3)♠(0.6)**
anna *gaze to Oliver
daniel ♠gaze to Oliver

05 ANNA **[ei (tää)-]**
(this) doesn't

06 OLIVER **[mikä♠ val:◊ta] ♠meri oli;**
what was ocean
daniel ♠gaze to Anna♠gaze to Oliver
oliver ◊gaze to Daniel

07 **(0.4)**

08 ANNA **ei *toimi ♠näp+*päi(n).**
doesn't work the key ((=the key doesn't work))
→ anna *gz to Daniel *gaze to Sara
daniel ♠glances at Anna, then glances around
sara +gaze to Oliver, then to Anna

09 DANIEL **ä::+*::n o-se-an♠**
a::::n oh-seh-un ((=an ocean))
sara +gaze to Anna's iPad
anna *gaze to her iPad, taps screen 4 times
daniel ♠gaze to Oliver

10 ANNA **e◊i toi*mi (yy);**
doesn't work (y)
oliver ◊gaze to his iPad
→ anna *gaze to Sara

11 SARA **no >(oota ku ♠sä< oot)=**
well (wait cause you've)
daniel ♠gaze to Anna's book

12	**SARA**	**=räm*pyttäny sitä nii pitkään;**
		kept hitting it for so long
	anna	*gaze to iPad, starts typing

In Extract 2, the gaze shift functions as a display of trouble and a way to deal with it. As Anna notices that the key for "Y" on the keyboard does not seem to produce the letter on the screen (this can be seen from her screen on camera), she stops typing (l. 2). To recruit Sara, Anna needs to renegotiate the existing interactional space, from individual lines of action to a shared focus on Anna's trouble. She attempts this by turning her head and shifting her gaze to Sara (l. 2). The markedly long sustained gaze indicates trouble and solicits attention from Sara. Nonetheless, it does not induce a mutual gaze: Sara's gaze and body posture display orientation to her iPad and the task that she is required to finish. Anna then reacts to Oliver's turn (l. 3) by turning towards him (l. 4) and starts a report of trouble. Since Oliver starts recruiting Daniel to solve his own vocabulary problem (l. 6), Anna refocuses on Sara. Through two reports of trouble and gaze shifts to Sara (l. 8 and 10), she finally secures Sara's attention to her (l. 8) and her iPad (l. 9), mobilizing her response (l. 11–12; see Section 6 for response pursuits).

Extracts 1 and 2 demonstrate that gaze is relied on as a resource for displaying trouble and recruiting assistance in instances of trouble related to the task or the device. Whether or not it is successful, however, depends on the availability of the participant being recruited. For the recruiting participant to renegotiate the interactional space and to secure a mutual focus on the trouble, they need not only to suspend their *own* ongoing activity, such as typing an answer on an iPad (Extract 2), but also to get the recruited participant to momentarily prioritize the solving of the trouble over *their* simultaneously ongoing activity. A gaze shift to a coparticipant allows them both to check the availability of others and to attempt to recruit them, usually together with other multimodal resources, such as trouble alerts and verbal formulations.

6 Gaze in response pursuits

In the present data, gaze is systematically used as a resource in response pursuits (cf. Stivers & Rossano 2010). Out of the 17 cases in the data, seven involve gaze to a coparticipant as the only resource used to mobilize an answer, and in one case, the gaze shift is accompanied with nods (Extract 3). In four cases, gaze is paired with a verbal repetition, and, in five, with a modification of the initial verbal turn (Extract 4). Other embodied resources, such as touching, leaning towards a recipient, and showing a device, are sometimes used. Gaze shifts tend to occur right after a response to a sequence-initial action is perceived to be missing, thus initiating a new

sequence of response pursuit. If the gaze alone does not induce a relevant response (Extract 4), other resources are harnessed to secure one.

In extract 3, we find an embodied response pursuit effectuated by Hugo, a pupil on an 8th grade EFL lesson seated next to a peer, Joel. The class are playing a Kahoot about infinite and -ing forms, using their own mobile phones. Each pupil plays individually but they commonly assist each other during the game. A sentence with a missing verb (*Let me _____ you!*) has just appeared on the whiteboard. The pupils are required to fill in the blank in the sentence by clicking on one of the three options visible on their phone screens: *help*, *to help*, and *helping*. Both Hugo and Joel, focusing on their own phones, tap their screens to choose an answer, and wait for others to answer (data not shown). Hugo then utters the correct answer (l. 1).

(3) Help you
* = Hugo's embodied conduct
\+ = Joel's embodied conduct

01 HUGO **#help you;**
fig. #Fig.7

02 **(0.4)*(0.6)#+**
→ hugo *gaze to Joel
joel +turns slightly towards Hugo
fig. #Fig.8

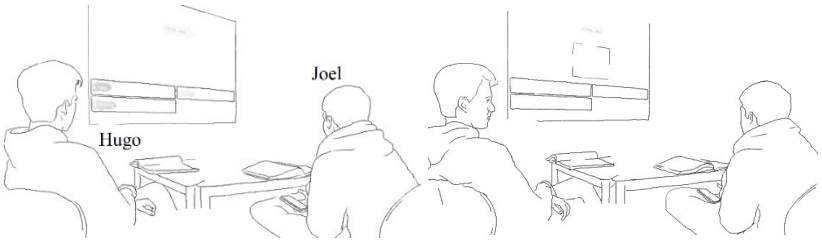

FIGURE 7. FIGURE 8.

03 **(0.2)*(1.4)+**
hugo *starts nodding
joel +starts nodding

04 **(0.5)***
hugo *turns towards whiteboard

In Extract 3, both the response pursuit and the ensuing response are achieved without a verbal input. In line 1, Hugo seems to utter one of the options presented on screen as a candidate answer for the question (this is done regularly by these participants during the game), making a second-pair part by Joel relevant. After a gap of 0.4 seconds, a pending response is indeed made accountable through a gaze shift to Joel. Joel's response is delayed, however, as attending to Hugo's pursuit makes a suspension of his focus on the game relevant. After a sustained gaze by Hugo, Joel turns his head slightly towards him (l. 2 - it is unclear from the camera angle if there is mutual gaze), and Hugo further invites a response by starting to nod (l. 3). Eventually, Joel also starts nodding (l. 3), and Hugo seems to treat this as a sufficient response. Withdrawing his gaze and focusing on the whiteboard (l. 4), he indicates a sequence closure (Rossano 2013). The extract thus shows how participants seem to treat gaze as a central resource for pursuing a response.

Response pursuits are not always effective, however. Extract 4 comes from another lesson of the same 5th grade group as Extract 2. Sara and Anna are preparing a short presentation on gymnastics as a team. They are looking for information online on their iPads, and Sara is taking notes in her notebook. They are trying to decide what to state as the reason for choosing the sport for the assignment, and Sara recruits Anna in spelling the word *because*. Anna then orients to her iPad before Sara finishes writing (data not shown). Sara soon initiates a new sequence, suggesting a reason they could write down for choosing gymnastics (l. 1).

(4) It's fun

* = Anna's embodied conduct

\+ = Sara's embodied conduct

01	**SARA**	**.mthhhhhh #it's fun:?**
	sara	gaze to notebook
	anna	gaze to iPad
	fig.	#Fig.9
02		**(0.3)*(0.2)+#(0.9) *(0.4)**
	anna	*gaze to her right *gaze to iPad
→	sara	+gaze to Anna
	fig.	#Fig.10

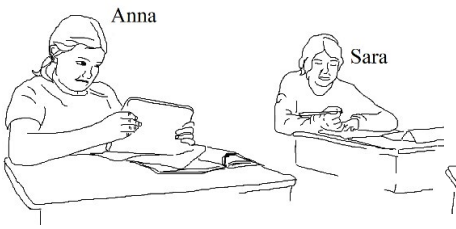

FIGURE 9.

FIGURE 10.

03 SARA **may*be,**
anna *lifts iPad

04 **(0.4)+(0.2)**
sara +gaze to Anna's iPad

05 SARA **is it *fu+n:;#**
anna *gaze to Sara, smiles
→ sara +gaze to Anna
fig. #Fig.11

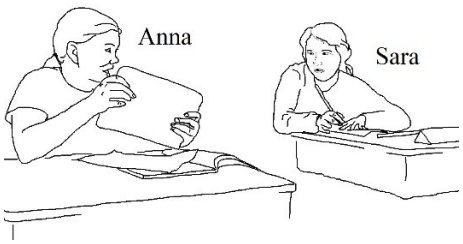

FIGURE 11.

06 **(0.5)*(0.3)+(0.4) *(0.9) ***
anna *gaze to iPad*gaze to Sara*gaze to iPad
sara +gaze to Anna's ipad

07 ANNA **°kato ketä mä nään tääl(tä)°**
look at who I see (from) here

The trouble in Extract 4 lies in the progression of the sequence that Sara has initiated with her turn in line 1. The turn is "try-marked" with a rising intonation (Sacks & Schegloff 1979: 18) and can thus be heard as a suggestion of how to continue their sentence (*We chose gymnastics because it's fun*). Anna, however, seems to shift her focus between her iPad and the opposite side of the classroom, and fails to react to

the suggestion (l.2). Sara seems to hold Anna accountable for the missing response and, through a gaze shift to Anna, initiates what could be called a sequential repair (Schegloff, 1997: 510), a boundary case of repair initiated when an action does not receive a sequentially relevant response. In addition, Sara uses verbal resources in pursuing a response. With the increment *maybe* (l. 3), she converts the gap between her turn and the pending response into a pause inside her own turn and thus mitigates the problem of the missing response (see also Bolden et al. 2012). In the continued absence of mutual gaze and a response, she then reissues a new version of her initial action (Bolden et al. 2012: 138), reformulating her suggestion as a question, and shifts her gaze back to Anna after a brief gaze to Anna's device (l. 5).

Through the gaze shift and the verbal formulations, Sara is engaged in resuming a momentarily fragmented interactional space. Their joint focus before the extract has been on the shared writing task, and Sara is now striving to restore this mutual line of action. Interestingly, Sara fails to mobilize a response and eventually abandons the pursuit. The problem seems to lie in Anna's simultaneous orientation to an off-task activity and her apparent ignorance of Sara's suggestion. Even the brief mutual gaze (l. 5) does not result in a successful mobilization but, rather, invites Sara to follow Anna's line of action, looking at what she can see on her iPad screen (l. 7).

Extracts 3 and 4 demonstrate that, even though gaze is typically directed at devices during technology-mediated tasks, it is often the first resource available to and employed by participants to address trouble in interaction. It is used to (re)negotiate a mutual focus on the trouble to enable the mobilization of a missing response. As we saw in Extract 4, however, the successfulness of the pursuit depends on the availability of the recipient, and competing lines of action may stall the progressivity of the task interaction.

7 Concluding discussion

Offering a new context for research on eye gaze, this article has investigated gaze functions in recruitments and response pursuits in classroom interaction during tasks on mobile devices. The analysis has revealed that gaze to coparticipants is systematically used as a resource in displaying and solving trouble. The findings are in line with previous research on the role of gaze in sequence initiations (Rossano 2013) and response mobilization (Auer & Zima 2021; Duran & Jacknick 2020; Stivers & Rossano 2010). In addition, however, the article has shown that, in the context of the study, gaze seems to be one of the first resources that participants use to display trouble, check the availability of others, and negotiate a shared focus on the trouble source.

The article has focused on how participants themselves orient to the context and its affordances, or the possibilities for action that the context offers (see e.g.,

Hutchby 2001). Thus, it has attempted to avoid the pitfall that research on technology is at risk of facing: any patterns of behaviour are determined to be straightforward results of technology. In fact, the analysis has shown that the gaze patterns around mobile devices in the data are quite consistent with contexts where any other types of objects are handled. Gaze is often needed for the manipulation of objects, for instance, but can quite fluently be harnessed for other purposes, such as recruiting help, whenever it is needed (cf. Deppermann 2014; Nishizaka 2014; Tuncer et al. 2019). Occasional hick-ups in the division of resources between the device and peer interaction are solved step-by-step, using multimodal resources afforded by the context. Technology can therefore only be assumed to have relevance for the interaction if the participants themselves perceivably orient to it as relevant.

Moreover, the analysis has shown that, to accomplish learning tasks on mobile devices, pupils need to manage interactional spaces around the devices, splitting their orientation between the device and interaction with peers. This has pedagogical implications for teachers, who are required to balance the learning aims and the affordances of devices as well as the interactional needs of pupils when planning technology-mediated tasks. Using multimodal resources, pupils actively participate in classroom interaction and manage multiple modalities simultaneously, and the possibility to do this should be taken into consideration when integrating technology into learning.

The article has hopefully offered a glimpse of the competencies needed in today's educational contexts. It has shown how interaction is multimodally accomplished around mobile devices and how trouble is actively addressed through resources such as eye gaze. The challenge for future research on classroom interaction is to unravel more of these competencies and to investigate how embodied resources and technology itself are used to build mutual attention and joint action in educational contexts.

Literature

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Appendix:

Transcription conventions

The participants' talk has been transcribed according to the Jeffersonian transcription notations used in CA methodology. Other embodied behaviours have been transcribed adapting conventions from multimodal CA (see e.g., Harjunpää et al. 2020).

.	final falling intonation
,	continuing intonation
;	slightly falling intonation
?	interrogative intonation
↑	rising intonation
↓	falling intonation
hhh	outbreath
.hhh	inbreath
what	word emphasis
°what°	speech that is quieter than the surrounding talk
°°what°°	whisper
>what<	speech that is quicker than the surrounding talk
<what>	speech that is slower than the surrounding talk
WHAT	speech that is louder than the surrounding talk
wha::t	prolonged vowel or consonant
wha-	cut-off word
(what)	uncertain hearing
[what]	overlapping talk
=	no break between utterances or units of talk
((ocean))	transcriber's comments
(1.5)	silence in seconds
(.)	micro pause
→	a line that is focused on in the analysis
*, +, ♠, ◊	Each participant in an extract is assigned one of these symbols. The occurrence of the symbol in a line of talk indicates the beginning of a focal embodied action that is explained underneath the spoken representation and its translation in grey font.
#	Indicates the temporal placement of a figure in a line of talk.