Final Research Report

Social constructivist approaches to language learning in multilingual early and elementary years classrooms

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Executive Summary

Research focus

This research project has been commissioned by the International Baccalaureate Organisation to investigate literature related to professional learning practices in language education. In the first report, we document and discuss findings of stage one of the project, which involved a comprehensive literature review. The purpose of the review was to gain insight into the teaching and learning of language that is influenced by social-interactionist perspectives, and, in particular, the social-semiotic theories of Systemic Functional Linguistics. Findings were related to the current IBO framework and culminated in the formation of preliminary design principles for professional learning experiences that target PYP teachers.

This report forms the second and final report of our project. It is an extension of the original project brief, as we saw the possibility of not just creating design principles from a synthesis of literature, but also beginning the process of applying and testing these principles. We thus extended the original brief to a second 'implementation' stage, specific to the teaching of language and literature in PYP contexts. We report on our implementation and evaluation of professional learning with two teachers in one European and one Australasian PYP programme.

Our investigation of professional learning is driven by the overarching research question of:

I. How do teachers use semiotically-informed social interactionist perspectives on language learning within standards based curricula?

There are also two sub-questions:

II. To what extent and in what way do teachers use a metalanguage to talk about how texts work?

III. How does professional learning impact teachers' understanding and talk about language use?

IV. Is there any evidence of change in students' writing that can be related to professional learning?

These questions are explored through the collection and linguistic analyses of pre- and post-professional learning data, as outlined in our research methodology. Our comparisons focus on teachers' knowledge about language before professional learning and any shifts that occur related to their professional learning experience. We also investigate connections between the content of professional learning and students' subsequent engagement in preparing for and composing a written text.

Research Methodology – overview

The research approach taken in this study involves interpretive qualitative research. This approach involves detailed analysis to generate insights into texts that are not available in quantitative studies of large data sets. More specifically, we conduct a qualitative linguistic analysis in order to illuminate what teachers and students do in professional learning and classroom activity. An underlying assumption with this approach is that detailed analysis, such as the close linguistic analysis of language and other semiotic resources, is central to understanding pedagogic activities and pedagogic relationships (Hammond, 2011). Our qualitative approach is further informed by theoretical frameworks in the field of applied linguistics (Halliday & Matthiessen, 2004; Martin & Rose, 2007, 2008) and Design Based Research (DBR) approaches (Andersen & Shattuck, 2012; Reeves & McKenney, 2013; Reeves, Herrington, & Oliver, 2005). The main steps in our DBR sequence include: 1) *generating theoretically informed design principles;* 2) *cyclic testing of design principles;* 3) *evaluating;* and 4) *redesign of design principles.* These steps in two detailed case studies, in order to make generalisations about critical aspects in the design of professional learning experiences, in PYP contexts.

The case studies we present and analyse in this report involve the enactment of step two and three, in our DBR sequence. While step one involved generating the foundational design principles, step two involved their cyclic testing in the context of specific sites of professional learning and PYP classroom teaching. The data from step two is then analysed and evaluated in step three. The extended and detailed discussion and analysis of our

collaboration with teachers provides significant insights into the consolidation of our design principles.

Overview of key findings

A key finding of the project relates to the importance of the enactment of ongoing 'elbow to elbow' professional learning within teaching and learning contexts, which are immediately relevant to teachers. While such a model may require intensive resourcing initially, there is far more likelihood that knowledge is used and developed in meaningful classroom activity.

A further finding relates to the developing research partnership between the academic mentor and teacher. Teachers were guided to investigate how semiotic theory and a metalanguage developed from SFL theory could provide a toolkit for inquiry and to appreciate text inquiry as a focus of instruction. At the same time the academic mentor was challenged to investigate ways in which space for inquiry could be opened within the teaching learning cycle, foregrounding the shared interrogation of meanings which can occur as teachers model meanings in texts and gradually shift responsibility through guided and independent activity.

While image was used in both units primarily to open an inquiry into verbal text, our analysis of the two teachers' work enables a possible pathway for developing students' repertoire of semiotic understandings related to images as well as those for exploring verbal language in information reports.

Positive impacts were also found on students' developing language use, particularly in writing for scientific inquiry. Analysis of extended literacy practices revealed students' engagement in analysing and composing texts, distinguishing and using semiotic features of scientific register to take an expert role in informing audiences. Through these activities all students were guided to be *'multi-modal scientific writers'*.

Through insights gained from the professional learning stage of the project, a number of revisions to the foundational principles presented in stage 1 of the project are proposed. These changes involve amending and integrating the initial twelve individual principles to form eight revised principles to guide the future collaboration between PYP teachers/co-researchers and external mentors – specifically in professional learning which draws upon social-semiotic theories of language and learning to investigate how texts work.

Report Organisation

The research report is organised into a total of 8 sections, as outlined in Table 1, below.

Report sections
1. Introduction
2. Research methodology
3. Findings related to pre-intervention data

4. Findings and reflections related to professional learning: Case study 1 & 2
5. Evaluation of case studies 1 & 2
6. Revisiting the design principles
7. References
8. Appendices

Table 1: The report structure

List of abbreviations

IB International Baccalaureate

IBO International Baccalaureate Organisation

KAL Knowledge about language

PL Professional Learning

PCK pedagogic content knowledge

PYP Primary Years Programme

SFL Systemic Functional Linguistics

TLC Teaching and Learning Cycle

1. Introduction

This second and final report involves discussion and analyses of our professional learning collaboration with participating PYP teachers. It draws on findings from stage one of our research to apply and test our design principles in specific PYP contexts. We report specifically on our implementation and evaluation of professional learning with two teachers in one European and one Australasian PYP programme. The findings contribute to the refinement of the design principles.

In this introductory section, we revisit key findings from stage one of the project which inform our professional learning design and close collaboration with PYP teachers. In particular, we connect findings from the analyses of the IBO language framework and the synthesis of social-semiotically informed professional learning to stage two of our project. Please refer to report 1 and the methodology section of this report for discussion of the theoretical frameworks underpinning these analyses and findings.

IBO language framework (see full analysis in report 1)

The analysis of curriculum documents focused on how socio-cultural theories inform IB's current curricula documents about language teaching and learning. Our findings indicated the need for an overarching theory to connect language concepts and inform decisions for the selection and sequencing of language in classroom practice. Currently there is no emphasis placed on

developing and using a shared metalanguage with which teachers and students can identify and talk about specific language choices. In light of the fact that on-going feedback across units of work is valued, there is the potential for the IB curriculum framework to consider how a common metalanguage can assist with reflecting upon and assessing language use. As Gibbons (1999) argues, without a language framework it is difficult for:

> *teachers and students to reflect on language itself, so that teachers are guided in language planning and student assessment by an explicit model of language and can make explicit to students who are unfamiliar with the language of school how to use the registers associated with power and educational success' (*1999, p. 24*).*

A further finding was the absence of a teaching and learning model to guide teachers' choices about specific instructional steps to support students' literacy development. Concepts like 'scaffolding', for instance, tended to be discussed more in terms of configurations of student learners and less as examples of theoretically informed classroom activities. Given that reflection in both teaching and learning practices is a core feature of the IB curriculum framework, there is a need to identify and critique the value of specific models of instruction, in particular, how particular sequences of classroom activity in language learning target specific literacy goals.

Both these findings involve the process of drawing on teachers' knowledge of language and language learning. In this regard, research suggests that

professional learning needs to include knowledge from outside of teachers' collective knowledge base (Alton-Lee, 2008; Stoll, 2009; Stoll, Bolam, McMahon, Wallace & Thomas, 2006) in order to extend their existing 'horizons of observation' (Little, 2003, p. 917). Newly developed knowledge can then be integrated with existing pedagogic content knowledge and shared with monolingual and multilingual students for the benefit of their language development.

Social-semiotic theory in elementary teachers' professional learning (see full analyses in report 1)

The synthesis of professional learning studies related to social-semiotic theory involved 30 studies in elementary school contexts. Findings consistently showed a strong relationship between extending teachers' knowledge about language and supporting students' enquiry of how texts work. In particular, a systemic view of language can support teachers to recognise, connect and explain language patterns in texts targeted for composition as well as in texts students read and critique.

In terms of pedagogical practice, the review also found that teacher-guided analysis of exemplar texts provides a valuable context to support students' critical enquiry of texts. In this regard, a crucial finding is that a shared metalanguage (language about language) is imperative for investigating the meaning-making resources of texts. More specifically, a metalanguage informed by systemic functional linguistics was found to support students' confidence in composing valued curriculum texts and facilitate their

understanding of language use across curriculum contexts. In Shulman's (1986) terms, these findings highlight areas of Pedagogic Content Knowledge (PCK) that are related to language teaching and learning and essential for the successful integration of deep language knowledge in specific teaching and learning contexts.

The foundational design principles

The analyses of IBO language framework documents and the synthesis of past professional learning studies culminated in the formation of twelve design principles for professional learning in PYP contexts. These principles are listed below and organised into two groups: design principles to guide the development of teachers' Pedagogic Content Knowledge; and design principles to guide the enactment of professional learning. Collectively, these twelve principles informed the design and implementation of our professional learning with PYP teachers (see specific detail in the methodology section).

Design principles related to PCK

1. PYP teachers have invaluable knowledge of their specific teaching contexts (including of their students, PYP curriculum and policies, and the sequencing and planning of lesson activities) which needs to be drawn upon prior to and during professional learning. This will cultivate teachers' ownership of their professional learning.

2. PYP teachers' engagement with language knowledge of the language in texts that are used for curriculum learning is essential for changing language teaching and learning practices and thereby improving student learning outcomes.

3. Language knowledge needs to have a functional-orientation in order to support and be relevant to the practical inquiry of how language works in the PYP curriculum, including knowledge which enables PYP teachers and students to compare, contrast and critique the language patterns in texts.

4. The exploration of how language works needs to focus on how systems of language make meaning (in SFL terms a metafunctional perspective) and how these systems relate to the context in which texts are composed and received (in SFL terms register and genre).

5. Developing knowledge about language needs to attend to grammatical and expression level patterns within sentences and discourse patterns across texts.

6. The introduced language knowledge must connect to specific assessment tasks and thereby focus on the language that researchers and teachers have analysed as essential to the language development and success of PYP students.

7. Developing deep knowledge of language is best accomplished with specific guidance in how it can be explicitly and creatively shared with students as a resource for learning.

8. Metalanguage is crucial for mediating language learning, i.e. making language constructs accessible, relevant and fun to use in PYP classrooms.

9. For metalanguage to be accessible to PYP teachers and students, it needs to involve a range of ways to identify and talk about language, such as the use of technical and non-technical terms, body movement, gesture and intonation etc.

Design principles related to enactment

10. For professional learning to be successful and sustainable PYP teachers need on-going support from expert mentors as well as collaboration within school communities and PYP networks.

11. Analysing and assessing the impact of professional learning practices in schools that host PYP requires the collection of data before and after professional learning activities, including data that enables the connection between knowledge, changed classroom practices and change/lack of change in the learning of students.

12. Iterative cycles of professional learning activity with PYP teachers support the gradual refinement of PL design and content.

The overall aim of this report is to revisit the foundational design principles from stage one (above) in light of findings from our professional learning. Our investigation is framed by the overarching research question of:

How do teachers use semiotically-informed social interactionist perspectives on language learning within standards based curricula?

This question and related sub-questions are explored through the collection and linguistic analyses of pre- and post-professional learning data, as outlined in our research methodology, as well as analysis of data from the collaborative research partnerships that emerged through the project.

The report begins with an explanation of our research methodology. We then analyse and discuss the findings related to data before professional learning. This is followed by detailed analysis and discussion of two case studies with PYP teachers in one European and one Australasian context. Finally, we discuss the foundational design principles in light of our research findings.

2. Research Methodology

While stage one of the project comprised of an extensive literature review (see Introduction), stage two involved the design of language and literacy interventions to conduct professional learning in schools with existing PYP programs. This design responds to IBO's interest in 'successful implementation' of professional learning that focuses on language in the elementary and early years setting (as per the research project brief). In this report we provide two detailed accounts of professional learning (see section 4). Before the analysis and discussion of these case studies, this section provides an overview of our research approach, theoretical framework, methods of analysis and design steps. We also relate the design to findings from stage one of the project, which culminated in the generation of design principles for professional learning with PYP teachers.

The specific research question that relates to stage two of the project was presented in report 1. It is reproduced here as a point for reference for choices made about the research design. The overarching question is:

How do teachers use semiotically informed social interactionist perspectives on language learning within standards based curricula?

Additionally, during the design of stage two, three sub-questions were formed:

1. *To what extent and in what way do teachers' use a metalanguage to talk about how texts work?*

2. *How does professional learning impact teachers' understanding and talk about language use?*

3. *Is there any evidence of change in students' writing that can be related to professional learning?*

2.1 A qualitative research approach

The research approach taken in this study involves interpretive qualitative research. This approach involves detailed analysis of curriculum documents, classroom talk, interviews with teachers, students' writing samples to generate rich insights into cases that are not available in quantitative studies of large data sets. More specifically, we conduct a qualitative linguistic analysis of classroom talk in order to illuminate what teachers and students do in professional learning and classroom activity. An underlying assumption with this approach is that detailed analysis, such as the close linguistic analysis of language and other semiotic resources, is central to understanding pedagogic activities and pedagogic relationships (Hammond, 2011). Our qualitative approach is further informed by theoretical frameworks in the field of applied linguistics (Halliday & Matthiessen, 2004; Martin & Rose, 2007, 2008) and supplemented by Design Based Research (DBR) approaches (Andersen & Shattuck, 2012; Reeves & McKenney, 2013; Reeves, Herrington, & Oliver, 2005).

2.2 Theoretical frameworks informing analysis

While qualitative researchers may generally agree that language and social interaction play a key role in the construction of knowledge (Mercer, 2004), they are conducted within a range of theoretical frameworks. In this study, we respond to the research brief by drawing on social-semiotic theories of language within the tradition of Systemic Functional Linguistics [SFL] (Halliday, 1975; Halliday & Hasan, 1976, 1985; Halliday & Matthiessen, 2004; Martin, 1992; Martin & Rose, 2007; Martin & White, 2005). SFL provides a distinctive and robust theoretical framework largely due to its focus on the complexity of language and how specific patterns of language use relate to context. It is a framework that is relevant to investigating the process of language teaching and learning because it theorises how people use language and other semiotic resources to make meaning and thereby provides specific tools with which to investigate our meaning-making resources, that is, how texts work.

Two core components of its theoretical architecture are now briefly reiterated from report 1, as they provide the basis for understanding the treatment of data (see section 2.3).

2.2.1 Metafunctions as meaning organisers

SFL proposes that social interaction involves choices about three simultaneous strands of meaning, called metafunctions (Halliday & Matthiessen, 2004). These strands are ideational, interpersonal and textual meanings. Ideational

meanings which construe different kinds of social activity and their relationships can be further delineated as experiential and logical metafunctions; interpersonal meanings enact social relationships; and textual meanings involve resources to organise language into coherent text (Martin & Rose, 2008). The three metafunctions of language provide simultaneous perspectives on meaning-making activity. Crucially, a metafunctional perspective allows language to be viewed in terms of the role it plays in enacting the particular contexts. Relevant contextual variations include: the field or subject matter – the WHAT; the tenor, including roles and relationships of interactants – the WHO; and the channel or mode of communication – the HOW. Table 2.1 represents the relationship between these aspects of context and the systems of language which realise them.

Contextual Variable	**Metafunctions – systems of language choices**
Field	Ideational • Experiential • Logical
Tenor	Interpersonal
Mode	Textual

Table 2.1 Dimensions of context and the language systems through which they are encoded

2.2.2 Strata or layering of meaning

SFL describes the relationship between context and language in terms of strata. SFL further conceptualises social activity with more to less abstract layers of meaning. The most abstract perspective is that of genre (Martin, 1992; Martin & Rose, 2008). This layer of social activity involves 'recurrent configurations of meanings' which have a certain degree of predictability within cultures (Martin & Rose, 2008, p. 6). Different genres achieve different social purposes and the semiotic choices that encode them provide insights into how language practices develop and change over time. Genres are related to and distinguished from each other by specific configurations of the contextual variables of *field*, *tenor* and *mode,* as introduced above. These three dimensions are collectively known as *register*. They refer to the general 'functional domains' of any immediate social situation (Halliday, 1978; Halliday & Hasan, 1985; Halliday & Matthiessen, 1997). The remaining three less abstract layers all theorise texts in their context of use in relationships of realisation. That is, a higher level pattern is encoded by semiotic patterns in the next lowest level. The level of discourse semantics (see Martin, 1992; Martin & Rose, 2007) encompasses meanings that unfold and accumulate across texts, above the level of clause. The next lowest level is lexicogrammar (Halliday & Matthiessen, 2004), which includes the language functions and forms within clauses. Finally, the expression level involves phonological and graphological resources for sounding and scribing patterns of meaning. Each of these 'text in context' layers is represented by tangent circles in Figure 2.1, below the more abstract layers of genre and register. The overall aim of SFL's

modelling of language and context is to theorise cultural activity, including language teaching and learning, as semiotic activity.

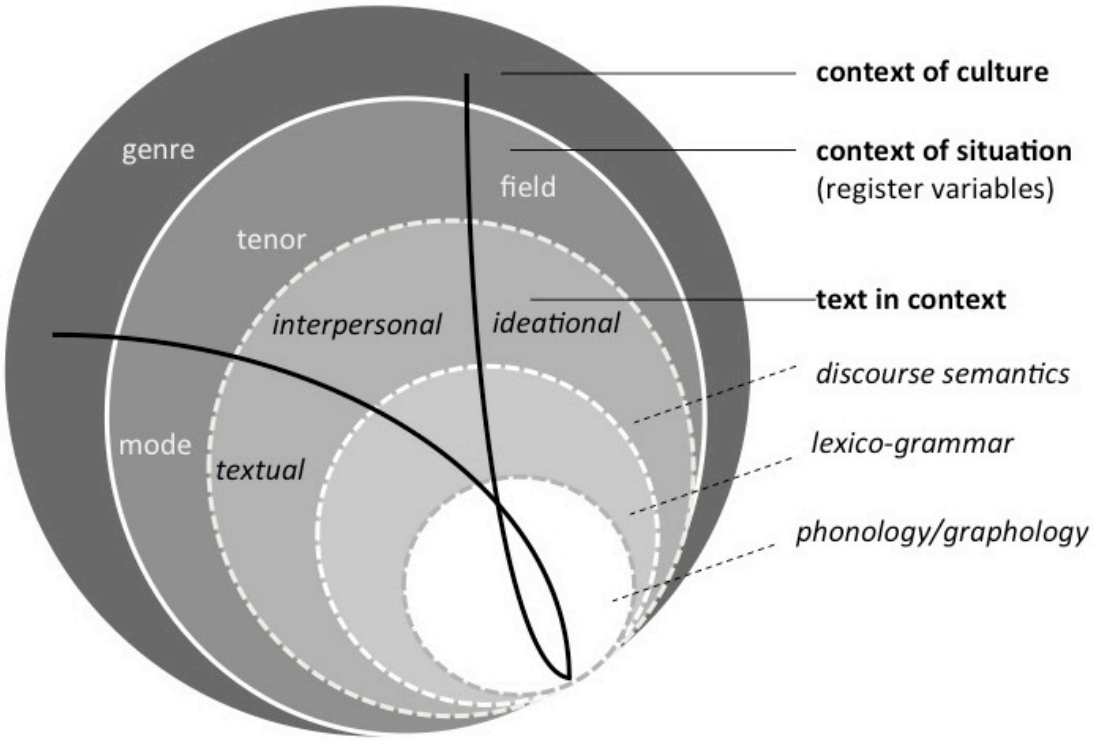


Figure 2.1: Modelling language in context (adapted from Martin & White, 2005)

Of particular relevance to this study is understanding how teachers support their students to develop knowledge of academic registers as appropriate for different stages of schooling and curriculum contexts. Macken-Horarik (1996a, 1996b) has expanded the SFL models of academic register to include three cultural domains: everyday, specialized and reflexive. These domains can be characterised in terms of the different kinds of learning and literacy (e.g. functional, reproductive, critical) as well as clusters of genres and registers, as represented in Figure 2.2 below. These domains usefully identify and categorise broad shifts, such as when students initially draw upon common-

sense knowledge in the everyday domain and then extend their responses to include discipline knowledge in the specialized domain.

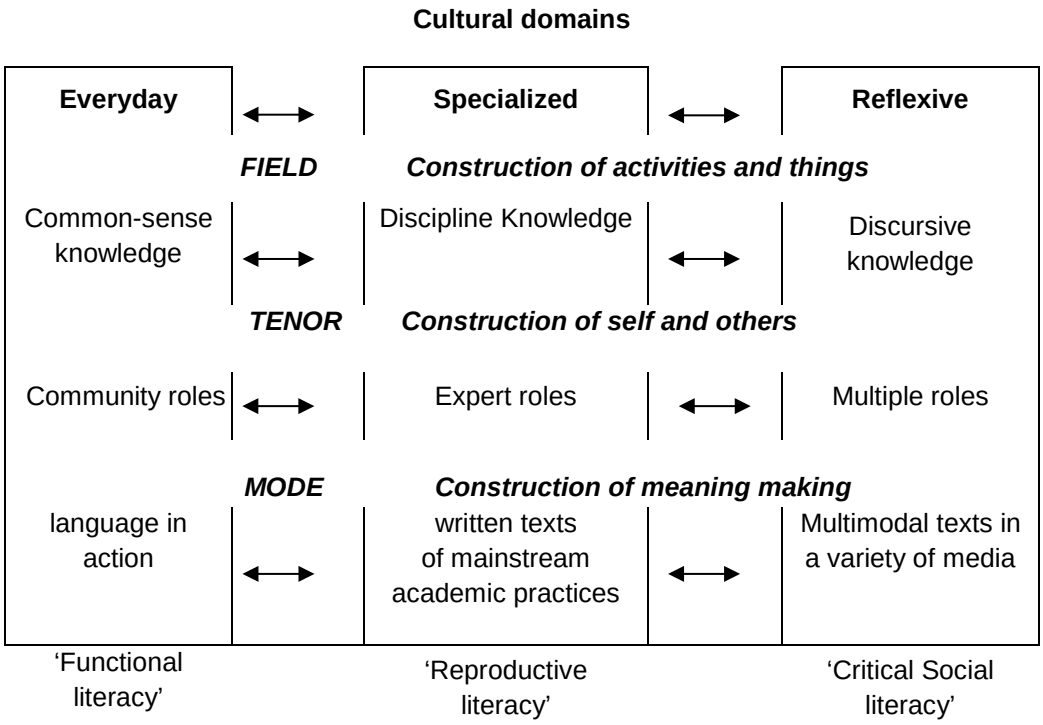


Figure 2.2: Articulating features of three domains (adapted from Macken-Horarik (1996a, 1996b).

2.2.3 The Teaching and Learning Cycle

SFL inspired 'genre-based pedagogy' provides a useful tool with which to design and analyse pedagogic experiences for teachers and students. This pedagogy draws on social-semiotic theories that privilege learning through

social interaction and methods of explicit instruction, as discussed in report 1. In addition to the aforementioned linguistic theories, genre-pedagogy is informed by research from the sociology of education (Bernstein, 1975, 1990, 2000), which has been concerned with relationships between stratified educational outcomes and socio-cultural influences. In genre-based pedagogy, teachers take an expert role to make their knowledge about language accessible to learners. Classroom teaching, therefore, aims to identify and explain reoccurring patterns of meaning in texts and supports students to create the kinds of semiotic patterns that are associated with highly valued texts for school learning (Rose & Martin, 2012).

While a variety of more or less complex models of genre-based pedagogy have been developed over the last three decades (Rose & Martin, 2012), a simple four-part model is illustrated below in Figure 2.3. Such models are commonly referred to as a Teaching and Learning Cycle (Callagahan & Rothery, 1988).

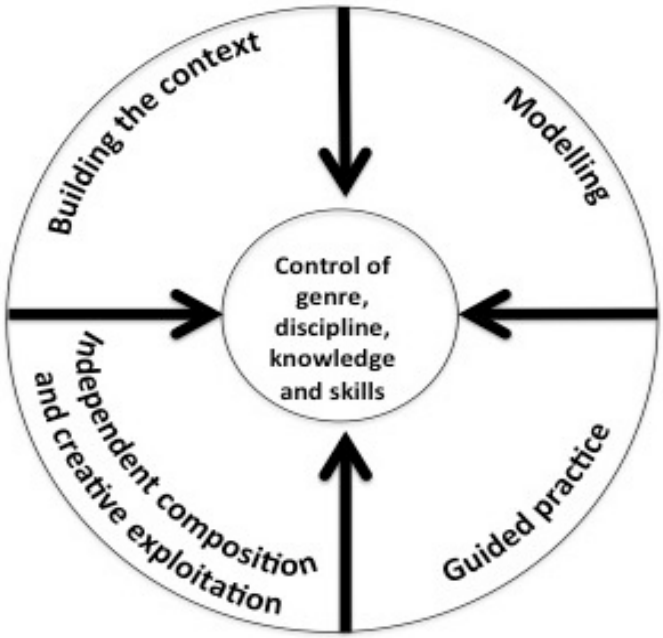


Figure 2.3: A genre- based Teaching and Learning Cycle
(adapted from Callaghan & Rothery, 1988 by Humphrey & Feez, in press)

As detailed in report 1, the first stage of the cycle, *building the context*, involves exploratory activities that build understanding of the context of inquiry, including the curriculum context. Part of this exploration aims to negotiate the field of inquiry with students, draw out their existing knowledge of both the field and texts related to that field and then set up processes for extending knowledge of text and relevant discipline content. During the *modelling stage*, students engage with carefully planned learning activities that focus attention on one or more exemplary, or model, texts in the genre targeted. Through whole class analysis of texts, a metalanguage is built, which enables teachers and students to engage in meaningful interaction about how texts make meaning and which promotes critical awareness of the relationship between semiotic choice in the text and the immediate contexts of language

use. The next stage, commonly consists of a form of teacher-led collaborative writing called *joint construction* or *guided writing.* Here teachers lead students in the co-creation of a communal text. They support students to apply knowledge of the writing topic and knowledge about language to explore language choices. In the final stage of *independent composition and creative exploitation* students integrate what they have learned in the prior stages to write a text by themselves. Across all stages, the pedagogy may be adapted and differentiated in response to student progress, moving in and out of each stage to ensure success in the independent performance of tasks (see examples in Humphrey & Macnaught, 2015; Mahboob & Yilmaz, 2013). This project explores and analyses the use of this model in relation to the IBO framework.

2.3 Methods of analysis

The method of discourse analysis (Martin & Rose, 2007) is used to examine texts in context. Specifically, we draw upon theories of SFL to closely examine texts of classroom interaction, interviews, student writing and teachers' written comments (see section 2.7). More specifically, to facilitate and systemise discourse analysis of a range of texts, across different research sites (i.e. specific teaching and learning contexts), a framework known as 'a 4x4 meta-semiotic toolkit' (Humphrey, 2013) is used. This framework is based in SFL's theorisation of different strata or language levels which are glossed in the toolkit as: *word, sentence, paragraph* and *whole text,* as shown in Figure 2.4.

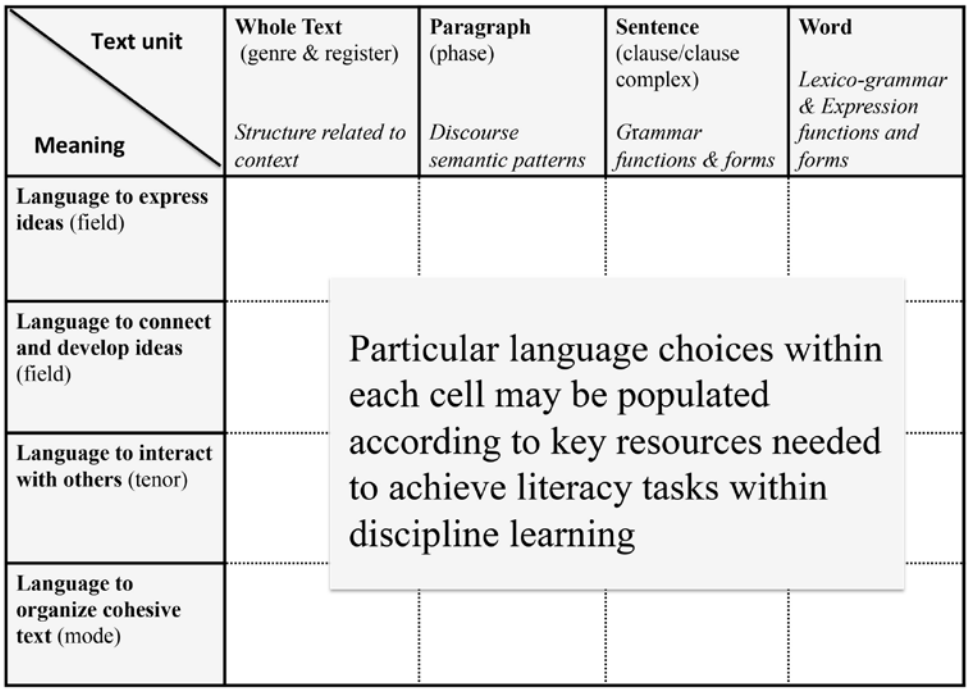


Figure 2.4: Dimensions of the 4x4 metalinguistic framework

(Humphrey & Macnaught, 2015)

A further dimension of the framework involves the theorisation of systems of meaning or metafunctions, which are glossed as: *language to express ideas, language to connect and develop ideas, language to interact with others* and *language to organize cohesive texts.* The cross-classification of these two dimensions creates the '4x4' categories with which to analyse data. The toolkit is designed to be populated according to different literacy and discipline contexts, such as appreciating and responding to literature in elementary and early years of schooling. In other words, while the broader categories remain constant, the identification and selection of specific language features in each category is flexible and depends on the kinds of texts being analysed.

Additionally, interviews were analysed in relation to the foundational design principles. We considered teachers' reflections in terms of whether they affirmed, challenged or provided new insights about the principles (see Appendices 5b and 5c).

2.4 Design Based Research

The design of specific research steps to generate and analyse data involves Design Based Research (DBR). This is an approach to investigating educational innovations that aims to generate practical solutions to educational problems (Reeves, 2000). DBR is concerned with the link between processes of enactment, such as new professional learning practices, classroom activities and classroom talk between teachers and students, and specific educational outcomes, such as improvements in students writing. Key features of DBR include theoretically-informed design principles and collaboration between researchers and practitioners. The overall aim of DBR is to create plausible causal accounts of meaningful change in teaching practice, and thereby generate design knowledge that may be applicable to similar contexts (Reeves, Herrington, & Oliver, 2005).

The main steps in our DBR sequence are shown in Figure 2.5, below. They include: 1) *generating theoretically informed design principles;* 2) *cyclic testing of design principles;* 3) *evaluating;* and 4) *redesign of design principles.* In this project, we follow these steps in two detailed case studies, in order to

make generalisations about critical aspects in the design of professional learning experiences, in PYP contexts.

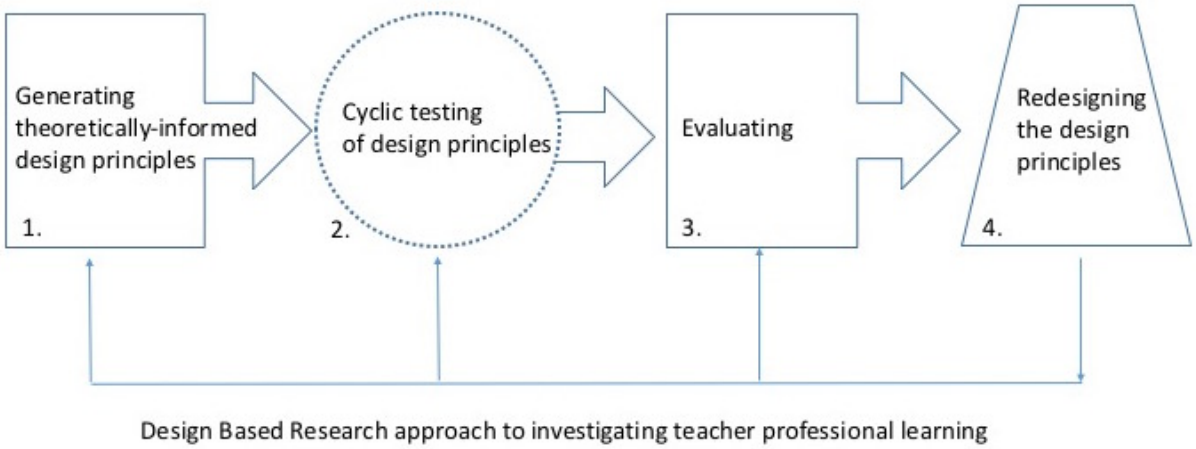


Figure 2.5 The main Design Based Research steps in our project.

While these steps will be further discussed and illustrated in the case study sections, it is important to emphasise that our generalisations take the form of design principles. The initial design principles were created in stage 1 of the project and these were then drawn upon and tested in our professional learning collaboration with teachers (steps 2-4). The influence and contribution of the principles in the research steps is represented in Table 2.2, below. All principles relate to extending and integrating teachers' knowledge about language and language teaching for the benefit of IBO's PYP students. The overall objective is to revisit and, where needed, redesign the initial principles based on the research findings.

Step	**Phases and description of research**	**Foundational design principles** (numbered as per report 1)

<table>
<tr><td>1</td><td colspan="2">Generating theoretically- informed design principles (SEE REPORT 1)</td></tr>
<tr><td rowspan="3">2</td><td>Cyclic testing of design principles
a) Analysing the specific research context</td><td rowspan="2">1. PYP teachers have invaluable knowledge of their specific teaching contexts, which needs to be drawn upon prior to and during professional learning.</td></tr>
<tr><td>b) Negotiating the professional learning context</td><td>2. PYP teachers' knowledge about the language of texts that are used for curriculum learning is essential for changing language teaching and learning practices and thereby improving student learning outcomes.

6. Knowledge about language must connect to specific learning and assessment tasks that researchers and teachers agree are essential to the broader learning goals of PYP students.</td></tr>
<tr><td>c) Introducing theoretical principles: opening the semiotic tool kit</td><td>3. Language knowledge needs to have a functional-orientation in order to support and be relevant to the practical inquiry of how language works in the PYP curriculum, including knowledge which enables PYP teachers and students to compare, contrast and critique the language patterns in texts.

4. The exploration of how language works needs to focus on how systems of language make meaning (in SFL terms a metafunctional perspective) and how these systems relate to the context in which texts are composed and received (in SFL terms register and genre).

5. Developing knowledge about language needs to attend to grammatical and expression level patterns within sentences, and discourse patterns across texts.</td></tr>
</table>

	d) Illustrating the application of knowledge	8. Metalanguage is crucial for mediating language learning, i.e. making language constructs accessible, relevant and fun to use in PYP classrooms. 9. For metalanguage to be accessible to PYP teachers and students, it needs to involve a range of ways to identify and talk about language.
	e) Applying knowledge: integrating, language, literacy and learning in lesson sequences.	7. Developing deep knowledge of language is best accomplished with specific guidance in how it can be explicitly and creatively shared with students as a resource for learning. 10. For professional learning to be successful and sustainable PYP teachers need on-going support from expert mentors as well as collaboration within school communities and PYP networks. 12. Iterative cycles of professional learning activity with PYP teachers supports the gradual refinement of PL design and content.
3	**Evaluating**	11. Analysing and assessing the impact of professional learning practices in schools that host PYP requires the collection of data before and after professional learning activities, including data that enables the connection between knowledge, changed classroom practices and change/lack of change in the learning of students.
4	**Redesigning the design principles**	

Table 2.2: DBR steps and the corresponding initial design principles.

As Table 2.2 highlights, in our research sequence, step 2 involves a number of sub-steps. These sub-steps involved our close collaboration with teachers where we tested the initial design principles during professional learning. They thus constitute a 'literacy intervention' and are exemplified and discussed in the case study sections of this report. An overview of the sub-steps in step 2 is shown in Figure 2.6. Each sub-step responds to a specific research context, that is, the initial and emerging needs of a particular teacher and group of students, as well as the individual nature of the collaboration between the researcher and the classroom teacher. Collectively the sub-steps are informed by research which argues that although teachers' beliefs and existing knowledge are a starting point or foundation for professional learning and crucial to on-going reflection, social-interaction with mentors is crucial to extending what teachers already know (Alton-Lee, 2008; Stoll, 2009; Stoll et al., 2006); Brisk & Zisselsberger, 2011; Humphrey & Macnaught, 2016).

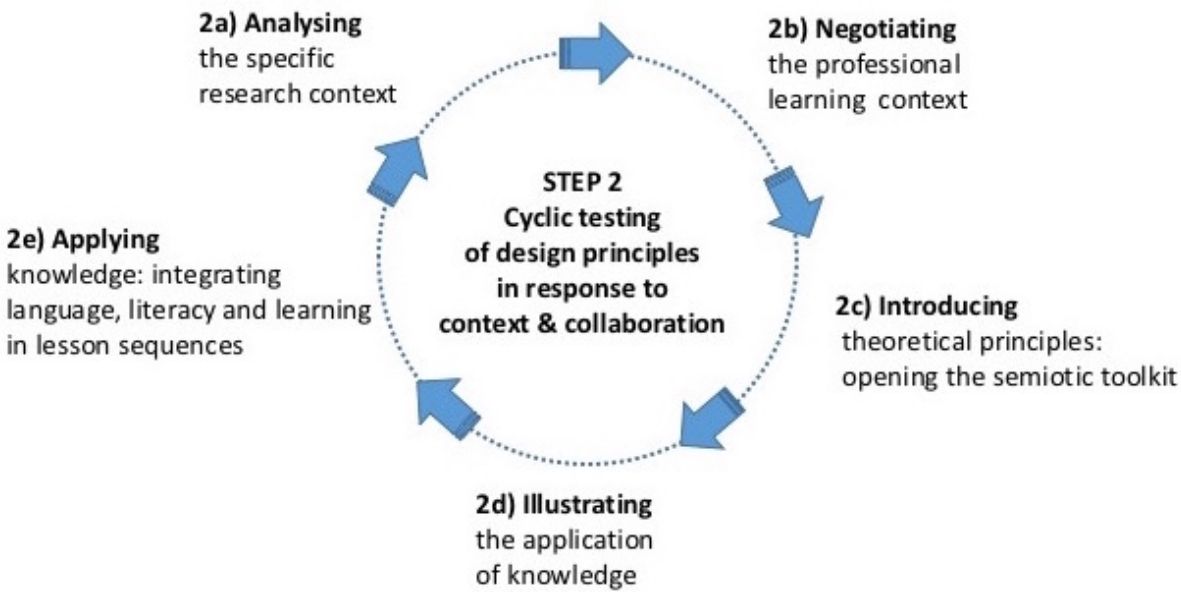


Figure 2.6: Sub-steps within research step 2

2.5 Process of school recruitment

The process of school recruitment proved to be time-consuming and unexpectedly challenging. Although the IBO provided a short-list of potential schools to approach, and were optimistic about school participation, this list was not provided until well into the second month of our project. Disappointingly, only two of the proposed schools responded to invitation letters that were sent by email. Of these two initial responses, only one school on the original short-list has followed through to participation. It was therefore necessary for us to start a second recruitment cycle from December-February 2015. Our efforts here were constrained by the onset of long school vacation periods, and we therefore needed to provide additional time for schools who expressed interest.

One aspect of recruitment difficulties seemed to involve some teachers' reluctance to participate in comparison studies. Our invitation letter and subsequent getting started information (see Appendices 2a, 2b, 2c) made clear that we would be gauging differences in classroom talk, lesson sequences and student writing before and after professional learning. Comparisons would also be made between teachers who had participated in professional learning and the 'shadow' teacher who provided a 'business as usual' point of reference. Through conversations with school principals and PYP coordinators, we

learned that these comparisons made some teachers feel reluctant to participate, even though all teachers had the option of participating in a second round of professional learning. In light of teachers' concerns, face-to-face meetings with school principals, PYP coordinators and, in some cases, interested teachers, was critical to our eventual success in recruitment. However, it is recommended that this lengthy and time consuming process is taken into consideration in future projects.

In addition to difficulties with recruitment, there were a number of other factors that directly caused delays in commencing and progressing the project. These are summarised in Table 2.3, below.

Factors causing delays in commencing and progressing the project	
technical & logistical	Email correspondence to teachers being found in 'junk mail' folders
	Teachers and schools operating in different time zones
	Teachers and schools operating with different school holiday periods

administrative	The majority of teachers having no or minimal support with distributing and collecting ethics documents
	Teachers having to personally explain the project to potential parents for whom English (the language of the information and consent forms) was not a first language
	Teachers having no or minimal support with collecting and uploading data
professional	Teachers reluctant to participate in studies which made comparisons between current and new practices and between participating and 'shadow' classes

Table 2.3: Significant factors causing delays in commencing and progressing the project

In spite of these difficulties and timeframes, we were eventually able to set up personal, face-to-face meetings with an additional 5 schools in Australia and New Zealand. We also sent further email invitations abroad. The face-to-face meetings proved to be pivotal in getting schools interested and committed to the project. In total, we persistently approached 20 PYP schools, between November, 2015 and May, 2016. Data from three schools informs this report.

2.6 Sites of data collection and participants

Three schools participated in the project. Two of the schools participated in the full cycles of intervention, while one participated in providing data to establish teachers' prior knowledge. These schools are located across three different continents and constitute the three 'willing' schools from our

recruitment process. The only criterion for selection is that they have a PYP program and school principals expressed interest in the research project.

The teachers in our study responded to initial information letters that were distributed in each school. Apart from being PYP teachers, the only criterion for participation is that teachers are involved in teaching year 2 or 3 students and willing to participate in the project. Each teacher has the option of being an 'active' or 'shadow' teacher. This distinction refers to the delivery of step 2 in the research sequence where the 'active' teacher participates in the first round of professional learning, while the 'shadow' teacher only participate in classroom data collection. In other words, the 'shadow' teacher provides a point of reference for classroom activities and teacher-student interactions that occur without the influence of our professional learning delivery. Then, the 'shadow' teacher has the opportunity to participate in a repeated round of professional learning, while the original 'active' teacher may take on a supportive, mentoring role. A summary of schools and participating teachers, with pseudonyms, appears in Table 2.4.

School	**Participating teachers/classes**		
	'Active' role	*'Shadow' role*	*Pre-data only*
School 1: 'Woodlane' (Europe)	'Kerry'	'Kate'	
School 2: 'Sunnyville' (Australasia)	'Robyn'	'Richard'	

School 3: 'Riverland' (Australasia)			'Anne' 'Audrey'

Table 2.4: Summary of data collection sites and participants

2.7 Data types and collection status

Data collection from each school took place following ethics clearance from the Australian Catholic University and relevant government departments. The timing of data collection involves pre-, during and post-professional learning data. In line with Design Based Research, this organisation enables change/no change in classroom practices to be related to the content and delivery of professional learning.

Timing	**Data type**	**Collection status**		
		Woodlane	**Sunnyville**	**Riverland**
PRE	Teacher language activity	Kerry Kate	Robyn Richard	Anne Audrey

	Audio recorded mini lesson	Kerry Kate	Robyn	**N/A**
	Student texts with teacher comments	Kerry Kate	Robyn	
DURING	Teaching documents	Kerry	Robyn	
	Audio recorded classroom interactions	Kerry	Robyn	
	Teacher-researcher recorded conversations	Kerry	Robyn	
POST	Teacher language activity			
	Student texts with teacher comments			
	Reflective interview	Kerry	Robyn	

The data types are all characterised as texts, which were subject to linguistic discourse analysis, as discussed in section 2.3). Texts include: a teacher language activity (see Appendix 2d); transcribed audio-recorded mini lessons (recorded by teachers on mobile devices); students' written text with accompanying comments/feedback from the teacher (collected by teachers); transcribed Skype or face-to-face conversations between mentor researchers and teachers; classroom documents, such as teaching slides and handouts; transcribed audio-recorded classroom interactions; and transcribed interviews. These texts and their collection status are outlined in Table 2.5 below.

Table 2.5: Summary of data types and their collection status

3. Findings related to the pre-intervention data

Our six participating teachers all completed a knowledge about language (KAL) activity prior to their professional learning experiences. This activity asked teachers to identify and comment on sentences that were indicative of specific genres, as well as provide written comments on 4 sample student texts. These texts consisted of more and less developed narratives and information reports from year 3 students (see Appendix 2d). Two sample texts for teacher feedback appear in Table 3.1, below.

How is the language in this sentence typical of this type of text?	
Toogong is near Mount Canobolas, which is an extinct volcano.	
Student text	**comments**
I snail has very intresting patterns on its shell and it has a very hard shell too which it uses for shelter and when you look closly at it you can see that it has scales and its mouth is very tiny and when you are very quiet you can hear its chomping and you cannot see its breathing holes because they are most ly microscophic and snails are food to alot of animals.	
Feedback to the student:	

Table 3.1: Sample text for teacher feedback

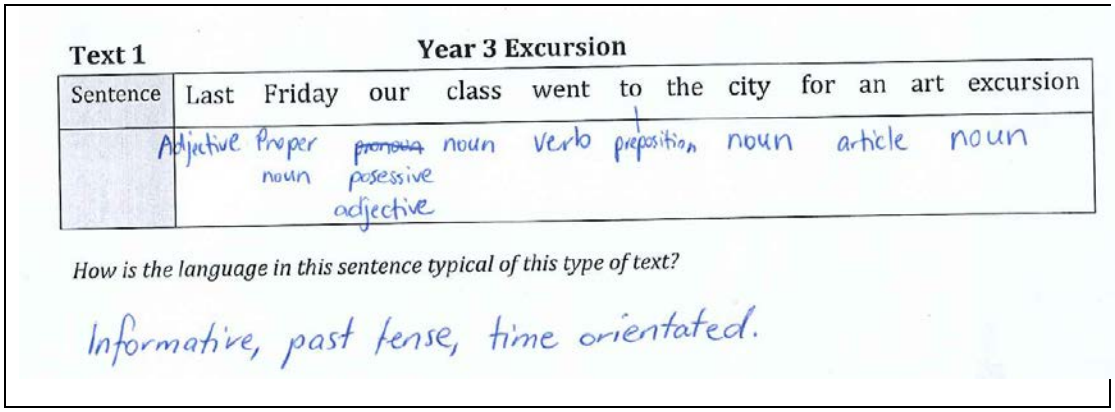
The purpose of this activity was to see the kinds of language patterns that teachers identified and the metalanguage they used to comment on student work. The teacher responses thus provided an indication of their current knowledge about language. The analysis of the KAL activity contributed to identifying possible areas of language knowledge to focus on in professional learning. This section provides a summative analysis, with a particular focus on teachers' metalanguage related to information reports, as this type of text emerged as the focus of the professional learning.

Overall, the six pre-professional learning KAL responses showed that teachers had a strong general awareness of the connection between genres and their social purpose. In identifying text types, teachers wrote comments about a text's purpose such as:

> *to recount an event in time order;*
>
> *to give instructions for how to do or make something;*
>
> *to describe and give factual information about people, places and things.*

Teachers also tended to identify and comment on the structure of whole texts and also word level patterns. At the level of the whole text, teachers identify text parts in comments, such as: *clear beginning, middle (problem) and end (solution) to the story*; and *You don't' have paragraphs but you could easily include them because you have a beginning introduction, a middle series of events and an ending resolution.* At the level of word, teachers identified parts

of sentences as different word classes in comments, such as: *noun; verb;* and *adjectives are precise.* These findings indicate that in addition to genre awareness, teachers had some knowledge of traditional grammar categories to express ideas and also a degree of awareness about part-whole relationships in texts. An example is shown in Figure 3.1, below.



Text 1 **Year 3 Excursion**

Sentence	Last	Friday	our	class	went	to	the	city	for	an	art	excursion
	Adjective	Proper noun	~~pronoun~~ possessive adjective	noun	verb	preposition	noun	article	noun			

How is the language in this sentence typical of this type of text?

Informative, past tense, time orientated.

Figure 3.1: Example of teachers' knowledge of traditional grammar (Robyn)

The tendency for teachers to predominantly focus on whole text and word level patterns of language use was also evident in metalanguage related to information reports. Indicative examples of teacher metalanguage appear as populated cells in the 4x4 framework, in Table 3.2 below.

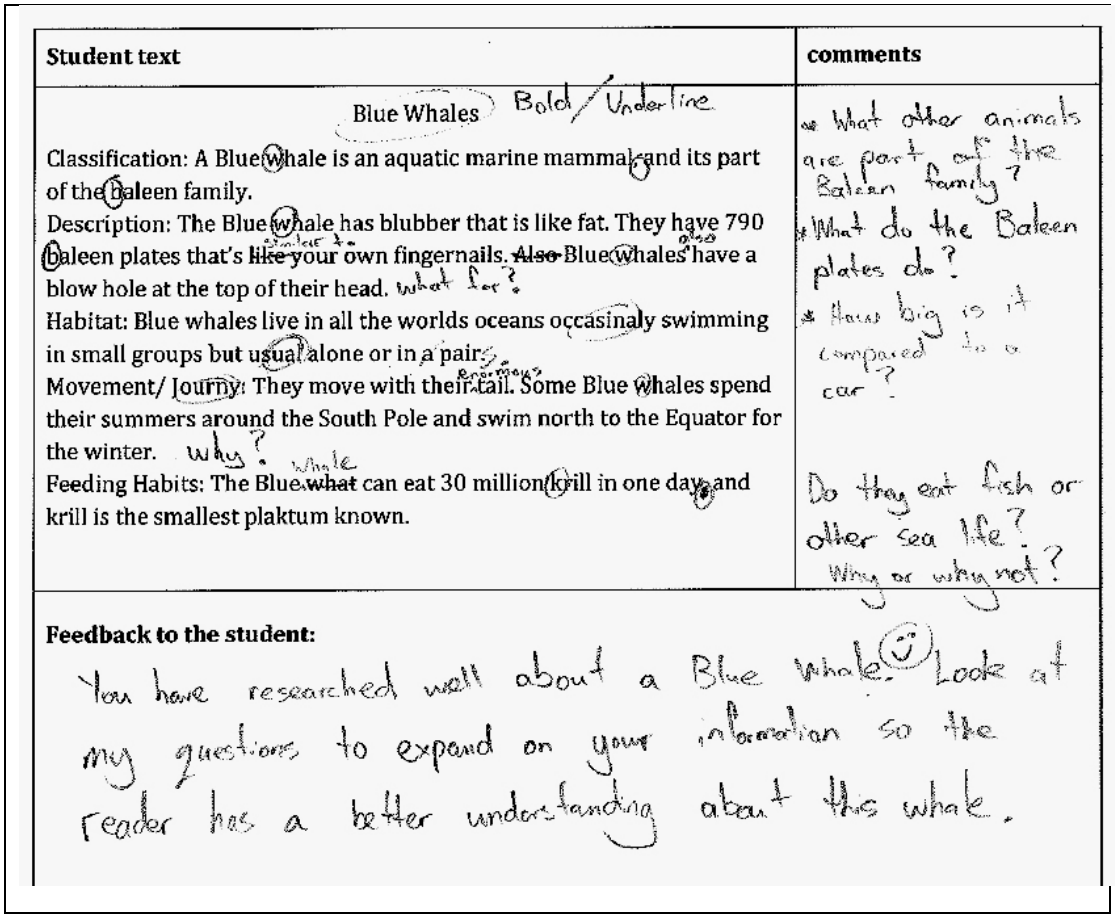
Text unit/ Meaning	**Whole text**	**Paragraph**	**Sentence**	**Word**
Expressing ideas	Text purpose: *to describe and give factual information about people, places and things;* *All this report needs now is an illustration to go*	*good organisation of paragraphs* *Summarising paragraph ending with a statement about the snail;*	*The simple sentence is a complete sentence – it gives meaning.* *Complex sentence* *Work on sentence structure*	*Adjectives are precise;* *Nice descriptive words help create an image;* *You could use 'similar to' instead of 'that's like' to make it*

	with your fantastic information; *many interesting observations and facts about snails;*			*sound more scientific;* *Good use of technical language such as <u>microscopic.</u>* *adjective, proper noun, preposition, verb, article*
Connecting and developing ideas		*could add more detail;* *Add more details and include some 'wow' words;* *examples will need to be included;* *Look at my questions (Do they eat fish or other sea life? Why, why not?) to expand your information so that the reader has a better understanding about this whale;*	*The dependent clause adds to the independent clause.* *Try to break up the sentence into smaller points.*	
Interacting with others				
Organising cohesive text				
KEY: black = the most common areas of teacher metalanguage Light grey = frequent but less precise areas of metalanguage				

Table 3.2 Indicative metalanguage in written feedback on information reports

The cells shaded in black represent consistent dimensions of language use that teachers identified and commented on (expressing ideas at the level of word

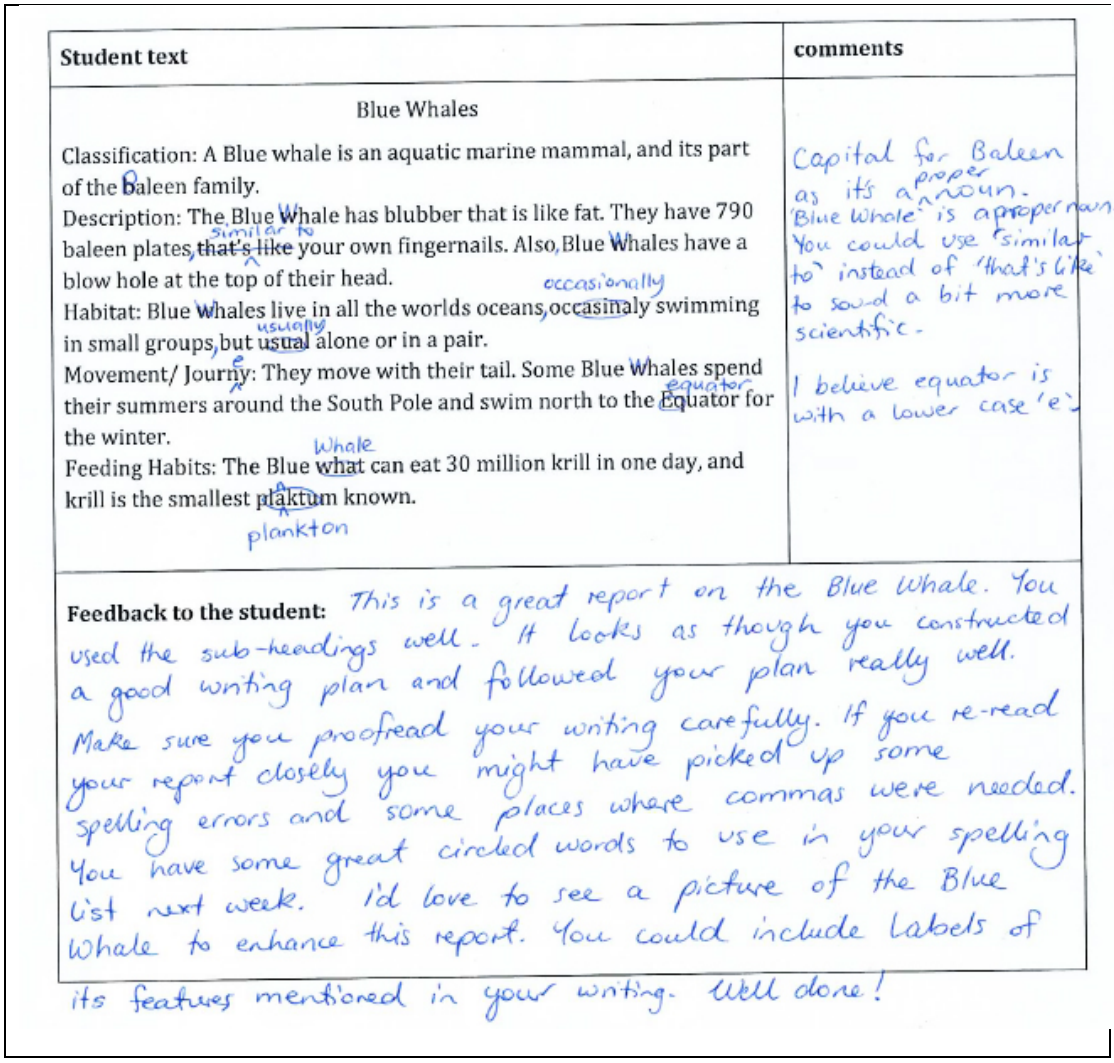
and whole text); the light grey cells highlight areas in which teachers frequently made comments, however, their metalanguage tended to be less precise. For instance, in metalanguage related to connecting and developing ideas within paragraphs, teachers usually provided general comments, such as asking for '*more details'* and *'more development'.* An example is shown in Figure 3.2 below where the teacher asks the student to '*expand on your information so the reader has a better understanding about the whale'.* In the absence of metalanguage to suggest 'how' to expand meanings, the teacher provides prompt questions about the field of the text (subject matter), such as: '*Do they eat fish or other sea life?* This kind of feedback shows how teachers may draw on the field of the topic for writing when they have minimal metalanguage with which to talk about meanings at the level of discourse semantics.



Student text	comments
Blue Whales Bold / Underline Classification: A Blue whale is an aquatic marine mammal and its part of the baleen family. Description: The Blue whale has blubber that is like fat. They have 790 baleen plates that's ~~like~~ your own fingernails. ~~Also~~ Blue whales have a blow hole at the top of their head. what for? Habitat: Blue whales live in all the worlds oceans occasinaly swimming in small groups but usual alone or in a pair. Movement/ Journy: They move with their tail. Some Blue whales spend their summers around the South Pole and swim north to the Equator for the winter. why? Feeding Habits: The Blue ~~what~~ can eat 30 million krill in one day and krill is the smallest plaktum known.	* What other animals are part of the Baleen family? * What do the Baleen plates do? * How big is it compared to a car? Do they eat fish or other sea life? Why or why not?
Feedback to the student: You have researched well about a Blue whale. Look at my questions to expand on your information so the reader has a better understanding about this whale.	

Figure 3.2: Example of feedback at the level of discourse semantics (Richard)

A further area of less precise metalanguage concerns image text relations. This is exemplified in figure 3.3 (below) where the teacher made the comment: *I'd love to see a picture of Blue Whale to enhance this report'.* This kind of comment is indicative of a semiotic pattern/relationship for which teachers may currently only have an intuitive level of understanding. However, the reasoning for a particular choice is not always articulated to students through metalanguage, that is, *how* or *why* an image may 'enhance' the written meanings of texts.



Student text	comments
Blue Whales Classification: A Blue whale is an aquatic marine mammal, and its part of the baleen family. Description: The Blue Whale has blubber that is like fat. They have 790 baleen plates, that's like your own fingernails. Also, Blue Whales have a blow hole at the top of their head. Habitat: Blue Whales live in all the worlds oceans, occasinaly swimming in small groups, but usual alone or in a pair. Movement/ Journy: They move with their tail. Some Blue Whales spend their summers around the South Pole and swim north to the Equator for the winter. Feeding Habits: The Blue what can eat 30 million krill in one day, and krill is the smallest plaktum known.	Capital for Baleen as it's a proper noun. 'Blue Whale' is a proper noun. You could use 'similar to' instead of 'that's like' to sound a bit more scientific. I believe equator is with a lower case 'e'.

Feedback to the student: This is a great report on the Blue Whale. You used the sub-headings well. It looks as though you constructed a good writing plan and followed your plan really well. Make sure you proofread your writing carefully. If you re-read your report closely you might have picked up some spelling errors and some places where commas were needed. You have some great circled words to use in your spelling list next week. I'd love to see a picture of the Blue Whale to enhance this report. You could include labels of its features mentioned in your writing. Well done!

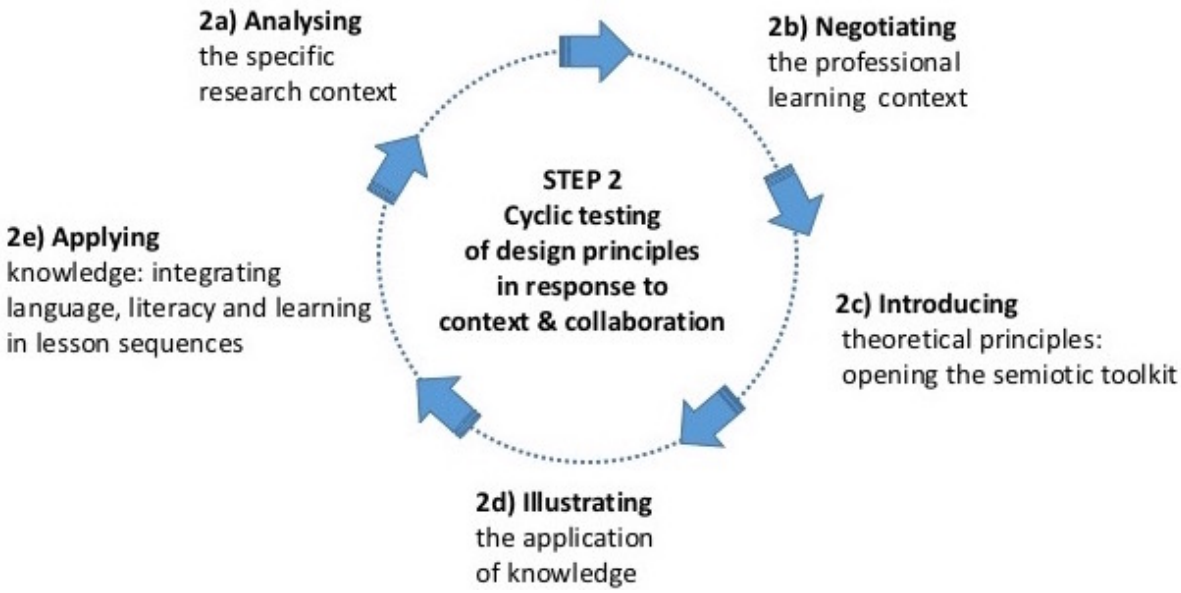
Figure 3.3: Example of feedback about image text relations.

In sum, the analysis of pre-data has drawn attention to a number of areas for potential development in professional learning. These include collaborating with teachers to further develop their knowledge of register and discourse semantic patterns of language use, and also the way semiotic resources combine to create meaning, such as in image-text relations. The case study

sections continue the analysis of metalanguage in relation to individual teachers.

4. Findings and reflections related to professional learning: Case study 1 & 2

This section outlines our close collaboration with two PYP teachers as they participated in professional learning. The design of their professional learning experiences was informed by our foundational design principles, as documented in report 1. While these principles emerged from an extensive literature review, the implementation of professional learning provided the opportunity to apply and test the principles in specific teaching and learning contexts. The overall design of professional learning is illustrated below, as sub-steps of step 2 in our DBR sequence (as introduced in the methodology section).



Repeat of Figure 2.6: Sub-steps within research step 2

Each case study begins with a summative analysis of teachers' existing

metalanguage, i.e. indicative language about language that appeared in data prior to professional learning. This is followed by a summative analysis of pre-data related to students' writing to provide further insight into existing understandings and writing processes. Details of each sub-step then follow, accompanied by researcher reflections.

Case study 1 – Woodlane

4A.1 Case study 1 - overview

Participating teachers	Kerry; Kate (comparison)
Stage of learning:	Year 1 (aged 6-7)
Curriculum area	Science - Living Things
Informing Data (see Appendix 4A) • ***Teachers' professional learning and application***	Recorded PD Skype sessions (4x 40 mins) Slides of 4x lessons (6 literacy activities) Recorded lessons focusing on
• ***Students talk and writing***	Students' written planning and reports on animals prior to intervention Recorded Small group interactions and presentations (x4) Students draft reports on animals Students independent reports on plants

4A.2 Cycle step 2a: Analysing the specific research context

Findings of teachers' prior knowledge of language & literacy assessment

The analysis of Kerry's pre-professional learning data, including her KAL activity, comments on student writing and mini-lesson, align with the general findings for all participating teachers reported on in Section 3 of this report. Her metalanguage clearly identifies genres and their overall social purpose, and, like other teachers, focused on word and whole text level feedback related to expressing ideas. At discourse level Kerry showed awareness of a range of meanings, including interpersonal meanings. However, the feedback reporting on language patterns at this level was quite general (e.g. *examples will need to be included; Change the personal statements: 'you are very quiet' to factual non-personal statements).*

Findings of students' prior writing

Our analysis of students' prior writing (see Appendix 4.1) indicated that all students in the class were using a substantial repertoire of resources to conduct an inquiry drawing on researching and recording information on an animal. Three tasks in this process were analysed: the use of a mindmap template to form questions to guide inquiry; recorded planning notes from research; report presentation using powerpoint.

- ***Mindmap***

Most students used a mindmap effectively to form questions oriented towards scientific inquiry (e.g. what are dinosaurs? What do they eat?) following the PYP framework. A minority of students also formed questions oriented towards establishing a personal relationship to the animal under investigation (e.g. why are cats nice to have as pets?).

Children also showed good control of the structure of questions, and spelling and punctuation. Handwriting was for the most part legible.

- ***Planning notes***

All children's planning notes were presented as handwritten extended text, typically one to two pages in length. In almost all cases, information included the class/type of animal and description of features such as appearance, eating habits. The selection of field was relevant to curriculum learning in science. Some children also included knowledge related to the care of an animal, though this was limited to animals kept as pets. This information too is relevant to curriculum learning in the early years. Very few children included information which was not relevant to curriculum learning.

- ***Final presentation – multimodal display***

Analysis of multimodal displays showed a range of responses in terms of genre and register. All students used images and text and approximately half used sound as well, presenting their work as a voiced slide show. Four patterns were evident in the verbal and visual language choices:

1. information classified according to scientific topic areas (e.g. class, habitat; behaviours such as eating;). Images analytical – photos extending verbal. Well-structured sentences with name of animal consistently as topic theme (sentence starter). Frequently two or three sentences included within each sub-topic. Grammatical choices include: Generalised participants (i.e. class of animal) consistently in theme position. Choice of relating and material processes in present tense (relating and action verbs).

2. information classified accorded to scientific topic areas but presented as dialogue with questions and answers. Images analytical – photos extending verbal. Often single sentence responses to each question. Grammatical choices include: Generalised participants (i.e. class of animal) consistently in theme position. Choice of relating and material processes in present tense (relating and action verbs)

3. information not classified clearly but still related to scientific topic areas. Images analytical – photos extending verbal. Always single sentence on each topic. Grammatical choices include: Generalised participants (i.e. class of animal) consistently in theme position. Choice of relating and material processes in present tense (relating and action verbs)

4. information selected from sources but related to what animals like and/or the composers emotional response to the animal. Focus on

qualities of the animal and composers attitudes. Grammatical choices include: generalized and particular participants (I love…); sensing processes (they love/like). Images include background scenes; human participants interacting with the animal; animal looking straight at camera – establishing contact. This pattern was most noted by EAL/D girls.

Research Reflection: students' prior learning as a context for intervention

The extensive repertoire of academic language resources already controlled by most students presents an ideal context for explicit instruction of language patterns related to scientific inquiry. The relationship of image and verbal text in the construction of multimodal displays is highly relevant to 21st century literacy and learning contexts. The needs of EAL/D students in the class may be addressed by developing further knowledge of scientific register and the role of scientists as observer/recorder rather than interactor/carer.

4A.3 Professional Learning Intervention: Building foundational KAL for Science curriculum literacies

As noted in the methodology, the professional learning intervention with Kerry at Woodlane school was conducted over four Skype sessions and twice-

weekly email exchanges over four weeks. Transcripts of recordings with analysis of representative interactions are included as Appendix 4A.2.

The professional learning to build KAL with Kerry can be described as occurring at 'elbow-to-elbow' level throughout. While an orientation session, introducing the semiotic and pedagogic theory was planned, the delay in beginning the PL encouraged the academic mentor to infuse theoretical understandings throughout the PL interactions. It also encouraged far greater flexibility to ensure that the PL and intervention could be managed without impeding the particular curriculum activity in progress.

4A.4 Cycle step 2b: Negotiating the professional learning context

This important stage was conducted by Skype during school time when the teacher's class was engaged in a specialized curriculum activity away from the classroom. The session was thus limited to forty minutes.

- ***Negotiating a curriculum context for professional learning***

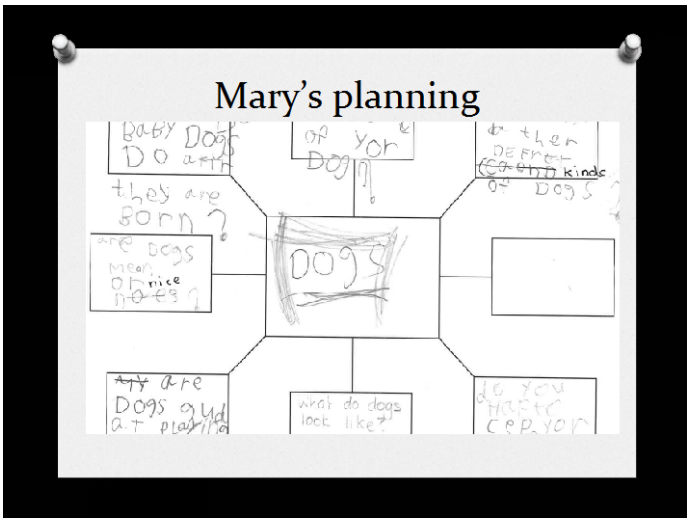
Initial discussion of the curriculum context with the teacher established that the scientific inquiry was on plants and particularly on the instructional text type, expressed by the teacher as 'how we tell people what to do'. Language features identified as relevant to the text type were 'verbs in the present tense'. A second literacy goal pursued in the writer's workshop block was

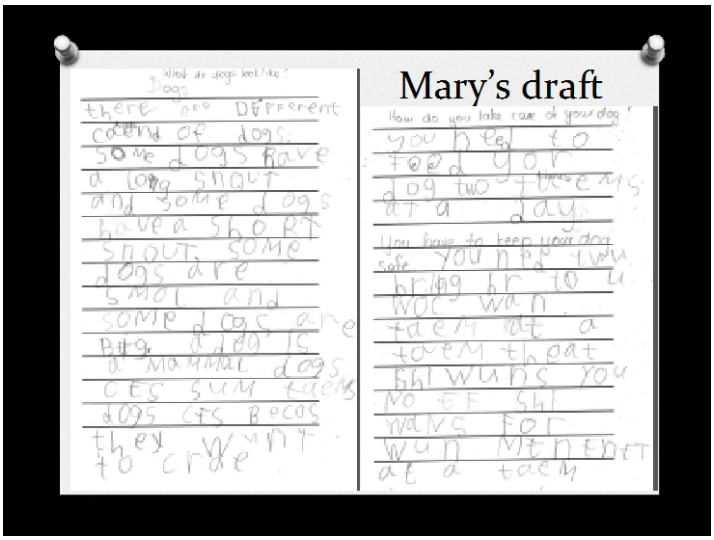
expressed as 'non-fiction writing', including continuing research on an information report on animals.

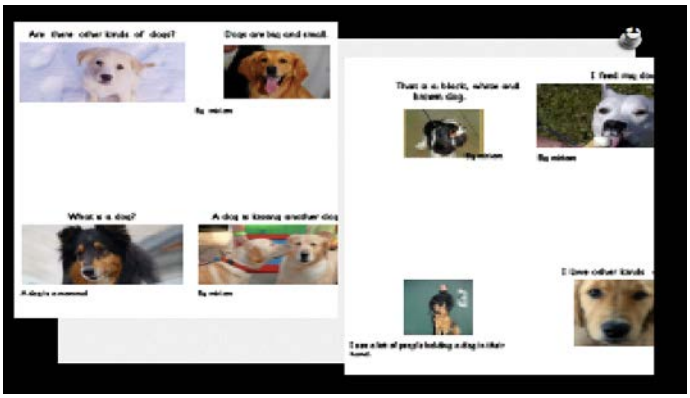
The mentor expressed openness to either of the literacy contexts, acknowledging valuable opportunities for language instruction in both a focus on procedural and report genres. As we will discuss further, the flexibility is facilitated by the use of an SFL model of language and the extensive genre-based research, which has described patterns of meanings across curriculum genres.

- ***Reflecting on students' learning needs as language needs***

A further important context for professional learning was established through a guided reflection on students' language use in their writing prior to the intervention. To facilitate the discussion, the texts of one student were selected prior to the PL session (see Figure 1a, b, c below). This student, Mary was selected because she was identified as a second phase EAL/D student and an analysis of her final written report evidenced particular needs of this group identified by Cummins and others (refs).







Figures 4.1a,b,c

The language repertoire used in Mary's final multimodal report, like others identified above as Group 4, was limited to everyday genre of observation/comment and everyday, personal register. This was despite extensive preparation and support, including framing of scientifically relevant questions and rehearsal of academic language in her written planning text.

To guide the teacher's initial reflections of Mary's writing, the mentor presented the criteria for writing prepared by teachers for the class (see Figure 2) and encouraged her to set the teaching and learning context which stimulated Mary's writing.

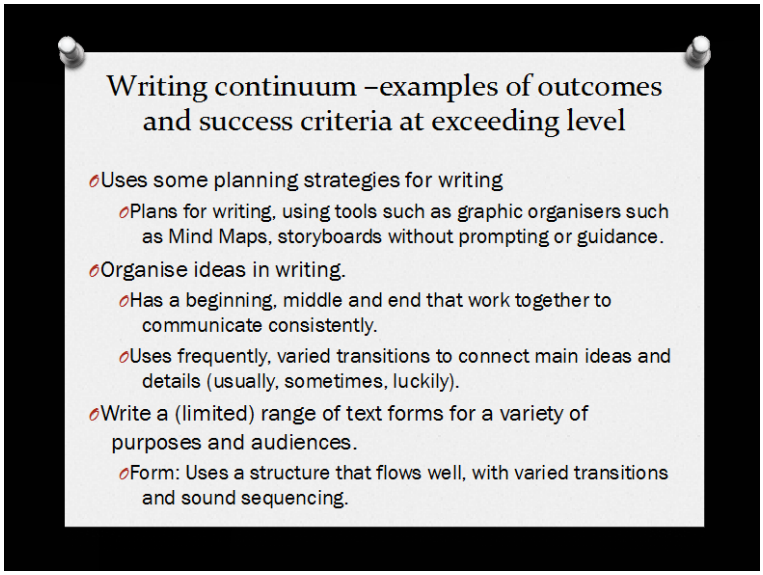


Figure 4.2

The teacher reflected that preparing questions was basic to the PYP curriculum foregrounded in the inquiry based PYP curriculum and provided positive guidance for students to research. She reflected however that Mary, and other EAL/D girls in the class had difficulties between the guided

planning and independent application stages of the inquiry and in differentiating 'fact' from 'fiction'. In the case of the animals task, the teacher explained that students were guided in setting questions and creating planning notes by an EAL/D teacher but, when independently searching for information on the selected web sites, students were engaged by images of the animals which appealed to them personally. In the teacher's words:

> *What we found was that the draft was one thing but when they went to use the technology to make a digital book, and they selected pictures off the internet, the safe internet as we call it, then suddenly the pictures directed what they were writing about. So it is really quite an interesting experience, ...particularly with these set of girls, the EAL/D girls, who thought 'Oh that dog is cute' and then thought 'well I have to write about these dogs are cute' because the picture came first and directed them...*

As we will discuss further, the reflection of students' writing was particularly relevant to selecting semiotic resources to focus on, both in professional learning and classroom instruction.

4A.5 Cycle step 2c: Introducing theoretical principles: Opening the semiotic toolkit

The initial PL session included a brief overview of key principles of the SFL model of language in the context of language as a set of 'tools' within 'a language toolkit'.

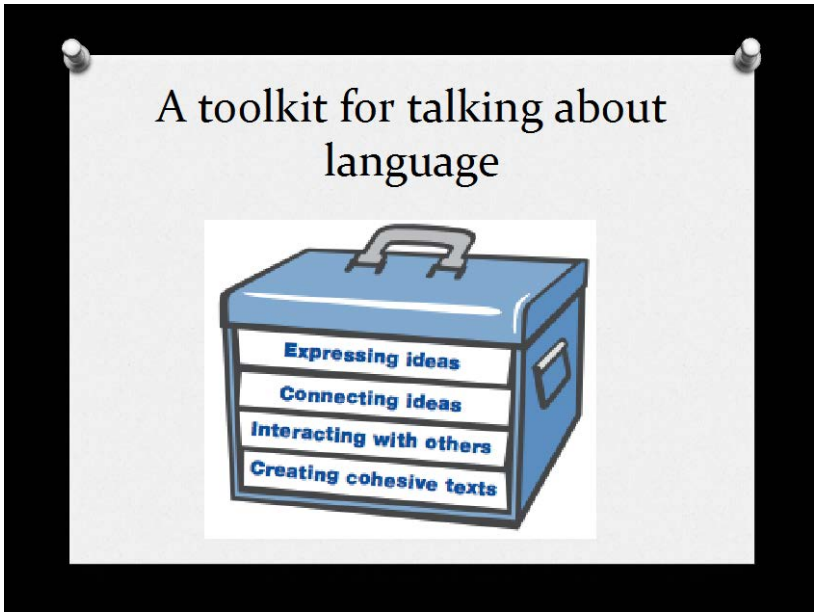


Figure 4.3

The principle of metafunction was expressed by the mentor as:

'…the theory of language that we are working with is multi-lens'.

Drawing on the metalanguage shown in Figure 3 above, and using the example of a one word text, 'STOP', the mentor briefly illustrated how meanings could be explored from each of the meaning perspectives.

Following this metafunctional orientation, a particular 4x4 framework was presented with resources related to the report genre in the early years. Table 4.1 shows the experiential and logical resources related to field (See Appendix for full framework).

A 4x4 for teaching the language of scientific reports in the early years				
Language to	**Whole text**	**Across sentences and paragraphs**	**Groups in sentences**	**Word & expression**
express ideas *meanings related to field or topic*	A living or non-living thing or place is described and/or classified through stages of: • Identification • Description	Information bundles • classify • describe parts • tell doings	• **verb groups** o **relate** things & qualities o name the **action** • noun groups with classifiers & factual describers say **What**? • adverbials say **where, when, how?**	Technical terms for specific topics Present 'timeless' tense
develop ideas *logic connecting ideas of field or topic*	ideas about the topic are connected analytically as: • features • parts • types	Multiple ideas are added to form a bundle Analytical Images expand meanings of verbal text	Verb groups and noun groups combine to form well structured simple sentences with adverbials where relevant	Conjunctions add or contrast information

Table 4.1

The mentor revisited the context of the student's report on dogs to illustrate the work of experiential meanings (i.e. language to express ideas).

For example:

> *In scientific reports we might look at* ***technical terms*** *to name dogs and technical terms to name 'types of dogs' and of course as you've noticed in your feedback to students we tend to express this in* ***timeless present tense.***

In the conversation that followed this illustration, the teacher immediately applied the knowledge to her own teaching and learning context, providing evidence that she found the metalanguage relevant. This conversation begins

with the mentor directing attention to the descriptions recorded in the cells of the 4x4 and opening space for comment or question.

M: Is there anything there that, as you look at it that leaps out at the page at you.

T: (takes time to think and then focuses on descriptions of logical meanings within the 'whole text' cell) *What's the difference between features and parts?*

M: Good question. I guess a good way to think about that is… if I am thinking about Australia for example, if I am thinking about features of Australia I might think about its climate or its terrain or something like that; whereas If I am thinking about parts, I might think about the states, and of course I can't think about types of Australia, but I can think about types of people in Australia or types of animals. That way of thinking about ideas as how are they related to the whole, so the whole is 'this country' – and I am thinking about the information I need in terms of 'Am I thinking about its features?' 'Am I thinking about its parts? Or am I thinking about its types? And generally when we think about information reports, they tend to be about one or more of those – a report may have all of them.

T: So if I am looking at a plant, for example. I got the kids to bring in a plant and talk about it. So we looked at 'What's it like?' ' that's its features. We looked at 'What are the different parts of that plant?' So 'a cacti may have thorns'. And different types of cacti.

M: Exactly

T: So we could use that to create a format for their writing

M: I'm really glad you took that question because it is really phenomenally interesting to talk to children because it connects with their numeracy,

classification and thinking about how things might be grouped. Information reports are all about bundling, how do we bundle things in different ways

T: Yes, that's a really terrific idea, yeah that's good.

Text 4.1

Research reflections: negotiating and introducing

Analysis of the interactions within this first 'negotiating the context' phase of professional learning provided us with a number of insights related to the process of working in this 'elbow to elbow' conversational mode with teachers. Firstly, conversations relating to teachers' own pedagogic context (e.g. assessment of children's curriculum writing; questions of an inquiry based curriculum) appear to provide a meaningful 'way in' to developing their knowledge of semiotic features that realize those contexts. Because SFL's model of language in context enables theoretical concepts to be related to the immediate concerns of teaching and learning, issues raised by teachers about their students' composition can inform which resources from the elaborate semiotic systems are targeted for instruction. This 'explanatory power' of SFL ensures that teachers valuable professional learning time is not used on knowledge building which is not relevant.

A further insight relates to the accessibility of the metalanguage introduced in the '4x4 toolkit' designed for curriculum literacy contexts. As we discussed, recently developed curricular for English worldwide have included language knowledge across all levels. While developing grammatical knowledge has been found to present considerable challenges to teachers, the more abstract meaning patterns in SFL's discourse semantic systems encourage the relationship to curriculum goals and discipline practices to be

made and provide an accessible metalanguage to then explore grammatical patterns.

In sum, analysis of the interactions across this setting the context phase reinforces findings from the literature that teachers can be engaged in building knowledge of language through discussion of their everyday teaching and learning concerns. The SFL model allows teachers to recognize metalanguage as a practical tool in the inquiry based approach of PYP curricula.

4A.6 Cycle step 2d: Illustrating the application of knowledge

Having provided an overview of the toolkit informed by SFL's theoretical principles, the mentor was concerned in this initial professional learning session to illustrate the application of the toolkit in classroom activity. A sequence of activities relevant to language, literacy and curriculum goals of early years classes internationally was designed for this purpose. Below we show how key activities within this sequence were used to both build the teacher's pedagogic content knowledge and provide guidance in planning and application of that knowledge. We focus on activities where learning about language is most prominent (i.e. Opening inquiry/ modeling/guided practice stages of the Teaching and Learning Cycle).

Classroom activities

a) Opening an inquiry of text through image

A starting point for demonstrating how language instruction can be integrated into the PYP curriculum was proposed as a broadening of the concept of inquiry to encompass 'inquiry into how texts work'. Building on the earlier discussion of EAL/D students' needs, the mentor presented a classroom slide with images related to different literacy contexts (Figure 4.4).

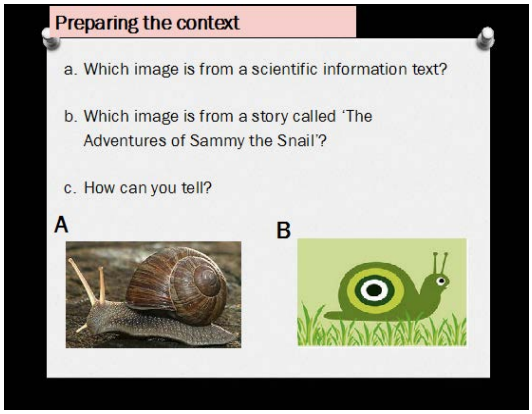


Figure 4.4

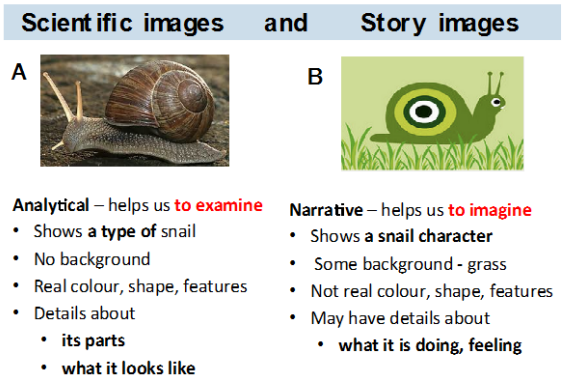


Figure 4.5

The mentor invited the teacher to share her own observations and prior knowledge of meanings in the two images of snails and then built on these understandings to introduce key descriptions of image developed for multimodal discourse analysis (MDA) by Kress and Van Leeuwen (2006). Figure 4.5 was presented to introduce an accessible metalanguage from this model, focusing on distinguishing the analytical images typically used in science reports from a story or narrative image. As is shown in the following exchange, Kerry related the MDA analytical tools to a previous model of visual design she had used but was open to applying an MDA analysis. Kerry

expressed her intention to apply her knowledge to her own teaching context 'if I could replace the snail with the plant', indicating development of deep knowledge (Biggs & Tang, 2007). Research has shown that teachers who apply and transfer their professional knowledge to new contexts, such as developing teaching practices, have a significant impact on student outcomes (Darling-Hammond, 2006).

b) Opening a Inquiry of topic (field focus)

After having developed a shared metalanguage for discussing meanings in scientific images, the mentor shifted the focus to the field of the scientific inquiry, showing illustrative mindmap activities and questioning typical of PYP inquiry (e.g. Figure 4.6). Drawing on the accessible metalanguage of the 4x4 framework, the mentor discussed ways of classifying ideas to build the field or topic area in a way valued within science. As is shown in Figure 4.7, features of the animal form sub-topics, which are glossed as 'bundles of information'.

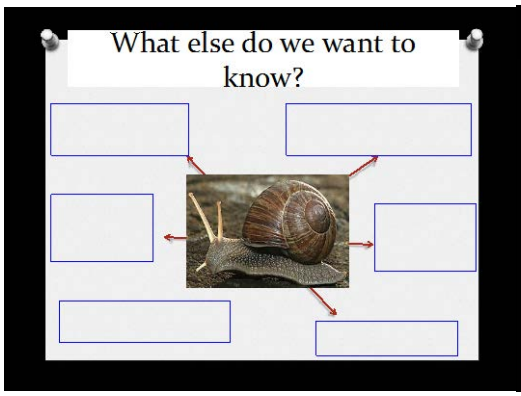


Figure 4.6

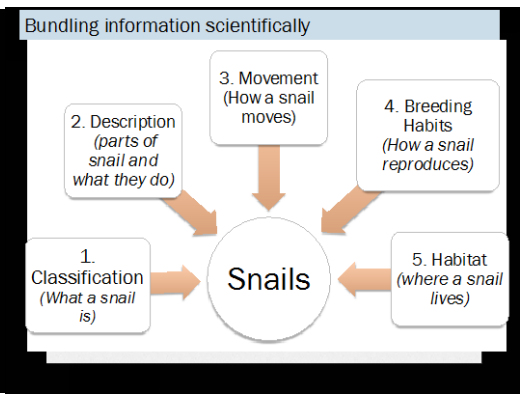


Figure 4.7

These inquiry based activities, which were very familiar to Kerry, provided an essential foundation for the more explicit modeling of a target or model text that is crucial to the explicit genre-based pedagogy. Figure 4.8 shows a mode text.

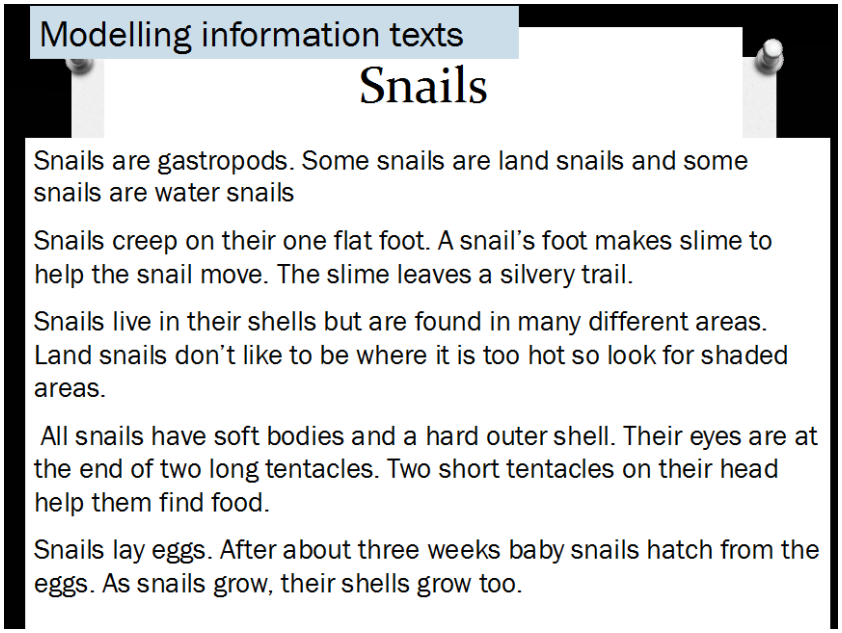
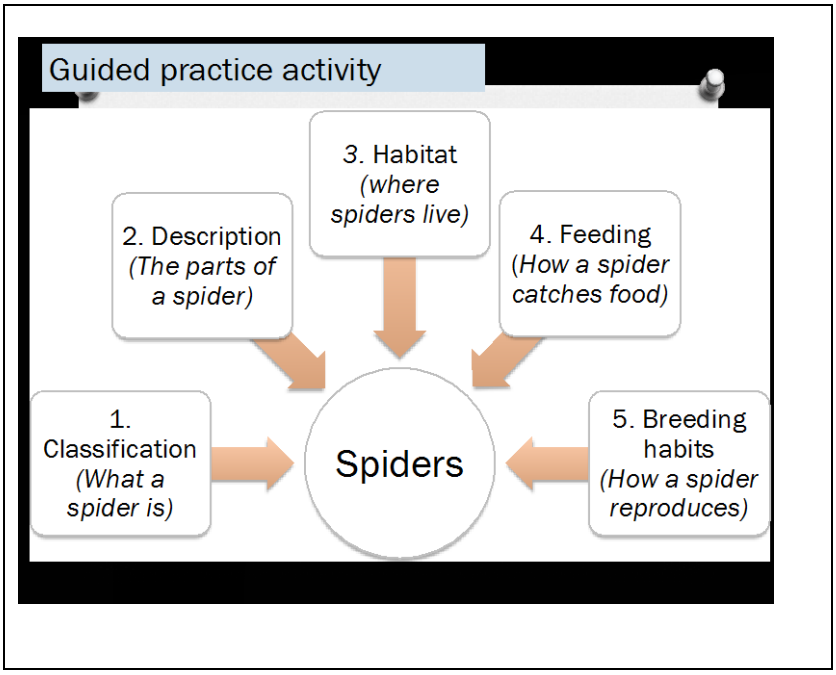


Figure 4.8

Although time for discussion of language features of the text was limited, the mentor related each of the paragraphs to a bundle in Figure 4.7 At this stage little elaboration was provided of lexical and grammatical patterns that distinguished each of the bundles. Instead, the mentor provided illustration of how knowledge of scientific 'bundling' could be applied to create an engaging classroom activity. Figure 4.9 presents such an activity, requiring students to bundle information about a related topic, spiders, according to scientific categories.


Guided practice activity
3. Habitat (where spiders live)
2. Description (The parts of a spider)
4. Feeding (How a spider catches food)
1. Classification (What a spider is)
Spiders
5. Breeding habits (How a spider reproduces)

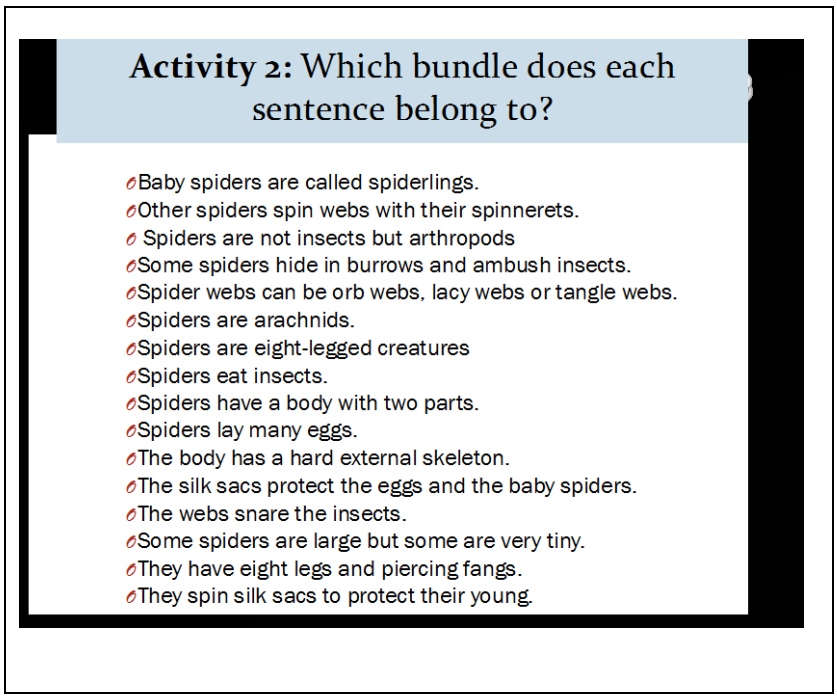


Figure 4.9

These slides, with teaching notes to guide application were provided to the teacher and she was encouraged to prepare a lesson for her class to immediately apply some knowledge of language and image. Here too Kerry expressed her intention to adapt the materials to guide a scientific inquiry of information reports about plants.

Research reflections: illustrating the application of knowledge

The classroom activities prepared to model explicit teaching of language served a number of professional learning purposes. The use of image analysis provided an accessible context to apply SFL's context/language theory to a critical pedagogical issue facing the teacher, i.e. the difficulty faced by EAL/D students in recognizing and maintaining an appropriate scientific role or voice in writing, while also providing a context to engage students in an inquiry into the language patterns of scientific information texts. The universally relevant topic of animals makes it possible for teachers to use the already designed slides and teaching notes immediately and/or to adapt them to related fields of inquiry (e.g. plants). The materials provide both useable teaching resources and valuable scaffolding for teachers' own language development.

The use of two related fields for modelling and guided practice also promotes student led activity. However, as student activity is designed to follow teacher-led modelling of textual features, the approach represents a significant shift from social constructivist pedagogic models.

Given the very real time constraints of this introductory session, introducing a metalanguage for both image/text analysis and 'bundling' may risk 'cognitive overload'. During this phase of the session, there was little opportunity for the teacher to examine the materials closely and to participate in guided practice, using the metalanguage introduced by the

mentor. It may have been best to focus on the image analysis, including the introduction of further metalanguage tools for distinguishing and characterizing analytical images. There is a danger that in responding to pressure to present engaging possibilities for applying knowledge, opportunities to deepen that knowledge may be missed. However, as we will discuss further in the following section, the modeling provided in this session, in addition to the 'take-home' teaching notes to accompany the classroom slides, enabled Kerry to develop successful lessons in both image analysis and bundling.

4A.7 Cycle step 2e Appling knowledge: integrating language, literacy and learning

In the week following the Skype introductory session, Kerry recorded a lesson in which applied her knowledge of image analysis. Despite her intention to change the lesson to the topic of plants, Kerry decided to use the materials prepared by the mentor. The familiar field of animals enabled the class to focus the inquiry on text – in particular on the compositional features of the images and the relationship to context. The lesson began by opening the 'scientific inquiry' and then focused on extending students' knowledge through modeling and guided practice.

Lesson 1: Opening an inquiry of scientific language

- *What do scientists do?*

To open the inquiry and thus set the context for an analysis of scientific images, the teacher and students discussed the role of a scientist. In response to the question 'What do scientists do?' one student suggested that they 'examine things'. The concept of examine, which the teacher unpacked as 'looking at something carefully so that we know what it is' opened space for an analysis of the images using the initial image of snails shown as Figure 4.4 above.

- ***Exploring features of scientific and story images***

Analysis of the recorded lesson showed that students were well able to contribute meaningful observations to distinguish features of the image that they considered to be scientific. These observations included:

S1: It is 'real'

In comparison they gave evidence that the narrative image was not 'real', using the modifier 'fake' *(i.e. The fake snail is floating)* and adding several more observations such as:

S2: Normally snails don't have a green shell

S3: the antennae and its head shouldn't be up there

S4:it looks more like a drawing

At this stage there is no technical talk about the images – beyond distinguishing them as scientific and story – however features such as 'colour', 'detail' and 'information' are noted and present a foundation for building a shared functional metalanguage.

Following this discussion the teacher made links between the 'analytical' features noted and the more personal attributes of the images included in some of the EAL/D students' reports. Without referring to individual reports, she commented

Snail B is cute – would that be ok to put in a scientific information text?

- ***Guided recording of scientific observations***

In the final phase of the lesson, the teacher led students in recording information about snails they had gained from the scientific image on the white board. As can be seen from the interaction, all information which was provided by students can be characterised as 'fact'.

T: What do we know about snails from this picture?

S1: Snails are different from us because they have eyes here

T: So.. they have eyes on their antennae.

S2: They do like to live in the dirt

T: what is your fact?

S3:Can I tell you the joke and then tell you the fact

What do you call a snail without a house?

A slug – because a snail without a shell is a slug

..

T:One more fact… anyone got the last fact

S 4: snails have spirals on their shells

S5:What's a spiral

T: A big whirley circle

- ***Reflection***

Following this recording, the teacher stopped to reflect with students on the scientific detail available from the image

We've got lots of information about snails – just from looking at the picture

Reflection on 'Opening an inquiry' step

The analysis of this opening step in the classroom teaching and learning cycle revealed key insights about the use of knowledge about language in inquiry based classroom instruction.

Firstly, the professional learning focus on semiotic distinctions between the scientific and 'everyday' register directly informed the ongoing scientific inquiry of the class. According to Ryder (2012) 'the greatest promise for scientific inquiry lies in supporting students' understandings of the professional scientist'. As we have argued, a crucial practice of a professional scientist is communicating with 'expert' scientists and 'interested' non-scientists. In guiding students to delineate the practices of science (i.e. to examine) and contrasting that with the goals of story writers (to entertain, to engage), Kerry opens space for students to reason about the semiotic choices in images. The activity can then be characterized as promoting students' discipline literacies.

Importantly, the shared analysis of images leads directly to supporting students' own practices. Having shared knowledge of features of scientific images and a metalanguage for distinguishing them from 'story' images, teachers can provide guiding criteria to students in their research.

While at this stage, the language used to talk about language cannot be characterised as metalanguage as it focuses on examples rather than

patterns, sharing understandings of contextual expectations opens space for such a metalanguage to be developed.

As can be seen in the excerpt from Kerry's email report her evaluation of the lesson was very positive.

> *T: The lesson on the pictures of non-fiction and fiction went really well. … you can enjoy a whole 20 minutes of the thinking that was going on in my class with regards to the slides. We did not finish all but what we did was quality!'*

The reflection related to the time 'we did not finish' is of interest as teachers are often reluctant to spend time exploring language in disciplines beyond English. But Kerry's recognition of the quality of the work reflects the value of integrating text and content inquiry.

The mentor's response to the classroom data was also positive

> *M: That was amazing!!! Thank you so much for taping it and giving me the pleasure of hearing you and your scholars at work. So engaged!*
>
> *I think these kids might be ready for a bit more metalanguage related to the images too so will prepare a few probe questions of 'things that make a scientific images scientific!!' and send it to you tomorrow to*

see what you think. Are you planning to work on the 'bundling' slides next?

In this response the mentor brings in the issue of metalanguage and offers to provide guidance in extending the repertoire of resources available. The context for explicit knowledge of language is couched in inquiry terms as 'a few probe questions'. As can be seen in the teacher's response, the offer to provide more instruction is welcomed by the teacher, who also shows her interest by revealing that she listened again to the recording.

T: When I listened to it again, I thought they were quite amazing too. Yes, planning to do the bundling and had everything prepared for the lesson on Friday, but they got all involved in the images that we did not get that far. Would welcome any slides to do with furthering their metalanguage related to images!

Such reflective practice and willingness to make time for such knowledge building is remarkable given the pressure on the teacher during this period. It indicates the importance characterising language inquiry in ways that are recognised as 'core business' to teachers and of selecting engaging and accessible 'ways in' to learning about language.

To further support the teacher's knowledge to distinguish features of scientific images (e.g. conceptual images) from those used frequently in fiction (e.g. narrative images), a set of slides with teachers notes was

prepared and sent to the teacher following the first Skype session (see appendix x). While Kerry's response to these slides was positive, the focus of her application in the classroom moved to supporting students' knowledge of bundling using verbal text. In our report of our second case study we will discuss how a Year 4 teacher used the extended metalanguage of scientific 'conceptual' images including 'analytical processes', to introduce a metalanguage to talk explicitly about discourse patterns of verbal language.

Lesson sequence 2: Bundling ideas in information reports

Following the sequence distinguishing the reporting work of a scientist through exploring visual images Kerry focussed on verbal language of reports and particularly on discourse semantic patterns which develop topics and sub-topics in reports. The metalanguage used to introduce different ways of classification in the early years was 'bundling'.

Following reading and of the information report on snails (Figure 4.8) and the use of the diagram on Figure 4.7 to relate paragraphs to particular topics or bundles (see Figure x above and slides x-y in appendix b), students engaged in a guided practice activity using information on the related field of spiders. Analysis of this lesson, which was recorded by Kerry, provides further evidence of the application of professional learning. An orientation to the lesson was provided in the email to the mentor.

Today I gave out the sentences on strips of paper, which after a little introduction and looking at the slides on bundling, they then bundled the sentences in collaborative groups of 3. I managed to make recordings of 2 group's talk. It is a little noisy but ***the talk is very interesting...***

Also I have a video of one group ***explaining their thinking*** *and why they placed the sentences in the groups they did. I will continue with this tomorrow...*

Texts produced during this activity included:

- student led interactions, which were initiated by teacher instructions to not only bundle the sentences but to explain how they bundled them
- completed charts of bundled sentences
- student-led formal reporting (monologic) of their reasoning teacher student interactions which occurred during this activity as well as the bundles texts
- teacher led summary and reflection

Illustrative samples of these texts are provided as Appendix x.x-u

- ***Bundling in small groups***

Analysis of the group activities revealed great engagement of students in the activity, with conversation relating always to the activity even when the teacher was not present. The activity required students to read the sentences

and to negotiate the group each belonged to. All students demonstrated understandings of the principles of classification – using simple 'bridging' metalanguage such as 'go together', 'we've sorted everything' and more abstract concepts such as ' these are related' in addition to the frequently used term 'bundling'. This term was used as a verb, 'we've bundled everything' and in noun 'bundles' and gerund form 'bundling'.

Examples of such metalanguage are highlighted in the following excerpts from two groups:

Group 1

*S2 These ones **go together***

*S3 and these two **go together***

S2 Spiders' webs can be orb webs or tangle webs

S1 Oh this one goes here!...

S2 Orb webs and tangle webs...

...

S1 This one goes with the body parts

S2 Spiders are large but some are very tiny

...

S1 And this one is spiders eat insects. Where does spiders eat insects go?

S1: ***We've sorted everything***

Group 2

Some spiders hide in burrows and they can get insects - ***I think that would fit together***

And baby spiders are called spiderlings – we have to find another one for it

And here the webs snare the insects and spiders webs can be orb webs, lacy webs or tangle webs. ***They should be together***

And other spiders spin webs with their spinnerets

These go together.

In this group, students were also able to identify gaps in their knowledge and areas of further investigation. For example:

And we want to find out more about spiders, their body parts because we don't know their body parts so we need to concentrate on that bit

This one, 'spiders eat insects', is really interesting because what kind of insects do they eat?

Some reasoning was also attempted by students in their groups. For example:

S2 where should these ones go? Spiders are not insects but arthropods

S1: Sea urchins! – Well …I think these are related ***because they are sea urchins and those are like sea urchins just with legs and they're not spiky …***

However, the students were more successful in reasoning when guided by the teacher, using their knowledge of 'topic'. For example:

T Can you explain why you are bundling what you do as you do?

S1: Because like – Spiders have bodies with two parts and spiders are 8 legged creatures. That would fit together

T: Why?

S: Because it's like a body part.

T: It's like a body part so all the body parts fit together. Ok

S1: And they have 8 legs and…

T: Those fit together.

- ***Reporting back***

Following this activity, each group of students presented their 'findings' to the class in an oral presentation, supported by a chart with their organised bundles and scaffolded by questions by the teacher. One of the sample oral reports was closely analysed to track students' developing understandings of how knowledge is organised in scientific reports and their developing control of the scientific report genre.

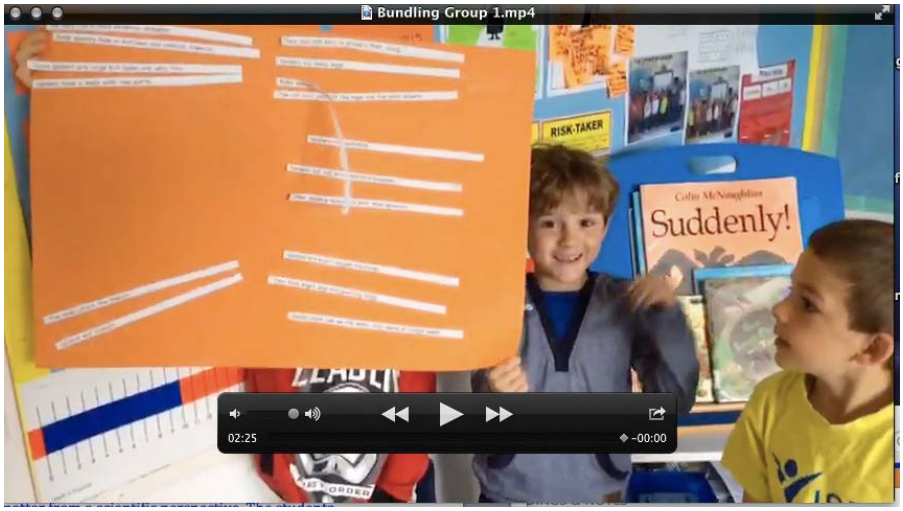


Figure 4.10

The move from this group of students' bundling conversation to the formal report was marked by a move towards the organized, 'written like' mode and more general 'academic register'. The presentation was monologic and organised around topic bundles. As is evident in the following excerpts, the move from bundle to bundle was clearly signalled to their audience. Also evident is the expert tenor role taken by the student, with a clear intent on informing rather than sharing feelings about the topic.

> *S1: We did this group because it was about the body part of the spider. So lets say 'the body has a hard extroskeleton and spiders have bodies in two parts.*
>
> *And then our second group, we did what the spiders eat. So the web snare the insects and the spiders eat the insects*
>
> *T: So how they get the insects and that they eat insects you put into one group, OK*
>
> *S1: They spin silk sacs to protect their young, they're protecting their young eggs that are opening*

T: How do they protect them E?

S1: They protect them by…

T: What's that sentence? They spin silk sacs to protect their young. So that has everything to do with?

S1:Baby spiders

T: OK

S1: And our fourth group, we have spiders are arachnids and spiders are not insects but are arthropods and other spiders spin webs with their spinnerets

T: So everything to do with what spiders are. And the last group … (if you can just hold it up a bit)

S How many legs they have and about the web.

T Ok excellent great

S1: Spiders are eight-legged creatures

T: so everything about their parts and what they've got

Throughout the presentation the teacher played a crucial role in supporting students to move to more abstract, condensed ways of naming the bundles (e.g. *how they get the insects; that they eat insects; their parts and what they've got).*

Following this activity, students worked more independently but with continued support to record and bundle information about an animal, insect or plant of their choice. The teacher then worked with a small group and took one child's sentences and bundled them. As they did so they were able to identify gaps and find more information relevant to the scientific field.

Reflections on guided practice and independent activity

Important insights from this section relate to the emphasis on reasoning in the class and the shared understanding of students for the need to reason. Also evident, however is the important role of the teacher in co-construction of reasoning – i.e. forming explanations.

The use of two related fields for modelling and guided practice appears to promote student led activity as the modelling provides students with clear expectations and a metalanguage – setting them up for success in the group activity. However, as student activity is designed to follow teacher-led modelling of textual features, the approach represents a significant shift from social constructivist pedagogic models.

Professional learning Session 3: Learning about meanings inside bundles

The third professional learning session focused on extending knowledge of the meanings that 'tie the bundles together' – forming a bridge between a discourse semantic perspective on language to a lexico-grammatical perspective. In this 'elbow-to-elbow' mode, the boundary between professional learning and classroom application was considerably blurred. Professional learning input was provided largely through classroom slides prepared by the mentor and directed to students. Each slide included elaborating notes for the teacher. Following discussion of these slides with the teacher, the mentor was

invited to the classroom through Skype to lead the application as a modelling/team-teaching session.

- ***Knowledge about language – Discourse semantic meanings for representing experience***

The starting point for exploring meanings in bundles was on experiential meanings which flow across paragraphs and sentences. These meanings, which are shown in column 3 of the 4x4 toolkit below, are discourse semantic patterns within SFL's system of Ideation. Martin & Rose (2007) define these meanings as 'representing experience' or 'what the text is about'.

In the 4x4 toolkit for early years reports, we included more generalised meaning bundles than those the children had used for the specific topic of animals. These meanings, which are typically found in information reports across a range of topics in science and social sciences, relate to classifying, describing parts and telling doings.

Language to	**Whole text**	**Across sentences and paragraphs**	**Groups in sentences**	**Word & expression**
express ideas *meanings related to field or topic*	A living or non-living thing or place is described and/or classified through stages of: • Identification • Description	Information bundles • classify • describe parts • tell doings	• **verb groups** o **relate** things & qualities o name the **action** • noun groups with classifiers & factual describers say **What**? • adverbials say **where, when, how?**	Technical terms for specific topics Present 'timeless' tense

Table 4.2

Lesson sequence 3: Learning about meanings inside bundles

As with other applications, the lesson sequence was designed as Teaching Learning Cycles with iterative stages of: opening the inquiry; modelling; guided and independent practice. The initial opening the inquiry and modelling stages were presented as team teaching mode with the mentor leading.

- ***Opening the inquiry***

a) Review and Reflection (feedback on student texts)

To begin the lesson sequence, the mentor provided feedback directly to the students on the oral texts they had produced in their two lessons, celebrating their success in scientific bundling and in reasoning. Students were well aware of the mentor's role as a 'listener' to these recorded lessons and had actively participated in recording their group activities.

Reflection of the students' completed bundles opened space for a shift in the focus of inquiry to language patterns within bundles. For example:

> *M: You didn't bundle in exactly the same way because each group saw different things to put together. So today we want to spend a few minutes talking about the different ways we know that information goes into a bundle*

Questions were firstly posed to elicit patterns related to the elements of meaning which 'tied the bundles together'. Two representative slides which show this iterative 'opening the inquiry' stage are shown as Figure 4.11 and 4.12

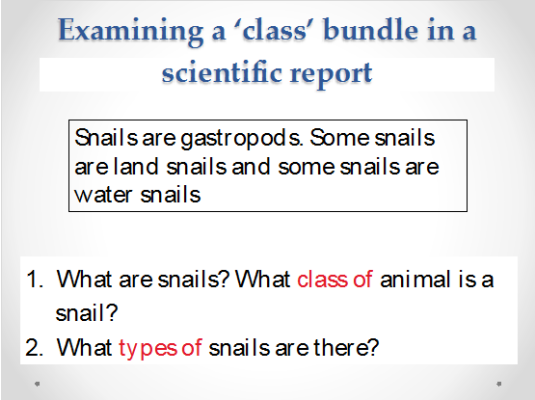


Figure 4.11

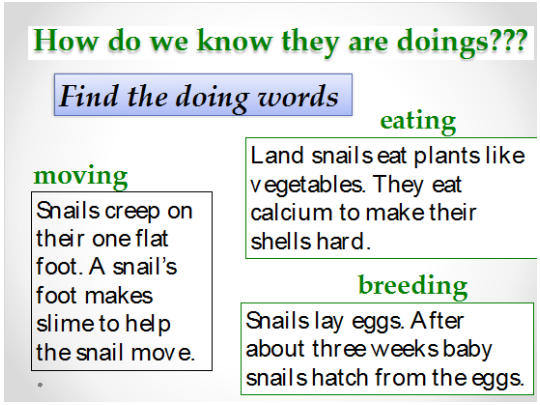


Figure 4.12

Note the colour coding on these slides with classes and types provided in red and doings provided in green. The choice of colours prepares for later attention to the association of these meanings with particular grammatical groups. 'Class' and 'type' meanings focus on things and descriptions, which are termed participants in functional grammar. Participants are traditionally colour coded in red when working with young children. Meanings in doings groups are predominantly expressed through processes and particularly action processes, which are coded in 'green'.

- ***Modelling***

Although modelling is typically viewed as a teacher-oriented activity in genre-based models the focus on relatively recognisable discourse semantic patterns

enabled students to be active in constructing meanings throughout this stage of the lesson sequence. This is demonstrated in the classroom resources where an inquiry slide always precedes explicit demonstration of the language pattern. Language patterns that distinguished parts, classes and doings bundles were made visible through teacher talk and colour coded responses to the questions on the slides. Working with an interactive white board would naturally further blur boundaries between the different stages, but the more static Powerpoint model made visible to students the patterns and their relationships.

In the sequence shown in Figures 4.13-4.15, the first modelling slide also opens inquiry for exploring more delicate modifying meanings which 'add information' to parts.

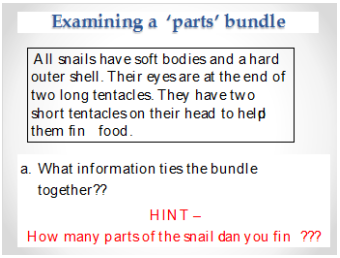


Figure 4.13

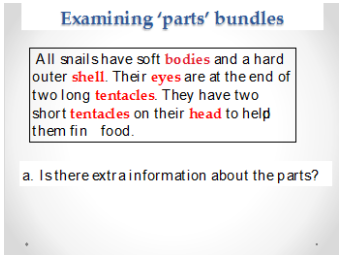


Figure 4.14

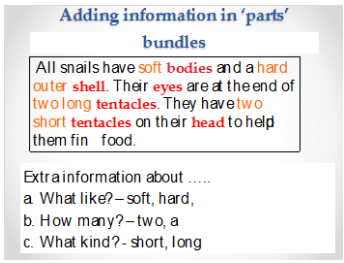


Figure 4.15

- ***Guided practice***

Guided practice activities provided students with opportunities to more actively engage with knowledge construction throughout the lesson sequence. This activity was initially carefully scaffolded, revisiting the now familiar field

of spiders. Meanings within each bundle were examined with the same probes as those used in the modelling stage and patterns discussed as a whole class before students moved to examining the next bundle. For example:

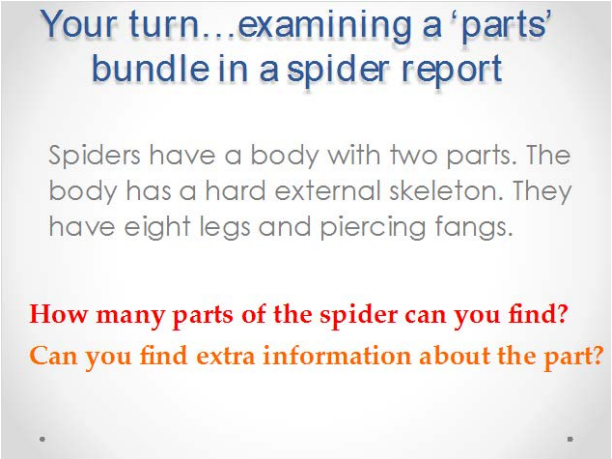


Figure 4.16

More independent practice activities were then conducted in small groups using sentences from their own topic. The teacher continued to provide guidance and also encouraged students to reason about their choices. As is evident in the following excerpts from the reporting phase of the activity, students very confidently bundled according to these more generalised meanings and both the teacher and students used the metalanguage of classes, parts and doings to explain their bundling.

Report 1

T: What about you L. Did you finish yours? Can you explain what you have done?

L: Mine is about wolves. I did parts in the orange and that is number 2. Number 1 is class and that's pink.

T: What sentences are in your classes?

L: Class is 'Wolfs are mammals. Wolfs are members of the dog family'

T: And the parts?

L: And the parts are 'wolves have many teeth, wolves have four legs'

T: And the doings?

L: Wolfs live in cold places. Wolfs hunt at night. Wolfs hunt in a pack

T OK perfect.

Report 2

T: E, what have you got there?

E: I'm doing my project about lions

T: So what are the classes? What are the sentences that belong to the classes?

E: Lions are mammals, lions belong to the cat family

T: Oh very Good – not only are they mammals but they also belong to a family. What about the parts of the lion, have you got any sentences about the parts of the lion?

E: No

T So is that something you need to have more information about?

E: Yes

T: And the doings?

E. The doings, I've got lions live in Africa and in India in the mountains and in the wild.

Lions like to eat wild deer. Lions go around and get lunch and dinner for free.

Lions run a lot and waste energy a lot

T: Good! Excellent, so lets share those.

- ***Whole group teacher-led reflection and evaluation***

In bringing this activity together to discuss with the whole class, the teacher chose examples of bundling patterns to reinforce key features of language. In the first excerpt, she uses E's example to draw attention to the need to find more information about 'parts'

Now I chose E's because he has got two bundles. He has a lot of the doing.

So E hasn't got a lot of information about parts… so when you go back to writing your information text, you might need to focus on 'what are the parts of the lion that I want to tell people about?'

Or C – who has lots of good information, but it is only about their doings. So he has got lots of good information about sharks, but he needs to now think about what class a shark belongs to and what are the sharks parts.

So that has helped us to think about information texts and what we need to put in them.

The bundles were also used to probe the use of personal descriptions by one student

T: Lets have a look at M. Now, 'Dogs are cute'. Which bundle does that belong to, the classes, the parts or the doings? If it belongs to a bundle at all, think about it. Does it belong to any of those bundles?

S: Class

T: Do you think it's class? It belongs to the class 'cute'

S: It could belong to the 'cute class'

T: You could look at it that way

S: Parts

S: Doings

T: The doings. They are cute, so they do cute things. Maybe that's what you're thinking. Some people don't think dogs are cute

Lots of comment from students 'I hate dogs', 'I love dogs'…

T: Remember when we put on our scientific hat, we are putting on a hat which looks at facts, information. Dogs are cute. Is that somebody's opinion or is that a fact?

S: Somebody's opinion

T: It's M's opinion. M thinks dogs are cute but it doesn't mean that everyone thinks dogs are cute. So, it's not really a fact. It's M's opinion. So it doesn't belong to any category. Because it is an opinion.

Reflections on exploring meanings in bundles lesson sequence

The confident participation by all students in categorising their own information and explaining the patterns indicates the accessibility of the metalanguage used to name bundles. Identifying bundles such as parts, classes and doings does not require the technical knowledge of grammar but still allows for clear patterns to be made visible, which can later be connected to grammatical realisations.

Working with discourse semantic meanings allows students to be set up for success. Working at the grammatical level (e.g. types of verbs) require sharper definition but discourse semantic meanings are closer to context in the SFL model and can therefore be more easily related to meanings in the field (e.g. class). This also means that science inquiry questions can be easily turned into language phases or bundles.

The metalanguage of bundles and types of bundles in the scientific reports is used effectively here to categorise functions of language at the phase level (class, parts, doings) and to evaluate the type of information that is relevant to scientific reports.

There is much room for discussion and students take full advantage of this room to negotiate where information belongs, evidencing deep thinking about language and its functions. Also vital is the impact of the analysis in

terms of providing direction to students to continue their writing by making visible the bundles which are still to be examined.

Importantly, the scaffolding provided prior to this activity has set up students to achieve. Aspects of each child's writing can thus be celebrated and built on. There is real inquiry going on here – inquiry which is focused on language choices but which infuses inquiry into text with inquiry of the field.

The evaluation of this three lesson sequence by the teacher (see Appendix x) also attests to the value of integrating language and discipline learning. Of particular relevance are her comments related to the use of metalanguage.

> *We do share our writing a lot but it is not focused on the actual components or grammar, it is more general. Providing them with terms: bundling, class, parts, doings, has really helped give the discussion a focus.*

Also important are the reflections related to using discourse semantics rather than grammar as a starting point of language instruction. The teacher comments

> *…Grade One children are still very focused on getting their thoughts down on paper in words that others can read – some are hindered in writing because they feel they have to spell all words*

correctly. Thinking things through sequentially is a big concept for them to practice.

Also valuable are the teacher's reflections on the place of text analysis in an inquiry

I am thinking that the negotiation is a big part of inquiry. Reflecting on what others are saying and questioning whether it is true, is a discussion value that is very democratic and scientific and so this whole process of deciding through the use of cues, which category a sentence belongs to, and considering the implied contextual meanings (dogs are cute), has been really worthwhile for them and for me!

4A.8 Impact of language knowledge on students' writing

While final reports produced by students were not available at the time of this report, analysis of their ongoing drafting and reflection on their compositions revealed considerable expansion of language. Analysis of classroom conversations above revealed that all students were able to effectively reason about their language choices in their own writing. Kerry's observations of students' preparation for writing supported this finding. For example, she reported

> *They used images on their Ipads ..they had to find an image of their animal or whatever it was, and tried to describe what they saw. This was quite useful. It meant that their reliance on other people's texts was lessened. Their actual observation and the use of what they can see and what they know as scientists themselves was brought to the forefront. That was one of the most useful things.*

As the support required to guide students such as Mary through the writing process of a scientific inquiry had been significant prior to the intervention, findings of students growing independence in selecting information and composing texts is indeed a positive writing outcome.

4A.9 Teacher's reflections on professional learning and application

Following the elbow-to-elbow professional learning and application cycles described above, Kerry participated in an interview conducted by a second researcher. A full analysis of this interview is provided as Appendix 5. Of relevance here is her reflection as the enabling effect of knowledge about language and the functional metalanguage. Her comments attest to the flexibility of the metalanguage and, importantly, the characterisation of linguistic patterns in terms which were able to be immediately related to the context of learning (e.g. parts, classes, doings). This accessible terminology is possible because of the 'top-down' perspective on language which was foregrounded in the 4x4, with discourse semantic level of language mediating more technical exploration using lexico-grammatical tools. Kerry expressed that as matching children's developmental understanding, however, the

terminology from discourse semantics is accessible also because it describes language patterns which are closer to context. The contribution of Kerry's evaluation of her professional learning experience to the ongoing design of professional learning will be further discussed in Section 6 of this report.

Case study 2 – Riverland

4B.1 Case study 2 - overview

Participating teachers	Robyn Young; Richard
Stage of learning:	Year 4 (aged 9-10)
Curriculum area	Science - Energy
Informing Data (see appendix 4B) • ***Teachers' professional learning and application***	Teachers' prior knowledge task Recorded PD face-to-face sessions (3x 40 mins) Slides of 4x lessons (6 literacy activities) Recorded lessons
• ***Students talk and writing***	Students' written persuasive texts prior to intervention Recorded Small group interactions and presentations (x4) Students draft reports on energy Students independent reports on a form of energy

4B.2 Cycle step 2a: Analysing the research context

Findings of teacher's prior knowledge of language & literacy assessment

The analysis of Robyn's pre-professional learning KAL activity also has strong similarities with the general findings for all participating teachers (see section 3). Her metalanguage clearly identifies genres and their overall social purpose, such as in the following comment to identify the function of a text: *to describe and give factual information about people, places and things.* Like the other teachers, Robyn also consistently identifies word level patterns, including: *adjective, proper noun, preposition, verb,* and *article.* A further similarity was that there was also little evidence of metalanguage to identify phases of meaning and their contribution to the greater text.

A further feature of Robyn's feedback was acknowledgment of image-texts relations. Robyn drew students' attention to the potential of images to work with written text, as evident in comments like: *All this report needs now is an illustration to go with your fantastic information; I'd love to see a picture of a Blue Whale to enhance this report.* These comments highlight the multimodal dimension of text creation and an area of possible development in Robyn's own understanding of the relationships between written texts and other semiotic resources.

- ***Analysis of programs***

Analysis of program related to persuasive writing task specified language as *'Students will explore and compose persuasive texts with a focus on ideas, strong voice and present tense'.*

- ***teacher metalanguage used in discussion of assessment***

In discussion with teacher prior to professional learning, it was established that the 6+1 writing traits, originally proposed by Beaverton (Grundy, 1986), had been introduced to address the need for a shared metalanguage amongst teachers.

Figure 4.17

However, when probed to elaborate on her understanding of these concepts, the teacher recognised that not all were relevant to all genres. For example, Voice was delimited as a concern for persuasive writing. As shown in the following excerpt, it was challenging for the teacher to relate the concept of voice to patterns in texts.

M: And how do you understand voice?

T: I think that we specifically chose that for the persuasion. We just wanted students to choose a side of the argument and we wanted to hear that voice from them, so we wanted to hear their voice coming through, loud and clear. Some students they didn't have a very loud voice in their writing and others did.

Reflection

There is a need to both make connections between understandings of language in programs and assessment frameworks used in the school already and to support teachers to unpack concepts so that they provide a metalanguage. Assessment criteria doesn't necessarily give us a metalanguage – in terms of making meanings visible in patterns of language in texts and explaining how they realize more abstract meanings in particular contexts.

Findings of students' prior writing

To assess students' use of language prior to the intervention, samples of a recently completed assessment task were collected. The task required students to respond to the prompt 'school uniforms should be compulsory'. This prompt is typical of persuasive writing tasks set for external assessment such as NAPLAN and the field is not related to a curriculum context. Overall there was little variation in the language choices made by students:

- All students showed good control of the overall stages of an analytical exposition – position, arguments and reinforcement
- The field of all texts related to everyday activities and behaviours typical of school, home and in some cases extended to workplaces.

- All students showed good control of textual meanings to organise arguments into a cohesive written text, including signal devices such as text connectives.
- Good use of text preview but varying use of topic sentences to preview argument by expressing the point to be developed.
- All students used personal voice to put position with high modality of probability. Few students used interpersonal metaphor and when they did it was in reinforcement stage.
- Image included as afterthought – represents two sides with evaluative stance

Some distinguishing features between texts included:

- The degree of elaboration of arguments. Reasoning was evident to some degree through causal conjunctions 'because', 'as' – however, few arguments extended the reasoning
- Paragraphs in some texts included more than one point – often not developed

Research Reflection: students' prior learning as a context for intervention

As with Case study 1, students in this study demonstrated control of an extensive repertoire of academic language resources. Although this task did not require scientific register to be built, the 'everyday' register does present an ideal context for exploring and contrasting register. As with case study 1, the images used present an ideal way of opening inquiry to scientific register.

4B.3 Professional Learning Intervention: Building foundational KAL for Science curriculum literacies

The context of language for recording scientific information shared by both case studies resulted in a number of similarities between the progress of the professional development and intervention by the two teachers. In this section, therefore we focus on aspects which were distinctive, due to the curriculum demands and developmental level of the children.

Elbow to elbow professional learning with Robyn was conducted over three face-to-face meetings with the mentor of 1 hour each. Samples of recorded transcripts with analysis are included as Appendix 4B. Each PL session was supported by emailed slides to support the negotiated intervention with teacher notes.

4B.4 Cycle Step 2b: Negotiating the professional learning context

This important stage was conducted by during school time when the teacher's class was engaged in a specialized curriculum activity away from the classroom. Each session was approximately 1 hour.

- ***Negotiating a curriculum and literacy context for professional learning***

The curriculum area of science had been previously negotiated and Robyn specified the topic area of energy. As with Kerry, Robyn's first suggestion for literacy focus was the context of scientific method – and specifically a type of procedural text for investigating. She was open to exploring 'another text'. Later in the discussion she observed that in teaching the unit last year, she thought it was a bit 'light on' in writing. She observed

Reflection on negotiating curriculum and literacy context

It is not surprising that procedural texts appear to be the most relevant to scientific study as these are directly related to scientific inquiry 'working like a scientist'. However, as a number of theorists argue inquiries conducted by professional scientists differ significantly from those of the

classroom. Veel (1997, p. 169) for example, argues that for science to be 'learnable', students need to be guided in 'organising knowledge into taxonomies, to create axioms, laws and principles to explain phenomena' – drawing on understandings developed from centuries of scientific activity before they can move on to the empirical research and dispute that is 'real science'. From a literacy perspective, this means learning to read and write a range of information reports and explanation genres. School procedural genres thus focus on organising research activity rather than on reporting research activity and challenging research.

The teacher's reflection on the experience teaching the unit in the previous year indicates that herself recognises the relevance of information report within the inquiry. This shows also that teachers reflections on the gaps and possibilities for planning literacy goals need to be listened to in planning for literacy – develops a sense of ownership in the planning

> *they were learning a lot about energy, forms of energy, so they could easily choose a form of energy and write a report on energy from that.*

Negotiation of the focus of the writing takes into account the lines of inquiry – how is it used?, how it works?

- ***Students language learning needs and metalanguage***

As student pre-intervention tasks had not been received prior to the professional learning session, discussion of student needs took the form of reflections by the teacher on the perceived needs. She noted the need for proofreading as well as the problem that 'some of them are writing in one big paragraph and sentence' and that 'they haven't got connection between what they are writing and their audience'.

Reflection on language learning needs and metalanguage

Although the purpose of the writing task did not relate closely to the curriculum goals of the planned unit, reflection of students' writing provided a useful context for planning in the short and long term. The teacher's concern that students were 'writing in one big paragraph and sentence' provides evidence that they also needed support in analysis – i.e. breaking a broad argument as parts such as topics and developing ideas around each of these topics.

In the medium to long term, the teacher's concern to establish a whole school metalanguage and the identification of existing shared ways of may be addressed through making explicit reference to concepts to introduce functional metalanguage – e.g. Voice in relation to persuasive writing.

4B.5 Cycle Step 2c: Introducing theoretical principles: Opening the semiotic toolkit

The initial PL session included a brief overview of key principles of the SFL model of language in the context of language as a set of 'tools' within 'a language toolkit' and, links were made to organisers of the Australian Curriculum.

Research reflections: theoretical principles

As with Case study 1, introducing theoretical framework in context of students writing needs and curriculum goal – with relationships made to already existing concepts. Existing frameworks have been chosen in reasoned principles and cannot be challenged lightly. Teachers prior knowledge may be developed from other theoretical paradigms that are not easily 'translated' – this is very different from most early childhood learning situations where prior knowledge may be more easily expanded.

4B.6 Cycle Step 2d: Illustrating the application of knowledge

The illustration of the application of knowledge in the classroom followed the similar phases as Case study 1. However, in addition to the Year 2 pilot study on snails and spiders, further metalanguage for examining image was provided to distinguish conceptual from narrative images and particular conceptual images, including analytical images. For example

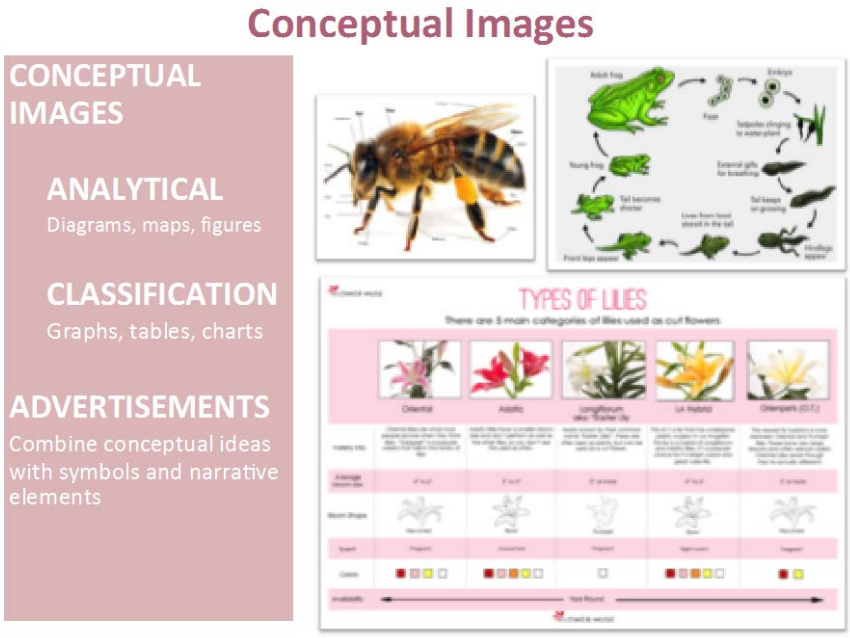


Figure 4.18

Probe questions developed to open inquiry into image were discussed, using narrative and conceptual: analytical images

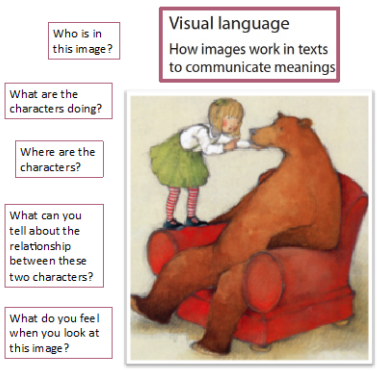


Figure 4.19

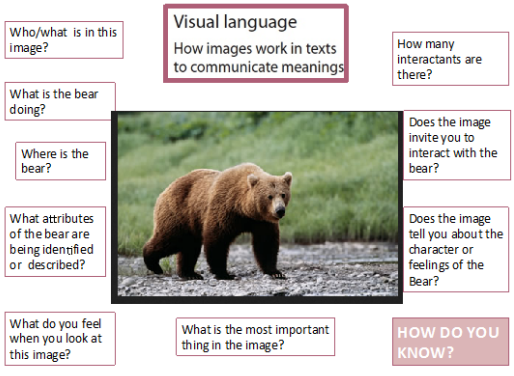


Figure 4.20

Robyn engaged fully in responding to the probe questions in a guided analysis of the images – technical metalanguage included:

- dynamic images with reaction processes - sight lines/vectors – shows the process

- Warm colours – emotion they are touching each other
- The circumstances
- conceptual images: Analytical, classification, Advertisements
- Analytical images – parts of a whole, for example types and forms of energy, energy cycle

Image analysis was related to language through 'bundling' of parts to a whole and sentence types as in professional learning described in Case study 1

Research reflections

For teachers at year 4 level, further technical metalanguage needs to be introduced to assist them to understand the more varied conceptual images they will encounter in an investigation of the more abstract topic of energy. Providing more delicate descriptions of 'conceptual images' and also of different kinds of analytical images is one way of developing more specialised foundations for communicating scientific inquiry. Despite the technicality, image analysis and report writing were recognised by the teacher as valuable activities to enhance the knowledge building capacity of the unit.

4B.7 Cycle Step 2e: Applying knowledge: integrating language, literacy and learning in lesson sequences

The move from illustration to classroom application was scaffolded by the mentor, who adapted the illustrative slides of images and bundling to the

topic area of energy – and particularly forms of energy. These slides, which are provided as Appendix 4B, are organised to support teaching and learning through stages of:

- opening the inquiry through analysis of everyday and field specific scientific images;
- modelling, which focussed on a verbal information report on thermal energy;
- guided practice, which focussed on the form of solar energy;
- planning to research for an independently written report, on another chosen form of energy.

The teacher drew on these slides and the teaching notes beneath them to work through a teaching learning cycle, with ongoing reflection and knowledge building with the mentor in further elbow-to-elbow session via email or face-to-face. Following are findings and reflections from analysis of recorded classroom activities.

Opening an inquiry

a) exploring scientific and narrative images and their contexts

As in the Year 1 class, the teacher used images to open the inquiry, posing questions to students in articulating their observations of the context and semiotic features of a conceptual analytic and narrative image. The more detailed images used (Figures 4.19 and 4.20 above) invited significantly more

discussion of semiotic features, particularly of the evaluative meanings. Questions probing the interpersonal dimension of register included

- *Are you drawn to the picture? What draws you to the picture?*
- *What do you have to do as an audience, as a reader with this diagram?*

b) making connections: exploring images for an inquiry into energy

In the second activity, the teacher recontextualised the field to focus on the topic of energy. This discussion of the lines of inquiry and the articulation of learning goals.

T: So we've got our lines of inquiry. Lets go through them (reads from slide)

- *What is energy?*
- *What forms of energy?*
- *How is energy used?*

I believe that when we finish this lesson we are going to be able to look at all of those lines of inquiry.

A further field specific set of images was used to introduce features of images which may be encountered by students in conducting their research into the topic.

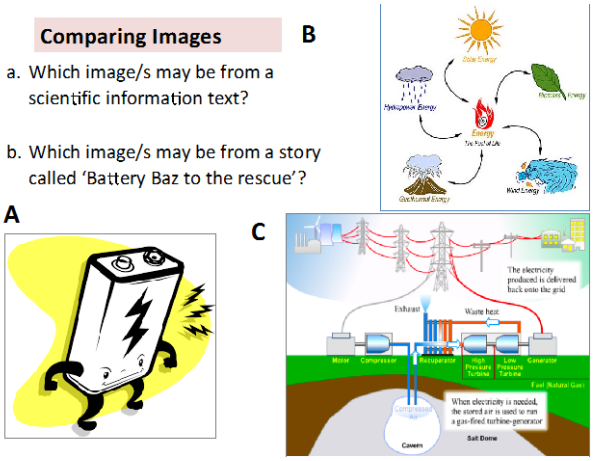


Figure 4.21

These images were probed to provide reasoning using textual evidence. To do so the teacher drew on the semiotic metalanguage as is evident in the following interaction:

…

T: What are the main things or participants?

S: all the different things

T: And energy itself

T: How are the participants related? You start at one thing and it builds up to another

S: Arrows

T: Do you prefer looking at this one? (pointing to cartoon)

S: No, this one because it has my favourite form of energy (B:)

- ***Modelling and guided practice: Bundling***

As with case study 1, modeling focused on experiential meanings – and particularly on discourse semantic meanings related to bundling. Figures 4.22 and 4.23 illustrate the recontextualisation of activities from the animals to energy field.

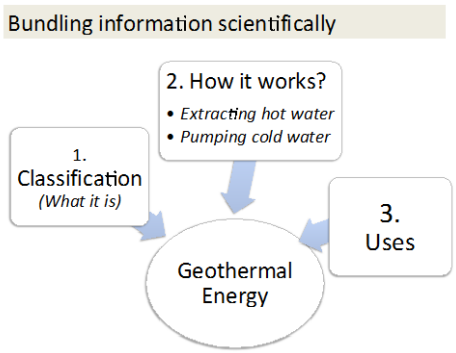


Figure 4.22

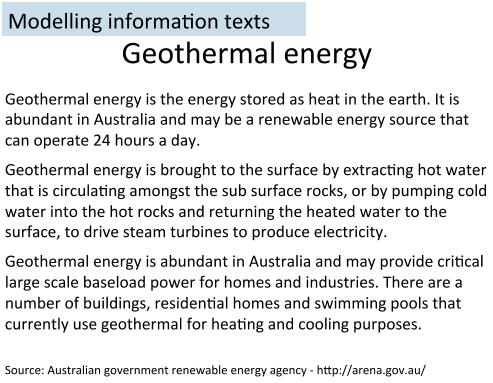


Figure 4.23

- ***Guided practice***

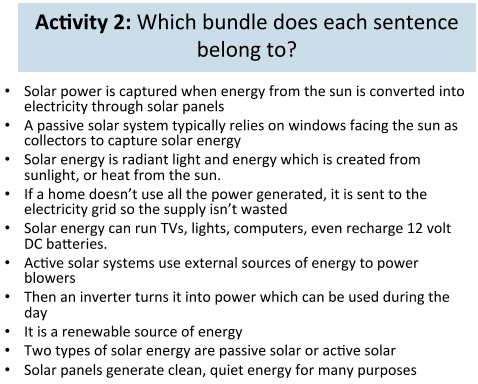


Figure 4.24

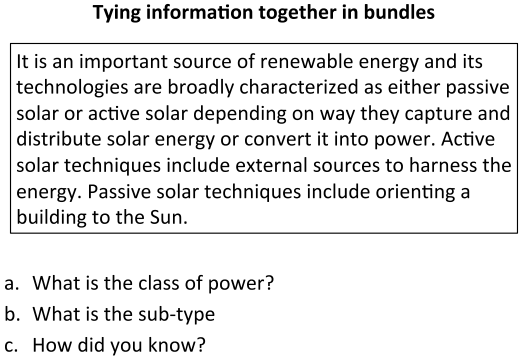


Figure 4.25

While the activities are designed in the same sequence as those for the Year 1 class in case study 1, the field specific bundles (classification, how it works and uses) relate directly to the scientific inquiry questions which guide the unit of work.

Analysis of classroom talk during modelling and guided practice revealed further layers of classification in bundling than those evidenced in the Year 1

activity. For example, in the following reporting back phase, teachers were trying to move students from 'class' to 'type':

> *T: We're going to bring it all together now. So in your first bundle, the classifying – what did you have?*
>
> *S: Solar energy is radiant light and energy which is created from sunlight, or heat from the sun.*
>
> *T: That's what I thought it was too. Did you have anything else for that bundle?*
>
> *S: It is a renewable source of energy. Two types of solar energy are passive solar or active solar*
>
> *T: OK, so what I was thinking was that it might finish after 'It is a renewable source of energy'. You could start to introduce two types of energy, passive energy and active energy because technically you are still classifying …*

This excerpt also shows the negotiating possible in bundling. The teacher reassures students that there is not one way to bundle:

> *T: Don't forget that you are the author and you might have different ways of bundling*

- ***Independent composing***

Support continued throughout the independent research and composing process with the by now recognizable analytical framework presented to guide 'bundling' of information.

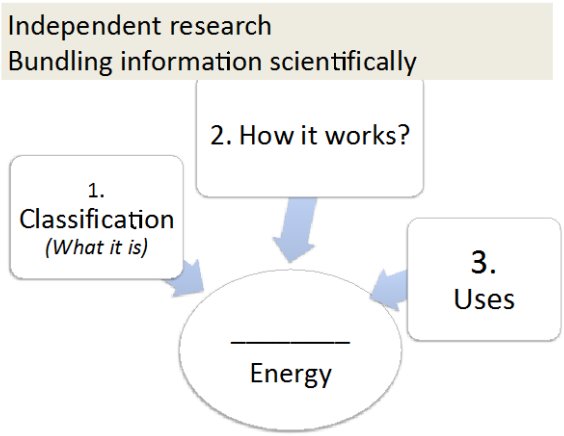

Independent research
Bundling information scientifically
2. How it works?
1.
Classification
(What it is)
3.
Uses
Energy

Figure 4.26

5. Evaluation of case studies 1 & 2

In evaluating the overall impact of the case studies in this report, we draw on the reflections of the mentor following each professional learning and application cycle, on analysis of students' expanding repertoire of language as a tool of inquiry and composition, and the formal evaluation of both Kerry and Robyn of the intervention. The evaluations from these teachers were elicited through interview questions (see Appendix 5a) and their responses were analysed in relation to the design principles, as documented in Appendix 5b and 5c. Key findings from the evaluation of the case study are discussed below according to specific themes relevant to both cases.

Situating professional learning in authentic teaching and learning contexts

Both Kerry and Robyn stressed the importance of the enactment of professional learning within their own teaching and learning contexts. While such a model may require intensive resourcing initially, there is far more likelihood that knowledge is used and developed in meaningful classroom activity. Moreover, the contextually responsive resources, guided by teaching notes enables targeted teachers to mentor colleagues in knowledge development in ongoing 'elbow-to-elbow' professional learning journeys.

The importance of research partnerships between academic mentor and teacher

The researcher participating as academic mentor throughout the case studies brought considerable knowledge of SFL semiotic theories, of discipline literacies and of scaffolding pedagogy. Both classroom teachers brought expertise in inquiry based scientific inquiry and of ways in which students can be effectively engaged, guided and challenged throughout a cycle of enquiry. From the perspective of ongoing research into the development of language learning pedagogies, partnerships with both teachers has opened space for inquiry within the teaching learning cycle, foregrounding the shared interrogation of meanings which can occur as teachers model meanings in texts and gradually shift responsibility through guided and independent activity. From the perspective of teachers conducting scientific inquiry in the early and middle primary years, the partnership has enabled them to better recognise the role of language theory as a toolkit for inquiry and to appreciate text inquiry as a focus of instruction.

Creating and adapting classroom resources

Having robust semiotic and pedagogical models as starting points for both professional learning and classroom implementation meant that resources prepared for the classroom can be efficiently adapted for shifts in the field of inquiry and other contextual variables. In particular:

- Knowledge of predictable structure and language features of information report genre enables efficient preparation of model texts;
- Knowledge of the stages of pedagogical cycle enables adaptation of activities to scaffold developing understandings of the genre.

Designing a pathway for language learning in the context of scientific inquiry

Analysis of this lesson sequence provided significant insights not only to inform models of professional learning and classroom language instruction but also to inform decisions related to the scope and sequence of knowledge about language within a science inquiry.

While image was used in both units primarily to open an inquiry into verbal text, our analysis of the two teachers' work enables a possible pathway for developing students' repertoire of semiotic understandings related to images as well as those for exploring verbal language in information reports.

Table 5.1 presents a preliminary map of metalanguage for exploring meanings in scientific reports including both visual and verbal text. Expansion of meanings is informed by analysis of metalanguage used in the early and later years of primary schooling by the teachers in the two case studies studied in this project.

Building a metalanguage toolkit to explore visual and verbal language in information reports for science inquiry

	Year 1 – early years	Year 4 – towards middle years
Context	**What do scientists do?** Examine things	**What do scientists do?** Analyse = examine each part of something closely classify, explain
	Why do scientists write? To tell what they have done and discovered To give information about scientific things	**Why do scientists write?** To build on knowledge from other scientists To record their observations and experiments To inform others
Image	What 'world' does the image belong to? (e.g. 'scientific', 'everyday, fiction etc..) Scientific v story images	Metalanguage: reinforce distinctions and characteristics of: Types of texts - purpose: • narrative – text and narrative image • information texts / conceptual image
	How do we know it is scientific or story? • Story – not real colour, happenings, cartoon, background, extra details • Scientific – 'real', Information – labels, no extra details	Information images = conceptual • Analytical (diagrams, maps figures) • Classification (graphs, tables, charts) • Advertisements (combination of conceptual, narrative) Analytical images – parts of examples of photograph timelines
	Scientific images build a scientific world of: • Types • Parts • Doings	**Representation** – how do the images build the field • Processes – parts in relation to whole • Participants – carrier (whole) and its attributes (parts or stages or events) • Circumstances – where is it happening?
	How do scientific images inform us?	**Interaction**

	• Realistic • animals not looking at us, not cuddling, playing or doing human like things	Audience use of images • Narrative – predict • Information – examine effect on audience –
	The scientific thing we are studying is alone on the page	**Composition** – arrangement on the page, most important part of the image
Text (verbal language)	**What kinds of texts do scientists use?** Information, fact	**What kinds of texts do scientists use?** Information report, explanation, scientific method, arguments, research report
	Bundles Types of bundles parts, classes, doings	**Bundles** – **Relating bundles** – parts to a whole - building an analytical framework
	Language patterns in bundles • Classifying Sentences (what is it?) • Describing Sentences (what is it like?) • Doing Sentences (what does it do?)	**Language patterns in bundles** • Lexical cohesion – e.g. relationship of synonymy between words like 'purpose' and 'use' • Previewing – introducing sub-types in classification to preview to the reader but not elaborating
		Organising information within bundles Packing and unpacking information – Topic sentence to preview bundle ^ Elaboration to give details or examples Example of different types of bundling in persuasive and information text
		Breaking bundles into sub-bundles Metalanguage related to textual function of signalling and previewing

Table 5.1 a preliminary map of metalanguage for exploring meanings in scientific reports

Impact on students' writing

Throughout the application lessons, both Kate and Robyn collected examples of students' writing, both in guided and independent situations. Analysis of extended literacy practices, included composition of texts using analytical images to complement scientific bundles. Analysis of language patterns across these texts are found in Appendices 4a and 4b. The following sequence of texts illustrates the range of writing practices in which students in both classes successfully engaged.

1. Students' analysis and reconstruction of others' scientific writing

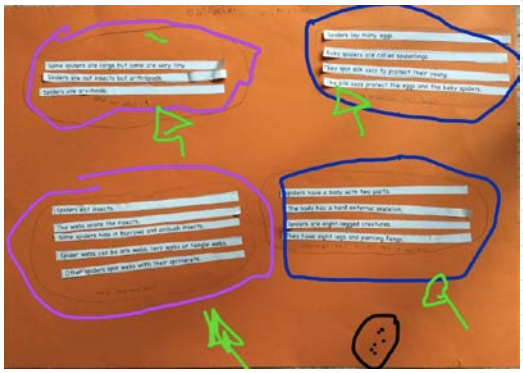


Figure 5.1a

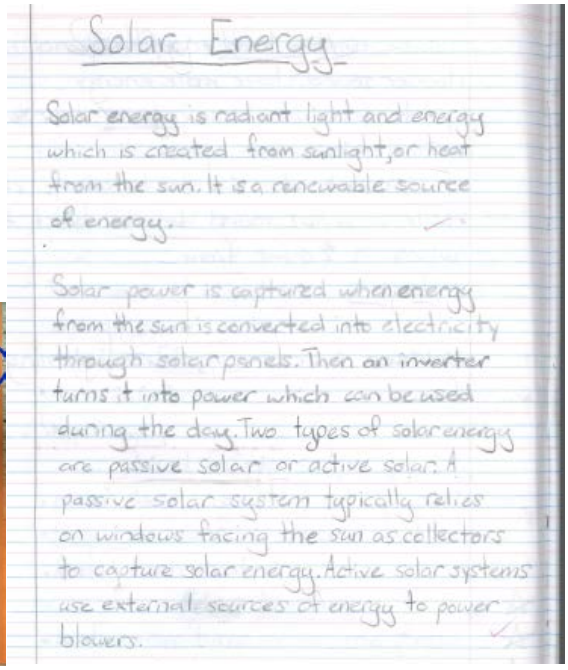


Figure 5.1b

2. Joint construction of scientific text and image

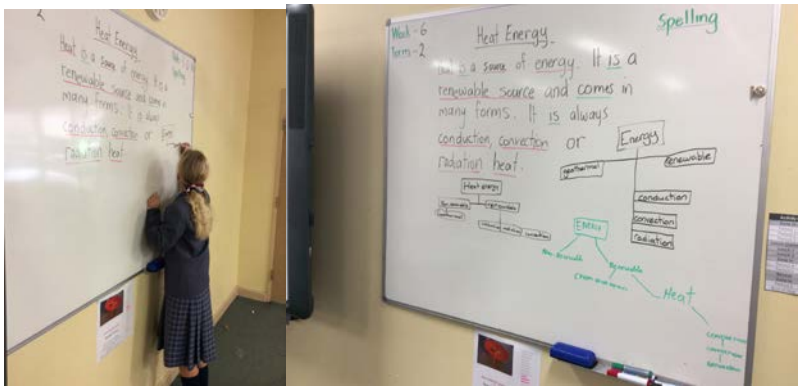


Figure 5.2a

Figure 5.2b

3. Independent construction of analytical images

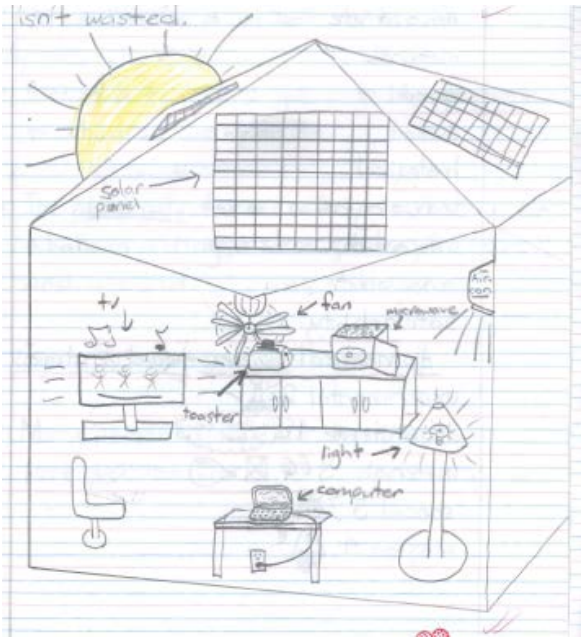
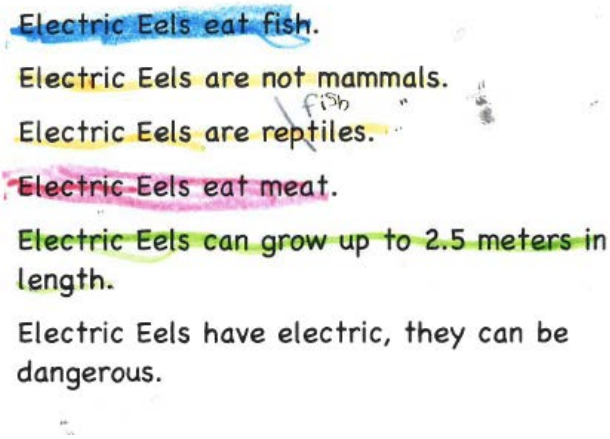


Figure 5.3

4. Independent construction and analysis of multimodal text


Electric Eels eat fish.

Electric Eels are not mammals.

Electric Eels are reptiles.

Electric Eels eat meat.

Electric Eels can grow up to 2.5 meters in length.

Electric Eels have electric, they can be dangerous.

Figure 5.4a

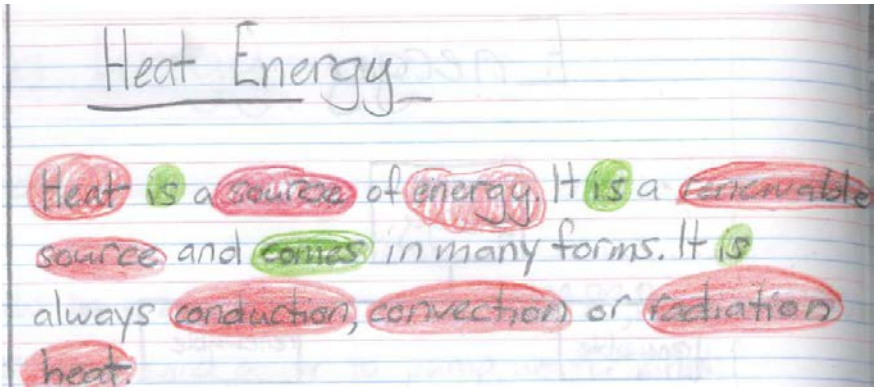


Figure 5.4b

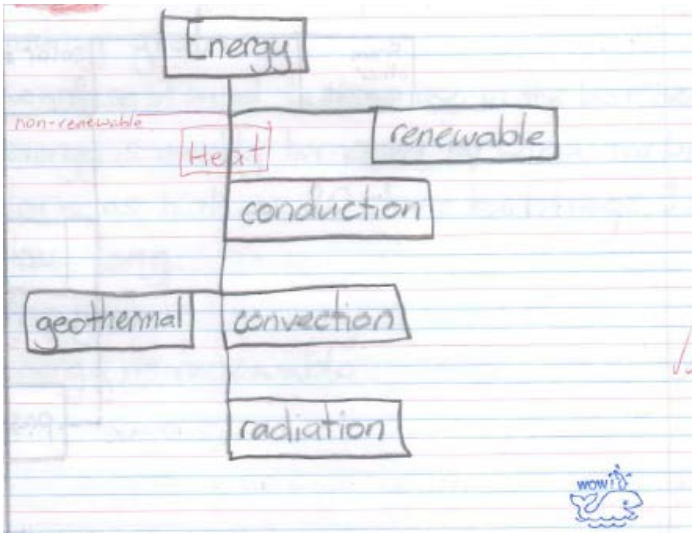


Figure 5.4c

Evidence of teachers' satisfaction with their students' engagement in and achievement of composing multimodal texts in a scientific register is found not only in the range of semiotic resources deployed but also in teachers' reports.

In her commentary on her early years students construction of texts, Kerry commented:

> *Most AMAZING is that [student], who still produced a text with "Dogs are cute" on it has now of her own initiative, written a final draft that focuses only on factual, scientific sentences. When we talked about what dogs do, she said that they run after cats. I asked her if we could write that dogs like to run after cats and she thought not because the word like does not fit…!!!! SUCCESS.*

In a similar vein, Robyn sent a text message to the mentor, commenting

> *My students are now quite fixated on being 'multi-modal scientific writers'*

While assessment of students' written texts requires further analysis of patterns of language in a range of genres over time, the range of texts produced over three weeks and the reflections of changed practice reported by teachers attests to the efficacy of pedagogies which are infused with explicit language instruction.

6. Revisiting the design principles

The first stage of our research project culminated in the generation of design principles for professional learning, with a focus on language education in PYP programs. These foundational principles were formed following an extensive literature review and analysis of IBO documents. Initially, twelve design principles were proposed related to developing teachers' Pedagogic Content Knowledge (PCK) and the enactment of professional learning experiences. These principles were then tested in stage 2 of the project, throughout cycles of professional learning, as documented in the methodology and case study sections of this report. The overall aim of stage 2 was to revisit the foundational design principles, in light of findings from our close collaboration with teachers on PYP programs.

Through insights gained from the professional learning stage of the project, a number of revisions to the foundational principles are proposed. These changes involve amending and integrating the initial twelve individual principles to form eight revised principles. An outline of these changes and their rationale appears in Table 5.1, with further discussion in the case study section. These design principles have been created to guide the future collaboration between PYP teachers/co-researchers and external mentors – specifically in professional learning which draws upon social-semiotic theories of language and learning to investigate how texts work.

#	**Foundational design principles** (from literature review – report 1)	**Revisited design principles** (from the implementation of professional learning)	**Rationale**
1	PYP teachers have invaluable knowledge of their specific teaching contexts (including of their students, PYP curriculum and policies, and the sequencing and planning of lesson activities) which needs to be drawn upon prior to and during professional learning. This will cultivate teachers' ownership of their professional learning.	REVISED **1. PYP teachers have invaluable knowledge of their specific teaching contexts, which needs to be drawn upon prior to and during professional learning. This will cultivate a co-researcher relationship during the joint investigation of texts in context.**	*The case study research has foregrounded the crucial role of teachers as co-researchers in the design and implementation of professional learning and curriculum design.* *Such partnership is compatible with design-based research approach principles.*
2 & 6	PYP teachers' engagement with language knowledge of the language in texts that are used for curriculum learning is essential for changing language teaching and learning practices and thereby improving student learning outcomes. The introduced language knowledge must connect to specific assessment tasks and	REVISED AND INTEGRATED **2. Supporting students' language development requires teachers to have knowledge of methodological tools to investigate language patterns in texts and be able to apply these tools in analysing students' learning goals and assessment tasks.**	*This principle foregrounds semiotic knowledge as a resource for teachers' ongoing inquiry oriented towards effective teaching practice.*

	thereby focus on the language that researchers and teachers have analysed as essential to the language development and success of PYP students.		
3, 4 & 5	Language knowledge needs to have a functional-orientation in order to support and be relevant to the practical inquiry of how language works in the PYP curriculum, including knowledge which enables PYP teachers and students to compare, contrast and critique the language patterns in texts. The exploration of how language works needs to focus on how systems of language make meaning (in SFL terms a metafunctional perspective) and how these systems relate to the context in which texts are composed and received (in SFL terms register and genre). Developing knowledge about language needs to attend to grammatical and expression level patterns within sentences and discourse patterns across texts.	REVISED AND INTEGRATED **3. In order to support reasoning in the practical inquiry of how language works in the PYP curriculum, semiotic theory needs to be functionally oriented. A systemic functional linguistic theory can explain meanings in the context and connect these meanings with discourse and grammatical patterns in print and digital multimodal texts.**	*This principle foregrounds the explanatory power of the SFL model of language and particularly its understanding that contextual meanings are realised as patterns within text. Teachers in case study emphasised the role of SFL understandings in making more abstract concepts visible with evidence expressed beyond the level of textually bound example.*

8 & 9	Metalanguage is crucial for mediating language learning, i.e. making language constructs accessible, relevant and fun to use in PYP classrooms. For metalanguage to be accessible to PYP teachers and students, it needs to involve a range of ways to identify and talk about language, such as the use of technical and non-technical terms, body movement, gesture and intonation, etc.	REVISED AND INTEGRATED **4. A metalanguage that is responsive to learning contexts is crucial for mediating language learning, i.e. making language knowledge accessible, relevant and fun to apply in PYP text-based inquiry.**	*Teachers in case studies emphasised the role of metalanguage in both their own classroom explanation and their students' ongoing investigation of text. Teachers gained confidence through experiencing their students' use and engagement with metalanguage.*
7, 10 & 12	Developing deep knowledge of language is best accomplished with specific guidance in how it can be explicitly and creatively shared with students as a resource for learning. For professional learning to be successful and sustainable PYP teachers need on-going support from expert mentors as well as collaboration within school communities and PYP networks.	AFFIRMED (unchanged) **5. Developing deep knowledge of language is best accomplished with specific guidance in how it can be explicitly and creatively shared with students as a resource for learning.** **6. For professional learning to be successful and sustainable PYP teachers need on-going support from expert mentors as well as collaboration within school communities and PYP networks.**	*Teachers emphasized that embedding 'elbow-to-elbow' professional learning within authentic teaching and learning contexts was essential – not only in developing their own knowledge and confidence but also in providing immediate evidence of its efficacy and relevance to their students' learning.*

	Iterative cycles of professional learning activity with PYP teachers supports the gradual refinement of PL design and content.	**7. Iterative cycles of professional learning activity with PYP teachers supports the gradual refinement of PL design and content.**	
11	Analysing and assessing the impact of professional learning practices in schools that host PYP requires the collection of data before and after professional learning activities, including data that enables the connection between knowledge, changed classroom practices and change/lack of change in the learning of students.	REVISED **8. While text comparisons between pre- and post-data are essential for investigating change/lack of change (particularly in longitudinal studies), data types need to include dialogic talk around texts.**	*The analyses of data from all stages of professional learning is essential for exploring possible changes in the process through which teachers and students investigate how language works. Dialogic talk around texts is also critical to understanding how teachers are using knowledge about language to realise curriculum goals.*

Table 5.1 Summary and rationale of changes to the foundational design principles

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8. Appendices (List only - SEE separate document)

Appendix 2a: Invitation letter to school coordinators/principals

Appendix 2b: Getting step 1a

Appendix 2c: Getting steps 1b & c

Appendix 2d: Pre-data KAL teacher activity

Appendix 4a: Case Study 1

Appendix 4b: Case Study 2

Appendix 5a: Interview questions

Appendix 5b: Summary analysis of Kerry's interview

Appendix 5c: Summary analysis of Robyn's interview