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The Multi-timescale, Multi-modal and Multi-perspectival Aspects of Classroom Discourse Analysis in Science Education

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Background of Special Issue

Classroom discourse is an indispensable process through which the teaching and learning of any discipline, including science, takes place. In classroom discourse studies, many researchers use a variety of approaches under the umbrella term of "discourse analysis" to understand the dynamic of interaction and sometimes how learning happens in the classroom. Discourse analysis is recognised and frequently discussed as a methodology in applied linguistics (Rex et al. 2010). Researchers in science education typically borrow several analytical tools from discourse analysis and apply them to study the teaching and learning process in the science classroom (broadly defined as a space of learning in and out of school).

For many years, the adoption of methods from discourse analysis developed outside science education was not a major issue. However, in light of the increasing emphasis and contextualisation on the disciplinary nature of science, some unique features of science discourse become more evident: the first characteristic that is overwhelming in this issue is multi-modality. Science discourse in general, and science classroom discourse in particular, is multi-modal in the sense that it needs more than verbal language to make sense. Another feature which appears in several papers in this special issue is that science is related not only to its content but also to the epistemic process of creating scientific knowledge. Science is an inquiry-based enterprise, it values more questions than answers, and it has an empirical base. The language of science itself has some particular features, such as the use of nominalisations, which goes beyond technicality (Fang 2005). Accordingly, it is time to review the methods that were historically adopted from other disciplines and evaluate how they have evolved to take into consideration the unique multi-modal and empirical character of science.

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There has been little discussion thus far within the science education community on the overarching methodology of discourse analysis, such as its underpinning paradigm and the relative advantages and limitations of various approaches. This special issue dedicated to discourse analysis is therefore the first of its kind within science education. Compilations focusing on discourse analysis have appeared in applied linguistics and language education (e.g. Gee and Handford 2012; Zuengler and Mori 2002). What is different in this special issue is the attention to the conditions, settings and peculiarities of science classrooms. It is also written mainly by science education researchers who use discourse analysis to address issues that are more unique to science education.

Through an open call, we initially received 59 abstracts for this special issue from 24 countries across 6 continents. We were encouraged by this overwhelming response, which affirms the central role analytical methods play in science classroom research. As our focus is on the methodology of discourse studies, we asked the authors to highlight the rationale, application, and affordances of their methods, rather than reporting the full results from their study. After an initial selection by the guest editors and double-blind peer review process by the reviewers of *Research in Science Education*, we are pleased to present 11 original articles and a commentary for this special issue. The 11 papers highlighted similar yet different interpretations and applications of discourse analysis in science classrooms. In this editorial, we offer our perspectives of discourse analysis distilled from the collective ideas in all the papers.

Definitions of Discourse and Discourse Analysis

It is important to have a common definition of discourse in order to be clear about what is the construct we are analysing in the science classroom. Many authors in this issue are explicit in articulating their views of discourse. Incorporating their views, we define discourse as *languages-in-use that shape and are shaped by sociocultural practices*. This definition encompasses a number of key theoretical ideas as elaborated below.

First, language is not merely verbal language in the form of speaking or writing; it is also multi-modal. If we see language as a system of meaning-making resources (Halliday 1978), then language is not limited to the linguistic system of words but also encompasses a diverse range of semiotic modes used in communication (Kress and van Leeuwen 2006). Lemke (1998) argues that scientific discourse consists of all the "languages of science", including scientific English, Portuguese or Luxembourgish, as well as the languages of visual representation, mathematical symbolism and experimental operations. This is the reason why we use the pluralised "languages" in our definition. Second, a language is not a static and abstract system but it is always "in-use" by people to do certain things with specific purposes in specific activities. In this sense, people use language to construct discursive events that are interactive, dynamic and contingent (Kelly 2007). Furthermore, extending from Bakhtin's (1981) idea of dialogism, language does not occur as an isolated event of communication but as a continuous chain within a social dialogue in a discourse community. Third, discourse is more than a local instance of languages-in-use. It also incorporates broader sociocultural practices, including knowledge, norms, expectations and identities, that are affiliated to a specific community (Gee 2010; Kelly 2016). A discourse then is a product of social institutions that use languages in a particular way to construct some aspects of reality from a particular ideological stance (New London Group 1996, p.25). Fourth, there is a mutually constitutive relationship between languages-in-use and sociocultural practices, as captured in the phrase “shape and are shaped by” in our definition. A particular instance of languages-in-use is always constrained and contextualised by a larger practice of using the language. Simultaneously, a practice is also an accumulation of recurring instances of using language in a social context. As such, a sociocultural practice is also shaped by repeated instances of languages-in-use and can be changed over a long period of time.

While it is relatively easier to define discourse, it is more challenging to give a simple definition of discourse analysis. The reason is partly because discourse analysis is not just a set of methods that can be universally applied across disparate contexts, much like factor analysis in statistics or constant comparative method in inductive coding. As Rex et al. (2010) argue, discourse analysis is both a theoretical way of viewing a phenomenon as well as a logic of inquiry that guides the generation and interpretation of empirical data. Another complexity in the use of discourse analysis is the diversity of perspectives, methods and contexts that have been adopted by various researchers. This diversity does not only manifest within the field of applied linguistics, where discourse analysis originated, but also within science education as evident from this special issue. In this issue alone, there are a multitude of theoretical lenses employed, including interactional ethnography, social semiotics, practical epistemology analysis, systemic functional linguistics, distributed cognition, positioning theory, activity theory and legitimation code theory. Some lenses emphasise how people interact in building new meanings in science classrooms, focusing on meaning-making and the difficulties teachers and students face in this process. Other lenses emphasise power and position in classrooms in order to make explicit other features that count in the meaning-making process, like identity, gender, authority, and so on.

Thus, rather than defining categorically what is and what is not discourse analysis as applied in the science classroom, it is more useful for the purpose of this editorial to introduce a number of methodological issues that often concern discourse analysts in science education. Many of the authors wrestled with these issues and put a lot of thoughts into addressing them. Through this process, they have generated rather creative innovations that not only helped them to resolve their specific problems but also offer interesting insights for other researchers faced with similar issues. In what follows, we discuss these common issues as a way to introduce the different foci, methods and perspectives adopted by the various authors in this special issue.

Common Issues in Science Classroom Discourse Analysis

Scale of Analysis

The first issue we want to highlight is the scale of analysis, which will involve the notion of timescale (Lemke 2002) in discourse analysis. To analyse languages-in-use, it is useful to discuss three different levels according to their respective timescales. At the shortest timescale of seconds and minutes, discourse analysts typically pay attention to the micro-discursive talk, move, utterance, and gesture. At a longer timescale that could last for hours, the analytical focus shifts towards meso-level events such as episodes, activities and lessons. And the longest timescale lasting days, weeks and sometimes months and years, we can begin to examine patterns that relate to macro-level phenomena we are interested to investigate in science education. A major challenge in discourse analysis is to weave in and out of events at different timescales in order to construct a narration of how the social phenomenon we are investigating unfolds and develops from seconds to minutes, to hours, days, weeks, months and even years.

Almost every author dealt with this issue of multiple timescales in one way or another. Some authors were particularly explicit in addressing this methodological challenge in their papers, situating different timescales and how they matter from the point of view of the analysis. We introduce three such examples that provide a rich discussion of timescale, in what follows: Franco and Munford (this issue), Sandoval, Kawasaki and Clark (this issue), and Colley and Windschitl (this issue).

Grounded in the traditions of interactional ethnography, Franco and Munford used an hourglass as an analytical metaphor to illustrate three levels of analysis in order to understand how various sociocultural elements are intertwined with science learning opportunities. At the top of the hourglass is a broad characterisation and selection of events relevant to members of a community. The timescale at this level varies from years to days. In their words, "the complete timeline, over the three years, allowed us to identify different intercontextual references/ resources: the community of students, their family units and networks of friends, Internet and social networks, out-of-school sources of information, issues such as those of gender, religion, ethnicity, and social class". Funnelling to the vertex of the hourglass is a micro-analysis of the discursive actions of the participants (in seconds and minutes). The vertex was chosen considering the notion of *frame clash* by Green, Skukauskaite, and Castanheira (2013), which are events that highlight the conflicting expectations among the participants or between the researcher and participants. Finally, at the bottom of the hourglass is an expansion of the analysis to interpret how different events are related across time in a timescale of days, months, or even years. Franco and Munford used this approach to make connections between "classroom discourse and larger sociocultural patterns", like gender, religion, ethnicity, and family experiences.

Sandoval et al. discuss the relative strengths and weaknesses of different analytical approaches that examine classroom discourse at different timescales. For their purpose of tracking changes in science teaching that focuses on students' appropriation of various scientific practices, they argue that more "traditional discourse analysis" of using fine-grained micro-analysis to examine short timescale of interaction is difficult to scale up, thus making them infeasible for longer studies that are interested in comparing several different classrooms. Thus, they developed an approach to "characterise classroom discourse that directly supports comparisons between classrooms, both to show differences between teachers and to show change over time". Their starting position was similar to Franco and Munford in terms of having a broad review of the video record that was informed by Erickson's (1992) interactional ethnography. However, their point of departure was the second stage of video viewing where they incorporated the use of a priori coding to capture teaching variations that correspond to the demands from the Next Generation Science Standards (NGSS). These variations were teacher framing of activity, locus of epistemic agency, and versions of science practice. While acknowledging their approach cannot supersede fine-grained discourse analysis, they found it to be a suitable "middle out approach" to expand the scale of micro-analysis and to facilitate comparisons between different classrooms.

Colley and Windschitl also problematise the issue of timescale in their analysis of explanation building and argumentation, which often extend over multiple timescales across several lessons. They argue quite rightly that all transcriptions by themselves are not well suited to show talk patterns at a lesson timescale, particularly in representing the qualities of collaborative, dialogic and disciplinary talk that are desirable in a science classroom. In order to help them identify emerging patterns over multiple points in a school year, they developed a unique visual analytical tool called barcodes to show when and how the unfolding classroom talk occurred in ways that promote, sustain, or constrain students' collective development of ideas. "Each barcode visually summarises critical features of a science lesson, including the sequence of activity structures, temporal boundaries of discussion episodes, student and teacher participation, and the degree to which students work towards building or revising ideas together". Using the barcode allows researchers to have an immediate sense of what happens in a science lesson and to decide where to use fine-grained micro-analysis to examine short timescale of interaction, according to the aims of their study.

Collectively, these papers exemplify that discourse analysis does not merely pay attention to the linguistic or discursive details of what was said at a short timescale, but also to the larger meaning at a longer timescale that are influenced by various sociocultural characteristics of the groups. For instance, Franco and Munford, in their hourglass approach, considered the historical influence of the group in order to select events for analysis. Consequently, their funnelling analysis was what indicated gender as a sociocultural element with important consequences for the discursive practices in the science classroom, in the group they were following. On the other end of the timescale continuum is the analysis of utterances produced over a short period of time, as exemplified by several papers (e.g. Wilmes & Siry, Maeng, this issue). Utterances are generally short-lived although each utterance, when taken up, is built on to form an episode or an event. "Any utterance, no matter how weighty and complete in and of itself, is only a moment in the continuous process of verbal communication" (Voloshinov 1973, p. 95). As such, analysis of utterances is typically a starting point for many discourse analyses in the classroom. From utterances, researchers can reconstruct different larger scales of analysis, which explains the usefulness of analysis of short timescales to reconstruct the process of verbal or multi-modal communication in classrooms.

Multi-modal Nature of Discourse Analysis

One overwhelming characteristic in this special issue is the pervasive acknowledgement of multi-modality as an integral part of discourse analysis. From the authors' work, it is evident that science classroom discourse analysis is intimately a multi-modal task. This multi-modal nature applies to both the *research phenomenon* we are analysing as well as our own *research practice* in generating, interpreting and transforming data.

In terms of the research phenomenon, discourse analysis has traditionally focused on the use of verbal language (e.g. speaking and writing). However, this is a limitation imposed by two historical factors. One was a theoretical view developed mainly out of linguistics while the other was a technological limitation where tape recorders were then the main equipment used by classroom researchers. Today, with the advancement of contemporary theories and the use of video cameras as the quintessential tool of choice, we are no longer constrained by these two limitations. In what follows, we introduce four examples from this issue to further contextualise and discuss the multi-modal nature of discourse analysis.

Wilmes and Siry (this issue) used a multi-modal interaction analysis in their study as they recognised that linguistic-centric approaches cannot fully capture students' embodied engagement in science practices. Their methodological choice was driven by a very practical consideration in Luxembourg where children are instructed in three different official languages (French, German, and Luxembourgish) and more than half of them do not speak these languages as their first language. Thus, they argue that the "foregrounding of [verbal] language as an organizer of discourse and participation in science can disadvantage students who are engaged in doing science, yet who are working to master the [official] language they are using to communicate”. Grounded in Bakhtin’s (1981) dialogism and Wertsch’s (1998) mediated action theory, they adopted a multi-modal view that prioritise both the talking and doing aspects of science. Their analysis was divided into four interrelated phases. A novel decision they took in the second phase was to mute the video when they re-watched the video a second time, so that they could focus on the embodied and material aspects of the unfolding interaction. Wilmes and Siry argue that this approach reduces the verbal language bias we tend to have in examining interaction, thus allowing more detailed observation of embodied and material engagement among the students’ and teachers’ participation in science.

Knain, Fredlund and Furberg (this issue) also explicitly focus on multi-modality as they examine the meaning-making practices of science involving a coordination of multi-modal representations (e.g. verbal language, images, graphs, equations). With a focus on students’ reasoning with representations, they appropriated several ideas from Kress and van Leeuwen’s (2006) social semiotics and Jordan and Henderson’s (1995) interaction analysis. Interestingly, the theory of social semiotics originated historically from a linguistic-oriented framework, back when Halliday (1978) theorised language as a “social semiotic system”. Halliday’s grammar-based theory and analytical framework were later expanded to other modes, most notably images (Kress and van Leeuwen 2006), which Knain et al. were analysing. Interaction analysis also has a sociolinguistic origin, tracing back its intellectual roots from Sacks, Schegloff and Jefferson’s conversation analysis and Garfinkel’s ethnomethodology. Subsequent research in this area later began to expand the verbal analysis to include human embodied actions around material artefacts, in so-called “‘deictic resource’ that students can talk about and point to”. Thus, Knain et al.’s study exemplifies how the theoretical shift from a traditional linguistic framework to a more contemporary multi-modal one can make a significant impact in our application of discourse analysis.

Wieselmann, Keratithamkul, Dare, Ring-Whalen and Roehrig (this issue) examine how multi-modal resources were used by sixth-grade students to position themselves and others in an integrated STEM learning context, focusing particularly on gender roles in small group interaction. They also draw on the theory of social semiotics to consider the relative affordances of various semiotic modes. Like Wilmes and Siry, they were consciously aware that verbal language is often unfairly prioritised over other modes in classroom contexts. Thus they adopted a critical lens informed by positioning theory (Davies and Harré 1990) and activity theory (Engeström 2000) to examine how power circulated within a group as the modes changed in the activity system. They noted an interesting disturbance in the activity system when the lesson changed from more structured science activities to less structured engineering activities. Part of this change was attributed to the physical materials used in engineering activities, which prompted the boys to become more involved, thus shifting the power dynamics across gender roles in the group.

These studies exemplify the multi-modal nature of science activities and practices that we analyse as a research phenomenon or area of interest. But this is not the only reason why multi-modality is an integral part of discourse analysis. Another reason has to do with our own research practice and interpretation in generating, interpreting, and transforming data. In discourse analysis, we typically start with a corpus of videos, which are multi-modal artefacts themselves with sound and visual tracks. We then transform the videos into numerous transcripts interlaced with words, tables, numbers, notations (e.g. Jefferson transcription system), and sometimes snapshots from the videos. Finally, after several rounds of writing and talking among collaborators, we finally produce written interpretations in articles or monographs that are mixed with the occasional figures and tables. In sum, there is a high degree of multi-modal transformation that is built into the practice of discourse analysis.

Through such multi-modal transformation, a number of authors in this special issue have also produced highly visual tools to represent their data analysis. This includes the earlier mentioned barcode visualisation tool (see Colley & Windschitl) and hourglass metaphor diagram (see Franco & Munford). Another good example is the paper by Barreto, Rodrigues, Oliveira, Almeida, Felix, Silva, Quadros, Macedo and Mortimer (this issue) who drew on Legitimation Code Theory (LCT) to show the chemistry knowledge-building process in a university lecture. Researchers are increasingly using LCT to analyse science concepts in terms of epistemic semantic density (ESD), which indicates the degree of how much meanings are condensed into a particular term. By examining the shifts in ESD over time in a science lesson, many researchers build a semantic profile of the lesson—a graph-like representation with ESD along the vertical axis and time along the horizontal axis. Studies in LCT have shown that semantic profile resembling a wave (i.e. semantic wave) is most productive for student learning, as opposed to a flatline profile where the ESD remains either high (complex) or low (simple) for a long period of time. Although semantic profiles can be useful as a quick glance of the knowledge-building intensity in a lesson, Barreto et al. showed that they are insufficient to show how meanings are connected in the lesson. Thus, they used a network science approach to build a constellation of meanings through the analysis of the interconnection between concepts used in the discourse. Importantly, this constellation of meanings is represented as a visual diagram showing a network in which the size of a node represents how many connections a term has and the edges represent the relations between terms (see Fig. 5 in Barreto et al.). In both cases, semantic profiles and network science diagrams demonstrate the multi-modal transformation work carried out by many researchers in discourse analysis.

Complementary Theories and Frameworks

Discourse analysis is often framed by a particular theory of discourse or language. Such theoretical framing is crucial in order to provide a lens through which the phenomenon can be examined and studied as well as to situate the key constructs that are being analysed. However, every theory has its own affordances as well as limitations. In this issue, we were particularly intrigued by several authors who drew on multiple complementary theories or frameworks to inform their analysis. We highlight three examples to illustrate why a combination of various theories and analytical lenses is often necessary to analyse science classroom discourse.

Maeng (this issue) used two perspectives that have been widely applied in science education—systemic functional linguistics (SFL) and practical epistemology analysis (PEA). SFL is a linguistic tool to analyse grammatical features of language use while PEA is useful to examine participants' enacting epistemology in discursive transactions. The use of PEA requires analysts to take a first-person perspective to closely analyse interlocutors' language use based on what they said, rather than a third-person reinterpretation through an analyst's lens. For this reason, Maeng gives a good argument that the linguistic rigour and precision in SFL provides a complementary tool to enhance PEA in reflecting the "interlocutors' epistemic language use closer to their perspectives". Towards this end, Maeng applied SFL's register analysis to analyse the ideational (content), interpersonal (mood) and textual (organisation) metafunctions of language found in students' talk in two elementary science classrooms, in order to identify the linguistic evidence that show gap and relation—two of key concepts in

PEA. For instance, Maeng drew on thematic pattern (semantic relation diagrams) from Lemke's (1990) work to show that whether or not a gap was filled with relations really depends on the *semantic relationships* made by the students (e.g. grain is a *meronym*, or constituent part, of a rock).

Convertini (this issue) also used two different frameworks to help her analyse the implicit inferential argumentation among kindergarten children as they solved tasks involving STEM. Unlike Maeng who combined SFL and PEA *simultaneously*, Convertini combined pragma-dialectics and argumentum model of topics (AMT) *sequentially*. The pragma-dialectical approach was first used to establish the argumentative structure of a dialogue, paying attention to the participants' roles, their standpoints and arguments, and the rules of discussion. This was followed by the use of AMT to analyse the implicit premises of the argument, such as the logical principle of the reasoning, shared knowledge and factual information. Convertini argues that both tools were necessary in order to complement each other's strengths and limitations. In particular, she made a good point that as inference in argumentation is often implicit, we need an interdisciplinary approach that "combines tools belonging to different disciplines (theories of argumentation, linguistics, psychology, education) in order to make explicit these inferences".

Another interesting paper that further provides insights into this theme of multi-perspectival aspect of discourse analysis is by Martin, Xu and Seah (this issue). The aim of their paper was not to combine different perspectives to analyse discourse but to engage in a "meta-methodological" discussion of the three authors' inquiry practices and decision-making processes. Based on video data from a joint research project, each author reflected on how their individual theoretical perspective—positioning theory (PT) for Martin, distributed cognition (DCog) for Xu, and systemic functional linguistics (SFL) for Seah—shaped different data generation processes. For instance, the attention to students' choices of words at a grammatical level required a verbatim transcription in SFL. By contrast, the attention to a student's agentic self-positioning, which is often not made with words alone, required a more detailed phonological transcription in PT. As for DCog, the attention to cognitive artefacts requires an identification of the material objects and interactions in the transcripts. Thus, the paper provides a clear articulation of how our theoretical lenses have a direct bearing on the methodology of discourse analysis, with three well-known theories (PT, DCog, SFL) provided as illustrative cases.

Unique Conditions of Science Education for Discourse Analysis

The various papers in this special issue demonstrate that the use of discourse analysis is not a straightforward affair that can ignore the disciplinary and sociocultural context of the science classroom. The kind of multi-timescale, multi-modal and multi-perspectival approaches adopted by various authors are the results of thoughtful consideration to the unique and peculiar conditions within science education. In this section, we summarise some of these conditions that shape the development and application of discourse analysis taken by science education researchers.

One of the underlying conditions that underpins many of the authors' work is the epistemic nature of science. Science as a discipline is defined by a unique set of epistemic practices (e.g. empirical inquiry, evidence-based argumentation, theory-driven explanation) that generate not only the content matter of science education, but also the kinds of epistemic dialogue among science teachers and students in the classroom (Tan and Tang 2019). The importance of epistemic practices for teaching and learning has been highlighted by recent reforms in the NGSS in the USA. It is not surprising then that researchers are increasingly connecting discourse analysis to scientific practices, alongside the argument put forward by NGSS that “engagement in practices is language intensive and requires students to participate in classroom science discourse” (NGSS Lead States, 2013, p.50).

With the goal of scientific practices as a necessary condition, we can perhaps anticipate the kind of research topics that are likely to be of great interest to discourse analysts in science education. As we saw in this issue, some of these topics include reasoning and argumentation (Convertini), dialogic discussion (Colley & Windschitl), epistemic agency (Sandoval et al.), representation construction (Knain et al.), epistemic understanding of language use (Maeng) and epistemic aspect of chemistry knowledge-building (Barreto et al.). Moreover, the nature of scientific practices and its knowledge representations are also multi-modal. This is another unique condition that has shaped the focus of discourse analysis in science education, thus prompting researchers like Wilmes and Siry and Wieselmann et al. to examine the “doing of science” in terms of the embodied and material engagement, alongside the “talking of science”.

We also sense that there is an implicit expectation among researchers to examine the quality of discourse in the science classroom according to certain prescribed standards of scientific practices (e.g. Sandoval et al., Convertini). Thus, the analysis of classroom discourse is not simply about what *are* the languages-in-use in the science classroom, but also an evaluation of what they *should be*, based on education frameworks informed by a collective vision such as NGSS (e.g. asking questions, arguing with evidence). The review of discourse frameworks by Criswell, Rushton and Shah (this issue) provides a good account of how the vision of science discourse as inscribed in national standards such as NGSS has shaped the development of several frameworks that “provide guidance to both researchers and teachers for studying and supporting productive science classroom talk”. Examining the ways in how these frameworks emphasise the structure (form) or practical use (function) of language, they focus on the impact of the frameworks on quality discourse in a number of areas, such as teacher questioning, scientific argumentation, meaning-making, and classroom communities. Criswell et al.’s review thus emphasises the goals of discourse that are useful for science teachers as they facilitate classroom discourse with their students.

In connecting research to practice, the final paper in this special issue by Criswell et al. provides a good reminder that the goal of discourse analysis must also have a social and practical agenda that can potentially improve science teaching and learning. On this note, we are reminded of the early work in discourse analysis in the 1970–1980s that reveals the ubiquitous *Initiate-Response-Evaluate* (I-R-E) interaction pattern where a teacher initiates (I) a question, a student gives a response (R), and the teacher evaluates (E) that response (e.g. Lemke 1990; Mehan 1979). Although an I-R-E pattern limits student thinking and voices, later works have expanded this basic idea to reveal new interaction patterns that are more dialogic in nature, such as the I-R-F-R-F chain of interaction where the teacher, instead of evaluating the answer as right or wrong, gives feedback or elaborates on the student’s answer (e.g. Mortimer and Scott 2003). Thus, many of the teachers’ interventions or discourse strategies that are considered good teaching in science education were built on years of research that use discourse analysis to study and codify experienced teachers’ tacit practices, and subsequently transform them into useful knowledge for teacher education (see Tang 2020).

Concluding Remarks

We have come a long way since the early research on I-R-E discourse pattern almost 50 years ago. As this special issue demonstrates, we have ventured beyond linguistic moves and turn-taking to contemporary issues that consider the multi-modal, disciplinary and epistemic nature of science and science education. With the widespread adoption of videographic technologies, we have also concomitantly developed sophisticated techniques to address core methodological issues such as timescale and multi-modality, as well as highlight implicit power relations associated with gender roles and multi-lingual learners. We also often mix perspectives and approaches that were developed from different disciplines in order to generate pragmatic solutions that combine the relative affordances of each approach. Overall, it is encouraging to see in this special issue the progression of innovative ideas developed by discourse analysts to tackle the unique methodological issues and challenges in science education. Based on the collective work we saw in this issue, we argue that discourse analysis has reached a level of maturity as a recognised and sophisticated methodology that is increasingly developed *by* and *for* science education researchers.

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