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Combining sociocultural discourse analysis and multimodal analysis to explore teachers' and pupils' meaning making

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A B S T R A C T

This paper explores a common educational dilemma, namely that of how to resource meaningful teaching and learning experiences, and the research challenge of how to represent the multimodal complexity of pedagogic intentions and instantiations. We share the sociocultural view of talk as a central tool in meaning making, aligned with attention to how teaching and learning conversations are mediated by communicative cues and interactions orchestrated *across* modes. We present extracts to exemplify the benefits of combining sociocultural discourse analysis (SCDA) and multimodal analysis, to explore classroom data at different levels of detail and temporal range. The context for the data collection was a series of lessons on the Great Fire of London with a Year 2 class (6–7 years). Lessons were part of a project using dance and interactive technologies to support understanding. We highlight the purposeful use of different analytic foci, enabled by SCDA and multimodal analysis, and explore what this can add to researchers' understanding of the contextualised nature of meaning making, building and weaving over time, in often unexpected ways. The original contribution of this paper is in offering an innovative mixed-methods approach to explore the complex detail, development and multimodal array of educational interaction.

1. Introduction

Researching an educational dilemma: How to resource meaningful teaching and learning experiences.

This paper offers an innovative mixed-methods approach which enables researchers to explore the complexity of educational interaction, where meaning making is viewed as cumulative and iterative: as mediated knowledge building in action. In doing this, we:

1. Build on research exploring the nature and central significance of classroom dialogue – when used in direct teaching, and when used as an opportunity to explore and build on what pupils already 'know', in pursuit of meaningful knowledge building – considering talk as a 'social mode of thinking' (Mercer, 2004).
2. Attend to multimodality – how teaching and learning exchanges are resourced, in accordance with the established view that all communication is inherently multimodal (Gillen et al., 2007; Johnson & Kress, 2003; O'Halloran, 2011). In exploring the technological and multimodal nature of education, we recognise that we must also pay attention to issues of 'orchestration' – how teachers orchestrate teaching and learning opportunities (e.g. Littleton et al., 2010), to recognise children's potential needs, and facilitate understanding through collaborative, constructive meaning making.

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3. Build on previous research around the need to explore educational perspectives on trajectories and temporality (e.g. Mercer, 2008; Rasmussen, 2005).

There are specific concepts that have informed our methodological and analytic approach. We share Vygotsky's (1962, 1987) view of talk, and all activity, as contextualised, and, through this, the importance of emphasising and exploring the teacher's 'mediational toolkit' (Wertsch, 1991) – which includes talk as well as other tools. We are particularly aligned with Mercer and colleagues' work concerning the importance of classroom talk as a meaning-making tool: building up and building on 'common knowledge' (Edwards & Mercer, 1987); and on the use of talk to encourage and evidence 'interthinking' (Littleton & Mercer, 2013). We also acknowledge that talk occurs within and to orchestrate actions and tools that are multimodal – thus the multimodality of communication, including gesture, movement, and use of digital technologies (drawing on Baldry & Thibault, 2006; Jewitt, 2009; Kress & van Leeuwen, 2001). Within this, we view talk as a central communicative tool, used to draw salience to and integrate aspects conveyed through other communicative modes, whilst also attending to moments of communication that are mediated without words.

In terms of researching such interactions, Sefton-Green (2017) articulated that:

'Video (or film) is particularly rich in capturing the semiotic multi dimensionality of the present especially in the way that objects, things (c.f. Latour, 2007), the physical interpersonal relations between people… all combine to create layers of meaning.' (p. 116).

This argument makes video data of classroom interactions particularly valuable. Sefton-Green (2017) however emphasises caution, where in employing metaphors representing a sense of 'travel' in learning, we should be wary of the danger of reducing learning to a linear, one-way process, or perpetuate a notion of learning as 'transfer':

"I am concerned that the assumption of a trajectory in and of itself biases our capacity to see what learning is in the first place. At the same time as, what I have called, 'learning lives' research has given us insight into experiences and ways of learning that have hitherto existed more as assumptions or even prejudices, so I want to ask what if learning isn't a journey? Can we conceptualise a notion of education that does not contain within it version of a trajectory, a direction or movement?" (p. 117).

In our use of trajectory to explore teaching-and-learning interactions however, we are not focusing on the end point, or a linear journey. We instead employ the trajectory metaphor to address the complexity and interweavings that make the journeys or trajectories – instantiate them – through personal experience, meaningful terms and activities. This is what frequently distinguishes a teacher's intended meaning-making trajectories from students' instantiated meaning-making trajectories (Twiner et al., 2014). We further argue that the methodological combination presented in this paper, of SCDA and multimodal analysis, enables in-depth analytic attention to the various paths, diversions and false starts that teaching and learning interactions can take.

In considering the tools used within educational interaction, as well as the temporal dimension to researching educational interactions, Mercer et al. (2019) argue that:

'Technologies such as a computer or IWB [interactive whiteboard] can additionally allow co-constructed artefacts (including annotations during a lesson on images or texts, or positioning of digital objects…) to be saved, revisited, modified or repurposed at a later time. Thus, these artefacts render both learning histories and trajectories more visible, which can help dialogues progress over time.' (p. 8).

This is a concept we raise in previous work, and revisit here, in exploring the use of an IWB to resource a 'digitally-mediated improvable object', where the affordances of the technological tool facilitate valuable meaning-making activity (Twiner, 2011). In considering the use of such resources, we acknowledge Wells' (1999) work on the creation and development of 'improvable objects' – where discussion and interaction over time are given material form through revising, adding detail to or 'improving' a shared resource that represents common knowledge. We consider such work as mediated, multimodal activity, where various tools are used in connection-building activity (Gee & Green, 1998), to extend what is familiar and what is known. A focus on connection building indexes attention to interaction over time, and so concepts of temporality and trajectories in and across teaching-and-learning interactions are central to this aim (Baldry & Thibault, 2006; Furberg, 2010; Mercer, 2008; Rasmussen, 2005; Twiner et al., 2014).

In presenting our methodological approach within this paper we therefore emphasise:

- Talk and all interaction as contextualised – recording educational activities as they happen; exploring the take-up of tools and activities as enacted by teachers and learners;
- Talk as historic and dynamic (influenced by the work of Mercer, and also a recent special issue of *Learning, Culture and Social Interaction*: Ritella & Ligario, 2019) – where the effective use of talk is not always allied to finding 'correct' answers, and where pupil contributions are valued;
- And talk as one tool within a multimodal mediational toolkit.

In terms of such a methodological approach, much research has been conducted using sociocultural discourse analysis (SCDA: e.g. Gillen et al., 2007; Gillen et al., 2008; Knight & Littleton, 2017), and much using multimodal analysis (Bourne & Jewitt, 2003; Maine, 2013; Nind et al., 2010), with valuable insights and findings reported. Later in the article we will outline the particular focus of SCDA, and how it contrasts with other forms of analysis, including its history and aim to evidence different forms of talk in action, for instance 'exploratory talk' (Mercer et al., 1999). We then do the same for the genesis of and influences on multimodal analysis.

To give an example and identifying analytic need, Rasmussen and Damsa (2017) presented a microanalysis, through interaction analysis and SCDA, to explore students' individual, with peers and with teacher, use of online and offline activities and (re)sources, as

well as verbal exchange, in working through History and Engineering tasks. In framing this work, the authors articulated that:

> 'There is a need for better understanding of how aspects of the sense-making process (e.g. participants' actions, knowledge, (re) sources and characteristics of the [material and digital context]) blend together and generate learning experiences, as well as how these processes rely both on planned and emergent activities.' (p. 80).

In reporting their work, Rasmussen and Damsa also identified 'a persistent challenge of capturing the plurality of actions performed or emergent across sites and occasions and of knowledge resources employed in the process.' (p. 88). In writing this, Rasmussen and Damsa set a pertinent challenge – in researching and analysing classroom interaction we must acknowledge that there is so much to natural, unfolding interaction of which we cannot be aware. Within the methodological approach we present in this paper, we build on our previous work calling for a similar need to attend to the complexity of unfolding interactions (Twiner, 2011), that predates but reinforces Rasmussen & Damsa's (2017) call, by combining multimodal and sociocultural discourse analysis. This combined approach draws explicit attention to the multimodal and temporal depth and breadth of educational interaction – whereby the multimodal lens offers an additional dimension to that explored by Rasmussen and Damsa's combination of interaction analysis and SCDA. We would argue, however, that no research method can truly represent, or even be mindful of every element that informs understanding and interaction, but as Mercer (2008) argues – this should not stop us from exploring the understandings and interactions that can be observed.

What is missing from most existing research is the detail and coverage that could be enabled by a combination of sociocultural discourse analysis and multimodal analysis. Ritella and Ligario (2019, special issue of *Learning, Culture & Social Interaction*) put out a call to action, stating 'we need innovative empirical methods to investigate the complex and often interwoven constructs of a dialogical approach, and show how they illuminate contexts of practice' (p. 1). We argue as we did in our 2011 work (Twiner, 2011), that combining SCDA and multimodal analysis offers such a method, which is what we present in this paper.

On the basis of this review of existing approaches and challenges, in this paper we address the research question:

> How can a combination of sociocultural discourse analysis and multimodal analysis allow researchers to effectively attend to detailed interweavings *and* development of multimodal unfolding classroom interaction, in the co-construction of meaning?

In the next Sections we outline the background and process of SCDA and multimodal analysis, before exemplifying the added scope of insights made possible by combining these already powerful tools.

2. Background on methodologies, and levels of transcription

2.1. Sociocultural discourse analysis (SCDA) – theoretical underpinning and rationale

SCDA adopts a view of language, in the words of Mercer, as 'a social mode of thinking – a tool for teaching-and-learning, constructing knowledge, creating joint understanding and tackling problems collaboratively' (2004, p.137). It is based on the assumption of the central role of language as a cultural and psychological tool in making and negotiating meaning. This implies a focus on language within the social context in which it occurs, and so on the joint activity, content and structure of talk between interactants – in other words, how knowledge is being jointly constructed, negotiated or disputed. Broadly speaking SCDA combines:

- qualitative analysis of lesson extracts – such as detailing the dialogue and interactions around contextualised use of certain resources or activities as they occur over a series of lessons;
- with corpus linguistic analysis of full lesson transcripts – such as identifying keywords or collocates within a series of lessons or highlighting patterns or changes in teacher and pupil talk over time.

SCDA also enables attention to links between 'the educational processes and learning outcomes' (Mercer, 2004). In this paper we focus on the methodological approach in analysing the educational processes – as observed through video recordings of classroom interactions – and on the meanings co-constructed in the moment and over time. A further development of this work could be to explore the in-depth analysis of classroom interaction enabled through combining SCDA and multimodal analysis, with learning outcomes of the activities. It could be argued, of course, that verbally-expressed understandings are themselves valid learning outcomes – as pupils create and re-voice meanings in their own words. In the school context of assessment and accountability however, it tends to be a written or tangible outcome that has greater weight in terms of evidence of learning.

2.1.1. Corpus linguistic analysis element

The quantitative element of SCDA is conducted using corpus linguistic software such as Wordsmith Tools to analyse transcripts of verbal exchange, to uncover patterns in the talk data. This enables researchers to follow the development of meanings as they were made, whether contributions were made by teachers or pupils, and any changes in meanings that occurred through the evolving verbal interactions. In this way data can cover a large time period (for instance a series of lessons over a period of some weeks), which is less possible or at least far more labour-intensive through most qualitative methods. Within the data, researchers may identify which terms were particularly common across a series of transcribed events – it is then possible to investigate what other words were frequently used alongside these common terms (collocates). Equally, it is possible, if identified in the transcript, to explore who tended to use certain terms more than others (such as teachers or pupils), and any developments or evolutions in the way particular terms or phrases were applied across the time period.

2.1.2. Qualitative analysis element

The qualitative element of SCDA is based on the assumption of the central role of language as a cultural and psychological tool in making and negotiating meaning. This implies a focus on language within the social context in which it occurs, and so on the joint activity, content and structure of talk between participants: how knowledge is jointly constructed or disputed. The importance in this method of the talk remaining in the context in which it was produced was highlighted by Mercer:

> 'We have had no wish to reduce the data of conversation to a categorical tally, because such a move into abstracted data could not maintain the crucial involvement with the contextualised, dynamic nature of talk which is at the heart of our sociocultural discourse analysis.' (2004, p. 146)

In attempting to address the contextualised nature of activity, a sociocultural perspective recognises that schooling, and all experiences, are part of our larger existence and experience within social worlds. All communicative events are therefore situated experiences, and so are shaped by and addressed to those with whom we share such experiences, or those who do not yet know about them. This highlights the sociocultural conceptualisation of education as a dialogic relationship between teacher, pupils and the resources and environments in which teaching-and-learning experiences take place.

In analysing such processes, Mercer (2008) argued that talk has historical and dynamic aspects. Therefore from this perspective it is important to address, at least in part, the historical aspects by gathering data from a series of lessons or events by a group, in which the historical dimensions of the learning are built (whilst remaining mindful of Sefton-Green's warning about the potentially-misleading interpretations of notions of 'travel' in educational research). The dynamic aspects may be evident as lessons progress, to view how opinions and concepts are introduced, queried and developed, where new experiences and understandings become explicitly appropriated as part of the 'common knowledge' (Edwards & Mercer, 1987). It is unlikely, if not impossible, to be aware of the entire historical aspects of classroom talk, due to the vast experiences the class have to which a researcher cannot have access or knowledge. Thus the dynamic aspects of interaction, as participants refer to historical resources available and that they perceive to be salient to the ongoing dialogue, can serve as researchers' entry and windows onto the common knowledge being used and developed. SCDA offers a means to observe how people use talk to establish and maintain such shared understanding:

> 'We can see how they use language to introduce new information, orientate to each other's perspectives and understandings and pursue joint plans of action.'
>
> (Mercer, 2004, p. 166)

Therefore analysis of talk enables a view of temporal development, where researchers can identify any changes in talk patterns and content over time. Combining this with the analysis of the activities being undertaken, that are being talked about, facilitates and shapes a view of how the subject and content of their evolving discussions are manifest in the work pupils produce. This in turn is one way in which the quantitative and qualitative elements complement each other, using corpus linguistic analysis to identify particular keywords, and the qualitative analysis to explore in more detail any evolutions and corresponding activity around use of such terms.

Having introduced the background, rationale and process for the components of SCDA, we now do the same for multimodal analysis.

2.2. Multimodal analysis – theoretical underpinning and rationale

Bourne and Jewitt (2003) described teaching as 'multimodal orchestration', highlighting the importance of transcribing more than speech in classroom interactions. They identified the theoretical background of their approach, and implications for the analysis of 'communication' and 'meaning':

> 'The starting point for multimodality is to extend a social interpretation of language and meaning to a range of representational and communicational modes. Multimodality assumes that all these modes, like language, have been shaped through their cultural, historical, and social usage to realise social functions. We understand all acts of communication as socially made and meaningful. At the same time we view meanings as realised differently in different modes.' (p. 65)

This aligns with a sociocultural view of meaning and knowledge as constructed in interaction, developed cumulatively over time. The stark difference, however, is the assumed place and importance of talk relative to other communicative modes:

> 'Even where speech is foregrounded …, the teacher also uses image, gesture, and body posture, both her own and that of her students, to construct meaning. To look only at language denies the meanings carried in other modes, and the complex interplay between modes in social interaction. Many of the meanings and connections made in the lesson which were carried in modes other than language would have been too time-consuming and contentious to verbalise.'
>
> (Bourne & Jewitt, 2003, p. 71)

Multimodal transcription and analysis therefore simultaneously employs affordances of visual and written modes to re-present the event they portray. In terms of Bourne and Jewitt's reference to a 'social interpretation of language and meaning', the influence of cultural-historical activity theory is evident in the literature on multimodal transcription. Roth and Lee (2004) referenced the work of Engeström in making this link, stating 'that human consciousness can only be understood when all relevant aspects of practical activity are taken into account (Engeström, 1987)' (p. 267). We would argue that researchers – who tend to be occasional visitors to the focal events – are unlikely to have access to 'all relevant aspects of practical activity'. However, we agree that it is beneficial to consider all interactions, data or reconstructions of data recording such interactions, within as much detail of their original context as possible.

The role of culture and culturally-transmitted meanings in analysing multimodal communication can also be linked to Halliday's (1978) theory of social semiotics. Within this we see the origins of Halliday's work primarily as a linguist, focusing on the role of language (particularly clause level grammar) as a meaning-making resource (a social semiotic). Despite this focus on language, however, Halliday asserted that communication is achieved and meanings made through the interactions of multiple semiotic modes, as a multimodal experience. Semiotics are considered as the forms of (modes) and systems for (media) meaning making, through use of 'signs'. Jewitt and Kress called this 'the fusions of meaning and form' (2003, p. 10). The 'social' in social semiotics refers to the human element, thus leading a simultaneous consideration of mode, media and sign-maker within the context of the activity.

2.2.1. Multimodal analysis and transcription

Multimodal analysis is based on highly-detailed transcription of video recordings, presented as series of annotated stills to form short extracts, to acknowledge and represent the multimodal nature of interaction (Jewitt, 2009; Kress & van Leeuwen, 2001). When taking a multimodally-grounded approach to transcription and analysis, interaction is considered as an integrated, 'multimodal ensemble' (Bezemer & Jewitt, 2009) rather than modes working in isolation. There is also a strong view, that all transcription will in itself only ever be a re-presentation of the event: that by being a written or categorised re-production of an integrated and bodily experience, it cannot 'capture' the true nature of the event as it occurred (Bezemer et al., 2007). This is an issue that cannot be resolved, but it is important to acknowledge in the transparent presentation of research process and findings.

Further issues to consider were outlined by Alant et al. (2006). In transcribing they comment that the researcher should reflect on the 'activity setting' in which the interaction occurs, such as the classroom, family location or event, and how this might influence the activity. They also caution us as to how the describing in words of various elements of interaction may reduce their interactional impact with regard to other elements, and result in perceived isolation of modal information – thus seemingly working against efforts to view communication as the multimodal ensemble emphasised above. With this in mind, they argue for 'a more holistic approach towards the study of human interaction' (p. 148). This again calls for further attempts to transcribe events multimodally, and genuine thought to what a 'holistic approach' would entail.

As Maybin (2009) argued, 'Studying language in context inevitably raises questions about the ways in which it is integrated with visual images, shape, texture and movement in children's learning' (p. 73). It is precisely the points raised in the quote from Maybin, the notion of the interplay of modes, which we address in our combination of SCDA and multimodal analysis. The aim, in using this type of transcription and analysis, is to reflect the multimodal nature of classroom interaction and how use of specific tools can be seen to foreground and background the salience of different modes. By this we emphasise the role of talk as a central but not the sole tool in conveying and making meaning – combining SCDA and multimodal analysis enables us to attend to this integration.

2.3. Tensions and challenges of combining SCDA and multimodal analysis

SCDA and multimodal analysis both emphasise attention to the fine detail of interaction, with deep-rooted theoretical rationales for the specific focus of this detail. It must be acknowledged therefore, that the theoretical underpinnings of SCDA and multimodal analysis represent different views as to the role of language in communication. O'Halloran (2011) highlighted this tension in commenting, 'The processes and mechanisms of semantic expansion arising from intersemiosis [communication across modes] have yet to be fully theorized' (p. 126). Generally, in those aiming to produce multimodal transcription, language is considered as potentially equal to other modes, though any mode can be foregrounded or backgrounded as appropriate (Jewitt & Kress, 2003). Multimodal transcription is therefore posed as an integrative model, rather than presenting material from a set of isolated modes. For instance, Baldry and Thibault (2006) claim in their approach to multimodal transcription that they do not automatically privilege language over other modes:

> 'the meaning of the text is the result of the various ways in which elements from different classes of phenomena –words, actions, objects, visual images, sounds and so on –are related to each other as parts functioning in some larger whole.' (p. 21)

From this we can see that, in aiming to view how modes are combined in production and interaction, the authors' aim was to provide a sufficiently 'thick' description (p. xvii) of activity within resource systems, whilst maintaining the combination and relationship between modes in analysis of a coherent 'text'. In contrast, researchers foregrounding a sociocultural approach tend to view language as the central component, used to orchestrate other modes as appropriate (Mercer & Littleton, 2007). It should also be noted that Baldry and Thibault's approach to multimodal transcription and analysis – which has directly influenced the work of this paper – is one of many. For a full discussion of different approaches and their individual theoretical groundings see Bezemer and Mavers (2011).

Despite their differences, both views – of the potential equality of all modes or centrality of language – recognise that transcription of just speech potentially misses or neglects a substantial amount of the communicative event, and conveyed or interpreted meaning. In many senses, any transcription will always be a construction of an event as interpreted from the view of the transcriber/analyst (which could be the same or different people, bringing in further issues around interpretations and meanings) in terms of what is deemed relevant or important. However, such interpretations are often also based on a researcher's intensive data collection and presence in the environments over a prolonged period of time (Hammersley, 2010). As O'Halloran contends, 'the path forward must necessarily involve interdisciplinary collaboration if the larger goals of understanding patterns and trends in technologies, text, context and culture are to be achieved' (2011, p. 136). Thus we argue that combining different analytic approaches toward different but complementary aims, does not necessarily have to cause tensions: employing the specific detail and foci of different levels of transcription to allow for different analyses of the data.

3. Combining approaches

In introducing this approach, we share data to exemplify the process, and identify the benefits that each method brings to the resulting combined analysis. All data collection, storage and use was approved by the host University. Data was only collected with pupils for whom we had both parental and pupil informed consent, as well as that of the class teacher. Where data has been presented in this and other papers, pseudonyms have been used. Enquiries regarding access to the anonymised data should be sent to the corresponding author.

3.1. Context of data collection

The context of this data was a series of Year 2 infant school lessons, with pupils aged 6 and 7 years, in the Autumn term 2009. Teachers and learners were using an interactive whiteboard (IWB), Sony PSP to record and view recordings, and dance to support teaching and learning within eight lessons on the History topic of the Great Fire of London. There were two topic lessons a week, for four weeks. All lessons were video-recorded for analysis, and the video data was transcribed by the first author.

The lessons were part of a pilot project led by contemporary dance organisation 'The Place', entitled 'LearnPhysical interactive'. The pilot involved three London-based primary schools where dance specialists team-taught with regular class teachers, to encourage use of dance as well as potentially interactive technologies in embodying and understanding abstract concepts across the curriculum. Across the three schools, subjects covered through this approach included Maths, Science, History and Geography. For simplicity of exemplification, in this paper we focus on the series of History lessons about the Great Fire of London.

In the following Sections we outline and exemplify how the different amounts and types of detail we included in transcription, for the quantitative and qualitative SCDA, and multimodal analysis, enable us to explore our analytic intentions. Thus it is useful here to remind ourselves of the research question:

How can a combination of sociocultural discourse analysis and multimodal analysis allow researchers to effectively attend to detailed interweavings *and* development of multimodal unfolding classroom interaction, in the co-construction of meaning?

3.2. Corpus linguistic element of SCDA

Using transcripts of purely verbal exchange, the corpus linguistic analysis element can usefully start with a keyword analysis, and then explore words that are considered particularly pertinent to the topic. There are many ways to start analysis of course (and indeed it will have been well underway in a researcher's immersion in the data through observing, recording, writing field notes, and transcribing the lessons). What a keyword analysis offers however is an effective 'birds-eye view' of specific words that are used far more frequently than others during the data covered in the lessons. This, of course, is reliant on transcription being an accurate representation of what people said, and does not indicate where words are used in different ways. Thus, in terms of our research question: a keyword analysis gives an overview of the detail presented in words used by all people recorded in the interactions, but does not give an indicator of meanings.

As an example, from the initial keyword list generated from the transcripts of the eight topic lessons, the term 'spread' was the 110th most commonly-used word in the transcribed lessons, with 104 uses. If this count includes the terms 'spreading' (41) and 'spreads' (1), it would make the term the 79th most commonly-used, with 146 uses. Comparing this with the other verbs used, and if different forms of the same verb are also combined (such as: is, are, was, were, be and am), this would make 'to spread' the 12th most common verb (see Table 1).

Following from this keyword analysis, and thinking in terms of 'the company it keeps' (Mercer, 2004), the most common collocates of 'spread' were 'the' (138), 'fire' (112), 'quickly' (88), and 'because' (60). The most common three-word clusters including 'spread' were 'the fire spread' (57), 'spread quickly because' (37), and 'fire spread quickly' (33). These figures may indicate the search for explanations and development of reasoning around why the fire spread – through linking the fact (that the fire spread), to the reasons for this ('it spread because…') – potentially as learners sought to understand rather than simply learn rote facts about the historical

Table 1
Frequency of verbs across transcripts of the eight topic lessons.

Verb	Frequency
to be (is, are, was, were, be, am)	1609
to do (do, did, done, does)	943
to be able (can, could, able)	745
to go (going, go, goes, gone)	628
to have (have, had, has)	453
to look (look, looking, looks, looked)	268
to see (see, seen, seeing, sees)	255
to like (like, liked, likes)	248
to say (say, says, saying)	183
to think (think, thinking, thinks)	173
to know (know, knew, knows)	164
to spread (spread, spreading, spreads)	146

event. This conjecture would need exploration through more detailed, contextualised analysis, which is where the qualitative element of SCDA and multimodal analysis are needed. What the keyword, collocate and three-word cluster analysis do, however, is indicate that the term 'spread' was a keyword within the lessons and around the topic of concern, making it worthy of further, qualitative and multimodally-framed analysis.

The Extract below exemplifies the transcription choices for quantitative SCDA – it includes who offers each contribution (T for teacher, P for pupil), and all audible talk. For the purpose of illustration in this paper, we have added emphasis to highlight the mixing in the teacher's talk of the terms 'spreading' and 'going' to describe the movement of the fire, and we can see one moment where the teacher corrected himself in this. There was very little pupil input in this Extract, though it is important to note it was the first topic lesson.

Exemplifying Extract 1
Lesson 1, 15.10–15.35
[teacher '<u>spread</u>' fire]
[teacher '<u>go</u>' fire]

1. T: Because September isn't too long after the summer, the city was very, very dry. So
2. strong winds, fanned the flames, which made them <u>spread</u> even quicker. So the wind,
3. was pushing the fire, onto different buildings. So the wind was fanning the flames. It
4. was making it bigger
5. Ps: The wind
6. T: And it was <u>going</u> across onto different, the fire was <u>spreading</u> across

3.3. Multimodal analysis

The following Extract evidences conventions used for multimodal transcription, adapted from that proposed by Baldry and Thibault (2006), with data from the second topic lesson. As above, there are many approaches to multimodal transcription, of which the one offered by Baldry and Thibault is just one. This approach was chosen due to its integration of verbatim transcription, still images of the visual scene, description of various elements including dynamic movement, body positioning and direction of gaze; whilst not being so detailed as to make following the flow of interaction cumbersome. Adaptations to transcription conventions were made to better suit the context of unfolding classroom interaction, in contrast to Baldry and Thibault's scripted context of recorded commercials (for more details on how the multimodal transcription was adapted to the educational context, see Twiner, 2011).

Across the eight lessons and four weeks learning about the Great Fire of London, the teacher extended a movement activity alongside the development of conceptual understanding, by developing the use of a line of pupils as the buildings, with another pupil as the fire moving over, under, around and through them. This activity was re-worked many times to explore how and why the fire spread and also how it was stopped.

Exemplifying Extract 2
Dance exploration to support conceptual understanding
Lesson 2, 08.07–08.25
Pupils (Ps) sat facing IWB at front. A few pupils are standing at the front

The teacher (T) was introducing a warm-up activity, with a small group of pupils to make an arch – representing the houses at the time of the Great Fire of London as close together in narrow streets. The other pupils (off camera) were to represent the fire, spreading through the houses.

Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
1 08.07	T: What I'd like you to do (pause) you guys are all houses from the past. Can you please, put your hands up (pause)?		T looking at Ps at front 'House' Ps look at T	T raises hands on 'can'

(*continued on next page*)

(*continued*)

Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
2 08.16			'House' Ps look at each other	Ps raise their hands
3 08.17	Hold each other's hands, yeah.		'House' Ps look at T	T brings hands together on 'hold' T holds Ps' hands together
4 08.20	So, now this is like a street in London,		T looks at rest of class 'House' Ps look at each other	T moves to the side of Ps at front
	it was all very			Pulls hands up opposite each other from 'it'

(*continued*)

Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
	narrow and close together.			and squeezes hands together and apart quickly five times across the words 'narrow… together', leaning forward

This physical representation was extended over the topic lessons, to include more topic-related elements. The sample Extract above involves only teacher talk (although use of this transcription method within our analysis also includes pupil talk), but the fine detail enables the pupils' physical contributions to be noted. It shows the scope for addressing the different ways in which all participants were involved in lesson activity, and how verbal exchange was used to orchestrate activity across other modes such as the teacher's gestures and pupils' actions.

In the eighth and final topic lesson, the improvable object of the physical representation depicted multiple elements pivotal to understanding why the Great Fire of London started, and was stopped:

- Pupils represented buildings, close together;
- Another pupil represented the fire, spreading along the houses;
- More pupils became representations of the fire, to embody fast spread of the fire;
- House pupils fall down, as 'firebreaks' – to prevent the spread of the fire;
- Fire stops as no more houses to spread to.

Use of multimodal transcription to explore this developing phrase enabled attention to the complex multimodal interweaving employed by the teacher and children, as they built incrementally their conceptual understanding of how the fire spread and was stopped. From the brief Extract above we can note the points the teacher is emphasising across speech, gesture, leaning forward and in orchestrating the children's positions: to highlight the importance of the streets being narrow and the buildings close together in enabling the fire to spread. We also get a clear sense from the multimodal transcript that the teacher is creating a 'worked example' with a small number of pupils at the front (with the front of class space often denoting a form of presentation space in schooling). By the teacher moving to the side of this small group (apparent through image and description in the transcript) to be clearly visible to the pupils sat facing the demonstration, his narration of the key points is made relevant and directed to the whole class. (The image and camera positioning was aligned purposefully so as not to show these seated pupils, due to not having consent to record their participation.)

With this number of actors and co-ordinated actions across modes, a transcript of purely spoken words would of course miss a substantial amount of the interaction – it would still convey the core historical reasoning, but not how the teacher was supporting his pupils to understand this. Likewise a heavily annotated transcript of spoken words, with typed descriptions of non-speech activity, would be pretty unwieldy for the reader, with it also being more difficult to see the critical alignment and simultaneity of actions across modes. The choice to use multimodal transcription here is also indicative of our acknowledgement that describing in words a visual scene, physical action or body position is fundamentally different to presenting an image of that scene, action or position (Bezemer & Mavers, 2011). Transcribing, analysing and presenting interactions multimodally at this point, reflecting our analytic intention to make salient this multimodal interweaving, enables the analyst and reader to explore and appreciate the evolving 'multimodal ensemble' (drawing again on Bezemer & Jewitt, 2009). (For more detailed analysis of the developed movement phrase over the eight-lesson period, see Twiner, 2011.)

3.4. Qualitative element of SCDA

Within the qualitative element of SCDA we were able to focus on how other modes were used together with talk, such as through the use of physical and digital objects, and movement. This is certainly not to downplay the role of talk, but rather to outline the valuable interplay and multimodal orchestration that occurred, and was rendered visible through a qualitative approach to the data, as exemplified in the Extract below from the third topic lesson. For purposes of illustration in this paper emphasis has again been added for the teacher's use of 'spread' and 'go'.

Exemplifying Extract 3
Lesson 3, 12.31–12.34 and 12.41–13.28
During whole class activity
The teacher was using an image on the IWB of a painting of the Great Fire of London, to talk about how the fire spread.
[teacher '<u>spread</u>' fire]

[teacher 'go' fire]

1. T: So, if you look at this (points to image on IWB slide) picture here, … the flames (tilts hand
2. in same direction as flames on IWB) are all facing which way? (lowers hand, looks back to Ps)
3. Mia: That way
4. T: All the fire, who's doing that? (pause) Is it Superman blowing? (makes blowing gesture)
5. Ps: No
6. T: What's happening? Who, is pushing (moves hand to other side of slide) it that way?
7. Ps: (intake of breath, raise hands)
8. T: I'm not doing it. (points to chest) Can people (makes pushing motion) push the fire?
9. How did it happen? How is the fire going that way? (points to P)
10. Nina: From the wind
11. T: The wind, well done. So the wind, was, was (pushes hands away from his body) blowing,
12. all the fire across from (jumps hand across points on image on IWB slide) house to house. So
13. that's one very important reason why the fire was spreading so quickly.

Within this Extract we can see how the teacher multimodally resourced his explanation of the spread of the fire – using an image on the IWB to which he verbally refers and physically points; making a blowing gesture; physical pushing movements, as well as talk to tie all these elements together into one explanation. We can also see how he switches between terms perhaps better suited to describing physical movement – 'go' – to a term more suited to the topic of the Great Fire of London, and how the fire 'spread'. The purely talk-based analysis and transcription for corpus linguistics would miss many of these non-talk features of the interaction, whilst a multi-modal transcription for just this short extract would be huge. Thus, in reminding ourselves of our research question, the qualitative SCDA element enables an appropriate focus on depth and breadth for this analytic aim – to attend simultaneously to detail and development of interaction in the pursuit of understanding.

Exemplifying Extract 4

As raised earlier, keyword and collocate analysis was a useful 'way in' to identifying patterns and development in the use of particular terms, and who terms are used by, across the series of eight lessons. Through detailed *reading* of the full transcripts, however, (which is not a necessary pre-cursor to corpus linguistic analysis), we could identify how one activity using sentence starters and reasons facilitated appropriation of the topic-specific vocabulary, as shown in the Extract below.

Lesson 3, 44.55–45.16

During individual work at tables

The teacher (T) asked a pupil (P) to read out her work to him, putting together sentences on why the fire spread quickly and how it was stopped.

[transcribed as for corpus linguistic element of SCDA]

1. T: Can you read this sentence to me?
2. P: The fire spread because the houses were made out of wood.
3. T: Good, next one.
4. P: The fire stopped because firebreaks were used.
5. T: Good.
6. P: The fire spread so quickly because.
7. T: buildings.
8. P: buildings were so close together.
9. T: Good girl, well done.

From this Extract it is evident to the researcher how and why 'spread' could have become a keyword in the corpus linguistic analysis. What the qualitative reading of the full transcripts adds, however, is attention and a contextualised sense of how the keywords 'fit' within the unfolding spoken interactions in addition to their mere absence and presence, and how students and the teacher co-constructed understanding around the topic.

Within this and the next Extract, from the final topic lesson, we see the importance of the mutual roles of the teacher and pupils in constructing dialogue together, in a sociocultural view of the mediated nature of learning, and the role of expert others in scaffolding learning and subsequently fading this scaffold support.

Exemplifying Extract 5

Lesson 8, 02.35–03.08

During whole class activity

[transcribed as for qualitative element of SCDA]

[teacher 'go' other]

[pupil 'spread' fire]

[teacher 'spread' fire]

1. T: (referring to image on IWB slide) It's a painting, that's right. And, tell me something about

2. the fire, that you can see. What's going on with the fire, er, Nina? (pause) What's happening
3. with the fire and the way it's leaning?
4. (Ps raise hands)
5. T: What's going on there? Go on then Cath
6. Cath: Erm, erm, it's leaning that way and there's, erm, and [there's the fire
7. T: [So what must be happening?
8. Cath: Erm, erm, the wind's making it spread
9. T: Well done the wind is spreading it across
10. Cath: and there's fire in that house so it's spreading over to, over to that house
11. T: That's right.

The pupil's involvement in this verbal exchange, to a greater extent than in some earlier lessons, indicates the relevance of Furberg's (2010) 'interaction trajectory' – as Cath shifted her orientation from describing the events (such as in earlier extracts) to explaining the reasons behind them and *linking* sources of evidence through cumulative contributions (lines 6, 8 and 10 of this Extract). We can also see the relevance of Rasmussen's (2005) 'participation trajectory', through the pupil's verbal participation, in the context of the physical activities used to support understanding, in constructing the common knowledge that at least some pupils were now able to express.

Building on this, we extend Baldry and Thibault's notion of a 'meaning-making trajectory', first developed in the context of ana-lysing how users navigate websites. Such a trajectory can be used as a tool to view how pupils worked with, constructed and appropriated subject understanding, through their interactions with cumulative (improvable objects) and consistent resources and activities across lessons. This was often supported through the series of eight topic lessons by:

- repeated and contextualised use of new terms – through pupils saying the words, saying the words in sentences or explaining them in their own words;
- labelling diagrams and identifying the terms on diagrams;
- dance interpretation.

The focus of qualitative SCDA employed here enables the researcher to attend to how the teacher works together with just one child, through a series of exchanges, to build the argument that by now was quite well rehearsed. In fact in line 10, Cath offers a further elaboration that is not a direct response to the teacher's question, to illustrate to the teacher (and researcher) her understanding of the various factors being discussed. We can also see exactly how Cath is embedding her use of 'spread' as a domain-appropriate way of describing the events. In terms of our analytic aims, the inclusion of details around pauses, the IWB slide, overlapping speech and students raising their hands helps to represent the flow of interaction amongst teachers and students. It is indicative of the following of fairly well-established classroom practices (teacher asking questions, pupils raising their hands and waiting to be 'chosen' to speak), but also offers a window on how the dynamic and multimodal exchange unfolded. As the analytic aim here was largely to focus on the verbal exchange, a multimodal transcription and analysis would have been quite long for presenting a 33-second Extract in a journal article. Equally, corpus linguistic analysis would not have allowed attention to the building of exchanges between one pupil and her teacher, the leaving of pauses (potentially allowing a pupil space to respond to an invitation to talk), and the indexing of the IWB slide which framed the points raised. Thus overall, and as exemplified through this paper, it is the combination and appropriate selection of breadth and depth of focus – enabled by using the quantitative or qualitative SCDA element or multimodal analysis for exploration – to achieve complementary analytic aims in researching data of classroom interaction.

4. Discussion and conclusions

The combination of these two powerful methods enables analysis at wider and broader levels of detail and temporal range than are possible using SCDA or multimodal analysis separately. We propose this alignment of SCDA with multimodal analysis, to provide a rich picture of unfolding interaction, by attention to the combination of verbal, annotated and multimodal transcription for analysis. This also enables researchers to utilise the benefits of the different approaches:

- to scrutinise the development of patterns of verbal interactions across a prolonged period of time, largely through quantitative SCDA;
- to add detail to verbal interactions to view use of tools and modes other than talk, largely through qualitative SCDA;
- and to address in detail the mediation of activities carried out largely non-verbally, but with verbal input evidenced where it integrates information conveyed in other modes, largely through multimodal analysis.

In building this body of work we acknowledge calls to the research field of and challenges to analytic foci – for instance around the centrality or not of talk in communicative interaction, and around the use of trajectory as a metaphor to represent and explore meaning making in action. We propose that these are useful tools and framings, grounded in our sociocultural approach, that serve as a foundation to explore contextualised and complex interweavings within unfolding classroom interaction. We are mindful of the ongoing challenge – that there will always be so much of the research context of which we as researchers cannot be aware. This is an important challenge, and even with the large amount of data that can be generated through video-recording classroom interaction, will

always be a true reflection of how research data can only gain snapshots of contextualised moments in time – specific and meaningful to the people, places and contexts involved. In response, however, we claim that using powerful data analysis tools and close attention enabled through multimodal analysis and SCDA, there is much that can be richly observed and should be explored to aid our understanding of meaning making in action. In fact, we argue that this specificity can be an advantage, in attending to the contextualised ways in which participants in educational dialogue and activities bring in personal and shared resources in the pursuit of understanding.

More fundamentally, we acknowledge tensions and challenges to such an integrative analytic approach due to the different theoretical foundations on which SCDA and multimodal analysis are built. In terms of similarities, both methods embody an assumption that attending to the fine detail of communicative interaction is important. Both also strongly advocate for the situated nature of interaction, and the need to acknowledge this in analysis. Where they differ, however, largely revolves around where communicative weight is seen to be located: centrally on talk or language, or potentially distributed equally across modes (with foregrounding or backgrounding according to communicative need). Any transcription in preparation for analysis would therefore be formatted with these foci and priorities in mind. For some, this may seem an insurmountable difference – how can you believe that talk is the central and most important communicative tool, whilst also believing that all modes can be potentially equal? We argue for the value of the proposed integration not to ignore these important theoretical groundings, but to make best use of what they each offer toward the ultimate aim of Research and Education – the pursuit of understanding, however it may be mediated.

We argue therefore that using this methodological combination to research educational interactions opens a new, exciting and insightful space and lens to attend to the unfolding, sometimes cumulative dialogue, within and across lessons, alongside bodily enactment and embodiment of evolving conceptual understanding. It also enables attention to where there are breaks in the continuity and flow of teaching and learning interactions, and how these are repaired by teachers and pupils in constructing meaningful knowledge together – to zoom in and zoom out along the detail and trajectory of teaching and learning events. The original contribution of this approach is significant in offering a tool for researchers to illustrate practices and evidence common challenges within teaching and learning, as well as researching educational interactions that are increasingly multimodal in nature.

Declaration of competing interest

There are no competing interest to declare.

References

Alant, E., Bornman, J., & Lloyd, L. (2006). Issues in AAC research: How much do we really understand? *Disability and Rehabilitation, 28*(3), 143–150.
Baldry, A., & Thibault, P. (2006). *Multimodal transcription and text analysis*. London: Equinox.
Bezemer, J., & Jewitt, C. (2009). Multimodal analysis: Key issues. In L. Litosseliti (Ed.), *Research methods in linguistics* (pp. 180–197). London and New York: Continuum Books.
Bezemer, J., & Mavers, D. (2011). Multimodal transcription as academic practice: A social semiotic perspective. *International Journal of Social Research Methodology, 14*(3), 191–206. https://doi.org/10.1080/13645579.2011.563616.
Bezemer, J., Mavers, D., & Sidiropoulou, H. (2007, September). Reporting multimodal data: A comparison of image-based and script-based representations of classroom data. In *Paper presented at the British Association for Applied Linguistics conference*. Edinburgh University.
Bourne, J., & Jewitt, C. (2003). Orchestrating debate: A multimodal analysis of classroom interaction. *Reading, 37*(2), 64–72. https://doi.org/10.1111/1467-9345.3702004.
Edwards, D., & Mercer, N. (1987). *Common knowledge: The development of understanding in the classroom*. London: Routledge.
Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki, Finland: Orienta-Konsultit.
Furberg, A. (2010). *Scientific inquiry in web-based learning environments: Exploring technological, epistemic and institutional aspects of students' meaning making*. PhD thesis. Norway: University of Oslo.
Gee, J., & Green, J. (1998). Discourse analysis, learning and social practice: A methodological study. *Review of Research in Education, 23*(1), 119–169. https://doi.org/10.3102/0091732x023001119.
Gillen, J., Kleine Staarman, J., Littleton, K., Mercer, N., & Twiner, A. (2007). A 'learning revolution'? Investigating pedagogic practice around interactive whiteboards in British primary classrooms. *Learning, Media and Technology, 32*(3), 243–256. https://doi.org/10.1080/17439880701511099.
Gillen, J., Littleton, K., Twiner, A., Kleine Staarman, J., & Mercer, N. (2008). Using the interactive whiteboard to resource continuity and support multimodal teaching in a primary science classroom. *Journal of Computer Assisted Learning, 24*(4), 348–358. https://doi.org/10.1111/j.1365-2729.2007.00269.x.
Halliday, M. (1978). *Language as social semiotic: The social interpretation of language and meaning*. Baltimore: University Park Press.
Hammersley, M. (2010). Reproducing or constructing? Some questions about transcription in social research. *Qualitative Research, 10*(5), 553–569.
Jewitt, C. (Ed.). (2009). *The Routledge handbook of multimodal analysis*. London: Routledge.
Jewitt, C., & Kress, G. (Eds.). (2003). *Multimodal literacy*. New York: Peter Lang.
Johnson, D., & Kress, G. (2003). Globalisation, literacy and society: Redesigning pedagogy and assessment. *Assessment in Education, 10*(1), 5–14. https://doi.org/10.1080/09695940301697.

Knight, S., & Littleton, K. (2017). A discursive approach to the analysis of epistemic cognition. *Learning, Culture and Social Interaction*, 16. https://doi.org/10.1016/j.lcsi.2017.11.003.

Kress, G., & van Leeuwen, T. (2001). Multimodal discourse: The modes and media of contemporary communication. Oxford: Oxford University Press .

Latour, B. (2007). *Reassembling the social: An introduction to actor-network-theory*. Oxford: Oxford University Press.

Littleton, K., & Mercer, N. (2013). *Interthinking: Putting talk to work*. London: Routledge.

Littleton, K., Twiner, A., & Gillen, J. (2010). Instruction as orchestration: Multimodal connection building with the interactive whiteboard. *Pedagogies: An International Journal, 5*(2), 130–141. https://doi.org/10.1080/15544801003611193.

Maine, F. (2013). How children talk together to make meaning from texts: A dialogic perspective on reading comprehension strategies. *Literacy, 47*(3), 150–155. https://doi.org/10.1111/lit.12010.

Maybin, J. (2009). A broader view of language in school: Research from linguistic ethnography. *Children & Society, 23*(1), 70–78. https://doi.org/10.1111/j.1099-0860.2008.00177.x.

Mercer, N. (2004). Sociocultural discourse analysis: Analysing classroom talk as a social mode of thinking. *Journal of Applied Linguistics, 1*(2), 137–168. https://doi.org/10.1558/japl.2004.1.2.137.

Mercer, N. (2008). The seeds of time: Why classroom dialogue needs a temporal analysis. *The Journal of the Learning Sciences, 17*(1), 33–59. https://doi.org/10.1080/10508400701793182.

Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom: Some educational implications of a continuing line of inquiry. *International Journal of Educational Research, 97*, 187–199. https://doi.org/10.1016/j.ijer.2017.08.007.

Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. London and New York: Routledge.

Mercer, N., Wegerif, R., & Dawes, L. (1999). Children's talk and the development of reasoning in the classroom. *British Educational Research Journal*, (1), 95–111. https://doi.org/10.1080/0141192990250107.

Nind, M., Flewitt, R., & Payler, J. (2010). The social experience of early childhood for children with learning disabilities: Inclusion, competence and agency. *British Journal of Sociology of Education, 31*(6), 653–670. https://doi.org/10.1080/01425692.2010.515113.

O'Halloran, K. L. (2011). Multimodal discourse analysis. In K. Hyland, & B. Paltridge (Eds.), *The continuum companion to discourse analysis* (pp. 120–137). London: Bloomsbury Companions.

Rasmussen, I. (2005). *Project work and ICT: Studying learning as participation trajectories*. PhD thesis. Norway: University of Oslo.

Rasmussen, I., & Damsa, C. I. (2017). Heterochrony through moment-to-moment interaction: A micro-analytical exploration of learning as sense making with multiple resources. *International Journal of Educational Research, 84*, 79–89.

Ritella, & Ligario. (2019). Dialogical approaches to learning: From theory to practice and back. *Learning, Culture and Social Interaction, 20*, 1–3. https://doi.org/10.1016/j.lcsi.2019.02.001.

Roth, W. M., & Lee, Y. (2004). Interpreting unfamiliar graphs: A generative, activity theoretic model. *Educational Studies in Mathematics, 57*(2), 265–290.

Sefton-Green, J. (2017). Representing learning lives: What does it mean to map learning journeys? *International Journal of Educational Research, 84*, 111–118. https://doi.org/10.1016/j.ijer.2016.05.003.

Twiner, A. (2011). *Sociocultural understandings of technology-mediated educational practices: Improvable objects and meaning-making trajectories in the ICT-literate classroom*. PhD thesis, The Open University.

Twiner, A., Littleton, K., Coffin, C., & Whitelock, D. (2014). Meaning making as an interactional accomplishment: A temporal analysis of intentionality and improvisation in classroom dialogue. *International Journal of Educational Research, 63*, 94–106.

Vygotsky, L. S. (1962). In A. Kozulin (Ed.), *Thought and language*. Cambridge, MA: MIT Press. Trans.

Vygotsky, L. S. (1987). In N. Minick (Ed.), *Thinking and speech*. New York: Plenum. Trans.

Wells, G. (1999). *Dialogic inquiry: Towards a sociocultural practice and theory of education*. Cambridge, MA: Cambridge University Press.

Wertsch, J. V. (1991). *Voices of the mind: A sociocultural approach to mediated action*. Harvester Wheatsheaf: Hemel Hempstead.