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Students' interactional strategies for resolving lexical issues in computer-assisted collaborative EFL writing

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Abstract

In the last decade interactional studies have been addressing the strategies of teachers of English as a foreign language (EFL) to teach impromptu vocabulary items. However, there is still a dearth of interactional studies that focus on students' own strategies to resolve lexical issues. Since the Swedish syllabus for English calls for students to be able to use different strategies when their language is lacking, we need to know more about what skills they use and whether there are ways in which their skills can be improved. The current study thus examines students' interactional strategies for resolving lexical gaps and other lexical issues in their collaborative writing, sometimes with recourse to digital lexical resources. It also explores the learning potentials of both collaboration and digital tools. The collection of students' lexical strategies comes from 31 hours of video-recorded data from collaborative computer-assisted writing tasks in the EFL classroom of four Swedish upper secondary schools.

The findings reveal five principal interactional strategies, three of which are unique to collaboration. Moreover, one strategy involves using digital resources by looking up lexical items in an online translation tool (e.g. Google Translate). Both collaboration and digital tools can create opportunities for learning lexis by extending access beyond individual knowledge resources. This is particularly so when it comes to students' lexical gaps. Moreover, training students to develop different strategies when using online translation tools should be particularly beneficial for both collaborative and individual writing.

Introduction

In interactional research, there has been a tendency to focus on teachers' strategies and methods for teaching vocabulary, for example to show how teachers turn impromptu vocabulary items into *teachables*, that is, "interactionally

emergent objects of explicit teaching" (Stoewer & Musk, 2019, p. 1; see also e.g. Eskildsen & Majlesi, 2018; Majlesi, 2014). While not denying the importance of strategies for teaching vocabulary, students also need strategies for dealing with lexical trouble that emerges on the fly, for example in the writing process. By examining how students resolve lexical troubles and the potential for turning these into *learnables*, we can ascertain whether students need explicit training to develop their skills in using appropriate strategies (see e.g. Jakonen & Morton, 2015; Kunitz, 2018; Majlesi, 2014 on learnables). Indeed, the Swedish syllabus for English (Skolverket, 2022) states that students should "develop their ability to use *different strategies* [...] when their language skills are inadequate" as well as "be given the opportunity to [...] produce [...] texts of different kinds, both on their own and *together with others*, *using different aids* and media" (italics added). Hence, the current study aims to examine the affordances of collaboration and digital tools in students' use of strategies to resolve lexical issues in their collaborative writing. These issues entail different kinds of "trouble", ranging from dealing with emergent lexical gaps to negotiating between different lexical items.

The study approaches strategies from an interactional and emic (participant-related) as well as socially and ecologically situated perspective, whereas the second/foreign language literature has traditionally approached strategies as the cognitive and self-regulated operations of an individual language learner (e.g. Oxford & Amerstorfer, 2018). Accordingly, the triadic ecology (student-student-computer) of digital collaborative writing necessitates a shift from focusing on the cognitive faculties of the individual towards viewing strategies as being both socially and ecologically *distributed* (cf. Hutchins, 1996), whereby students resolve lexical trouble together, often with recourse to digital aids, thereby achieving *epistemic progression*, that is, bridging knowledge gaps (cf. Balaman & Sert, 2017). Thus, strategies are respecified here as displayed and therefore observable participant concerns, as well as joint methods of solving problems in interaction (Burch, 2014; Musk & van der Meij, in review). Moreover, collaboration has been shown to encourage metatalk between students (Swain, 2001), whereby they reveal to each other their problem-solving (cognitive) processes, whilst also making them available to the analyst.

To uncover how these second/foreign language (L2; no distinction is made between the two in this article) students resolve emergent lexical trouble as well as the *learning potentials* of collaboration and digital tools (see e.g. Hellermann &

Pekarek Doehler 2010; Musk 2022), this study applies *multimodal conversation analysis* (CA; e.g. Broth & Keevallik, 2020). This approach is well suited to tracking how lexical trouble arises in the writing process and how students resolve it within the digital ecology of the classroom (see Musk, 2021a, 2022). The analyses are based on a collection of lexical troubles. These have been extracted from 31 hours of video-recordings of collaborative writing tasks in L2 English from four Swedish upper-secondary schools. The following research questions guide the study:

1. What interactional strategies do students use to resolve lexical gaps and other lexical issues in the collaborative writing *process*?
2. To what extent does collaboration and access to digital tools afford epistemic progression (i.e. knowledge gains) and how do they affect the final *product*?

Research review

Particularly over the last 10 years, there has been a steadily increasing number of CA and microanalytic studies examining interactional sequences where vocabulary items have been topicalised (i.e. made the topic of discourse; Waring et al., 2013, p. 89) in second/foreign language contexts. Most of these deal with teacher-student interactions in the various classroom settings, particularly those entailing vocabulary explanations or definitions. These include Danish as an L2 (Mortensen, 2011), English as an L2 (Lazaraton, 2004; Markee, 1995; Tai & Kabbazbashi, 2019a, 2019b; Waring et al., 2013, 2016), Swedish as an L2 (Majlesi, 2014), English in Content and Language Integrated Learning (CLIL) (Kääntä et al., 2018; Morton, 2015) and in mother tongue instruction in English (Stoewer & Musk, 2018). The vast majority of these studies have also included multimodal aspects of the classroom interactions in their analyses. One distinction drawn between different kinds of vocabulary explanations of particular relevance to this study is highlighted in Waring et al. (2013), namely what they call the *analytic approach* vs. the *animated approach*. Whereas the analytic approach relies heavily on verbal resources, "the animated approach deploys multiple semiotic resources including but […] not limited to explanatory talk" (Waring et al., 2013, p. 254).

Although the above studies mostly focus on explanation work carried out by teachers, this practice is not reserved necessarily to teachers (see e.g. Stoewer & Musk, 2018). Few studies, however, focus on how students topicalise and deal

with emergent lexical issues in their collaborative writing. Almost all of these focus more specifically on particular aspects of the digital collaborative writing processes, for example regarding spelling (Čekaitė, 2009; Musk, 2016, 2021a), online translation tools (Musk, 2022; Musk & van der Meij, in review), primary school students' reflective practices on style and correctness (Herder et al., 2018a) and their writing proposals (Herder et al., 2018b). To date there are to my knowledge no micro-analytic studies specifically focusing on or categorising students' interactional strategies in resolving lexical issues in general.

Analysing how students resolve lexical issues entails attention to the management of knowledge. Within interaction research, managing knowledge has received considerable attention under the term *epistemics* (e.g. Heritage 2012, 2013; Stivers et al., 2011). More recently, epistemics has been applied to teaching and learning contexts, not least in the L2 classroom (e.g. Balaman & Sert, 2017; Jakonen & Morton, 2015; Musk & Čekaitė, 2017). In this study, reference will be made to whether students display *epistemic access* to (i.e. that they know and can retrieve) lexical knowledge, how they may treat external epistemic resources (e.g. online translation tools, cf. Musk, 2022) as having *epistemic primacy* (i.e. affording the relative right to claim knowledge; see Stivers et al., 2011, p. 9 and p. 13), and how they achieve *epistemic progression* (i.e. bridge knowledge gaps; cf. Balaman & Sert, 2017) and thereby transform lexical items into *learnables* (Majlesi, 2014). Furthermore, the collaborative nature of the writing process in this study is characterised by the moral dimensions of *epistemic responsibility* (Stivers et al., 2011, p. 17), whereby students hold each other accountable for sharing their knowledge in pursuit of writing their joint text.

Data and method

The participants of the current study comprise nine pairs of students from five different classes in the first year (17-year-olds) of four upper-secondary schools in Sweden. All the students gave their written consent according to the ethical guidelines of the Swedish Research Council (Vetenskapsrådet, 2017), fulfilling the requirements of providing information, obtaining participants' consent, ensuring their consented level of confidentiality, data storage and use. In accordance with the students' individual consent, names have been changed in the transcriptions and images may have been blurred to ensure their anonymity. The written tasks carried out by the pairs were set by their respective English teachers as part of their regular English classes, in some cases in consultation

with the researcher. They comprised project work on famous Americans, argumentative essays on student-selected topics and an informational text on International Women's Day.

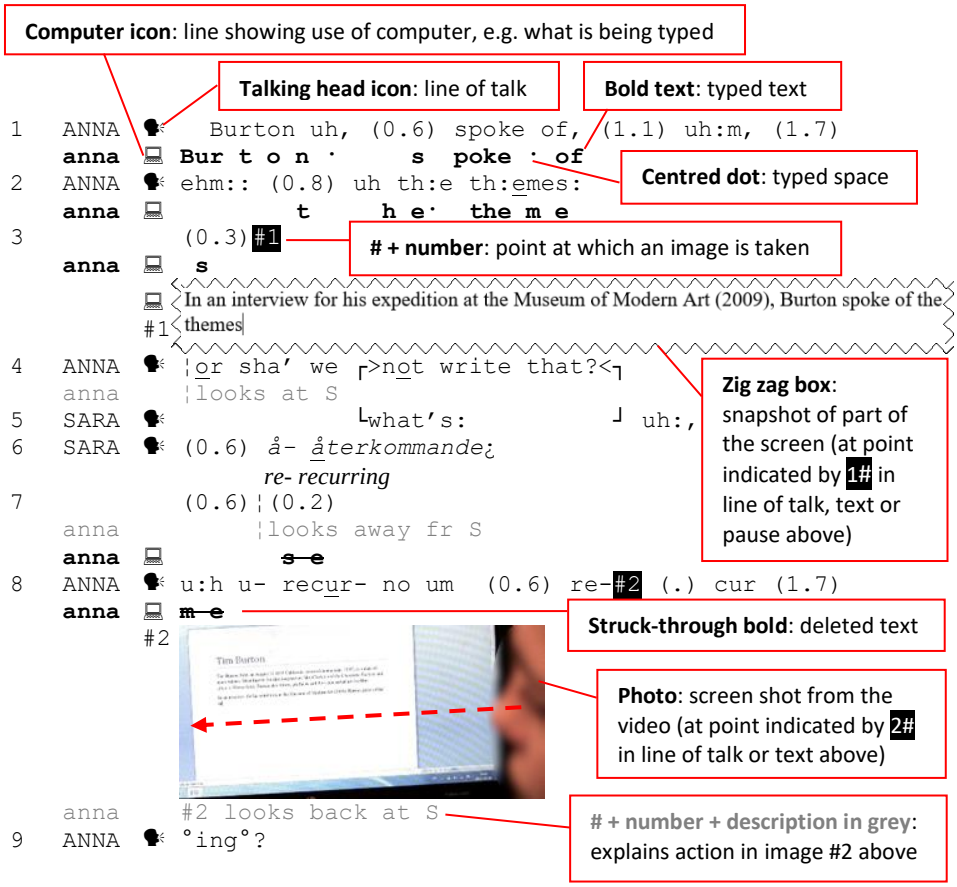
The collaborative writing data totals 31 hours of video-recorded pairwork, collected in 2012, 2018 and 2019 over a series of two to five classes. All the pairs were co-present in their respective classrooms. For most of the recordings, pairs shared one laptop, but in the some of the recordings from 2018, students worked in the same web-based document (Google Docs) but had a laptop each. The recordings were made using 2–3 video cameras, one to capture each screen and one filming from the side to capture the students' embodied actions. Some of the data from 2019 also made use of screen recording capture software (OBS Studio), which also video-recorded the pair via the computer's inbuilt video camera in the upper left-hand corner of the screen recording.

Analytically this study deploys multimodal conversational analysis (cf. Broth & Keevallik, 2020). Conversation analysis (CA) is an inductive (data-driven) method that investigates the methods that participants (here students) use to interpret each other's actions and solve problems. Thus, it prioritises an emic (participant-related) perspective as it emerges within the sequential organisation of interaction. This perspective is ascertained by recourse to the next-action proof procedure (Broth & Mondada, 2013, p. 52), whereby participants reveal in their next turn of talk or other next action how they have interpreted a previous turn or action. In order to make robust claims about interactional patterns found in the video data, CA builds collections of an identified phenomenon. For this study the data sets have been "trawled" for all cases where students topicalise vocabulary (the identified phenomenon), either to bridge lexical gaps or to resolve other lexical trouble. Through an inductive categorisation process, CA thus achieves a higher degree of generalisability about a phenomenon (Hutchby & Wooffitt, 2008, p. 88), the reliability of which can be corroborated by representative transcriptions and consolidated by cumulative empiricism across data sets and additional studies.

The transcriptions characteristic of multimodal CA typically share features of talk established for example by Jefferson (2004), augmented by multimodal features. The triadic participation framework (student-student-computer) of the current study necessitates the inclusion of multimodal features, not only of the students' embodied interactions (e.g. body movements, facial expressions and gaze), but

also their interactions with artefacts, not least the computer. The transcription conventions adopted here follow those developed by Musk (2016) for collaborative computer-assisted writing. Importantly, each line number may include laminated simultaneous modes of action represented by two icons (🗣 for talk and 💻 for handling the computer) which appear immediately after the name of the person whose talk or actions are represented. Significant actions are also illustrated by video stills. Only the lines of talk or pauses are numbered, whereas the unnumbered lines immediately underneath show embodied actions that occur simultaneously with the closest numbered line above (see Figure 1 for the augmented embodied features described above as well as some others). A full list of transcription conventions can be found in the appendix.

Figure 1. Main transcription symbols and features.



Analyses

The categories described and illustrated below are based on a collection of sequences in the collaborative authoring process where mutually satisfactory lexical items are not immediately forthcoming. Hence, what is *not* included here as its own category is when a mutually satisfactory lexical item is supplied by either the currently authoring student or the other student at *first* attempt after a word search sequence. Instead, the following five categories occur when students need to adopt additional interactional strategies to resolve a lexical impasse:

(1) Proposing the substitution of a lexical item
(2) Negotiating between alternative lexical items
(3) Offering a definition to elicit a lexical item
(4) Requesting a translation to elicit a lexical item
(5) Looking up a lexical item

In order to establish generic features and contrast the specific features of each category, and to ensure that the categories are emically motivated, the following aspects have been described and discussed, as far as possible in the same order under each respective heading:

- The strategy or method of resolving a lexical issue.
- The participation framework (including collaboration and use of the computer).
- The nature and length (in turns) of the lexical-solving trajectory.

The number of cases per category is not provided here, because there are issues of what to count, since one single trajectory from a lexical impasse until its resolution may include more than one strategy or more than one iteration of the same strategy. This will be illustrated and substantiated by the selected excerpts below, which follow whole trajectories. It appears more significant to establish the strategies adopted to resolve lexical issues and the order in which these tend to occur when "chained" than count the relative number of occurrences. We shall return to the order of the strategies in the concluding discussion.

Category 1. Proposing the substitution of a lexical item

A lexical substitution may be initiated by the typist or the non-typist, depending on who is currently the author. Furthermore, the initiation may occur before or

after it has been typed and it may or may not be accompanied by a metacomment. Proposed substitutions presuppose an improvement (made explicit in lines 1–2 of Excerpt 1) or finding a word that differs from the source text. Suggested substitutions in this category are accepted whether or not they are justified further and therefore these sequences are relatively short. Cases where students do not agree occasion negotiation and therefore belong to the next category.

In Excerpt 1, Adam has been typing biographical notes about the famous American actor and martial artist, Chuck Norris. After making an other-initiated spelling correction (cf. Musk, 2016) of "daughter" before the excerpt starts, he returns to a previously typed sentence and self-initiates the substitution of "called" (line 1, #1; hereafter line numbers only are presented within single parentheses).

Excerpt 1

Participants: Adam and Adolf

1 ADAM 🗣 *let's say#1 named mike instead (.) it sounds*
adam 💻 **~~d el l a~~**
💻 In 1958 chuck married a woman, Dianne Holechek and they got their first child in 1963. It was a boy
#1 called Mike. Only one year later they got a daughter, Diana.
#1 
2 ADAM 🗣 >a little bit °better°<.
adam **e**
3 (1.3)#2
adam 💻 **named**
💻 In 1958 chuck married a woman, Dianne Holechek and they got their first child in 1963. It was a boy
#2 named Mike. Only one year later they got a daughter, Diana.
4 ADOLF 🗣 EH:: ((yawning))

Adam's proposed substitution of "called" with "named" is proposed orally immediately before he moves the cursor and starts deleting **~~called~~** (1). After he has justified the substitution with the metacomment "it sounds a little bit better" (1–2), he carries out the substitution (3, #2). Both Adam and Adolf have been gazing at the screen throughout lines 1–3 (see #1), but Adolf explicitly signals neither his alignment nor disalignment. Therefore, Adam exercises his prerogative as typist (Čekaitė, 2009, p. 338) to make the revision, while also

asserting his epistemic access (i.e. that he has and can retrieve knowledge; Stivers et al., 2011, p. 9).

Category 2. Negotiating between alternative lexical items

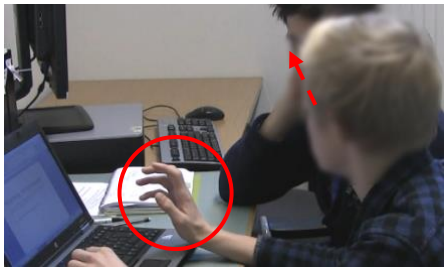
Negotiations typically arise when alternative lexical items are proposed by whoever is not currently authoring the text, most often in oral mode, slightly before or while the item is being typed. Unlike category 1, the alternatively proposed candidate is not (immediately) accepted and negotiation ensues, driven by disalignment. Moreover, the negotiation necessitates motivating proposed or rejected candidates, which frequently calls for metadiscourse, most notably definition work (as shown in Excerpt 2). The typist tends to have the upper hand in the negotiations, constantly determining what alternatives get typed and also deleted.

Excerpt 2(a–c) constitutes the most elaborate and longest negotiation sequence in the data. It has been selected here since it displays a wide range of actions that can be found in Category 2, many of which can occur across different categories. At the beginning of the excerpt, Bruce is both authoring and typing the second sentence of a text about Neil Armstrong in a project about famous Americans. The topicalised lexical item, which takes many turns to resolve, is the appropriate verb to describe Armstrong's historic moonwalk.

Excerpt 2a

Participants: Syd (S) and Bruce (B)

		💻	One of the most famous persons to leave our atmosphere is Neil Armstrong. Everyone knows who he
		#1	is and what he has done. Neil Armstrong was the first
1	BRUCE	🗣	#1 the first person (1.1) ↑to↓
	bruce	💻	**p e r s on·to**
2			(1)
3	SYD	🗣	°go¦ to moon°
	bruce		¦glances at S
4			(.)
5	BRUCE	🗣	t┌o
6	SYD	🗣	└go to the moon
7			(1.6)
8	BRUCE	🗣	¦*to*#2
	bruce		¦raises hand from keyboard & looks towards S

#2 

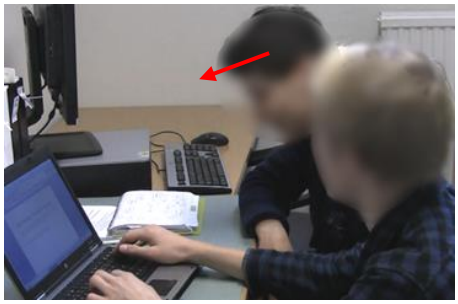
9 (1.3)
10 SYD to step on ┌(the) moon
11 BRUCE └<mou¦nt:> (.3) *the ¦moon* $h.ehh$
b & s ¦B & S's gaze meets
b & s ¦look at screen
12 (.5)
13 BRUCE $.huh ┌huh$
14 SYD └to ¦explore >the moon<
syd ¦looks briefly at B
15 (.6)
BRUCE **e**
16 BRUCE °*e:::h*°
bruce **[e]xplo**
17 (.4)
bruce **[explo]re** ·
18 SYD °if you°
bruce **t h e** ·
19 ¦(.9)
syd ¦turns head & upper body to face B
bruce **moon**#3 ~~n~~

#3 One of the most famous persons to leave our atmosphere is Neil Armstrong. Everyone knows who he is and what he has done. Neil Armstrong was the first person to explore the moon

As is often the case, a "co-authoring word search" (Musk, 2021b) is triggered by an infinitive marker followed by a pause (1–2), which displays syntactic incompletion (here a missing verb). Syd supplies a candidate in line 3 but it is delivered hesitantly in *sotto voce* and quickly rejected by Bruce, who repeats the infinitive marker and thereby initiates repair (e.g. Seedhouse, 2004, p. 34). Despite Syd's overlapping repair in line 6, where he (correctly) adds the definite article, Bruce initiates a new repair and word search by leaving a long pause before once again repeating the infinitive marker (7–8). The repair initiation is also signalled by Bruce demonstrably not typing by lifting his hand from the keyboard and looking towards Syd and pausing (8–9, #2). Syd then supplies a new candidate – "step on (the) moon" (10), but in overlap Bruce proposes another candidate – "mount the moon" – although his turn-final laughter particles suggest that this suggestion is not to be treated seriously. Indeed, Syd proposes yet another candidate – "explore the moon" – (14), which is initially accepted by Bruce, who proceeds to type this (15–19) before then deleting it and abruptly rejecting it verbally with an emphasised unmitigated "no:" in line 20 of excerpt 2b, thereby also claiming epistemic primacy (Stivers et al., 2011, p. 13).

Excerpt 2b

20 BRUCE 🗣 no: (.) n┌uh¿ ¦.hhh (1)#4
syd ¦looks away & up at window
bruce 💻 ~~oom·eht · e r o lpxe~~
21 SYD 🗣 └t-
💻 One of the most famous persons to leave our atmosphere is Neil Armstrong. Everyone knows who he
#4 is and what he has done. Neil Armstrong was the first person to
22 BRUCE 🗣 to¦:? (1) step: (.2) *on ¦the moon* (.2)#5
bruce ¦glances towards S
syd ¦looks back at screen
bruce 💻 **s t e p · o n · the m oo n.**
💻 One of the most famous persons to leave our atmosphere is Neil Armstrong. Everyone knows who he
#5 is and what he has done. Neil Armstrong was the first person to step on the moon.
23 BRUCE 🗣 ¦°nunuh°
bruce ¦glances quickly at S
24 (.4)
bruce 💻 ·
25 SYD 🗣 °step on moon°
26 (.8)¦
syd ¦turns towards B
bruce 💻 ~~·.~~
27 SYD 🗣 *do you like* ¦step#6 on the moo::n ¦crushed
syd ¦leans fwd & taps foot ¦taps foot
bruce 💻 ~~n o o m · e~~
#6



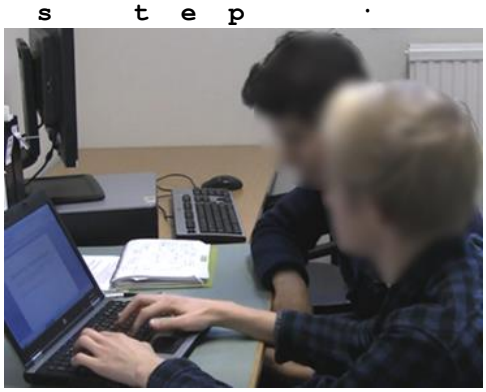
28 SYD 🗣 $underneath your feet$
bruce 💻 ~~h t · n o · p e~~
29 (.2)
bruce 💻 ~~t~~

Once again Bruce produces a prosodically marked infinitive marker followed by a pause, signalling a new co-authoring word search, displayed by him glancing at Syd (22). This time Bruce starts typing and repeats verbally a previously proposed candidate by Syd. Although typing a full stop suggests the close of the negotiation sequence, Bruce opens it up again by first repeating "°step on moon°" softly before challenging its contextual suitability through the ensuing definitional work. He does so both through an "animated definition" (Waring et al., 2013, p. 254), whereby he leans forward (#6) and audibly taps his foot while emphasising the verb "step" to act out its meaning as well as adding an "analytic definition" (Waring et al., 2013, p. 254) by supplying a verbal definition of "step", namely "crushed $underneath your feet$", whilst once again tapping his foot (27–28).

Even before Syd starts his definition turn challenging Bruce's typed candidate, Bruce has already started deleting the troublesome lexical item (26). He then almost completes the deletion during Syd's contesting turn (27–28). Yet, despite his apparent acceptance of Syd's repair initiation, Bruce proceeds to challenge Syd's definition in Excerpt 2c.

Excerpt 2c

```
30 BRUCE   🗣  ¦sta:mp ¦(.2) >you were thinking about< stamp
   b & s       ¦look at each other
   syd                ¦looks away at screen
   bruce           s
31                 (.)#7
                   One of the most famous persons to leave our atmosphere is Neil Armstrong. Everyone knows who he
   #7              is and what he has done. Neil Armstrong was the first person to
32 SYD     🗣  *no:
33 BRUCE   🗣  or ┌shtomp
34 SYD     🗣     └jus'*
35                 (.5)
36 SYD     🗣  stomp is another thing >it's like< pf¦#8fhh
   syd                                          ¦leans fwd &
                                                 stamps foot
   bruce      s    t  e  p       ·          o    n
   #8
```



```
37                 (.2)
   bruce       · t
38 BRUCE   🗣  yea:h (.2) but that  (.) let's:: (.) it sound like
   bruce       h e · m  o  n o    o  n
39 BRUCE   🗣  (i-) that ┌was th- thing#9 you were ¦des┐cri¦bing
   bruce                                          ¦rubs eye
   bruce       o o      n       ·
40 SYD     🗣           └take a step on the moon then,┘
   syd                                                ¦turns
                                                       to B
                   One of the most famous persons to leave our atmosphere is Neil Armstrong. Everyone knows who he
   #9              is and what he has done. Neil Armstrong was the first person to step on the moon
41                 (.2)
42 SYD     🗣  t#o make a step on the moon¿
43                 (.2)
44 BRUCE   🗣  ┌°¦to step on the moon°┐=
   bruce       ¦looks at S
45 SYD     🗣  └ something          ┘
46 SYD     🗣  =>step ¦on the moon is like< ¦you step on a pen
   syd            ¦looks away          ¦faces B
```

```
47 SYD     🗣  while walking,
48             (.4)
49 SYD     🗣  >it's not like you ¦stomp< on a ¦pen, $nhuh huh$=
   syd                          ¦leans fwd & taps foot
   syd                                      ¦looks at B smiling
50 BRUCE   🗣  =yeah well y- >¦you describe it that way.<
   syd                       ¦looks away & back again
51             (.4)¦
   syd             ¦looks away
52 SYD     🗣  °hrr¦rrhh°
   bruce           ¦looks away at screen
53             (1.4)
54 SYD     🗣  $uhu┌huh$
55 BRUCE   🗣       └>step on the moon ¦okay?<
   bruce                              ¦readjusts himself on chair
56             (.5)
57 BRUCE   🗣  e::m: ((clicks fingers)) (2) °*step on the moon,*°
```

In line 30 Bruce contests the meaning Syd ascribes to "step" by postulating that it better matches "stamp". However, given no initial acknowledgement by Syd, Bruce's increment is prefaced with ">you were thinking about<", which is a *type 1 knowable*, that is, where subject actors themselves have a greater right to know what they are thinking (Pomerantz, 1980, p. 187). Therefore, not unsurprisingly, Syd asserts his epistemic primacy by rejecting Bruce's postulation with a bald "*no:*", whereupon Bruce supplies a synonym "shtomp" (32–33). However, Syd rejects this synonym too by way of another animated definition (36), whereby he upgrades his previous animated definition (27), this time stamping his foot while producing the non-lexical "pffhh" (cf. Keevallik & Ogden, 2020). Despite Syd's displayed objections, Bruce has started retyping his previously deleted suggestion during Syd's definition of "stomp" (36) and he completes it while verbally defending why "stamp/stomp" better match Syd's definition. Although Syd supplies two more candidate lexical items (40 and 42) and performs further definition work by contrasting contexts using "step" and "stomp" – "on the moon" vs "on a pen while walking" – (46–49), Bruce finally dismisses Syd's objections (50). Syd quietly but audibly vocalises his continued disalignment with a non-lexical expression of exasperation (52), somewhat ameliorated by his delayed laughter particles (54), whereupon Bruce repeats what he has typed and brings the sequence to a close by readjusting himself on his chair and clicking his fingers before reiterating his lexical candidate (55–57). By doing so, Bruce demonstrates the uneven distribution of rights and responsibilities between the typist and non-typist, whereby the typist has the final veto (Čekaitė, 2009, p. 338), while simultaneously asserting his epistemic primacy.

Category 3. Offering a definition to elicit a lexical item

In all three remaining categories, an emergent lexical gap triggers a word-search sequence, typically initiated by the typist (as in Excerpt 2a), but otherwise whoever is currently authoring the text-in-the-making. In the CA literature, word searches typically start out as solitary actions, signalled particularly by the current speaker averting his/her gaze (Goodwin & Goodwin 1986, pp. 56–57). If a word search cannot readily be resolved, the current speaker may solicit help, signalled through gazing at a co-participant (Goodwin & Goodwin 1986, p. 63). In collaborative writing, this pattern is far less clear, partly because participants are co-authoring a text and share epistemic responsibility (Stivers et al., 2011, p. 18) for resolving word searches and perhaps partly because they are sitting side by side, both facing the computer where the text is being typed (see Excerpt 2a, 1–3 and 5–6 – with no gaze at co-participant). Even so, gazing at a co-participant does solicit help and some form of response (see Excerpt 2a, 8–10). Other features of word searches in the literature are also evident in co-authoring word searches, namely a "thinking face" (Goodwin & Goodwin 1986, p. 57), hand gestures (Duran et al., 2022, p. 504) and speech perturbations, such as "sound stretches, turn-holding tokens (e.g. um, uh, ehm etc.), cut offs, and pauses, which demonstrate that the speaker is engaged in a word search activity" (Duran et al., 2022, p. 503).

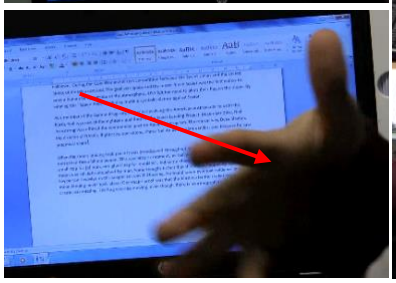
In category 3 the word search is carried out without recourse to Swedish (which may not be the students' first language, as in Excerpt 3), that is, by offering a definition of the word in English (see Waring et al., 2013). The duration of the word search trajectories may vary, probably depending on the precision of the definition or the closeness of the lexical prompt as well as the epistemic access (Stivers et al., 2011, p. 9) of the other student. If the initial definition or prompt does not prove successful, the initial speaker resorts to a further elicitation method. This is precisely what happens in Excerpt 3, where the initial definition is quickly succeeded by a translation request (category 4, a far more frequent strategy in the data).

Excerpt 3

Participants: Syd (S) and Bruce (B)

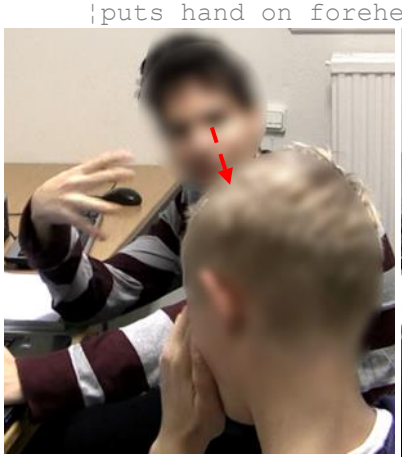
			Armstrong was offered the commander post on Apollo 11 program. The reason why Deke Slayton,
		#1	the director of NASA's flight crew operations, chose Neil to be the commander, was because
1	Syd		#1 **he·saw·poteni÷tial·**

2 ¦(1.9)
syd ¦turns head towards B
3 BRUCE 🗣 ((sniffs))
4 (2.0) ¦(1.7)
Syd 💻 **in¦ ·him· ¦**#2
syd ¦turns head back towards screen
💻 #2 Armstrong was offered the commander post on Apollo 11 program. The reason why Deke Slayton, the director of NASA's flight crew operations, chose Neil to be the commander, was because he saw potential in him
5 SYD 🗣 e¦hm
syd ¦starts turning back to B
6 ¦(2.7)
syd ¦moves right hand towards B #3; combs it towards him #4; shuts eyes & puts hand on forehead #5

#3 
#4 

#5

7 SYD 🗣 when you have arguments you need,
8 🗣 ¦(0.2)#6 *stö:d¿*
support
syd ¦combs hand towards himself twice
9 (0.2)¦#7
syd ¦puts hand on forehead still looking at B

#6 

#7

10 SYD 🗣 what's that ca┌lled
11 BRUCE 🗣 └support?
12 (0.2)
13 SYD 🗣 °eah°
14 (1.3)
15 SYD 🗣 >potential and< suppo:r- (0.6) -ted (.) by
Syd 💻 **s u p p orte d · by**

In Excerpt 3 Syd is authoring text and typing phrase by phrase (1), but at the end of line 4 a word search starts, characterised by a long pause, a hesitation marker (5), turning back to Bruce (5), making hand gestures (#3–4) and then displaying a thinking pose (#5), whereupon he produces a contextualised definition "when you have arguments you need" in the form of a designedly incomplete utterance (Koshik, 2002). Thus, Syd displays that he seeks Bruce's input in both verbal and embodied mode. When it is not immediately forthcoming, Syd follows up the definition with a translation request while continuing to gesture, display a thinking pose and gaze at Bruce (8–9, #6–7). In overlap with Syd's incremental explicit translation request in line 9, Bruce supplies a candidate item "support", thereby displaying his epistemic access (Stivers et al., 2011, p. 9). Both the Swedish word and its translation are nouns, but in Syd's typed text he post-edits the English word as a verb to match the emerging context (15): "**supported by great skills showed in earlier missions.**" (completed beyond Excerpt 3), which simultaneously confirms Syd's epistemic progression.

Category 4. Requesting a translation

As illustrated by Excerpt 3 in the previous category, translation requests tend to start with word searches (though usually without definitions to solicit help), but when the word search fails or when proposed candidates are not jointly accepted, translation requests often occur. Producing the Swedish word can help pinpoint the precise meaning of the sought-for L2 word in the emerging context and they are sometimes accompanied by explicit verbalised requests for help, such as "what's x?" or "what's x called?" (cf. Stoewer & Musk, 2018). In Excerpt 3 line 9 this explicit request is produced incrementally after the Swedish word, but usually the explicit request comes before.

In Excerpt 4 Anna and Sarah are writing their second sentence about the film producer Tim Burton, who they have chosen for their project on famous Americans. When Anna has audibly authored and typed the beginning of this sentence and checks whether it is to Sarah's approval (1–4), Sarah makes a translation request in line 4, using a "what's x?" construction.

Excerpt 4

Participants: Anna (A) and Sarah (S)

```
1  ANNA    🗣  (.4) Burton uh, (.6) spoke of, (1.1) uh:m,
   Anna    💻   Bu  r t o n ·    s  poke · of  ·
2                (1.7)
3  ANNA    🗣  ehm:: (.8) uh th:e th:emes: (.3)#1 ¦or sha' we
```

```
    anna                                                    ¦looks at S
    Anna    💻              t    h e · the m e  s
            #1   In an interview for his expedition at the Museum of Modern Art (2009), Burton spoke of the
                 themes
4   ANNA    🗣   [>not write that?<]
5   SARAH   🗣   [what's:          ] uh:, (.6) å- återkommande,
                                                 re- recurring
6                (.6)¦(.2)
    anna             ¦looks away
    Anna              s e
7   ANNA    🗣   u:h u-  ¦recur- no um (.6) re- (.) cur (1.7)
    anna                ¦looks back at S
    Anna    💻   m e
8   ANNA         °ing°?¦
    Anna               ¦looks away from S again
```

What then ensues is a word search sequence, where Anna is positioned as potentially having epistemic access (Stivers et al., 2011, p. 9). Typical word-search features characterise Anna's response, such as pauses, gaze direction and speech perturbations. Although Anna displays considerable epistemic uncertainty, she does actually supply a fragmented and increasingly quiet but also try-marked "re- (.) cur (1.7) °ing°?", albeit not perceived by Sarah (which transpires later: "I jus' don't [sic!] hear you say it"). Hence the translation request is not satisfactorily resolved in this sequence, either for Anna or for Sarah. Since the issue is then resolved by looking up *återkommande* 'recurring' in an online dictionary, this excerpt will be continued in the next category.

Category 5. Looking up a lexical item

In this final category, a word search results in the students looking up an emergent lexical gap or other lexical impasse in a bilingual online dictionary or other "online translation tool" (cf. Musk, 2022). This is not usually the first course of action, but as with the case of Excerpt 4, students tend to resort to this when they cannot satisfactorily resolve the issue between themselves. The different translation tools offer somewhat different affordances (see Musk, 2022), but very often there is more than one candidate translation offered, which necessitates a choice. The students' epistemic status vis-à-vis the alternatives offered and their mutual agreement in the selection process determines the length of the problem-to-solution trajectory.

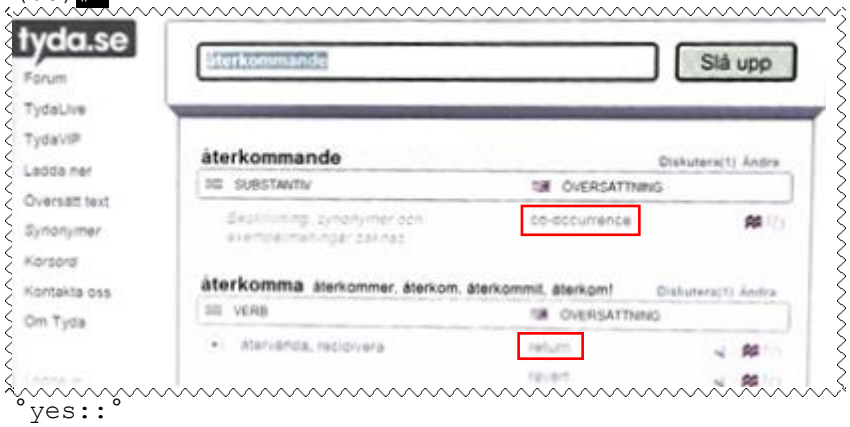
Excerpt 5 picks up where Excerpt 4 left off, with some lines omitted where Anna has typed *återkommande* 'recurring' into the online dictionary tyda.se (#2).

Excerpt 5

Participants: Anna (A) and Sarah (S)

1 ANNA 🗣 returning? °(khh- ri-)° $.h HUHUHUH ha$ >tha'sn't
2 right<=
3 SARAH 🗣 =$.h uhuhuhuhunh .hh$=
4 ANNA 🗣 =$.hu$
5 (.8) #2

💻 #2



6 ANNA 🗣 °yes::°
7 (1.1)
8 ANNA 🗣 co-¦occurs,
anna 💻 ¦scrolls down entry
9 (.5)
10 ANNA 🗣 >°här#3 *ha' vi*°< c- reCURRing I said rec- di- I
here we have

💻 #3

11 ANNA 🗣 ¦I said recurring an' it was a it was a WORD?
anna ¦looks at S
12 🗣 it's really weird.

What first appears in the dictionary entry is the noun and the verb (*återkomma* 'return'). Anna first rejects "returning" with some mutual hilarity and a dismissive metacomment (1–4) and then rejects "co-occurs" with less certainty. Interestingly, she has also verbally post-edited (inflected; cf. Musk & van der Meij, in review) the forms offered in the dictionary entry ("return" and "co-occurrence"), which would have been necessary since these belong to the wrong word classes (verb and noun, respectively). This also highlights a problem with using bilingual dictionaries and online translation tools, namely that of identifying not only the right word class, but also an appropriate equivalent with the correct inflection for the context (cf. Fredholm, 2021; Musk & van der Meij, in review). However, in this case Anna scrolls down to adjectives in the dictionary entry (8–

10, #3), where she finds "recurring" as the first entry. Code-switching momentarily into Swedish, Anna's use of the first person plural pronoun indexes the joint nature of the word search. Furthermore, Anna displays a "retrospective orientation" (Jakonen, 2018), whereby she shifts both from "we" to "I" and from the present to the past tense, "have" to "said", to assert that she had already produced the candidate translation "recurring". Although this confirms her original hesitant and fragmented proposal (Excerpt 4: 7–8), the continuation of her turn displays her surprise at it actually being a word (Excerpt 5: 11–12). At the same time Anna displays her epistemic progression, that is, a change in her epistemic status from being rather uncertain to now knowing (Balaman & Sert, 2017; Heritage, 2012). By doing so the online dictionary is afforded epistemic primacy in resolving the lexical trouble (Stivers et al., 2011, p. 13). In the remainder of this sequence (beyond Excerpt 5), Sarah questions whether Anna had previously said "recurring", whereupon Anna invokes the recording as evidence. The sequence closes with Anna typing "**recurring themes**" and her requesting that Sarah confirm the correct spelling.

Concluding discussion

This study has examined the potential of collaboration and digital tools in students' use of strategies to resolve lexical issues in their collaborative writing, whereby the term strategies has been respecified in interactional terms as an observable participant concern (Burch, 2014; Musk & van der Meij, in review). In answer to the first research question as to what interactional strategies students use to resolve lexical issues in the collaborative writing process, the study has identified five principal strategies ranging from repairs, whereby either (1) lexical substitutions are proposed or (2) lexical negotiations ensue to find the appropriate word, to various methods for resolving lexical gaps or other lexical trouble in word search sequences. Additionally, in word searches the data reveal a regular sequential pattern regarding the remaining three strategies:

(3) (offering a definition to elicit the word)
(4) requesting a translation of a Swedish word
(5) looking up the word

The bracketed third step is most often bypassed, and the word search only continues to the fourth and the fifth step if the lexical issue has not yet been resolved (illustrated by Excerpts 3, 4 and 5, respectively).

Let us now address the second research question: the extent to which collaboration and access to digital tools afford epistemic progression (Balaman & Sert, 2017; Musk, 2022), as well as the effect of both on the final written product. Three categories of strategies are unique to collaboration: negotiation and eliciting a lexical item either by offering a definition or requesting a translation. These strategies allow students to establish each other's epistemic access (Stivers et al., 2011, p. 9) and provide opportunities for epistemic progression (Balaman & Sert, 2017), particularly for any student that lacks epistemic access, either due to a temporary memory lapsus or a lexical gap. In the latter case, the lexical item becomes a learnable (Majlesi, 2014). We shall return to the learning potential shortly.

Collaboration also opens up for negotiation sequences driven by incongruence in claims to epistemic access as well as the moral dimensions of joint epistemic responsibility for the text-in-the-making (Stivers et al., 2011, p. 9). Thus, collaboration has the potential to push students to reconsider their initial lexical choices and jointly pursue the appropriate word, thereby orienting towards contextual appropriateness and a sensitivity to (formal) register and style. Inevitably, this process has an effect on the final written product, whereby the outcome tends to lead either to normatively acceptable or improved word choices, as illustrated in Excerpt 2a ("go to (the) moon" → **step on the moon**). Naturally, there can be a normatively incorrect outcome even if the students agree on a particular lexical choice, but in the vast majority of cases their final choice is a correct one.

Although the remaining two strategies, substituting or looking up a lexical item, may or may not be carried out collaboratively, in the current study they are shaped by their interactional dyadic (student-student) or triadic (student-student-computer) ecology, respectively. Indeed, the latter relies particularly on access to digital resources. As noted above, resorting to online dictionaries or other translation tools only arises in the data when collaboration has failed to provide epistemic access to the translation of the Swedish lexical item. In this regard, it is important to underscore translation as a legitimate strategy, which emerges from the data as a regularly occurring indigenous method for resolving lexical impasses. Online translation tools offer opportunities to extend the epistemic resources available to students (Musk, 2022; Musk & van der Meij, in review), frequently treated as having epistemic primacy (Stivers et al., 2011, p. 13). As in the case of collaboration, digital tools can afford an opportunity for epistemic

progression (Balaman & Sert, 2017), be it an issue of memory lapsus or a lexical gap that needs bridging.

By extending access beyond individual knowledge resources, both collaboration and digital tools can configure learning potentials for retaining new lexis or consolidating temporarily unavailable lexis (Hellermann & Pekarek Doehler 2010; Musk 2022). The chain of actions involved in the five strategy categories include: giving definitions (e.g. comparing and contrasting candidate meanings); doing words searches; proposing, evaluating and selecting words; translating and looking up words; saying, pronouncing and repeating words; typing and spelling words; and post-editing and contextualising words. These multiple actions engage with various aspects of their *form*, *meaning* and *use* (cf. Nation, 2013) and the greater the *involvement load* the greater the potential for remembering and learning (e.g. Laufer, 2016).

Finally, when it comes to students' strategies for achieving epistemic progression in digital collaborative writing, the greatest potential for assisting students lies in developing their strategies for using online translation tools, since students' own epistemic resources are limited when they encounter lexical trouble. Previous studies (Musk, 2022; Musk & van der Meij, in review), based largely on the same data set as in this study, reveal that students encounter problems in using these tools and tend to lack a range of specific strategies to deal with such problems. Therefore, providing training opportunities to make better use of these tools should be highly beneficial, both for collaborative and individual writing.

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Appendix: Transcription Conventions

(0.5)	Pauses in speech of tenths of a second
(.)	Pause in speech of less than 0.2 seconds
yeah= =yeah	Equal sign: latching between utterances
┌yeah └mm	Opening square brackets in adjacent lines: start of overlapping talk (between different participants)
yeah┐ mm ┘	Closing square brackets in adjacent lines: close of overlapping talk (between different participants)
¦(0.9) ¦rolls his hands	Broken vertical lines in adjacent lines: action during pause or simultaneous talk Text in grey: description of embodied action
lis-	Dash: cut-off word
o:::h	Colon: prolonged previous sound
.yeah	Initial fullstop: inbreath; before word: said on an inbreath
(swap)	Words in single brackets: uncertain words
(xx)	Crosses in single brackets: unclear fragment; each cross corresponds to one syllable
men vänta *but wait*	Words in italics: code-switching into Swedish Words in italics in different font: translation of code-switched line above
((*slaps desk*))	Double brackets: comments on contextual or other features, such as non-verbal activities
really	Underlining: focal stress (marked on stressed syllable)
AND	Capitals: noticeably louder than surrounding speech
°crap°	Encompassing degree signs: noticeably quieter than surrounding speech
hi	Encompassing dollar signs: laughter or laughter-infused speech
no	Encompassing asterisks: creaky voice quality
>yes sure<	Encompassing inward chevrons: faster than surrounding speech
use it then.	Full stop: final "stopping" (falling) intonation
to,	Comma: final "continuing" (slightly rising) intonation
pay?	Question mark: final rising intonation
mm¿	Upside-down question mark: final partially rising intonation
↑sure	Upward-pointing arrow: marked rising intonation in the following syllable
↓oh	Downward-pointing arrow: marked falling intonation in the following syllable
🗣	Talking head: line of talk
💻	Computer icon: line involving the computer screen
#1	# + number on black background: point at which a snapshot of action/screen shot is shown below with same number
people	Bold: typed text appearing on the computer screen during pause or talk in line above
~~**pepole**~~	Struck-through bold: typed characters/words that are deleted
people·that	Bold centred dot: typed space appearing on the computer screen

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