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Pedagogic register analysis: mapping choices in teaching and learning

David Rose

Correspondence:
david.rose@sydney.edu.au; d.rose@edfac.usyd.edu.au
University of Sydney, 55 Meriton St,
Gladesville, NSW 2111, Australia

Abstract

This paper offers a method for analysing pedagogic practice of all kinds that is detailed, exhaustive and applicable to designing effective teaching practice. The analysis builds on research into the structuring of pedagogic discourse by applying systemic functional (SF) research methods to the contextual stratum of register. Each meaningful element of pedagogic practice is presented as an option in systems that are selected by teachers and learners as lessons unfold. These are semiotic systems at the level of register, including options for pedagogic activities, negotiated in pedagogic relations between teachers and learners, and presented through pedagogic modalities of speaking, writing, viewing and gesture.

Introduction¹

The description of pedagogic register systems in this paper springs from SF research into the structuring of classroom discourse, including Christie (2002), Christie and Martin (1997), Martin (2006a), Rose (2004, 2007), Martin & Rose 2017a, 2017b) and Zappavigna & Martin (2018). In particular, this paper builds on work presented in Rose 2014, extending and clarifying that analysis of pedagogic discourse as systems of register. General variables in register include the tenor of social relations, fields of social activity and modes of meaning making (Martin 1992, Martin and Rose 2007a, 2008). Halliday (1978) proposes solidary relations between these dimensions of social contexts and metafunctions of language.² Indeed, SF research describes the features of language and other modalities in terms of registerial functions, “the basic functions that language has evolved to perform in human life” (Halliday 2013a: vii).

A further dimension of social context is genre, which configures variations in field, mode and tenor in regular patterns that are recognisable to members of a culture. Martin (1992: 405) describes genre and register as connotative semiotics, realised by language, image and other modalities as denotative semiotics (after Hjelmslev). That is, both denotative and connotative semiotics are planes of meaning making, comprised of systems of resources for meaning, or as Halliday (1978: 53) declares, “meanings are the social system: the social system itself is interpretable as a semiotic system” (his emphasis).

Pedagogic registers are a subset of cultures’ overall potential for field, tenor and mode. Their fields consist of pedagogic activities that are negotiated in pedagogic relations between teachers and learners, and presented through pedagogic modalities of speaking, writing, signing, drawing, viewing, gesturing and other somatic activity. The

cultural function of pedagogic registers is to exchange knowledge and values between teachers and learners. This knowledge and values comprise a further dimension that has been termed curriculum register (Martin & Rose 2017a). The exchange of knowledge and values through pedagogic registers is not simply ‘transmission’ and ‘acquisition’; rather learners **construe** curriculum registers from unfolding variations in pedagogic register. In Halliday’s terms, “by attending to text-in-situation a child construes the code, and by using the code to interpret text s/he construes the culture” (1994: xxxi). One implication is that both pedagogic and curriculum registers may be construed differently by different learners, which may lead to unequal learning outcomes. Pedagogic register and curriculum register are configured together in curriculum genres; that is, a curriculum genre is a configuration of pedagogic and curriculum registers, schematised in Fig. 1. Examples of curriculum genres analysed in this paper include classroom lessons in primary and secondary school, academic lectures, infant language learning, parent/child reading, student group work, and manual task instruction.

Central to SF research methodology is the paradigmatic organisation of semiotic systems. These systems are described as networks of contrasting features that are recognised by unique criteria (Martin 2013). Recognition criteria for systemic features are identified through observation of regular patterns in text corpora. They are tested by postulating proportionalities, such as ‘a is to b as x is to y’, that are then applied to further analyses of corpora. Systems of features are constructed, modified and reconfigured through repeated text analyses, until all instances in text corpora are accounted for. Delicacy of description may be guided by its applicability for text analysis. In the register systems described here, delicacy

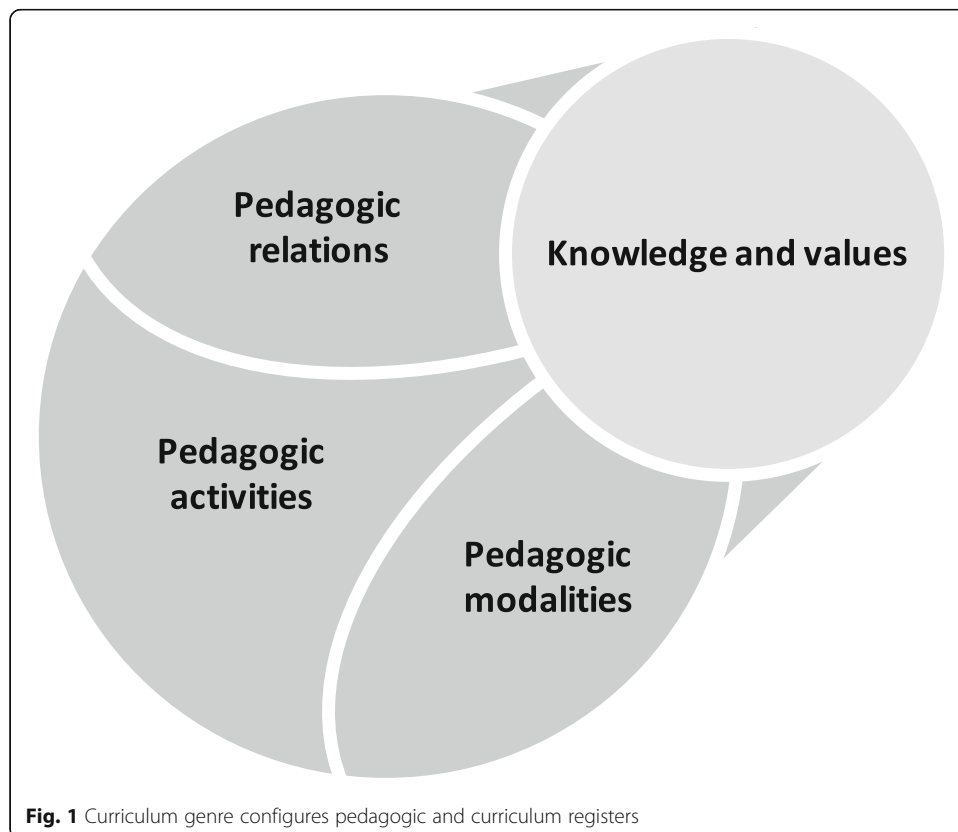


Fig. 1 Curriculum genre configures pedagogic and curriculum registers

is extended to naming features that can be readily recognised and usefully applied by educational researchers. Often a feature selects criteria from more than one system, in which case simultaneous systems may be postulated, whose outputs are co-selected as entry conditions for more delicate systems.

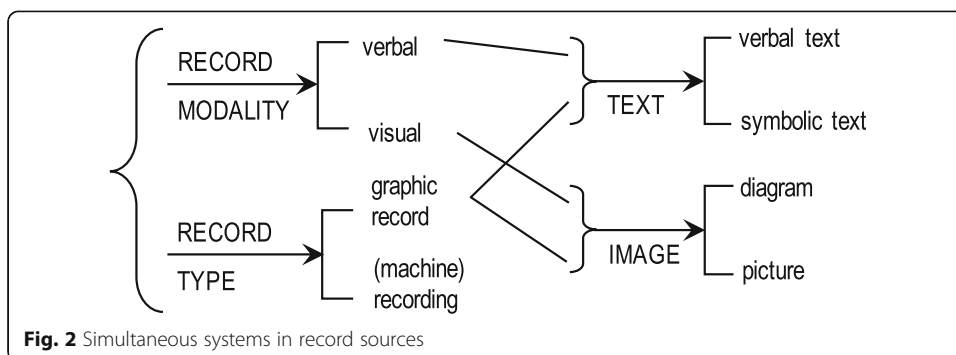
This is a model of semiosis as choice. Speakers bring repertoires of meaning-making resources to an interaction and deploy them to achieve social goals as the interaction unfolds. The aim of description is not to prescribe what can or should be said, but to account for the choices that interactants actually do make, from systems of potential options. The goal of pedagogic register analysis is to show empirically how teaching and learning occur, to inform teaching as a consciously designed professional practice.

By way of example, casual observation of classroom lessons shows a plethora of knowledge sources, such as books, photocopies, posters, white/blackboard, video and audio recordings. These are instances of pedagogic modalities, through which meanings are sourced into the teaching/learning discourse of the classroom. The question for systemic description is how to represent them as options that teachers and learners can choose from as lessons unfold. This entails asking how they are related to each other, and to the other dimensions of pedagogic register. One relation is that they are each sources of meanings. Other types of meaning sources include the knowledge of teachers and learners that is spoken in lessons, as well as features of the environment that may be indicated or named. The distinguishing criterion of the sources above (books etc.) is that they are recorded. So three general options can be proposed for a system of sources: environment, speaking or record.

A more specific question is how records are related to each other along axes of similarity and difference. One contrast is between verbal or visual records; another is between written texts or audio recordings; and another between still images or video recordings. On these criteria, written texts and still images are both graphic records, in contrast to recordings of video and audio. One pedagogic significance is that graphic records can be readily copied, marked and annotated by teachers and students, whereas recordings must be transcribed or stilled for these purposes.

This set of relations can be modelled by postulating two simultaneous systems: RECORD MODALITY and RECORD TYPE. Record modalities are visual or verbal. Record types include graphic records or audio and video recordings. Co-selection of visual with graphic record leads to a choice of images; co-selecting verbal with graphic record produces written texts. More delicately, visual images may be diagrams which generally need to be labelled or explained for pedagogic interpretation, or pictures which may be interpreted more intuitively. In addition, written texts may be verbal or symbolic, such as mathematical expressions and calculations. One significance for classroom discourse is that verbal texts can be repeated orally by reading aloud, whereas symbolic texts must be recast as spoken language. These co-selecting simultaneous systems are captured in Fig. 2, a fragment from the system of pedagogic modalities.

These types of reasoning have been deployed throughout the descriptions of pedagogic register systems here, but there is not the space to present this argumentation for each system. Rather the focus is on illustrating the applicability of the description to analysis of pedagogic practice. The breadth of testing across curriculum genres to date suggests that the systems are reliable for this purpose, while allowing for further specification and adjustment. Recognition criteria for systemic features emerge in the



discussion of instances in texts. Where necessary the discussion makes criteria explicit, particularly criteria from ‘below’ in discourse features that realise register features. These include experiential lexis, appraisals, reference items and conjunctions, which can be marked in the text for analysis. These realisations are illustrated in example texts, but as register/discourse relations are highly diverse, exhaustive realisation statements are not canvassed here.

Pedagogic relations

Pedagogic relations comprise the interpersonal dimension of pedagogic register. The term is adopted from Bernstein who uses it to generalise teaching/learning relations from a sociological perspective: “The relationship basic to cultural reproduction or transformation is essentially the pedagogic relation, and the pedagogic relation consists of transmitters and acquirers”. Bernstein is concerned with “the fundamental logic of any pedagogic relation”, which he regards as “essentially, and intrinsically, an asymmetrical relation”. More specifically, “the essence of the relation is to evaluate the competence of the acquirer” (2003:197–99). Bernstein insists that “the key to pedagogic practice is continuous evaluation... evaluation condenses the meaning of the whole [pedagogic] device” (2000:42–50).³ While evaluation is a constant throughout the pedagogic practices analysed here, the analyses show more broadly how the acquisition of competences is negotiated, in exchanges between teachers and learners. These terms are preferred, as the analyses show pedagogic exchanges to be more intricate than ‘transmission and acquisition’ imply.

Exchange structure

Pedagogic register variables are enacted in language through exchanges between speakers. Options for exchanges are provided by the discourse semantic system of NEGOTIATION (Martin 1992, Martin and Rose 2007a, 2007b), which involves two general dimensions: the roles of speakers and the type of exchange. Exchanges are either of knowledge⁴ or actions, and speakers are either in primary or secondary roles. The goal of an action exchange is performance of an action. The role performing the action is the primary actor (A1), and the secondary actor (A2) may demand or be offered the action. The goal of a knowledge exchange is provision of knowledge. The role providing knowledge is the primary knower (K1), while the secondary knower (K2) may demand or receive the knowledge.

A further choice is the role that initiates the exchange. If A1 or K1 initiates, the exchange may consist of just this role (action performed or knowledge provided). If A2 or

K2 initiates (e.g. demanding action or knowledge), the exchange may be completed in two steps as A2^A1 or K2^K1. On the other hand, A1 or K1 may also initiate by anticipating a secondary role. In this case the primary role is delayed, and the exchange may involve three roles. The initiating role is labelled dA1 or dK1 (delayed primary role), for example:

dA1 May I leave the room?
 A2 Yes, you may.
 A1 [leaves room].
 dK1 How many degrees in a right-angle triangle?
 K2 Ninety degrees.
 K1 Correct.

The latter knowledge exchange is characteristic of pedagogic registers across cultures, widely dubbed the 'initiate-response-feedback' cycle (Sinclair and Coulthard 1975, Alexander 2000). Although the learner displays knowledge by answering the the initiating question, the teacher has the final authority to evaluate the response, and is thus the primary knower, while the learner's role is secondary knower. The K1 evaluation informs learners of the value of the knowledge they have proffered.

Exchange roles are composed of one or more exchange moves.⁵ At each discourse rank of exchange, role and move, units can be complexed into series. Exchange roles can also be expanded by other moves that follow-up, track their meanings (checking, clarifying, confirming, replaying) or challenge preceding moves (Martin 1992, Martin and Rose, 2007a, b). A few of these additional move types will emerge in the analyses below. Example exchanges are presented here as tables with one move to a row, including non-verbal moves. Boundaries between exchanges are marked by lines between rows. A simple illustration is the parent/child interaction in Table 1, in which a 14 month old infant is using protolanguage, and the mother takes advantage of the child's attention to model a mother tongue word (from Painter 1984: 81–2). This interaction is a complex of four exchanges, each initiated by the child and evaluated by his mother.

Pedagogic relations: Acts and interacts

At the level of genre, Table 1 is an instance of a curriculum genre (a lesson), firstly since each exchange is completed by the mother's evaluation (pedagogic register), and secondly since the mother models word knowledge, *bird*, that the child finally displays as *ba* (curriculum register). This type of curriculum genre is very familiar in infant language learning across cultures, that we may call the 'pointing and naming game'. We can interpret the interactants' goals for the genre, on the child's part to be affirmed for displaying his perception, and on the mother's part to present some language knowledge.

The analysis of exchange roles enables us to see its discourse structuring as a series of K2^K1 exchanges. This is interesting in itself, as the child initiates but the mother usurps the K1 role. From this we might assume many previous instances in which the mother modelled pointing and naming, which the child emulates here. Precisely what has been modelled and reproduced can be analysed in pedagogic register, realised by both language and the child's gestures. In the first exchange, the child invites the mother's attention by pointing and articulating a demonstrative in his protolanguage, *dae* 'that/there'. The mother approves his perception *yes*, and models the word *bird*.

Table 1 the pointing and naming game

		Role	Speaker
1	[pointing at bird]		Child
	dae	K2	
	yes bird	K1	Mother
2	[pointing]		Ch
	da	K2	
	bird	K1	M
3	[pointing]		Ch
	da	K2	
	that's a bird	K1	M
4	[pointing]		Ch
	ba; ba	K2	
	[yes]	K1	M

The same interaction is then repeated in the second and third exchanges, but in the fourth the child displays the knowledge he has just acquired from the mother, by articulating the word as *ba*.

This series of interactions involves a set of conscious acts: attention, perception, knowledge (i.e. acts of knowing, including memory). These conscious acts are exchanged by what we may call interacts: inviting (attention), approving (perception), modelling (knowledge) and displaying (knowledge). The structuring of pedagogic relations in Table 1 can now be analysed in more detail, using these terms (Table 2).⁶

Inviting and displaying are options for the learner to interact, while approving and modelling knowledge are teachers' options. What is emerging here are two simultaneous systems for the structuring of pedagogic relations, a system of acts and a system of interacts, whose features may be co-selected in various combinations. Different options are available for learners and teachers.

More options in these systems become apparent in more elaborate curriculum genres. Table 3 is an extract from a primary school lesson studying Venn diagrams. The

Table 2 Pedagogic relations in the pointing and naming game

		Role	sp	Interact	Act
1	[pointing at bird]		Ch	Invite	Attention
	dae	K2			
	yes bird	K1	M	Approve Model	Perception Knowledge
2	[pointing]		Ch	Invite	Attention
	da	K2			
	bird	K1	M	Model	Knowledge
3	[pointing]		Ch	Invite	Attention
	da	K2			
	that's a bird	K1	M	Model	Knowledge
4	[pointing]		Ch		
	ba; ba	K2		Display	Knowledge
	[yes]	K1	M	Approve	Knowledge

teacher begins in a K1 role, providing information, followed up with a tag question directed to a student (K1f), that may not expect a response. She then initiates an exchange with a dK1 question that the student does not answer or answers too quietly, as she asks a series of clarifying questions (cl). Finally the student responds to the last clarifying question (rcl) and the teacher evaluates as K1. Where possible, linguistic realisations of pedagogic relations are marked in bold in Table 3.

At the level of pedagogic relations, the teacher in Table 3 first **directs** the student’s **attention** to the diagram by pointing, and then **models** the **reasoning** to solve the diagram. Reasoning is indicated by the concluding conjunction *so*, which relates the solution to previously given criteria. The tag question, *won’t it Hasan*, **inquires** whether the student **accords** with the teacher’s statement. The following dK1 and clarifying questions then **inquire perception**, *do you see why* and **inquire reasoning**, *can you explain why*. The student then **displays** his **reasoning**, with the criterion *five faces*. The teacher first **qualifies** this **display** with *pardon*, and finally **approves** it as *good*. This instance gives us three more types of act: reasoning, display, accordance, and two types of interact: inquire, qualify.

Table 4 is an extract from an undergraduate biology lecture (from Hao and Hood 2016).⁷ This extract is a monologue in which the teacher guides students’ perceptions of a diagram projected on the screen. The initiating move is interpreted as dK1,⁸ which the teacher answers himself, and follows up with a concluding K1f *Okay?* His K1 monologue alternates between **inviting** students’ **attention**, **perception** and **conception** of the image, and **imparting** new **knowledge** about the field. Each move in the K1 monologue is numbered for discussion.

Linguistic realisations of acts and interacts are highly variable. They may be lexically explicit, such as *look* and *see* realising perception in moves 1 and 5. Inviting may be realised by addressing, *let’s look, you’ve got, you can’t see*. Move 3 imparts knowledge of technical terms, enacted as ‘x is *called* y’. Move 4 invites perception by indicating where to look with gesture and language *you’ve got these*. In move 6, conception is realised by inviting learners to *imagine*, where there is no image to perceive. The concluding *okay* checks students’ reception of the verbal monologue.

Table 3 Pedagogic relations in a primary school lesson

	Role	sp	Interact	Act		
1	[pointing to the centre of the Venn diagram in the textbook]		T	Direct	Attention	
	So B will go right in the middle there,		K1	Model	Reasoning	
	won’t it Hasan? B.		K1f	Inquire	Accordance	
2	Do you see why it will go in the middle there?		dK1	T	Inquire	Perception
	[no response]			S		
	Do you see why it will go in there?		cl	T	Inquire	Perception
	[no response]			S		
	Can you explain why?		cl	T	Inquire	Reasoning
	It’s got five faces.		K2	S	Display	Reasoning
	Pardon?		cl	T	Qualify	Display
	[louder] It’s got five faces.		rcl	S	Display	Reasoning
	Good, it’s got five faces.		K1	T	Approve	Reasoning

Table 4 Pedagogic relations in a biology lecture

		Role	Interact	Act
1	So let's look at the basic structures of the kidney.	dK1	Invite	Perception
2	Like a lot of organs, the kidney has an outer and inner region. [point at image]	K1	impart Invite	Knowledge Attention
3	And like a lot of organs, the outer region is called the cortex, and the inner region is called the medulla. So it's true for any number of organs.		Impart	Knowledge
4	You've got these little tongues – or papillae – of medulla, which are sitting in this cup of connected tissue. [point at image]		Invite Invite	Perception Attention
5	You can't see the whole cup, because the thing's been cut in half.		Invite	Perception
6	But you can imagine it's almost like a funnel around the papilla. [point at image]		Invite Invite	Conception Attention
7	And these are called calices – each one's called a calyx, which I think is Latin for cup, or something like that.		impart	Knowledge
8	Several of the cups – or calices – will combine to form this large structure here, which is the renal pelvis – which is essentially a funnel into this tube here. [point at image]		Invite	Attention
9	So, the urine is produced in this part of the kidneys, drains through the calices, into the pelvis, and down through the ureter.		Impart	Knowledge
10	Okay?	K1f	Check	Reception

Options in pedagogic relations are mapped in Figs. 3 and 4. In INTERACT systems, the first distinction is between interacts available to learners and teachers. This contrast is conditioned by the asymmetric authority inherent in the pedagogic relation. Specifically, teachers have the institutional authority to **evaluate** learners' knowledge, **direct** their actions, and **present** knowledge.⁹ Learners may **display** knowledge and values, which is then evaluated by teachers. Learners may **concur** with or **demur** from teachers and peers, but these do not carry the institutional weight of teachers' evaluations. They are therefore classified as options in ACCORDANCE rather than EVALUATION. On the other hand, both learners and teachers may solicit certain acts, and types of soliciting grade obligation as **invite**, **inquire** or **insist**.

Teacher roles are generalised simply as TEACHING, which includes both instructing and directing the interaction. The domain of INSTRUCTION includes

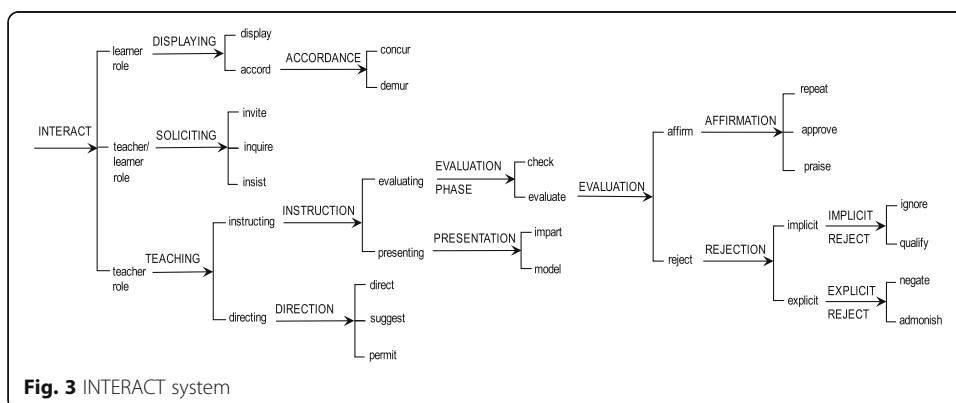
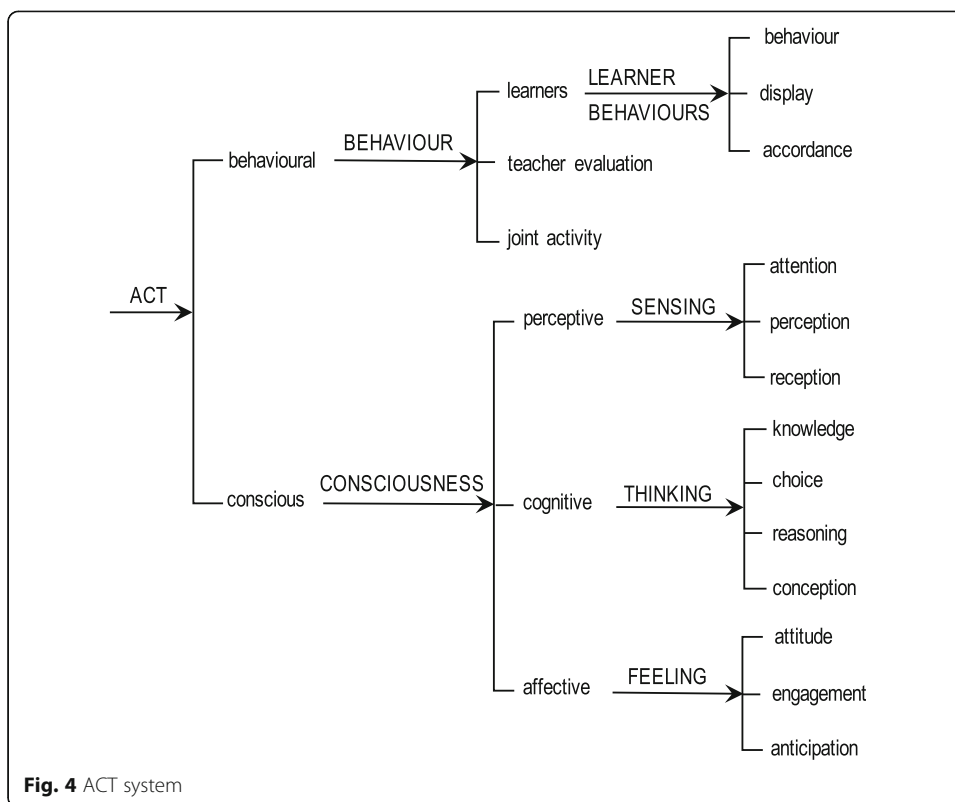


Fig. 3 INTERACT system



presenting knowledge and evaluating learners. Options in PRESENTATION are to **impart** knowledge verbally, or **model** it for learners to emulate. Evaluation completes an exchange, but prior to evaluating, teachers may check learners’ acts. The first choice in evaluating is thus EVALUATION PHASE: check/ evaluate. Evaluations are gradable. Affirmation may be graded by **repeating**, **approving** or **praising** the learner’s act. Rejection may be implicit by **ignoring** or **qualifying** the learner’s act, or made explicit by **negating** or **admonishing** it. Finally, teachers’ options for directing are also gradable as **direct**, **suggest** or **permit**.

Acts are distinguished between behavioural acts, which are directly observable, and conscious acts, which can be inferred from what interactants say and do. Types of behavioural act include learners’ knowledge **displays**, **accordances** with with teacher and peers, and other verbal and physical **behaviours**, teachers’ **evaluations**, and teaching/ learning **activities**. Teachers may solicit, direct and evaluate learners’ displays, accordance and behaviours; learners may solicit evaluations from teachers, and displays, accordance and behaviours from their peers; and learning activities may be directed by teachers or solicited by learners.

Conscious acts are classified in Fig. 4 as perceptive, cognitive or affective, reflecting the types of mental processes described in the transitivity systems of various languages (Caffarel, Martin & Matthiessen 2004). However, conscious acts may be realised in many ways other than mental processes in grammar. Perceptive acts are distinguished by sense: visual **perception**, verbal **reception**, or visual/verbal **attention**. Cognitive acts are distinguished by type of thinking: **knowledge** (knowing/remembering), **choice**, **reasoning** or **conception**. Affective acts have added emotional value. They are

distinguished by the orientation of feeling: **attitude** about persons, things and activities, **engagement** in an activity or text, or **anticipation** of activities to come.

The names for these types of conscious acts derive not from a psychological theory, but from the analytic process of classifying acts in exchanges. However they do correlate to some extent with types of conscious processing described in Edelman’s (1992) evolutionary theory of embodied consciousness, including perception, attention, memory (knowledge), concept formation (conception), value systems (attitude, engagement), planning (anticipation).¹⁰

Pedagogic relations involving learner’s behaviour and attitude are illustrated in Table 5, an extract from a curriculum macrogenre known as a youth justice conference (Caffarel, Martin & Matthiessen, 2004:166). What is being negotiated here is a young person’s (YP) attitude about a misdemeanour he has committed, receiving a stolen mobile phone. In Table 5, the conference Convenor (C) leads YP to state the required behaviour (apologising to the victim), by repeatedly inquiring about his behaviour, and approving it. As these exchanges are completed by evaluations, they are analysed as dK1^K2^K1.

In Table 6, the Convenor “guides the young offender towards expressions of remorse” (Zappavigna & Martin 2018:166). He is guided by inquiring his conception of his parents’ attitude, and then inquiring his own attitude, to which he repeatedly concurs. Again these are analysed as dK1^K2^K1 exchanges. In the first exchange the K1 affirmation is implicit; in the second the Convenor affirms the required attitude by repeating it, *you are (disappointed in yourself)*.

Options for pedagogic relations available to learners without teachers are illustrated in Table 7 (extracted from Wegerif, Mercer & Dawes 1999). This is a group interaction between Year 5 school students that these authors advocate as ‘exploratory talk’. The task is to identify a shape that matches certain criteria, from a set of alternative shapes on a test sheet. As there is no teacher, each student in turn assumes a K1 role and is challenged by another, who then assumes the K1 role. In terms of pedagogic relations, each student displays their choice of a shape, and another student demurs. S3 then goes further to display her reasoning, using the given criteria, to which S4 demurs and displays her own reasoning. The interaction proceeds in this manner, with each student displaying alternative reasoning (abbreviated here).¹¹ The debate is ended by the

Table 5 Negotiating behaviour in youth justice conference

	Role	sp	Interact	Act
Did you say anything to him [shaking head] when you found out that it was his phone?	dK1	C	Inquire	Behaviour
[shakes head] Nah.	K2	YP	Demur	Behaviour
So you didn’t say sorry to him? [shaking head]	cl	C	Check	Behaviour
(Nah), I said sorry and he goes “you don’t have to say sorry, it wasn’t you that did it”.	rcl	YP	Display	Behaviour
Right. [half nodding] OK.	K1	C	Approve	Display
Hey? So you’ve apologised to Jxxx already.	dK1	C	Inquire	Behaviour
Yeah.	K2	YP	Concur	Behaviour
OK.	K1	C	Approve	Behaviour

Table 6 Negotiating attitude in youth justice conference

	Role	sp	Interact	Act
Do you think that mum and dad were disappointed in you?	dK1	C	Inquire	Conception
[nods]	K2	YP	Concur	Conception
	(K1)			
[nods] Were you disappointed in yourself? Or not? Or you don't care?	dK1	C	Inquire	Attitude
[nods] Yeah.	K2	YP	Concur	Attitude
Yeah or you don't care? [nodding]	cl	C	Check	Attitude
Disappointed in myself.	rcl	YP	Concur	Attitude
[tilts head] You are.	K1	C	Repeat	Attitude
[nods]	K2f	YP	Concur	Attitude

approach of the teacher, which pushes the group to choose one shape for the teacher's evaluation. The inevitability of teacher evaluation is implicit in the authors' comment that this is 'the correct answer'.

Pedagogic modalities

The system of pedagogic modalities is the most complex system described to date for pedagogic register. It comprises resources for bringing meanings into each move of an exchange. Sources of meanings include the environment, verbal and visual records, and the knowledge of teachers and learners. In addition, meanings may be recorded as the exchange unfolds, and these records may become sources. Hence the primary systems in pedagogic modalities are SOURCE and RECORDING. Primary options in the SOURCE system are environment, record and speaking. Each of these options involves two simultaneous systems: one includes options for sources and the other the means of sourcing them into the exchange.

Table 7 Negotiating accordance in group interaction

	Role	sp	Interact	Act
I think it's number 4 to be honest.	K1	S1	Display	Choice
I don't,	ch	S2	Demur	Display
I think it's number 6.	K1		Display	Choice
I don't,	ch	S3	Demur	Display
I think it's number 3	K1		Display	Choice
look because that one (pointing) has that in the middle and it's got a half one in the middle.			Display	Reasoning
No	ch	S4	Demur	Display
because that one is that	K1		Display	Reasoning
I think it's that one.			Display	Choice
Mrs Dawes is coming.	K1	S2		
Do you agree on number 5? Do you agree on 5?	K2		Inquire	Accordance
[others presumably agree by nodding, DR]	K1		Concur	Choice
[writes '5']	K2f		Display	Choice

Environment sources

Table 8 illustrates options in environment and speaking systems. In the first three exchanges, the child indicates a **thing** in the environment (source), both gesturally and verbally (sourcing). The gesture **points** to the thing, and the verbiage **locates** it with a demonstrative, *dae/da* ‘that/there’. In exchange 3, the mother also locates the thing with a demonstrative, *that’s a bird*. With respect to speaking sources, the mother presents her knowledge at the end of each exchange, with the word *bird*. In exchange 1 this is **new teacher knowledge**. In 2 and 3 it is **restated teacher knowledge**. In 4 the child **recalls** these **prior moves** as *ba*.

Options for environmental sources are set out in Fig. 5. Sources are phenomena in the environment, which may be an **activity**, **persons**, **things** or **places**. Primary options for sourcing these phenomena are to name or indicate them.

Indicating involves two simultaneous systems, INDEXICAL TYPE: describe/point and INDEXICAL MODALITY: verbal/gestural, that are co-selected to produce further options. Verbal description may **compare** a phenomenon or relate it taxonomically as **class** to member or **part** to whole. Gestural description may **imitate** or **symbolize** a phenomenon. Verbal pointing **locates** phenomena in space with demonstratives or other items (*in the middle of, next to...*). Gestural pointing simply **points**.

Environmental sourcing is further illustrated in Table 9, in which a teacher is guiding a learner to dig for honey ants (*Camponotus* species) in Australia’s Western Desert. Demonstratives are used to **locate things** *this, that*, and **places** *here, there, over yonder*, along with other locative expressions, such as *other side*. Table 7 is directly translated from Pitjantjatjara (Rose 2001), suggesting commonalities of this curriculum genre across cultures.

Table 9 also displays further options in pedagogic relations, whose realisations are marked in italics. In exchange 1, the learner **invites evaluation** with a question, and the teacher **negates** his **perception**. In exchange 2, the teacher **directs activity** with a command, **approves** the **perception**, but then **negates** his **activity**. In exchange 3, the teacher **insists perception** with commands, *look...!* In exchange 4, the teacher finally **approves the activity**, and the learner **displays** his **perception** with *aha!*

Table 8 Pedagogic modalities in the pointing and naming game

		Role	sp	Sourcing	Sources	Interact	Act
1	[pointing at bird]		Ch	Point	Thing	Invite	Attention
	dae	K2		Locate	Thing		
	yes	K1	M			Approve	Perception
	bird			New	Teacher	Model	Knowledge
2	[pointing]		Ch	Point	Thing	Invite	Attention
	da	K2		Locate	Thing		
	bird	K1	M	Restate	Teacher	Model	Knowledge
3	[pointing]		Ch	Point	Thing	Invite	Attention
	da	K2		Locate	Thing		
	that’s	K1		Locate	Thing	Model	Knowledge
	a bird		M	Restate	Teacher		
4	[pointing]		Ch	Point	Thing		
	ba; ba	K2		Recall	Move	Display	Knowledge
	[yes]	K1	M			Approve	Knowledge

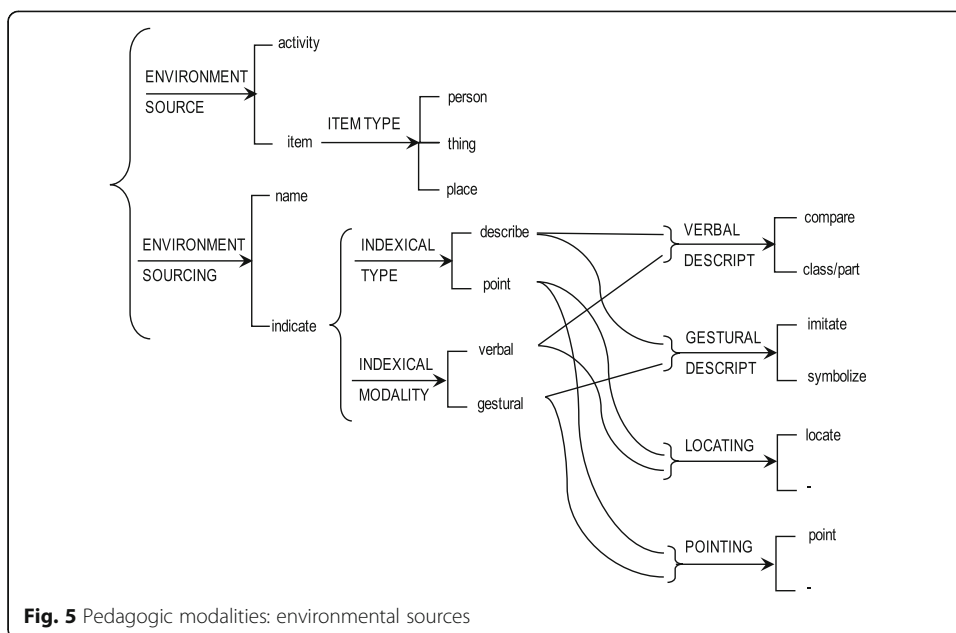


Table 9 Manual skills: digging for honey ants

		Role	Sourcing	Source	Interact	Act	
1	<i>What's this?</i>	L	K2	Locate	Thing	Invite	Evaluation
	[points to tiny hole]			point	Thing		
	<i>No that's no good.</i>	T	K1	Locate	Thing	Negate	Perception
2	<i>Throw more soil over here.</i>	T	A2	Locate	Place	Direct	Activity
	[points to other side of excavation]			Point	Place		
	<i>This?</i>	L	cl	Locate	Thing	invite	Evaluation
3	[pointing]			Point	Place		
	<i>Yes exactly, that hole there.</i>	T	rcl	Locate	Thing, Place	Approve	Perception
	[starts to dig]	L	A1				
4	<i>No, that's become no good.</i>	T	K1	Locate	Thing	Negate	Activity
	<i>Look, this is good.</i>	T	K1	Locate	Thing	Insist	Perception
	[pointing to other side]			Point	Place		
5	<i>Look, it's over yonder.</i>		K1f	Locate	Place	insist	Perception
	[pointing]				Place		
	<i>Dig away on the other side.</i>	T	A2	Locate	Place	Direct	Activity
6	<i>This?</i>	L	cl	Locate	Thing	Invite	Evaluation
	[pointing]			Point	Place		
	<i>Yes, that's it!</i>	T	rcl	Locate	Thing	Approve	Perception
7	<i>Try that there.</i>	T	A2	Locate	Thing, Place	Direct	Activity
	[starts to dig]	L	A1				
	<i>That's it!</i>	T	A1f	Locate	Thing	Approve	Activity
8	<i>Aha!</i>	L	A2f			Display	Perception

Recorded sources

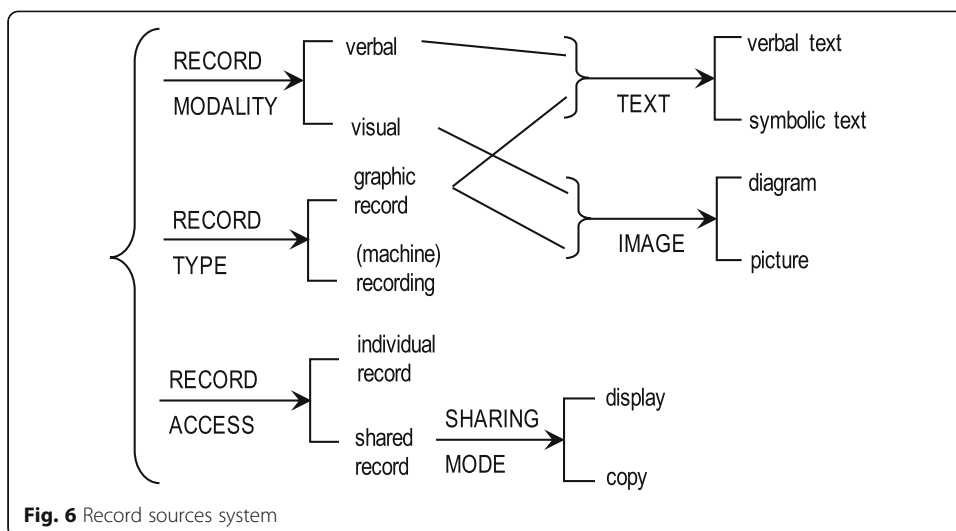
Record sourcing is illustrated in the biology lecture extract (Hao and Hood 2016), re-presented here as Table 10. Most of the sources are in the projected diagram of a kidney. The lecturer indicates parts of the kidney in the diagram, classifies them as *structures*, and compares them to *tongues, funnels* and *cups*. Sourcing in each move includes:

- 1) class *the basic structures*,
- 2) part *an outer and inner region*,
- 3–4) restate prior moves *the outer region, the inner region, any number of organs*,
- 5) locate and compare *these little tongues, this cup*,
- 6) locate *the thing*,
- 7) compare *it's almost like a funnel*,
- 8) locate *these, each one*,
- 9) locate, class and compare *this large structure here, this tube, essentially a funnel*,
- 10) locate *this part*. Move 10 also **recasts** the diagram as a verbal explanation.

Options for record sources entail three simultaneous systems: RECORD MODALITY, RECORD TYPE and RECORD ACCESS (Fig. 6). RECORD MODALITY is visual or verbal. RECORD TYPE includes audio and video recordings, or graphic records. Co-selection of visual with graphic record leads to a choice of images, between **pictures** or **diagrams**; verbal with graphic record leads to a choice of **verbal text** or **symbolic text** (such as mathematical formulae). The choice in ACCESS is between **individual** records

Table 10 Sourcing in multimodal biology lecture

		Role	Sourcing	Source	Interact	Act
1	So let's look at the basic structures of the kidney.	dK1	Class	Image	Invite	Perception
2	Like a lot of organs, the kidney has an outer and inner region.	K1	Part	Image	impart	knowledge
	[point at Image]		Point	Image	Invite	Attention
3	And like a lot of organs, the outer region is called the cortex, and the inner region is called the medulla.		Repeat	Prior		
4	So it's true for any number of organs.		Repeat	Prior		
5	You've got these little tongues – or papillae – of medulla, which are sitting in this cup of connected tissue.		Llocate	Image	Invite	Perception
	[point at Image]		Compare			
	[point at Image]		Point	Image	Invite	Attention
6	You can't see the whole cup, because the thing's been cut in half.		Llocate	Image	Invite	Perception
7	But you can imagine it's almost like a funnel around the papilla.		Compare	Image	Invite	Conception
	[point at Image]		Point	Image	Invite	Attention
8	And these are called calices – each one's called a calyx, which I think is Latin for cup, or something like that.		Locate	Image	Impart	Knowledge
9	Several of the cups – or calices – will combine to form this large structure here, which is the renal pelvis – which is essentially a funnel into this tube here.		Locate	Image		
	[point at Image]		Class			
	[point at Image]		Compare			
	[point at Image]		Point	Image	Invite	Attention
10	So, the urine is produced in this part of the kidneys, drains through the calices, into the pelvis, and down through the ureter.		Locate			
	Okay?	K1f	Recast		Check	Reception



or shared records, which may be shared as a **display** (such as a projector screen, white/blackboard or poster) or **copies** (books, photocopies, e-tablets).

Primary systems in record sourcing (Fig. 7) are SOURCING LANGUAGE and SOURCING MODE. The sourcing language may be the **same** as the source language, or **other** than the source language. This is a common option in bilingual classes and teaching other languages. The first choice in SOURCING MODE is between restating and indicating. Restatements may **repeat** or diverge from the source text. Degrees of divergence include **summarising**, **rephrasing** and **recasting** (illustrated in Table 10 above).¹² Only verbal records can be repeated in spoken exchanges, primarily by reading a written text aloud. In analyses this option this can be simply labelled as **read text**. Verbal records may also be summarised, rephrased or recast. In contrast, images and symbols must be recast in language to source their meanings into a pedagogic exchange.¹³ Options for **indicating** record sources are similar to those for indicating environment sources.

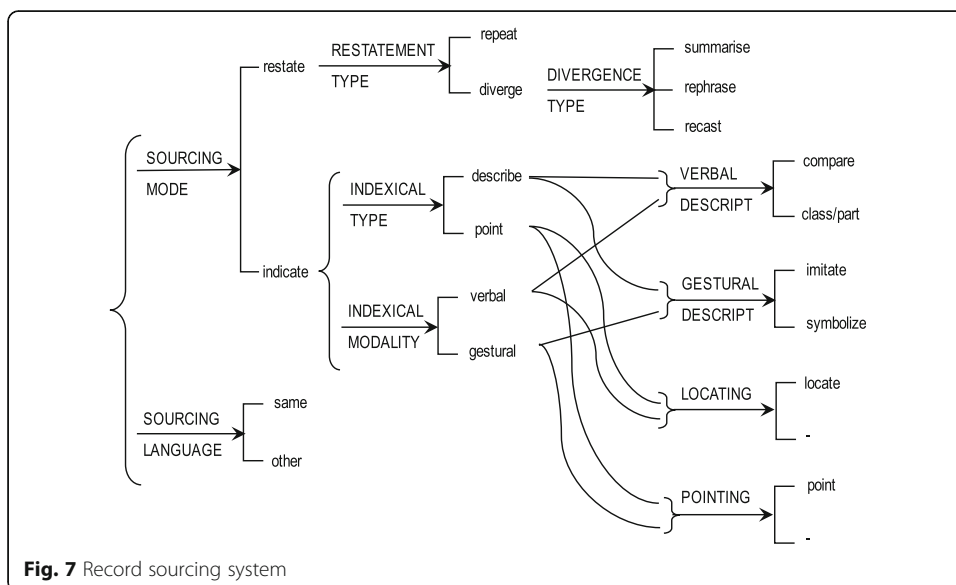


Table 11 illustrates options for sourcing from verbal texts, with an extract from a primary school reading lesson (from Rose 2017b). This is a curriculum genre known as detailed reading (Rose 2016, 2017a, Rose and Martin 2012). It begins with a monologue by the teacher who explains and reads a sentence, followed by an exchange in which learners are guided to identify and highlight a wording in the sentence.

In move 1 the teacher **locates** a sentence in the text, *the next sentence*. In 2 she **reminds** learners of the preceding sentence, *remember they said*. In 3 she **recasts** this preceding sentence with an inference, *so most people would be asleep*, and in 4–6 she **rephrases** the current sentence. This recasting and rephrasing prepares students to comprehend the sentence as it is read. In 7 she **locates** the sentence again, *in this next sentence*, and in 8 she **reads** it aloud.

In move 9 (Table 12), the teacher **directs** the **activity** to follow, *we'll have a look at it, and we'll break it up*, but first **models reasoning** for the activity, *it's a pretty long sentence*. In 10 she **locates** the target wording in the sentence, *first of all*. Moves 11–12 negotiate which student will respond; hands up **invites evaluation**, and the teacher **permits** one student to **display**. In 13 a student **reads** the wording aloud, *people*, and finally all students **mark** the wording in their copies. Text marking is an option in the RECORDING system, discussed below.

Table 11 also illustrates further options for acts and interacts. Move 1 **invites anticipation**, *now the next sentence tells us*. Move 2 **invites** learners to recall shared knowledge, *remember they said*. Move 3 **models reasoning** with the internal conjunction *so*. Move 7 **invites anticipation**, *so that's what will be talked about*. Move 11 is gestural [hands up], which **invites evaluation** by the teacher. In 12 the teacher **permits a display** by one student. In 13 the student **displays** her **perception** of the target wording *people*, and in 14 the teacher **praises** her **perception**, *fantastic*.

Table 11 Sourcing in detailed reading lesson, upper primary

	sp	ad	Role	Sourcing	Source	Interact	Act
1 Now the next sentence <i>tells us</i> that some people were awake, not all.	T	SS	K1	Locate	Text	Invite	anticipation
2 <i>Remember</i> they said, this was happening about 2 in the morning?				Remind	Text	Invite	Knowledge
3 <i>So</i> most people would be asleep.				Recast	Text	Model	Reasoning
4 <i>But</i> some people were awake, and they heard a sound that was a bit like a storm coming our way.				Rephrase	Text	Impart	Knowledge
5 <i>OK?</i>			tr			Check	Reception
6 And as the earthquake got closer, the ground started to shake.			K1	Rephrase	Text		
7 <i>So that's what will be talked about</i> in this next sentence.				Locate	Text	Invite	Anticipation
8 <i>So if we have a look at that</i> it says, 'Those people who were awake heard a sound like distant thunder, and as the first ripples of the earthquake sped towards the city the ground beneath their feet started to shake.'				Locate Read	Text Text	Invite	Attention

Table 12 Detailed reading lesson continued

9	It's a <i>pretty long</i> sentence, <i>so we'll have a look at it, and we'll break it up</i> into little bits.	A1	Locate	Text	Model	Reasoning
					Direct	Activity
10	First of all <i>who</i> heard and felt this earthquake approaching?	T SS	dK1	Locate	Text	Inquire Perception
11	[<i>hands up</i>]	SS	dA1			Invite Evaluation
12	Bonita?	T S1	A2			Permit Display
13	People?	S1	K2	Read	Text	Display Perception
14	People. Fantastic,	T S1	K1			Praise Perception
15	<i>Let's highlight</i> people. [highlight]	SS	A2			Invite Activity
		SS	A1	Mark	Text	

Participation

Table 11 also illustrates another system in pedagogic relations, PARTICIPATION. This is a set of options for learners to speak and be addressed as individuals, in groups, or as a whole class. Analysing participation is critical to identifying how many and which students in a class are addressed and speak, and how they are evaluated. It is often missed in classroom discourse analysis, as only speaking students are usually recorded in transcripts. In 1–10 the teacher addresses the class (SS), in 11 the students (SS) address the teacher with hands up, in 12 the teacher addresses an individual student (S1), in 13 this student speaks, and in 14 the teacher addresses the praise to her. Options in PARTICIPATION are set out in Fig. 8.

Speaking sources

Speaking sources are the knowledge of teachers and learners, which may be individual or shared knowledge (Fig. 9). If it is shared knowledge, the source may be a prior **move** in the lesson, or a prior **lesson**. Sourcing may involve teachers presenting their own knowledge or eliciting learners'. Teacher knowledge may be **new** or **restated**. (As with records, restating may repeat, summarise, rephrase or recast.) Elicitations may **remind** learners of shared knowledge or **enquire** of their individual **learner knowledge**. More delicately, teacher enquiries may be literal, which expect learners simply to recall knowledge, or inferential, which ask them infer an indirect relation between the question and the expected response. This distinction is picked up in learners response options, to **recall** knowledge or **infer** it from the teacher's enquiry.¹⁴

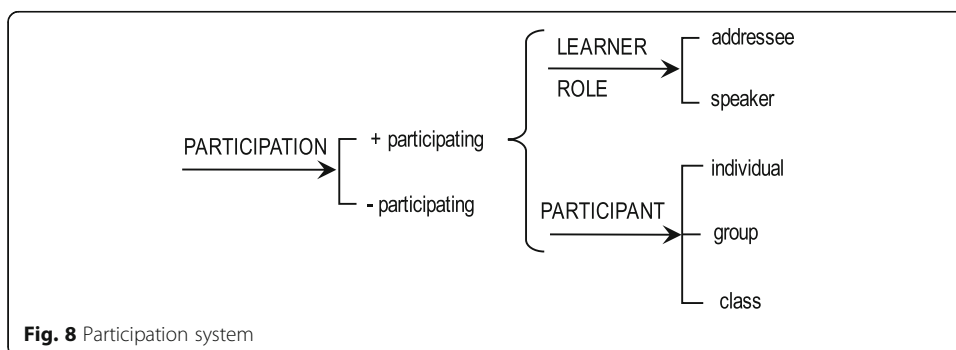


Fig. 8 Participation system

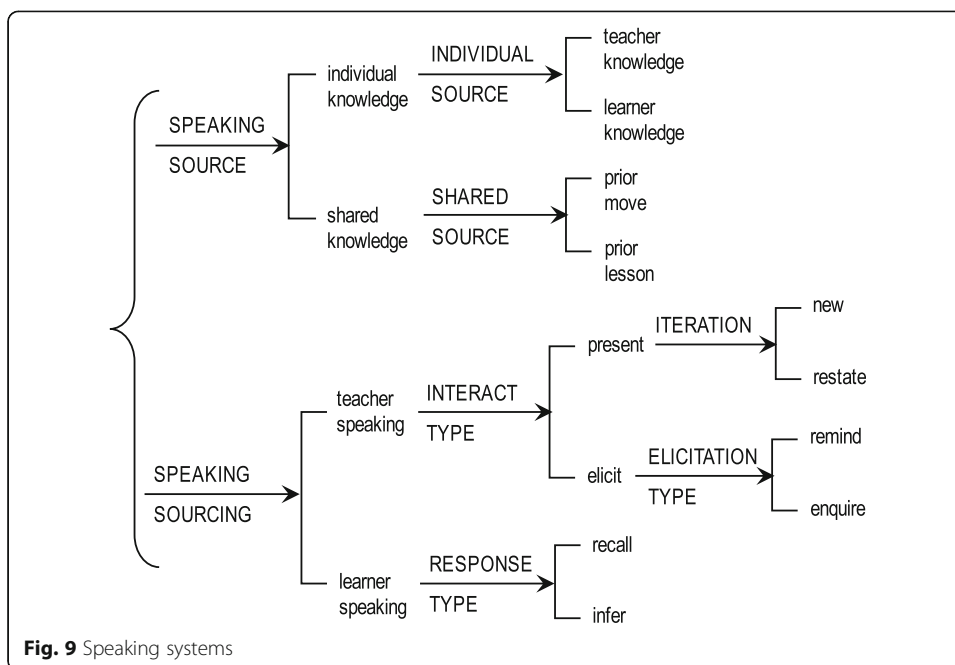


Fig. 9 Speaking systems

Table 13 illustrates contrasts between speaking sourcing and record sourcing. This is a shared book reading lesson with a year 1 primary class (from Williams 1995: 501). The story is *Jack and the Beanstalk*, and the first picture in it includes Jack, his mother and their cow.

The teacher reads the first sentence. She then initiates exchange 2 with a question that **enquires learner’s** individual knowledge, *what’s a widow*, but locates the answer in the **picture, inviting perception**, *it looks like a lady to me*. Accordingly S1 **infers an old woman** from the picture, but the teacher **qualifies** this reasoning, again locating criteria in the **picture**, *she doesn’t look too old*.

In exchange 3 (Table 14), the teacher again **invites perception** of the **picture**, *is there a daddy there*, but then switches in exchange 4 to **enquire learner knowledge**, by **inviting reasoning**, *what do you think has happened to the daddy?* However, S2 is still focused on locating the answer in the **picture**, and **displays** his **perception**, *it’s a little cow*, which the teacher **negates**.

In exchange 5, the teacher implicitly **invites reasoning** by presenting some **new teacher knowledge**, *when there’s a widow something’s happened to daddy*, without

Table 13 Sourcing in shared book reading lesson, early primary

	sp	ad	Role	Sourcing	Source	Interact	Act
1 Long ago in a far away land lived a widow and her son Jack.	T	Ss	K1	Read	Text	Impart	Knowledge
2 What’s a widow?	T	Ss	dK1	Enquire	Learner	Inquire	Display
It looks like a lady to me.			K1	Compare	Picture	Invite	Perception
What’s a widow?			dK1	Enquire	Learner	Inquire	Display
[hands up]		Ss	A1			Invite	Evaluation
Rhianna?	T	S1	A2			Permit	Display
An old woman	S1		K2	Infer	Learner	Display	Reasoning
Well she doesn’t look too old.	T	S1	K1	Locate	Picture	Qualify	Reasoning

Table 14 Shared book reading continued

3	Is there a daddy there?	T	Ss	dK1	Locate	Picture	Invite	Perception
	No.	Ss		K2			Display	Perception
4	<i>What do you think</i> has happened to the daddy?	T	Ss	dK1	Enquire	learner	Invite	Reasoning
	Looks like... a cow	S2		K2	Compare	Picture	Display	Perception
	David?	T	S2	cl			Permit	Display
	It's it's it's a little cow.	S2		rc1	Llocate	Picture	Display	Perception
	<i>No no.</i>	T	S2	K1			Reject	Perception
5	<i>When</i> there's a widow, something's happened to daddy.	T	Ss	dK1	New	Teacher	Invite	Reasoning
	He died? Miss, he died?	S3		K2	Infer	Learner	Display	Reasoning
	<i>Yes that's right</i>	T	S3	K1			Approve	Reasoning
6	A widow means that her husband has died	T	Ss	K1	New	Teacher	Impart	Knowledge

reference to the picture. This is a sufficient cue for S3 to **infer he died**. Finally in exchange 6, the teacher imparts the knowledge by presenting **new teacher knowledge**. This extract is a good illustration of the need to explicitly discuss types of sourcing in teacher education, amongst strategies for guiding learning.

Recording system

The RECORDING system (Fig. 10) comprises options for recording meanings during pedagogic activities, that may then become sources in the exchange. The first choice in this system is modality: writing or drawing. Writing involves two simultaneous systems, WRITING MODE: wordings or symbols, and WRITING TYPE: write text or annotate graphic record. A text written with wordings may be a **constructed text** or **notes**. A text written with symbols is a symbolic text, such as mathematical **expressions** or **calculations**. Graphic records, both verbal and visual, may be annotated with **notes** or **labels**. Finally three options for drawing include **marking** graphic records (e.g. underlining, highlighting, circling), drawing **diagrams** and drawing **pictures**.

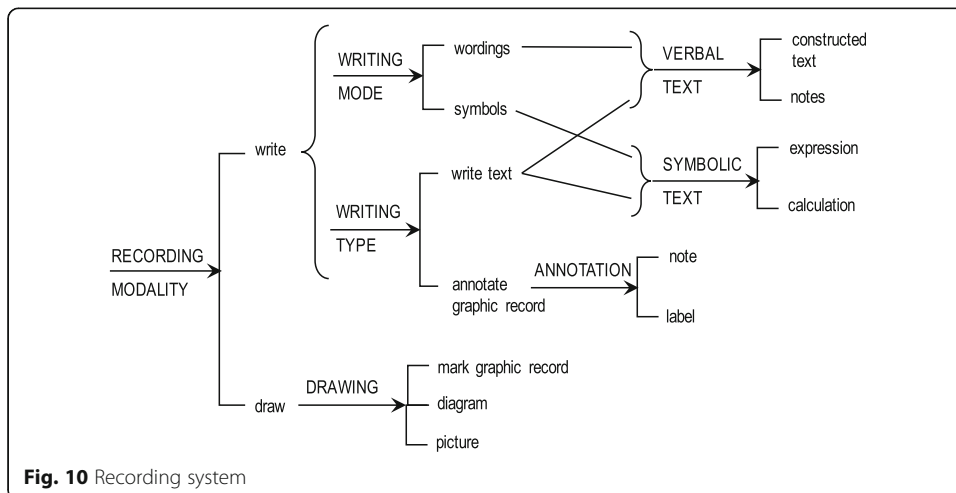


Fig. 10 Recording system

Table 15 illustrates options in the recording system. It is an extract from a secondary school maths lesson, in which the teacher is demonstrating, explaining and recording the steps to solve a problem in trigonometry. (See this lesson demonstration and transcript at NESAs 2017.) This involves a complex interplay of sourcing from knowledge and previously recorded text, recording by writing and drawing on the board, and using these records as further sources.

Table 15 Recording sources in maths lesson, junior secondary

	Role	Sourcing	Source	Interact	Act		
A							
1	OK	Step 3, let's use this information and draw this diagram	dK1	Locate	Expression	Suggest	Activity
		[draws right angle triangle]	K1	Draw	Diagram	Impart	Knowledge
		[labels sides and angles]		Write	Labels		
2	OK	Let's label angle L as theta.	dK1	New	Teacher	Suggest	Activity
		[Step3: Label L - L = θ]	K1	Write	Expression	Impart	Knowledge
		[labels angle with L and θ]		Write	Labels		
3	Step 3:	Write down all the information that is given in the question. And put all this information into a diagram.	K1	Recast	Expressions, Diagram		
		[points to diagram]		Point	Diagram		
B							
4	Step 4.	[Step 4:]	K1	New	Teacher		
				Write	Note		
5	Since this is a trigonometry question we're going to	write down all the trig ratios related to the question.	dK1	Classify	Text	Direct	Activity
		[points to diagram]		New	Teacher	Impart	Knowledge
				Point	Diagram		
6	We'll write down sine theta, cos theta and tan theta.	[lists on fingers]	dK1	Restate	Lesson	Direct	Activity
7	So looking from the sine of theta,	[Sin θ =]	K1	Restate	Move	Direct	Perception
		sine theta is equal to		Write	Expression		
		[points to diagram]		Rephrase	Expression	Impart	Knowledge
		opposite		Point	Diagram	Direct	Attention
		[points to opposite line]		Restate	Lesson	Impart	Knowledge
		divided by hypoteneuse.		Point	Diagram	Direct	Attention
		[points to hypoteneuse]		Restate	Lesson		
				Point	Diagram	Direct	Attention
8	Therefore MN	[Sin θ = MN]	K1f	Read	Label	Model	Reasoning
		divided by		Write	Expression		
		[points to hypoteneuse]		Rephrase	Expression		
		hypoteneuse		Point	Diagram	Invite	Attention
		[Sin θ = MN/9.2]		Restate	Lesson		
		which is 9.2.		Write	Expression		
				Rephrase	Label		

In exchange 1, the teacher **locates** *this information* in a list of mathematical **expressions** he has previously written on the board (data from a trig problem). He then **draws** a **diagram**, and **writes labels** on the diagram from the listed expressions. In 2 he presents **new teacher knowledge**, *label angle L as theta*, **writes this expression**, and **writes a label** on the diagram. In 3 he **recasts** the list of data and the diagram as a verbal procedure.

In exchange 4 (Table 15), the teacher **writes** a **note** *Step 4*, which he then proceeds to demonstrate. In 5 he **classifies** the question, *this is a trigonometry question*, then presents the content of Step 4, *write down all the trig ratios related to the question*. In 6 he **restates** these trig ratios from a prior lesson. In 7 and 8 he writes the ratio of *sine theta* in a series of micro-steps. He **reads** the **expressions** he is writing at each step, **points** to the **diagram**, **restates** the formula from prior lessons, **reads** the labels, **writes** this data in the expression, and **reads** it again.

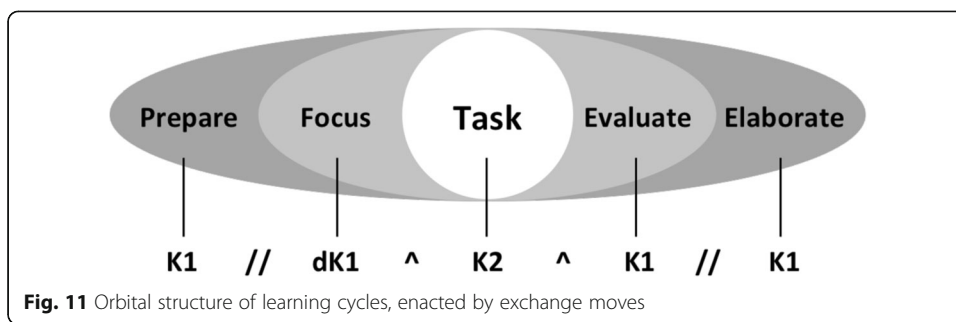
Pedagogic activity

The structuring of pedagogic activity has been described in Rose 2004, 2014, Martin 2006a, Martin and Rose 2007a, 2007b. The goal of this research has been to inform design of effective pedagogic practice, particularly scaffolding of reading (Rose 2007, 2017, Rose and Martin 2012, 2013). Rose 2014 describes a rank scale of pedagogic activity. The highest rank is a **lesson**, which is composed of one or more **lesson activities**, which are composed of one or more **learning cycles**. As with exchanges, units at each of these three ranks may be complexed into series. However, the structure within each unit is orbital, comprising nuclear and marginal elements, with variable sequencing. The nucleus is centred on a learning **Task**, through which knowledge is acquired/construed by learners. The Task is typically **focused** (specified) and **evaluated** by a teacher. In the marginal (optional) elements, learners may be **prepared** to succeed with the Task, and the knowledge acquired/construed in the Task may then be **elaborated**. These five structural elements are termed cycle phases, including Prepare, Focus, Task, Evaluate and Elaborate phases.¹⁵

At the rank of **learning cycle**, each cycle phase is enacted in discourse by exchange roles. In one common pattern, the learner's Task is enacted as a K2 role, the teacher's Focus is a dK1 role and Evaluate is the K1 role. The Focus may be a question, and the Task is to respond. Prepare and Elaborate phases are additional K1 roles. These relations between the orbital phases of learning cycles, and roles in exchange structures are diagrammed in Fig. 11. Double slashes between exchange roles indicate an exchange complex; learning cycles are typically enacted in discourse by exchange complexes such as this.

Tasks in learning cycles may involve **identifying** elements in texts and images, or **proposing** responses from learners' knowledge. Alongside the sequence of cycle phases, it is useful to identify the **matter** of each phase, i.e. the type of phenomenon that is being focused, identified, proposed, prepared and elaborated.

Table 16 is an extract from a parent/child reading session with an 18 month old infant (from McGee 1998:163). Horizontal lines mark learning cycle boundaries. First the child invites the activity by bringing the picture book *The Three Little Pigs*. In cycle 1 the mother attempts to focus the reading task, by pointing and reading the title on the cover. This phase is analysed as **focus people**, as the *little pigs* are the book's characters. However the child reads this as focusing on the **activity**, 'pointing and naming' so in cycle 2 she turns the page and **identifies a thing**, *tee*. She invites evaluation by looking at the mother, who approves and then **elaborates** by rephrasing the child's display,



modelling a whole clause and articulating the word *tree*. This cycle is repeated in 3, displaying, inviting evaluation and approving, but without elaboration.

In cycle 4 (Table 16) the mother **prepares** the child to recognise the activity in the picture, and invites her anticipation and engagement. She points at the image, names the **people**, *here are the little pigs*, and then recasts the illustrated **activity** verbally, *bye bye mama, we're going to build a house*, which invites anticipation of

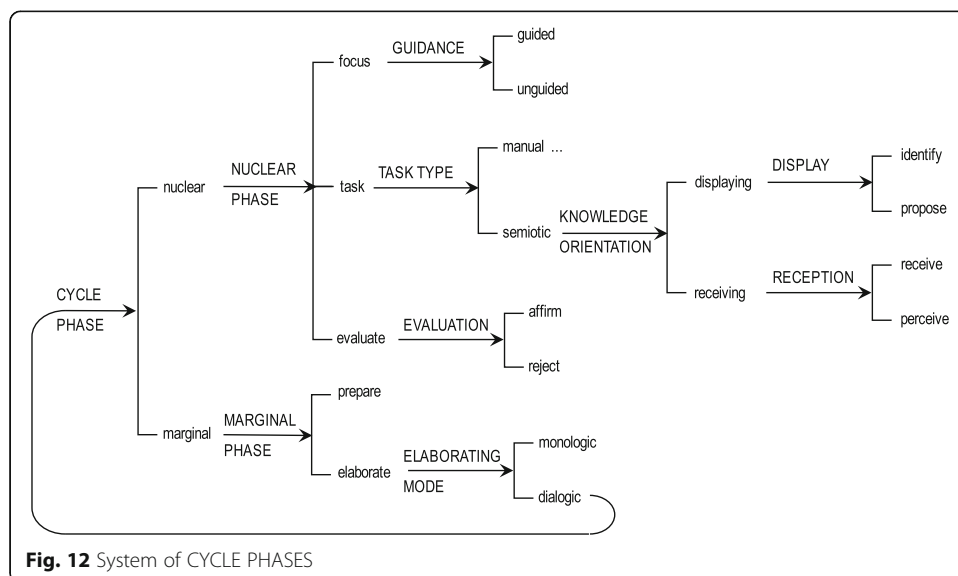
Table 16 Cycle phases in parent/child reading

	Role	sp	Phase	Matter	Sourcing	Source	Interact	Act	
A									
	[Brings book, sits on mother's lap]	A1	Ch				Invite	Activity	
1	[points to each pig on cover]	K1	M	Focus	People	Point	Picture	Direct	Attention
	<i>The three little pigs</i>					Read	Text	Impart	Knowledge
	[opens book and turns pages]	A1	Ch				Insist	Activity	
2	[points to picture of a tree]	K2	Ch	Identify	Thing	Point	Picture	Direct	Attention
	Tee					Recall	Learner	Display	Knowledge
	[looks up at mother]						Invite	Evaluation	
	Yes	K1	Ch	Evaluate	Affirm		Approve	Knowledge	
	It's a tree	K1f		Elaborate	Clause, sounds	New	Teacher	Model	Knowledge
3	[points to another tree in Picture]	K2	Ch	Identify	Thing	Point	Picture	Direct	Attention
	Tee					Recall	Learner	Display	Knowledge
	[looks up at mother]						Invite	Evaluation	
	Um, um	K1	M	Evaluate	Affirm		Approve	Knowledge	
B									
4	[points to each pig]	K1	M	Prepare	People	Point	Picture	Direct	Attention
	Here are the little pigs					Locate	Picture	Impart	Knowledge
	Bye bye mama			Activity		Recast	Picture	Invite	Anticipation
	We're going to build a house					Recast	Picture		
	[waves at picture]					Imitate	Picture	Invite	Engagement
	[laughs]		Ch					Display	Engagement
	[waves at picture]	K2		Identify	Activity	Imitate	Picture	Display	Knowledge
	[turns page]	A1	Ch				Insist	Activity	

the next episode. She then invites the child's engagement by waving at the picture, imitating the activity of the pigs' mother in the illustration. Accordingly, the child laughs, displaying engagement, and **identifies** the same **activity** by waving at the picture, displaying the knowledge she has just acquired. She then turns the page before the mother can affirm her display. The complexity here, of pedagogic relations and modalities within each cycle phase, illustrates the value of analysing all these dimensions of pedagogic register. The curriculum genre of parent/child reading is an intricate interplay of managing attention, engagement, anticipation, modelling and imparting knowledge, and sourcing meanings in text and images (Rose 2010, Williams 1995).

The system of CYCLE PHASES is set out in Fig. 12. The Focus may be **guided**, providing cues to support the learning Task, or **unguided**. Task types are manual or semiotic, but manual task types are not expanded on in this paper. Semiotic tasks are distinguished by knowledge orientation: displaying knowledge or receiving knowledge. Displays attract immediate evaluation, but knowledge reception precedes further tasks that may be evaluated later (such as answering comprehension questions or writing essays). As illustrated in Table 15, displays may **identify** elements in a text or image or **propose** knowledge. Reception may involve **receiving** knowledge verbally or **perceiving** visually. In the MARGINAL PHASE system, teachers' **elaborating** may be monologic or dialogic. If dialogic, the options in CYCLE PHASE are re-entered, with selections of focus, task etc.

Figure 13 sets out the MATTER system, which is more complex than CYCLE PHASES and invites further research. The first question is whether a cycle phase is concerned with the curriculum field, the pedagogic modality, or the pedagogic activity. A curriculum focus may be knowledge about field or about language. Knowledge about a field involves two simultaneous systems: the FIELD TYPE may be ostensive, i.e. perceivable with senses, or construed in text or image. The FIELD FOCUS may be an item or **activity**. An item may be a **thing, person, place** or **time**, together with its dimensions: **class, part** or **attribute** (see Hao 2015 on dimensionality of items).



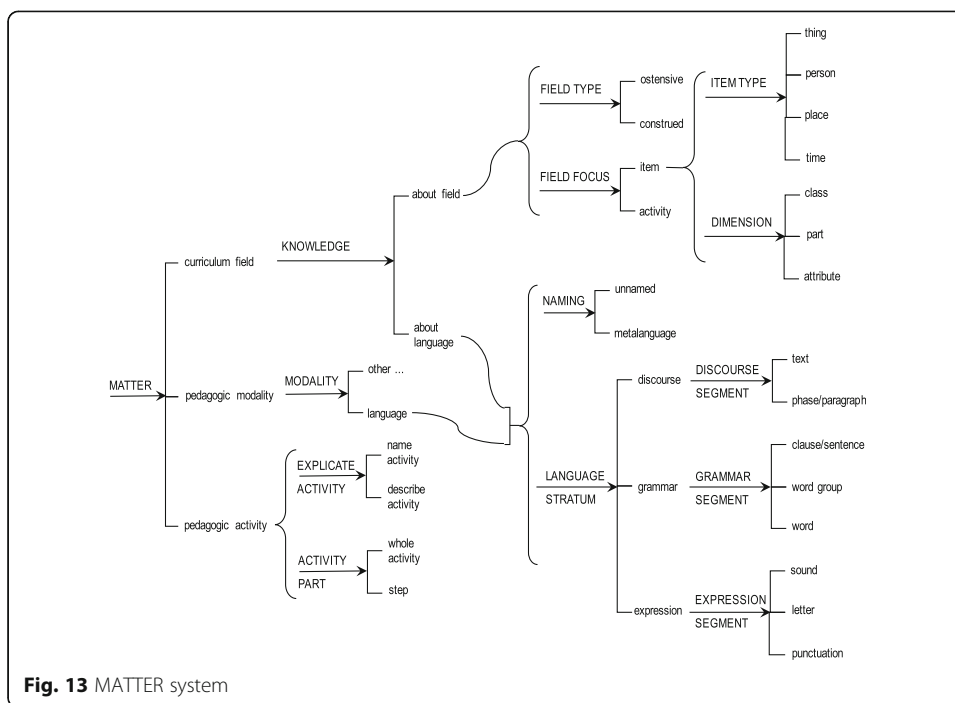


Fig. 13 MATTER system

Knowledge about language may involve using metalanguage to name a language segment. The segment may be at the stratum of discourse, grammar or expression. Discourse segments may be a text or text phase or paragraph. Grammar segments may be a sentence, clause, word group/phrase or word. Expression segments include sounds, letters and punctuation. These options could be extended in delicacy, but this may be sufficient for common educational purposes.

The same options are available if the cycle phase is concerned with language as the pedagogic modality. In this case, segments such as paragraph, sentence or word may be the domain of the learning task, whereas language as curriculum field is learning about such segments. In either case, a language segment may be named with metalanguage, or indicated without naming it. (Options for other pedagogic modalities are not expanded here.) If the cycle phase is concerned with the pedagogic activity, this may be the **whole activity** or a **step** in it, either of which may be explicated by **naming** or **describing** it.

Table 17 illustrates the activity structure and multiple potential functions of the dK1 Focus ^K2 Task ^K1 Evaluate pattern of classroom discourse. This is a later extract from the same trigonometry lesson as Table 15 (NESA 2017). Both cycles here are initiated with a dK1 focus question that provides guidance. The matter of both is an attribute of the trig problem. Each focus phase then includes a negotiation about which student will respond. A student identifies the attribute, and the teacher affirms and elaborates.

In cycle 1, the focus **locates** the attribute in the **shared text** and **invites reasoning**, *who can tell me the first important point?* The teacher then **insists** a **display**, *put your hands up*, students **invite evaluation** with hands up, and the teacher **permits** a display by S1. S1 **identifies** the attribute as *right angle triangle*, by **reading** the text. The teacher affirms by **repeating** this display. He then elaborates in three moves, first by

Table 17 Cycle phases in secondary maths lesson

	Role	sp	ad	Phase	Matter	Sourcing	Source	Interact	Act
1 <i>Who can tell me what's the first important point?</i>	dK1	T	SS	Focus	Attribute	Locate, recast	Shared	Invite	Reasoning
Put your hand up	A2							Insist	Display
[hands up]	A1	SS						Invite	Evaluation
Yes Jobchi	A2f	T	S1					Permit	Display
'Right angle triangle'	K2	S1		Identify	Attribute	Read	Text	Display	Reasoning
First it's a right angle triangle.	K1	T	S1	Evaluate	Affirm	Rephrase	Move	Repeat	Display
[It is a right angled triangle]	K1f			Elaborate	Step	Write	Note		
It is a right angled triangle.	K1f	SS				Read	Text		
First important point.	K1f					Restate	Move	Remind	Knowledge
2 Next one?	dK1	T		Focus	Attribute	Locate	Text	Inquire	Display
[hands up]	A1	SS						Invite	Evaluation
[points to student]	A2f	T	S2					Permit	Display
'Angle M is 90 degrees'	K2	S2		Identify	Attribute	Read	Text	Display	Reasoning
Angle M is 90 degrees.	K1	T	S2	Evaluate	Affirm	Restate	Move	Repeat	Display
[∠M = 90°]	K1f			Elaborate	Step	Write	Expression		

writing the answer as a sentence on the board, then **reading** it aloud, and then **recasting** it as a step in the activity, *first important point*. In cycle 2, the focus question **locates** the attribute in the **text** as *next one*, **inquiring** a **display** with a rising tone. S2 **identifies** this attribute, and the teacher again affirms by **repeating** this display. This time he elaborates the step by re-writing the answer as a symbolic **expression**.

The small sample in Table 17 illustrates a little of the pedagogic potential of the much maligned 'IRF' pattern of classroom discourse. In this case, the teacher's dK1 focus questions carefully guide students to appropriate responses, by precisely locating the answers in the shared text. With such guidance students' K2 responses can be consistently affirmed, as they read from the shared text. Elaborations then ensure equal access to the technical knowledge for all students, by repeatedly re-instantiating meanings in written and spoken language and symbolic expressions.

A greater degree of guidance can be provided by Prepare phases, illustrated in Table 18, a later extract from the same detailed reading lesson as Table 11 (Rose 2017b). In cycle 1, the dK1 focus questions ask students to identify a **thing** *what was it they heard?* A K1 preparation is also inserted that gives a precise position in the sentence, following the words *those who were awake heard*. A second focus question then emphasises that the target wording immediately follows, *heard what?* This combination of meaning and position cues provides a high degree of guidance for the identifying task. S4 identifies the word group *a sound like distant thunder*, which the teacher affirms and elaborates by directing the class to highlight the word group.

Cycle 2 (Table 19) is a dialogic elaboration of this identifying task. The curriculum goal is the metalinguistic term *simile*. The K1 prepare phase rephrases the text to focus on the comparative prepositional phrase *like distant thunder*. The dK1 focus question invites students to display their knowledge, adding a memory prompt from a prior

Table 18 Preparation and dialogic elaboration in detailed reading lesson

	Role	sp	ad	Phase	Matter	Sourcing	Source	Interact	Act
1 <i>Now, what was it they heard?</i>	dK1	T	SS	Focus	Thing	Locate	Text	Inquire	Perception
<i>It says those who were awake heard.</i>	K1			Prepare	Activity	Locate	Text	Invite	Attention
Heard what?	dK1			Focus	Thing	Locate	Text	Inquire	Perception
[hands up]	dA1	SS						Invite	Evaluation
William?	A2	T	S4					Permit	Display
A sound like distant thunder?	K2	S4		Identify	Word gp	Read	Text	Display	Perception
Fantastic,	K1	T	S4	Evaluate	Affirm			Praise	Perception
<i>So let's highlight sound like distant thunder.</i>	A2		SS	Elaborate	Word gp	Restate	Text	Invite	Activity
[highlight]	A1	SS				Mark	Text	Present	Knowledge
<i>Brilliant.</i>	K1f		S4	Evaluate	Affirm				

lesson. S5 proposes *simile*, which the teacher affirms, and further elaborates by inviting students to conceptualise a contrast between identification *it isn't the thunder* and comparison *but it's like thunder*. She then reminds them of prior discussions of this definition of similes.¹⁶

Table 20 illustrates both reception and display tasks, in a further extract from the biology lecture (Hao and Hood 2016). In move 1 the teacher prepares the task with an attribute of kidneys *two capillary beds*, inviting engagement by evaluating it as *unusual*. In move 2 he focuses on a part *this first one*, inviting perception *lets look at*, which frames the students' tasks as perception. Hence, the tasks in 3–4 are to **perceive** a part and attribute in the image, which the teacher locates and describes. In addition, the task in 4 to **receive** new knowledge, framed as a technical term *called the glomerulus*. In 5, students are invited to reason about this name, by **perceiving** a comparison with *a ball of wool, or a ball of twine*. In 6–7

Table 19 Detailed reading lesson continued

2 <i>Now we've got there that the sound was like distant thunder.</i>	K1	T	SS	Prepare	Attribute	Rephrase	Text	Invite	Perception
<i>Can anyone tell me what they call that, just before we move on, when something is said to be like something else?</i>	dK1			Focus	Metalg	Enquire	Learner	Invite	Display
[hands up]	A1	SS						Invite	Evaluation
[points to student]	A2	T	S5					Permit	Display
<i>A simile?</i>	K2	S5		Propose	Metalg	Recall	Learner	Display	Knowledge
<i>A simile. Right fantastic,</i>	K1	T	S5	Evaluate	Affirm			Praise	Knowledge
<i>So they're saying the sound is like thunder.</i>	K1		SS	Elaborate	Metalg	Rephrase	Text	Invite	Conception
<i>It isn't the thunder, but it's like thunder.</i>						Recast	Text	Present	Knowledge
<i>OK?</i>	tr							Check	Conception
<i>So we've talked about similes before.</i>	K1f					Remind	Lesson	Invite	Knowledge

Table 20 Cycle phases in biology lecture

	Role	sp	Phase	Matter	Sourcing	Source	Interact	Act
1 So the microcirculation of the kidney is unusual in that there are two capillary beds.	K1	T	Prepare	Attribute	New	Teacher	Invite	Engagement
2 <i>Let's look</i> at this first one.	dK1	T	Focus	Part	Locate	image	Invite	Perception
3 The first one has – like all capillaries – an afferent arteriole.	K1		Perceive	Attribute	Restate	lesson		
4 And here is the capillary bed, which is called the glomerulus.			Perceive	Part	Locate	Image		
5 It's called the glomerulus <i>because</i>			Receive	Name	New	Teacher	Impart	Knowledge
<i>it looks like</i> a ball of wool, or a ball of twine.			Perceive	Part	Compare	Image	Direct	Perception
6 <i>But here's the first thing</i> , which is <i>the unique thing</i> about this capillary bed.			Elaborate	Attribute			Invite	Engagement
7 It doesn't drain into a little vein – a venule. It drains into another arteriole.					New	Teacher	Impart	Knowledge

the teacher elaborates this attribute by evaluating it as *the first thing* and *unique*, inviting engagement, and explains why it is unique.

In 8–9 (Table 21), the teacher prepares by inviting reasoning about an activity of *arterioles*, and reminding about knowledge from prior lessons *because they've got a smooth muscle wing*. In 10 he asks a focus question about their activity, which restates the preparation *what can you do to them?* In 11, a student proposes an activity *you can contract them*, recalling the prior lesson and displaying reasoning. In 12 the teacher affirms by repeating this display, and in 13 he elaborates two classes of *arterioles*, restating prior mentions, and inviting reasoning *so think about that*.

Another consistent pattern across curriculum genres is intermodal re-instantiation. In its simplest form, gesture is re-instantiated as verbiage (pointing, locating, describing, naming), but as semiotic tasks become more complex, written wordings and images are re-instantiated as spoken wordings and symbolic expressions, and vice versa. Perhaps the most complex example here was Table 9 (NESA 2017), in which the teacher recorded a trig ratio by repeatedly pointing, restating and rephrasing elements of the expression from the text and diagram on the board, and from prior lessons, alternately directing students' attention, imparting knowledge and modelling reasoning. Table 22 is a short extract, analysed this time from the perspective of students' learning tasks.

Learning tasks in this extract switch back and forth between perceiving and receiving. Each one is explicitly framed by interacts and sourcing. In move 7 the teacher sets out a formula in a series of intermodal steps. The students' first task is to perceive an expression, as the teacher directs perception, *so looking at the sine of theta*, and writes the expression $\text{Sin } \theta =$. The next task is to receive this expression verbally, *sine theta is equal to*; the next to perceive a part of the diagram and receive it verbally as *opposite*; and then to perceive another part and receive it verbally as *divided by hypoteneuse*.

In move 8 the conjunction *therefore* frames the task as reasoning from this formula to the example on the board. The first task is to receive part of an expression, as the

Table 21 Biology lecture continued

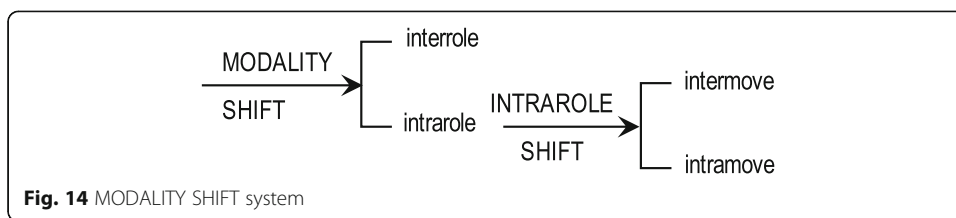
8	Now think about what you can do with arterioles.	K1	T	Prepare	Activity			Invite	Reasoning
9	Because they've got a smooth muscle wing,	dK1				Remind	Lesson		
10	what can you do to them?			Focus	Activity	Restate	Move		
11	You can contract them.	K2	S	Propose	Activity	Recall	Lesson	Display	Reasoning
12	Contract them.	K1	T	Evaluate	Affirm			Repeat	Display
13	So, think about that. So you've got an afferent arteriole, and an efferent arteriole.	K1f		Elaborate	Class	Restate	Move	Invite	Reasoning

teacher reads a label on the diagram *MN*; then to perceive the expression as it is written on the board, $\sin \theta = MN$; then to receive the expression part, *divided by*; then perceive a part of the diagram and receive the expression part *hypoteneuse*; then perceive the whole expression, $\sin \theta = MN/9.2$; and finally receive it verbally, *which is 9.2*.

Pedagogic register analysis reveals the complexity of this pedagogic practice. The analysis of sourcing and interacts, within and between moves, along with the matter under focus, shows how the learning task is construed by the teacher, and the intricate intermodal strategies he deploys to support his students to succeed with the task. The pace of intermodality is captured in the system of MODALITY SHIFT (Fig. 14). This system was described by Kartika (2016) to account for language shift in multilingual curriculum

Table 22 Perceive and receive tasks in secondary maths lesson

		Role	Phase	Matter	Sourcing	Source	Interact	Act
5	Since this is a trigonometry question we're going to write down all the trig ratios related to the question. [Point to diagram]	dK1	Prepare	Step	Classify	Text	Direct	Activity
					New	Teacher	Impart	Knowledge
					Point	Image		
6	We'll write down sine theta, cos theta and tan theta. [lists on fingers]	dK1			Restate	Lesson	Direct	Activity
7	So looking from the sine of theta, [Sin $\theta =$] sine theta is equal to [points to diagram] opposite [points to opposite line] divided by hypoteneuse. [points to hypoteneuse]	K1	Focus	Expression	Restate	Move	Direct	Perception
			Perceive	Expression	Write	Expression		
			Receive	Expression	Rephrase	Expression	Impart	Knowledge
			Perceive	Part	Point	Image	Direct	Attention
			Receive	Expression	Restate	lesson	Impart	Knowledge
			Perceive	part	Point	Image	Direct	Attention
			Receive	Expression	Restate	Lesson		
			Perceive	Part	Point	Image	Direct	Attention
8	Therefore MN [Sin $\theta = MN$] divided by [points to hypoteneuse] hypoteneuse [Sin $\theta = MN/9.2$] which is 9.2.	K1	Receive	Expression	Read	Label	Model	Reasoning
			Perceive	Expression	Write	Expression		
			Receive	Expression	Rephrase	Expression		
			Perceive	Part	Point	Image	Invite	Attention
			Receive	Expression	Restate	Lesson		
			Perceive	Expression	Write	Expression		
			Receive	Expression	Rephrase	label		



genres, but is generalised here to describe modality shifting across all systems of pedagogic modalities, including multiple languages. Modality shifting may be more common between roles or between moves within a role, but Table 14 illustrates how it may occur rapidly within moves.

Conclusion

The structuring of pedagogic registers

Descriptions of semiotic systems attempt to generalise features from instances of text. For example, descriptions of the grammar of MOOD in various languages classify clause structures as imperative, interrogative or declarative (Halliday 1994, Caffarel, Martin & Matthiessen 2004). But explaining the system requires two steps up in abstraction (Figueroa 2016). The first step is beyond language to register, where speakers demand and give commodities, material or semiotic. The second step is back into language, to the discourse semantic system of SPEECH FUNCTION, where speakers’ interactions are realised as sequences of commands, offers, questions and statements. Similarly, the discourse system of NEGOTIATION is explained at register level, as exchanges of knowledge or action, by speakers in various roles.

Each of these systems contributes to the realisation of social relations as language, but they do so in patterns that are highly generalised. These language patterns can be used as a guide for interpreting patterns of register, but not as a substitute for analysing register on its own terms. Hence a description of a specific register system such as pedagogic relations may usefully start from a model of interaction between speakers in certain roles exchanging certain ‘commodities’. In the case of pedagogic relations, these are roles of learners and teachers exchanging types of behaviours and consciousness. In the description here, these exchanged ‘commodities’ have been termed acts, and the processes of exchanging them as interacts. Lesson analyses suggest that each move in an exchange enacts a distinct function in pedagogic relations, by co-selecting an act with an interact.

The features of the system emerge by generalising these functions from corpus analyses. As systems are networks of choices, their organisation emerges from mapping the delicacy of these choices. So while the general themes of interpersonal language systems (of speakers taking roles to exchange commodities in sequences) are discernible in the pedagogic relations system, its organisation and details of the are unique to itself. They are explained by taking a step up in abstraction, to the cultural function of curriculum genres, in Bernstein (1990/2003) terms ‘cultural reproduction and transformation’. As teachers are vested with greater knowledge and authority by these institutional functions, their options for interacts are most diverse - soliciting responses, directing activities, presenting knowledge and evaluating learners. But equally significant are learners’ acts and interacts, including perceiving, receiving, attending, recalling, choosing, reasoning, conceiving, evaluating, engaging,

anticipating. These options indicate a social model of consciousness as unfolding pedagogic relations, that is remarkably consistent across the diverse curriculum genres here, but far removed from the metaphors of cognitivist and constructivist theories, of individuated minds as container, computer or constructor (Edelman 1992, Matthiessen 1993).

What is solicited, presented, evaluated, perceived, thought and felt in pedagogic relations are meanings. These meanings must come from somewhere, and must somehow be brought into the exchange. Hence the first choice in the system of pedagogic modalities is the sources of meanings – the knowledge of teachers and learners, phenomena in the environment, or recorded texts and images. Each of these domains then has its own clusters of source types, and means of sourcing them into the discourse.

The options for sources and sourcing are the most complex amongst pedagogic register systems. In discourse, both sources and sourcing shift rapidly from move to move in an exchange, and may even shift rapidly within moves. This complexity points to the intricate processes that have evolved in human cultures for construing shared meanings in pedagogic practices. Most complex of all are the systems that have evolved most recently for recorded sources, including processes of recording them as lessons unfold. It is noteworthy that options for indicating meanings in recorded sources are similar to those for indicating phenomena in the environment. A key difference is that environmental sourcing turns these phenomena into meanings, whereas recorded sources are already semiotic phenomena. As the latter entail recently evolved pedagogic practices in literate cultures, there are implications for the needs of learners from non-literate cultures, and the training of teachers to meet them. Table 16 illustrates the literate cultural practice of parent/child reading; Table 14 illustrates ineffective teaching of recorded sources; Tables 11, 15, 17, 18 and 20 illustrate effective teaching.

Meanings are negotiated in pedagogic relations, and sourced in pedagogic modalities, in the service of the learning task at the centre of each cycle of pedagogic activity. It is through these tasks that learners construe the knowledge and values of curriculum registers. To this end, pedagogic activities are organised in phases of learning cycles, with the learner's task at the centre, preceded by teachers' roles, preparing and focusing the task, and followed by evaluation and elaboration. The matter of each phase is the curriculum field, the pedagogic modalities, or the activity itself. The default discourse pattern is for each cycle phase to be enacted by one exchange role, but a phase may be enacted by a series of roles. With variations, it is remarkable how universal is the structuring of learning cycles (at least where a teacher is present to focus and evaluate tasks). As with pedagogic relations and modalities, these structures seem to have evolved as a fundamental human resource for cultural reproduction (Rose 2006).

These are some broad patterns of pedagogic practice that are displayed by mapping teachers' and learners' choices as system networks of semiotic options. But this is far from a complete description of curriculum genres, which requires two further descriptive steps. One is a step up in rank, from learning cycles to lesson activities. Each phase of a lesson activity is composed of one or more learning cycles, which serve distinct functions in the activity. Identifying these functions requires another descriptive step, from pedagogic to curriculum register. To describe how knowledge and values are built up through a lesson, three factors in the curriculum register need to be identified for each learning cycle phase. These include the specific phenomenon the phase is concerned with, its relation to the unfolding

field, and values ascribed to it. There is not the space to illustrate such analyses here, but see Rose (2014) for examples.

For the purposes of analysing pedagogic discourse, the networks here allow us to interpret pedagogic practice in close detail, with empirical consistency and coherence. The terms used for each feature, facilitate a commentary that is technical but accessible. For example, we can interpret pedagogic activity, modalities and relations in a single coherent sentence. “In cycle 1, the focus **locates** the attribute in the **shared text** and **invites reasoning**, *who can tell me the first important point?*” These kinds of statements recast moves in a pedagogic exchange as a set of principled choices by teachers and learners. Because they are generalised with consistent terminology, they can be compared and classified as types of choices. As a lesson unfolds in series of such choices, we can then generalise empirically about how learning occurs with various types of pedagogic practice. By extension, we can then use this information to design practices that are effective for different types of learning tasks and different communities of learners.

It is hoped that this pedagogic analysis and design practice offers an advance over criteria for analysing pedagogic discourse that are intuitive, or imported directly from other disciplines such as psychology, linguistics or statistics. Of course, effectiveness in terms of educational outcomes will always be one criterion. For evaluations of the effectiveness of the analysis and design practice illustrated here, see Carusi-Lees (2017), Culican (2006), Löfstedt & Rose (2015), Martin & Rose (2017a, 2017b), Rose and Martin (2012, 2013), Shum et al. (2016).

Endnotes

¹I am indebted to Harni Kartika and Lucy McNaught for the challenges in their pedagogic research that inspired the development of these systems, to Giacomo Figueero for rigorous guidance in developing the system networks in this paper, and to Claire Acevedo and Jim Marin for their unflagging support.

²Halliday 1978 applies the term ‘register’ to syndromes of semantic features realising contextual variables, whereas Martin 1992 applies it to contextual variables realised by semantic features. Both senses refer to relations between tenor/field/mode and meta-functions of language.

³One factor in Bernstein’s insistence was his struggle against progressivist/constructivist theories that seek to deny teachers’ roles, and hence the pedagogic relation itself.

⁴At the level of discourse semantics ‘knowledge’ is a technical term for this type of exchange, distinct from its usage at the level of curriculum register.

⁵A move is typically realised in grammar by a clause selecting independently for mood, or an ellipsed or minor clause (Martin 1992: 57). A stratified language model is assumed here, where patterns of discourse are realised in patterns of grammar (in formal SF terms, discourse semantics and lexicogrammar).

⁶The term act was used by the Birmingham school to postulate an exchange rank below the move, but Martin (1992: 51–57) critiques this proposal as already accounted for at the level of grammar. The term interact is used informally by Halliday & Matthiessen (2014: 107), “an ‘act’ of speaking is something that might more appropriately be called an **interact**”, and Martin (1992: 31) “consider two central MOOD systems, which classify English clauses as three basic types of interact”, without specifying the stratum it refers to. Both terms will be used here for units in pedagogic register.

⁷Hao and Hood (*in press*) offer an illuminating multimodal analysis of enactment of values in this biology lecture, through gesture and language.

⁸Seen from ‘below’, from the discourse rank of speech function, the initiating role in Table 3 appears to demand an action *let’s look*, but at the rank of exchange it initiates a knowledge exchange, which realises a phase in a curriculum genre. It is thus a dK1, not an A2 role. The dK1^K1 structure of this lecture segment represents a further K1 initiating option for exchange structure.

⁹Institutional authority applies to all types of pedagogic relations such as parent/child, doctor/patient, welfare officer/client, master/apprentice, as well as formal teacher/student relations in schools and further education (Bernstein 2000).

¹⁰The terms perception, reception and conception were inspired by Hao and Hood 2016. The term engagement is adapted from its common usage as affective engagement in a text, topic or personality. This is different from its usage as a system of voicing of appraisals in discourse semantics.

¹¹It would be interesting to know whether the students’ reasoning in Table 5 had been previously modelled by the teacher, and if so how it was modelled.

¹²These degrees of restating and diverging overlap with Martin’s (2006b) degrees of ‘intertextual relations’, of quotation, paraphrase or retelling.

¹³Note the dissonance here with the notion of ‘reading images’.

¹⁴Limiting learners’ sourcing options to responding may appear overly constrained, as learners do ask questions and proffer knowledge. Soliciting is an option for learners in the INTERACT system, but it is the teacher who presents knowledge, while learners display their knowledge for evaluation.

¹⁵Cycle phases are written here with initial capitals as they are function structures realising features in the cycle phase system.

¹⁶In common teaching practice, similes are defined as comparative, in contrast to metaphor, which is defined as identifying one thing as another.

Authors’ contributions

The author read and approved the final manuscript.

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